THURSDAY, AUGUST 1, 1918.

ARTIFICIAL LIMBS AND WAR INJURIES.

(1) *La Prothèse du Membre Inférieur.* Par Dr. F. Martin. Pp. viii+107. (Ambulance de l'Océan, La Panne.) (Paris: Masson et Cie, 1918.) Price 5 francs.

(2) *Troubles locomoteurs consécutifs aux Plaies de Guerre.* Par Prof. Aug. Broca. Pp. 155. (Paris: Masson et Cie, 1918.) Price 4 francs.

(1) IN the autumn of 1914, La Panne, the last village on the Belgian coast as one passes towards the French frontier and Dunkirk, consisted of a large hotel—Hôtel de l'Océan—and a number of lodging-houses, then crowded with refugees. It was to this site that the Queen of the Belgians summoned Prof. A. Depage, who, in peace time, was the distinguished occupant of the chair of surgery in the University of Brussels, but in the autumn of 1914, when summoned by his Queen, was busy establishing a military hospital in Calais. At the Queen's request Prof. Depage undertook to organise a field hospital in La Panne. He took over the hotel with its 150 bedrooms and surrounding villas; in a year's time he had more than a thousand beds at his disposal with laboratories and work-rooms attached. Under Prof. Depage La Panne became not only a beneficent institution for the relief of wounded Belgian soldiers, but also one of the great centres of surgical progress. In 1917 there began to be issued from the "Ambulance de l'Océan" a series of scientific publications, of which the excellent treatise here noticed is the latest number. Prof. Depage confided the difficult task of inventing, improving, and providing artificial limbs for mutilated soldiers to Dr. F. Martin. That he was fortunate in his choice there can be no doubt, for in his treatise on the "Prosthesis of the Lower Limb" Dr. Martin has produced a most useful and scientific contribution to a subject which medical men have hitherto totally neglected.

Up to the outbreak of war the United States was the only country in which the manufacture of artificial limbs had been seriously studied. When Dr. Martin commenced his investigations at La Panne he recognised the merits of the American models. But they were expensive, and had manifest defects in functional qualities and in adaptability. He saw that it was necessary to use a substance with all the qualities of seasoned wood, but one which could be moulded so as to form an exact socket or "bucket" for the stump of the amputated limb. He found the ideal substance in wood shavings cemented together by a particular form of glue. He saw that it was necessary that the artificial limb, so far as length of segments and axes of joints were concerned, must be a counterpart of the patient's sound limb. He invented a simple apparatus for obtaining the exact measurements required for the modelling of the artificial limb; he used the kinematograph to analyse the movements of the lower limbs in walking, and did not rest content until he found that his artificial limbs could simulate the movements of real ones. Thus he was able to improve on American models and to produce a more efficient article at a much lower price.

At La Panne certain useful principles have been laid down for the guidance of the surgeon when amputating and when treating the stump preparatory to the fitting of an artificial limb. At amputation the surgeon must leave as long a lever of bone as is possible; he must see that the muscles which are to move that lever are rightly placed and rightly fixed; he must see that the joint from which the bony lever is to act is free and movable. As the stump is shaped, the surgeon must foresee how the bucket of the artificial limb is to be given a sure support. At La Panne crutches are forbidden; their use is found to impair the mechanism of the body needed for the right use of an artificial limb. At the earliest date possible—in eight to twenty-four days, according to the nature of the amputation—the soldier is given a provisional limb—a "bucket" which is moulded to the stump, and remoulded as the stump atrophies—fitted to a wooden peg or stump. We have no doubt that the practice at La Panne—the practice of fitting out the maimed at once with provisional limbs instead of crutches—is right. We have, from reasons of space, had to omit any mention of Dr. Martin's original observations on the movements of the lower limbs in walking, but for those who are interested in the mechanism of walking, and wish to help in relieving maimed soldiers, we warmly commend this clearly and crisply written treatise from the "Ambulance de l'Océan."

(2) A British surgeon may well feel somewhat envious of the many excellent medical manuals which have appeared recently in France to meet the needs of the Army surgeon. The leaders of the French medical profession have placed their special experience, in the form of clearly and concisely written booklets, at the disposal of their colleagues in the field. In the booklet here reviewed Prof. Broca gives his experience and advice in the treatment of the various disablements which follow gunshot injuries of the limbs.

These are of many kinds and degrees—partial or complete fixation of joints, or disablements which follow injuries to muscles, nerves, or bones. In some respects the treatment adopted or recommended by Prof. Broca differs from that practised by the majority of British surgeons, but the underlying principles of treatment in both countries are the same. It is recognised that if permanent fixation or anchylosis of a joint is unavoidable, then the limb must be placed and kept in a position which will secure a maximum utility so far as the livelihood of the patient is concerned. In both countries it is recognised also—perhaps more so in Britain than in France—that the principles of treatment vary with the stage of recovery, complete rest by means of splints being the best treatment in the acute stages of the injury, and free movement the best medicine when the acute stage is over. Many French surgeons have a fear of

producing permanent stiffness, even in a healthy joint, by immobilising a limb. Indeed, Prof. Broca shares this fear to some degree, and recommends that complete immobilisation of limbs should be practised only during transport of the wounded.

For the recovery of stiffened joints voluntary movements are recommended in preference to passive movements. Indeed, Prof. Broca is of opinion that in many slight cases of stiffness of joints a ten hours' day at manual labour is the very best treatment possible, so long as such exercise is not attended by positive pain. We note, too, that the author, in his introduction, gives the following quotation from Ecclesiastes as being true of orthopædic practice in France: "There is no remembrance of former things; neither shall there be any remembrance of things that are to come with those that shall come after." We in England are making similar discoveries; we find that many of our discoveries are really rediscoveries.

THE PARASITIC HYPOTHESIS OF TUMOURS.

Tumours: Their Nature and Causation. By Dr. W. D'Este Emery. Pp. xx+146. (London: H. K. Lewis and Co., Ltd., 1918.) Price 5*s.* net.

DR. EMERY'S book is remarkable in two ways. In the first place, it is a clear and concise statement of the parasitic hypothesis of the causation of new growths—a welcome innovation in a subject around which more dubious writing has been perpetrated than any other in medicine. In the second, it does not contain any original observations. After summarising and discarding the current definitions of "tumour," the author sets up three postulates to which the required parasite should conform—viz. ultramicroscopic size, intracellular or intranuclear habitat, and production of a toxin capable of stimulating growth in the invaded cells. The remainder of the work is devoted to a rapid review of the more prominent features of tumours, showing how they fit in with these assumptions. Benign growths are those with few parasites in each cell, giving weak action of the toxin; in malignant growths the cells are heavily loaded, much toxin is produced, and growth is energetically stimulated. At once we come in contact with the subsidiary assumption that the cells of the body grow only when stimulated. It is at least arguable and probably true that, on the contrary, growth goes on so long as life lasts. The contrast to the form of growth presented by the limited reactions to known toxins is got over by assuming a nicely balanced symbiosis of host-cell and parasite, the parasite not getting out of bounds and killing the cell, and the cell not being sufficiently irritated to kill the parasite.

Sarcoma development in the stroma of carcinomata (spontaneous or propagated) is regarded as a transference of the virus from the carcinoma cells to the connective tissue cells. The stroma of tumours is not, as the author says, merely granulation tissue, unless we admit also that the stroma of the pancreas, the liver, the lung, and the kidney is also granulation tissue. Although derived from the homogeneous, ubiquitous mesenchyme of the embryo, each of these organs has a characteristic stroma, and the same has been demonstrated for quite a number of carcinomata of the mouse and rat. In both cases they appear to be specific reactions of a single tissue to different parenchymata. The peculiarities of the process of sarcoma development, the long contact which is necessary, and the ultimate loss of the property are not touched upon. Perhaps they would involve too many and too intricate subsidiary assumptions.

The chapter dealing with the evidence from the organ-incidence of cancer shows the weakest side of the hypothesis. If we restrict our survey to cancer in man, as Dr. Emery does, the distribution appears rational, but it is otherwise when the tumours of animals are taken into account. Cancer of the mamma and of the uterus are common in man; cancer of the mamma is nearly as common in mice, but carcinoma uteri is very rare. Cancer of the stomach also is rare in mice, but common in the cow, while in this animal cancer of the mamma and of the uterus are both rare. Cancer of the liver is the commonest new growth in the cow and other herbivora. Next in frequency are new growth of the adrenal and carcinoma of the stomach. In the horse carcinoma of the liver is rare, while growths of the adrenal are common. The mouse and rat are closely related animals in structure, habits, and diet. Their new growths have a totally distinct organ and tissue incidence. To harmonise these well-known facts of the natural history of cancer with the hypothesis would require, not three fundamental assumptions, but nearer three hundred.

To be of value a hypothesis must fulfil two conditions. It must embrace without violence the facts of the subject and require a minimum of subsidiary assumptions. It must stimulate inquiry and lead to the extension of knowledge. Whatever shortcomings Dr. Emery's essay may have in the first direction are made up for in the second. It is safe to say that there is scarcely an assumption made of which it is only necessary to ask oneself, "Is this true, and how would you prove it?" to provide a subject for an interesting inquiry. Dr. Emery has rendered a great service to those engaged in the study of cancer. He has put into succinct and intelligible form the vague general impression which hitherto has hovered around the subject under the name of the parasitic hypothesis.

J. A. MURRAY.

THE WAR AND THE BAGDAD RAILWAY.

The War and the Bagdad Railway. The Story of Asia Minor and its Relation to the Present Conflict. By Prof. Morris Jastrow, jun. Pp. 160+1 map. (Philadelphia and London: J. B. Lippincott Co., 1917.) Price 6*s.* net.

EVERYONE has heard of the Bagdad Railway, and that its project for capturing the trade of the East was one of the chief

causes which led Germany to contrive the present war; but few know the inner history of this project. This want is now well supplied by Prof. M. Jastrow, the well-known professor of Semitic languages in the University of Pennsylvania, and his exposures fully justify President Wilson's informed statement that this railway was "the heart of the matter" in the long-planned German arrangements for this war, and that "it is the bulk of German power inserted into the heart of the world."

The railway, intended to connect Constantinople and Bagdad, stretches across Asia Minor along one of the most historical highways of the ancient world. The scope of the story told by Prof. Jastrow and his interesting style are well seen in the following extract, which also summarises the scope of the book:—

"The purpose of this volume is to elucidate an aspect of the war which, although overshadowed at present by the paramount issue—the menace of a militarism in league with autocracy—was the most significant factor contributing to the outbreak of the long-foreseen war in 1914, and will form one of the most momentous problems when the time of the peace negotiations arrives. Ever since the announcement was made towards the close of the year 1899 that the Turkish Government had conceded to a German syndicate the privilege of building a railway to connect Constantinople with Bagdad through a transverse route across Asia Minor the Bagdad Railway has been the core of the Eastern question. There were, to be sure, other aspects of that question, which led to the two Balkan wars of 1912 and 1913, but the addition of the Bagdad Railway was an aggravating factor to an already sufficiently complicated situation, that involved the great European Powers—England, France, Germany, and Russia—in a network of diplomatic negotiations the meshes of which became closer as the years rolled on. The railway became the spectre of the twentieth century. It was a spectre that always appeared armed 'from tip to toe,' and when occasionally he 'wore his beaver up' the face was that of a grim, determined warrior."

Numerous excellent photographic illustrations give vivid glimpses of the scenery along the line of the railway and several of its bridges and mountain tunnels; and there are historical and archæological notes by the way, from classic down to Crusading times, with a good, useful, and up-to-date map. L. A. WADDELL.

OUR BOOKSHELF.

How to Enlighten our Children: A Book for Parents. By Dr. Mary Scharlieb. Pp. v+202. (London: Williams and Norgate, 1918.) Price 3*s.* 6*d.* net.

WE welcome this very useful little book on the vexed question of how to educate children in regard to their physical nature and its development. As Dr. Scharlieb says, the difficulty lies not so much in the shy reluctance of parents as in their absolute ignorance of what they ought to teach, and she here sets forth simply and straightforwardly the main facts the parent must know in order to guide the child aright.

A brief chapter on the child in the pre-pubertal stage is followed by an account of the reproductive organs and their functions in girls, the changes that take place at puberty, and the commoner physiological difficulties that may arise. Much wise advice is given to mothers on the need for sympathetic watchfulness during this period of physical transition, with its influence on the moral and spiritual nature. In the succeeding section the boy with his particular difficulties is dealt with in the same way, and a chapter is devoted to the special instruction he needs at the onset of puberty.

"How Life is Transmitted" gives an account of the beginnings of life in the plant and animal world. This is necessarily slight, but it is sufficient to indicate the way in which teaching of the biological facts of sex at a stage when they are still external to the child's mind may be used as a safe foundation for personal sex instruction when that comes to be necessary.

The last section of the book is devoted to the social aspect of the sex question—the dangers to which young adults of both sexes are exposed under modern industrial conditions, the "social evil" and how to combat it, and the value as a safeguard of continual insistence on the eugenic point of view.

Acoustics for Musicians. By Prof. P. C. Buck. Pp. 152. (Oxford: At the Clarendon Press, 1918.) Price 7*s.* 6*d.* net.

THIS text-book is intended to present to music students the scientific basis of their subject, and to many such students probably any science is somewhat difficult, even that with which they are most concerned proving no exception. Accordingly, the author of such a work undertakes a hard task; but in the present case its difficulties have been tackled with sympathy, insight, and skill. The result is a work which should prove welcome to those who, though their chief interest lies in the music itself, must acquire some knowledge of the scientific principles underlying it.

The book is divided into six parts, dealing respectively with production of sound, pitch, intensity, quality, temperament, and transmission. The sixth part includes chapters on combination tones, consonance and dissonance, and the human ear. The fifth part has a chapter on the equal and mean-tone temperaments. This subject is treated from the musician's point of view, and its inevitable mathematical difficulties are reduced to a minimum.

In a work otherwise so excellent it is regrettable that, in the diagrams of wave curves, *circular* arcs usually occur instead of true *sine* graphs. But this is practically the only blemish in a book which is to be heartily commended for its accuracy and lucidity. E. H. B.

LETTERS TO THE EDITOR.

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The Problem of Man's Ancestry.

HAVING read Prof. Wood-Jones's booklet, "The Problem of Man's Ancestry," reviewed in NATURE of June 27, p. 322, it seems to me that Prof. Wood-Jones's assertion that man, instead of being the descendant of the apes, may be looked on as their ancestor contrasts with what the author himself writes on the premaxillary bone (p. 36). If man, who is the forerunner, has lost the individuality of the premaxillary element (which is not present in the human embryo, according to the author), how is it that it is found in the apes? It cannot be a new acquisition, because the premaxillary bone is already found in primitive mammals. Therefore apes have this primitive characteristic instead of man.

As to the judgment of the late Hermann Klaatsch that "man and his ancestors were never quadrupeds as the dog or the elephant or the horse," I think it was superfluous already when written by Klaatsch, as no one then accepted such a view; it is, therefore, not worth Prof. Wood-Jones's while to repeat it, especially as this judgment does not at all say that man was not an ape.

Klaatsch only said that the anthropoids were attempts which had failed, and that man was the successful attempt (this, too, is a fairly banal idea); but he never denied the affinity between man and the Simiidæ. On the contrary, his last scientific opinion was an exaggeration of such an affinity, the so-called "pan-anthropoid theory," already criticised by Prof. Arthur Keith and myself.

V. GIUFFRIDA-RUGGERI.

Istituto di Antropologia, R. Università,
Napoli, July 14.

I THINK that Prof. Giuffrida-Ruggeri has somewhat misunderstood my meaning, for naturally I have never asserted that the premaxillary element is not present in the human embryo. All I have ever ventured to state is that "it has ceased to exist *as a separate entity on the human face*," and that this state of affairs is brought about remarkably early in the embryo. This I have alluded to as "a human specific character," a specialisation from that primitive mammalian condition which is still retained in all the rest of the Simiidæ, and I see nothing illogical in assuming that the mammal which possesses this specialisation is yet more akin to the primitive mammalian condition than are those animals which, lacking this particular character, exhibit a host of other features which we know to be departures from the primitive mammalian plan. It is upon a summation of characters that we must judge of the animal's zoological position, and my point is that, when such a complete survey is made, the balance of primitive mammalian features is found in the body of man, and not in the body of the monkey. I need scarcely say that I have never "denied the affinity between man and the Simiidæ," but I have insisted upon a proper recognition of the differences between the anatomical structure of man and the Simiidæ.

Two classes of criticism have been levelled against my very humble pamphlet. The one, typified by the review in NATURE, names it and condemns it as "a new hypothesis as to man's origin"; the other, on the lines of Prof. Giuffrida-Ruggeri's last paragraph, assumes that it has all been so long generally accepted that it is "not worth while to repeat it." Since these two types of criticism tend to neutralise each other, I have hitherto refrained from discussion; but if Prof. Giuffrida-Ruggeri imagines that no one believed, even when Klaatsch wrote, that man's ancestors were pronogrades, he should read the review in *Man* (No. 71, 1916), written by a well-known comparative anatomist, who "is, and has long been, convinced of the pronograde ancestry of man."

F. WOOD-JONES.

LICE AND DISEASE.

TYPHUS fever and the relapsing fever of North Africa are now both known to be transmitted from man to man by *Pediculus humanus*, and for this reason have been in past centuries perhaps the two most characteristic epidemic diseases of overcrowding and poverty, and during wars have attacked beleaguered cities in particular. A third disease, known in the British Army as trench fever, has recently been definitely proved to be conveyed by lice. In Germany this same disease is called *Febris volhynica* or *Febris quintana*. The especial association of the disease with life in the trenches was early noticed, and helped to bring lice under suspicion.

The German Army first recognised the disease in Volhynia, a region of South-West Russia; but it is said to have been previously known to Polish doctors. Cases of the disease were not noted in Mesopotamia, Egypt, or the Mediterranean area until the close of 1916. The disease is thought to have been introduced into Greece by chronic cases which arrived at Salonika from France in the winter of 1916–17.

The first published clinical account of the disease was by Major J. H. P. Graham in September, 1915, and since then much has been written on the subject. The first published attempt to investigate the pathology of trench fever was that by McNee, Renshaw, and Brunt. Two varieties of the disease were described by these authors, who showed, by a series of observations on volunteers, that it could be transmitted from man to man by taking blood from a patient during, or immediately after, an attack of the fever, and injecting it into a healthy man. The red-blood corpuscles especially were suspected of harbouring a causative micro-organism, but microscopical examination did not result in the discovery of a parasite. The virus was not conveyed by filtered serum or plasma.

Trench fever is still responsible for a very large share of the sickness in the Expeditionary Forces in France. Our knowledge of this disease has been summed up in a paper read before the Society of Tropical Medicine and Hygiene on May 17 last by Major Byam, who has had exceptional opportunities of studying cases at the New End Military Hospital, Hampstead.

Three chief obstacles to the investigation of the

disease are (1) its frequently mild, indefinite, and irregular clinical course, with the consequent difficulty in diagnosis; (2) our lack of knowledge as to the nature of the infecting virus; and (3) the difficulty, if not impossibility, of infecting experimental animals.

When the two cardinal features of the disease are present—*i.e.* the characteristic relapses of fever, occurring at fairly regular intervals of four, six, seven, or ten days, and severe pain in the lower part of the shins—its recognition is fairly easy, but in numerous cases only one or neither of these symptoms is present, and diagnosis has to depend on a general survey of the clinical symptoms. The causal micro-organism is unknown; though a spirochæte, a hæmogregarine, a bacterium, or a Rickettsia body similar to that described as the cause of typhus fever has each its advocates.

A few experiments on the transmission of trench fever by the louse were made before 1918, but the evidence published is scanty. Weldon and Davis allowed two lice to bite each of them after first starving the insects, and then feeding them on a trench-fever patient. Weldon developed the disease after eighteen days. The evidence for the transmission by these lice is, however, not quite convincing. Nankivell and Sundell failed to transmit by feeding lice and doubted the hypothesis of transmission by these insects.

In October, 1917, the American Red Cross Society, in conjunction with representatives of the British Expeditionary Force, formed a committee to investigate trench fever. This body has carried out much very valuable work, but its full report has not yet been made.

About the same time a War Office Committee, under the chairmanship of Major-General Sir David Bruce, was formed in England, in order to advance the knowledge of trench fever with a view to its prevention, and the research in progress at Hampstead was merged in that of the Committee, of which Major Byam became a member.

Up to the close of the year the work was confined to the study of clinical evidence, the examination of the blood and urine of patients, together with the feeding of lice on them during their febrile periods, followed by the subsequent microscopical examination of the insects with a view to the discovery of the infecting organism.

With the commencement of 1918, thanks to the financial assistance of the Lister Institute and the courageous and patriotic action of a number of volunteers, it became possible to widen the scope of the research, and very valuable results speedily followed. A confirmation was obtained of McNee's main results of direct inoculation from patient to patient by blood, and the problem of transmission by the louse was seriously attacked. The Committee was fortunate in having at its disposal ample stocks of lice, free from suspicion of previous infection, which had been reared under the direct supervision of Mr. Bacot, entomologist to the Lister Institute.

The first experiments in which the insect vector was concerned consisted in two of the volunteers submitting themselves to the bites of several hundred lice daily, the insects having been previously fed on patients during febrile periods both before and during the month of experiment. The lice, therefore, had many opportunities of becoming infected, and the men received the bites of these lice three times each day for thirty days. Neither showed any of the symptoms of trench fever.

Next, following the analogies of relapsing and typhus fevers, two volunteers were inoculated from lice which had fed repeatedly on trench-fever patients. In both the inoculation was made by scratching the skin and rubbing in, eleven crushed lice in one case, and excreta voided by the lice in the other. Both men developed typical symptoms of the disease, with a relapse in six to eight days. The inoculation of louse excreta into scratches has been repeated a number of times, and in every case an attack of the disease has resulted.

It was found that the incubation in man, when infected by scarification, was remarkably constant, *i.e.* six to eight days, and the ease and certainty with which infection could be produced pointed to the inoculation of the contents of crushed lice or louse excreta as in all probability the common, if not the invariable, method of transmission.

The excreta obtained by shaking through the gauze cover of the boxes in which the lice were confined were used in the form of a dry powder, which remained infective for at least sixteen days. In parallel experiments with the excreta of normal lice which had not been fed on trench-fever patients no symptoms of the disease were produced.

That a very small amount of blood, such as might be contained in ten lice, does not directly convey the disease through an excoriation of the skin, is indicated by the negative result obtained by rubbing 5 c.mm. of infective blood into scratches on the skin of a volunteer.

Moreover, the following series of experiments points to the fact that the louse, after a meal of infected blood, does not void infective excreta for some days. Lice were fed on a trench-fever patient on one day only, and then on healthy men. Excreta collected on the first, third, fifth, and eighth days after infection gave negative results, while those collected on the twelfth and twenty-third days proved virulent. The virus, therefore, would appear to undergo some preparation in the insect before it becomes infective. Whether this change in the louse is due to a simple multiplication on the part of the hypothetical micro-organism, or to a cycle in its development, is as yet undetermined. Further, it was shown that the ingestion of louse excreta did not produce trench fever in two men who daily swallowed a dose for seven and fourteen days respectively.

Incidentally, the transmission experiments by McNee and at Hampstead have proved that the different clinical types of the disease are really due to the same infective virus. The disease may persist in man for a very long period. A case is

recorded by Hurst lasting about six months, and relapses have occurred in men who have been more than eight months in England, while the infectivity of the blood of a patient has been proved as late as the seventy-ninth day from the initial attack.

With the certainty of the transmission of trench fever by lice the problem of how to check lousiness in the Army becomes urgent. What was previously a question of the comfort of our troops now becomes a matter of curtailing a heavy wastage of man-power from a preventable cause. It is to be hoped, therefore, that adequate steps to deal with body vermin will be instituted.

ADDENDUM.

Three varieties of lice attack man; two of these, *Phthirus pubis* and *Pediculus humanus* (*capitis*), are associated with hair, and the third, *Pediculus corporis*, with clothing, the body hairs serving as an occasional and final stronghold for the species. By close clipping of all hair at regular intervals the two first-named species may be finally disposed of, but the more difficult problem of dealing with clothing and bedding infected with *Pediculus corporis* remains to be dealt with.

Heat is still by far the most effectual and economical method of ridding infected fabrics of lice. An exposure for twenty minutes to 55° C. (131° F.) is sufficient under practical conditions, provided bundling is not resorted to. Three methods of utilising heat are applicable:—

Dry heat is the easiest, simplest, and most economical.

Steam requires a more elaborate and expensive equipment with a higher working cost; it is impracticable to work with it at temperatures below 65°–70° C. In the case of bundled articles the temperature for both methods should exceed 100° C.

Hot water is applicable to undergarments only, and does not require any chemical addition provided its quantity and temperature are adequate to the bulk of the garments dipped.

Vapour.—Sulphur dioxide (SO_2), as supplied by the Clayton gas apparatus, is expensive, both as regards plant and working cost, slow in action, and needs skilled management to maintain the necessary concentration, while even in experienced hands it may allow of the survival of a small percentage of nits.

Hydrocyanic acid gas is dangerous to generate, and its use, except with skilled management, is to be deprecated; its effect on lice and nits appears to be slow, but has not been adequately determined.

The vapours of volatile fluids or substances, such as benzene, xylol, petrol, etc., may be employed if air-tight containers are available; that of naphthalene is also applicable for use by this method.

Fluids.—Light oils, such as kerosene, give fairly trustworthy results if the period of immersion is long enough, and if their efficacy against nits is aided by the addition of a small percentage of some essential oil, such as oil of sassafras. More volatile fluids are effective against active lice, but may fail against nits if the period of immersion is short.

The most trustworthy and generally serviceable fluids to use for the destruction of nits in clothing would seem to be emulsions in water of soap and crude carbolic acid, cresol, tar or wood oils, which readily destroy both active lice and their nits. The strength of the solution and period of exposure are interrelated factors—five minutes' immersion in 2 per cent. lysol being adequate, provided the temperature of the solution is above 5° C.

The impregnation of undergarments with such solutions offers a hopeful chance of aiding any general scheme by coping with the difficulty of dealing with the front line and special posts, which form the main sources of the infection of clean troops. Up to the present, however, the experiments in the field, which are necessary before a final decision on the value of this process can be arrived at, have not been carried out by the authorities.

Finally, there is the personal use of insecticidal preparations as aids to the primitive method of getting rid of these pests—now referred to as "chat"-hunting. To be of service the preparation should be of quick action and easy of application to clothing, and its issue should be as general and comprehensive as that of food. Preparations in the form of pastes are more economical and convenient than powders; fluids are out of the question. Crude "unwhizzed" naphthalene, produced by coke-oven plants, affords the most effective base, and may be conveniently mixed into paste form by the addition of soft soap or some grease, such as vaseline, in the proportion of 10 to 20 per cent. It is suitable only for clothing, and should not be employed on the skin. When it is necessary to use an anti-lice preparation on a hair-clad surface the use of vaseline, to which has been added ½ per cent. of veratrine dissolved in 5 per cent. of benzene, may be recommended.

AGRICULTURAL RECONSTRUCTION AFTER THE WAR.

IN August, 1916, Mr. Asquith appointed a Sub-Committee of the Reconstruction Committee, under the chairmanship of Lord Selborne, to inquire into the subject of agricultural development after the war, and this body, having heard a considerable amount of evidence, has now issued its Report (Cd. 9079, price 1*s.* 3*d.* net). The recommendations cover practically the whole field of agriculture, and they have the double merit of boldness and consistency.

In a historical introduction it is shown that agriculture was very prosperous during the Napoleonic wars, but suffered a period of depression afterwards. Between 1832, when the Reform Act was passed, and 1846, when the Corn Laws were repealed, the political advantages of landed property were steadily being abolished, but on the other hand some of the farmers' grievances—the old Poor Laws, the tithes, statute labour for minor roads, bad markets and means of communication—were also dealt with. Still more important, from the year 1843 Science began to lend her aid and to teach the use of artificial fertilisers, more efficient implements, and better varieties of crops. From 1837 onwards came a period of rising prosperity, culminating in the 'sixties and early 'seventies, which are generally regarded as the golden age of agriculture in this country.

In 1875, however, a period of depression set in which was acute until 1884 and again became serious in 1893. Several factors operated. Speculation had taken some of the farmers' and landowners' reserves of money; there was a series of bad seasons, culminating in the disastrous year 1879; American wheat and meat began to arrive in quantities, driven here by the financial troubles of the West and transported in the new cargo

fleets then being constructed. The Government ordered inquiries, but did nothing; the political philosophy of the day was *laissez faire*—so long as food was cheap it mattered nothing if farmers went bankrupt and agriculture were ruined. Farmers and landowners struggled manfully against adversity, but many went under; the period was one of the saddest and most tragic in our rural history.

It was soon realised that grass farming was cheaper and less risky than arable farming. Between 1870 and 1900 the area of arable land in the United Kingdom fell from 24 to 19·5 million acres, and the pasture land rose from 22 to 28 million acres. At the beginning of the present century prices began to rise and farming to mend, but the farmer had learnt that he must depend on himself alone, and so he followed a system of husbandry which involved the minimum of risk and gave the maximum of return for the capital employed.

When war broke out it became apparent (as, indeed, experts had long realised) that grass farming, while beneficial to the individual, is not specially beneficial to the State. It does not produce anything like so much food per acre as arable land, and in particular it does not yield the bulk of cheap carbohydrate and protein that the nation needs. To the *laissez-faire* politician this did not matter; to a nation at war, however, it was vital.

The Committee draws from this historical review the general conclusion that the British farmer will not grow corn to any large extent unless he has some confidence that prices will be sufficient to repay expenditure. Agriculture is a business run for profit like any other business. On the political system in vogue at the end of last century the farmer gave up grain production because he had no guarantee that prices would remain at a remunerative level: they might always fall below the 34*s*. or thereabouts which it then cost to grow wheat. If the nation requires wheat to be grown here (and if it does not, "our reference is misleading, our opinions are erroneous, and this Report is waste paper"), the Committee insists that this risk of unremunerative prices must be borne by the community. Of course the farmer must in return accept certain responsibilities; he cannot guarantee delivery of so much wheat, because of the dominating influence of the seasons, but he can at any rate be compelled to raise his standard of farming and to pay decent wages. This recommendation has already been adopted and passed into law; unfortunately, the Committee states, the Act is a war-time measure only, and cannot have its full effect unless it becomes a permanent statute.

This is the central feature of the Report. Assuming it is carried out, the Committee makes further important recommendations. First, it asks for a survey of the condition of agricultural land throughout the kingdom from the point of view of its utilisation for food production, and it recommends that the Board of Agriculture shall have the power of temporarily superseding landowners or dispossessing tenants in case of bad management. More cottages should be erected, and more definite steps taken to encourage the growth of sugar-beet. The Development Commission should no longer be barred, as at present, from making advances to associations trading for profit. Alongside all this must go greater provision for agricultural education and research work. The United States spends above 4,000,000*l*. annually on agricultural education and research; France more than 1,000,000*l*.; Canada, 840,000*l*.; Prussia (in 1910), 490,000*l*.; but the United Kingdom only about 310,000*l*.

The Committee was very sympathetic to research work and agricultural education, as was only to be expected from its *personnel*. "The research work already being done," it says, "is quite admirable, but it needs stronger support yet from public funds. We reiterate that this is public expenditure which will bring in to the State a manifold return." "The evidence that has been laid before us has amply shown the ultimate value of pure scientific research and the dependence of the development of the industry upon investigation that is independent of any apparently immediate practical end." It is further clearly recognised that the old policy of underpaying the workers is futile and uneconomical. Some of the best workers are attracted to the Colonies and Dependencies.

With refreshing vigour the Committee insists on the absolute necessity for ample provision for education. The system of agricultural education in England and Wales is found to differ from the Irish or Scottish, and in the judgment of the Committee is less effective. The scheme itself is sound and provides a thoroughly good groundwork for expansion, but the execution is faulty. Too much is left to the discretion of the county councils, which can carry out or shirk their responsibilities as they please.

Rates and votes are the main excuses for inaction, and these can be very potent. The Committee urges that the responsibility for agricultural education in England and Wales should be definitely placed on the Board of Agriculture, which should take over existing staffs, colleges, and institutes from the county councils and run them out of Imperial funds and not out of the rates. If this were done much of the prejudice against agricultural education would undoubtedly disappear. Further, the Committee recommends that an improved ruralised curriculum for elementary and secondary schools should be laid down, and better prospects provided for rural teachers. Existing farm institutes and colleges should be developed so as to afford adequate opportunities for higher education to all who desired it. The present system of small demonstration plots should be extended; there should be demonstration and illustration farms where new and improved methods of farming could be shown as part and parcel of the actual system of farming. The method is found useful in Canada and might well be tried here. A certain number of large farms should be established on purely business lines,

but open to inspection, and giving publicity to their methods and accounts. In the opinion of the Development Commissioners the influence of these farms on agriculture (always supposing them to be financially successful) would be remarkable.

The Report is comprehensive and singularly opportune. Never before in our time has there been so grand an opportunity for laying the foundation of a noble rural civilisation. The touch of sadness brought into most homes by the war has done much to broaden our outlook and to level old prejudices. The problem must be approached in an enlightened but sympathetic spirit, looking only to the welfare of our children and our children's children; it can be solved, and the Report before us furnishes suggestive lines on which a solution can be found. E. J. RUSSELL.

PLATINUM.

A FEW months ago we noticed (vol. c., p. 486, February 21) the chapter on "Platinum in 1916" which Dr. G. F. Kunz contributed to the current volume of "The Mineral Industry," and now we have before us in pamphlet form the illustrated article on the same subject, though studied from a somewhat different point of view, which the same writer penned for the issue of the Bulletin of the Pan-American Union for November, 1917. On the last page—and, therefore, there being no cover, the back of the pamphlet—we are told that this union is an international organisation, which is housed at Washington in a beautiful building provided by the munificence of Mr. Andrew Carnegie, and is maintained by the republics, twenty-one in number, in both the Americas, the necessary funds being provided by the several countries in proportion to their population. The administration is in the hands of two executive officers—Director-General and Assistant-Director—who are appointed by, and are responsible to, the Board of Governors, which comprises the United States Secretary of State and the diplomatic representatives at Washington of the other American Governments, and they have the assistance of an ample staff of experts in various subjects, statisticians, translators, librarians, clerks, etc. The purpose of the union is to develop commerce and to promote friendly intercourse and good understanding between the several States—an admirable object that might with advantage be extended when opportunity occurs at the close of this tragic war.

The extraordinary rise that has during recent years taken place in the value of platinum is too well known to need emphasising, but it may not be without interest to note that in 1828 so little was it valued that the Russian Government commenced to coin of it 3-, 6-, and 12-rouble pieces. These coins would, according to present prices, be worth intrinsically about twenty times their nominal value. Although minted for seventeen years, they have become exceedingly rare; most of them having long since been melted down for their value as metal. Platinum appears to have been first introduced into Europe from South America about the middle of the eighteenth century under the name *Platina* (the diminutive of *plata*, the Spanish for "silver") *del Pinto*, and the first scientific description was published by an English physicist, Sir William Watson, who made the discovery that it was a new metal. Although first found in Colombia, then known as New Grenada, practically the whole of the world's supply has come from the Urals, the principal districts being Nizhne Tagilsk and Goroblagodatsk, where it is found in shallow drifts with pebbles of serpentine, which represent the original matrix. The working of the mines has been seriously interrupted by the war, and still more by the disintegration of society following on the revolution in Russia. Consequently the discovery of platinum in workable quantities elsewhere is much to be desired, so important and necessary is this metal for many industrial and scientific operations. Although so rare, it appears to be widely, if sparsely, distributed, occurrences having been reported in British Columbia, Alaska, Oregon, and California, in Borneo, New South Wales, and New Zealand, and even in County Wicklow.

Dr. Kunz describes some curious happenings at Quibdo, the capital of the Choco district in Colombia, in consequence of the great rise in the price of platinum. This metal was originally separated as waste in the refining of gold by the dry, or "blower," system, and thrown into the street. Later, when platinum became even more valuable than gold, the entire town of some 1500 inhabitants was turned into a mine, natives working the streets for the Government, and many property-owners mining under their houses. It is said that one man pulled his store down and recovered enough platinum to build a larger one, and yet net a balance of about 800*l*.

The total world's supply of platinum appears to be about 120 metric tons. Its principal purposes are in catalysing processes, for chemical, physical, and electrical apparatus, and for use in dentistry and jewelry.

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

IT has been our privilege during the four years of war to publish many articles upon scientific aspects of industrial developments in various directions. When supplies from enemy countries were cut off, it was necessary to establish here the manufacture of products and instruments for which we had previously been dependent almost entirely upon Germany. The sudden stoppage of the supply of optical glass required for the manufacture of sighting telescopes for guns, field-glasses, range-finders, and other service instruments was for a time the cause of national anxiety, but the situation was saved by the work of the Institute of Chemistry and Sir Herbert Jackson, which enabled manufacturers to produce the glasses required, not only for optical instruments,

but also for laboratory purposes. The pure potash required for certain glasses is obtained by an electrolytic process, and we need never again go to Germany for it or for the glass itself.

We are meeting all demands for such synthetic organic drugs as salicylic acid and aspirin, phenacetin, salvarsan, and many others, photographic chemicals, synthetic dyes and associated products, as well as hundreds of similar substances of which Germany had the monopoly. The magneto industry has established itself in a sound position, and the German instrument has been displaced for good. Hard porcelain for electrical fittings and laboratory ware is now British-made, thanks to scientific work and industrial enterprise. We produce all the tungsten required for special steels and metallic filament lamps, and can supply the world if necessary; we make aluminium alloys superior to any of the German pre-war products, and like success has been attained in other directions.

While our military, naval, and air services have been actively engaged in battle, the allied forces of science and industry have been making advances no less noteworthy, though their conquests do not occupy much public attention. What has been achieved in scientific industry during the last four years is most creditable both to scientific workers and to manufacturers, and we are glad that steps have been taken to enlighten the public upon this matter by the organisation of a British Scientific Products Exhibition, which will be opened on August 12 at King's College, London.

The British Science Guild, with the assent of the Ministry of Munitions and the approval of the Board of Trade, has arranged for this exhibition to be held for four weeks during August and September. The exhibition will include products and appliances of scientific and industrial interest which prior to the war were obtained chiefly from enemy countries, but are now produced in the United Kingdom. The chief purpose of the exhibition is to make clear the necessity of scientific research with respect to the application of its results in the arts and industries; and, further, to display to the public and to those intimately concerned how much has been successfully achieved in this regard since the advent of the war in the production of articles of prime importance, not only for the home, but also for foreign markets, hitherto manufactured in or imported from other countries.

Such an exhibition at the present time will have a most stimulating influence upon scientific and industrial research and upon manufactures, and the highest permanent interests of the nation will be promoted thereby. His Majesty the King has shown his interest in the exhibition by becoming the Patron; while the Marquess of Crewe is president, and the vice-presidents include the Prime Minister and other leading members of the Government as well as distinguished representatives of scientific, educational, and industrial institutions. More than 250 manufacturers are sending exhibits; and the Air Ministry is arranging a large display of its scientific activities, as well as the Food Production Department. It is understood, of course, that some manufacturers—for example, opticians and scientific instrument makers—are unable to send exhibits on account of their reduced staffs and the insistent demands made for immediate delivery of all instruments or appliances produced by them; nevertheless, there is no doubt that the exhibition will afford an impressive object-lesson of British scientific activity and industrial enterprise.

The manufacturers who are participating in the exhibition are doing so largely from patriotic motives, as no goods will be sold, and any advantage they may derive from their display will be indirect. What is desired chiefly is to educate the public to know that British science and British industry can, when conditions are favourable, excel in manufactures which were popularly supposed to be essentially German. We have recovered lost ground, and we need never lose it again if the development of industry through science is made a national aim.

It might have been supposed that the Department of Scientific and Industrial Research would have been able to afford financial aid to such an exhibition as that shortly to be opened, but we understand that neither it nor any other Government Department has yet contributed a grant towards the heavy expenses involved. The whole cost will have to be met by voluntary contributions, and it is to be hoped that the patriotic efforts of the British Science Guild to give confidence in our scientific strength and encouragement to its industrial application will receive generous support from all who are in the position to give it. Donations should be sent to the Treasurer, British Scientific Products Exhibition, British Science Guild, 199 Piccadilly, London, W. 1.

NOTES.

ATTENTION has been directed several times in these columns to the progress of the dyes industry in this country, and last week a brief statement was given of the proposals of the Government in the direction of giving further assistance to the firms engaged in the manufacture. The Supplementary Estimate referred to was discussed in the House of Commons on Thursday, July 25. Some opposition was raised to the scheme mainly on the ground that there was a lack of information before the House as to what had been done with the money already advanced, and how the present proposed grant of 600,000*l.* towards extensions and plant was going to be utilised. It would undoubtedly be interesting to have a clear statement as to the disposal of the funds already allocated to "British Dyes, Limited," but most of the speakers on Thursday last failed to appreciate the fact that the dyes industry is not only of the first importance to the country, but also a manufacture of a peculiar character, dependent as it is on the constant association of research in the laboratory with processes in the works. The amount of capital invested in the manufacture in Germany may be roughly estimated at about ten times that which is at the disposal of firms in this country, and during the first few years they will require all the encouragement and

assistance of every kind—financial and protective—which can be afforded.

THE progress made in this country in the production of laboratory requirements formerly imported has been referred to frequently in these columns. We learn that arrangements have been made at the National Physical Laboratory for the testing of scientific glassware and porcelain and of filter-paper. For the present, while the organisation is in course of development, firms sending vessels for examination will be required to give notice (on forms provided for the purpose) of their wish to have apparatus examined not less than a week before dispatching the goods. The tests will include volumetric tests of graduated vessels and tests on the resistance of vessels to chemical action and their suitability for use in chemical operations. In the latter case the tests to be applied have been discussed with the Glass Research Committee of the Institute of Chemistry. With regard to the volumetric accuracy of glassware the tests will be divided into (1) vessels of the highest scientific accuracy, and (2) vessels intended to possess only commercial accuracy. It is intended that those in the first category shall be examined at Teddington, and that those in the second shall eventually be tested locally when centres for the work have been established. Information with regard to the scheme is obtainable from the director.

WE regret to announce the death on July 28, in his seventy-ninth year, of Dr. F. T. Roberts, University College, London and author of a "Handbook of the Theory and Practice of Medicine" and many professional papers, as well as of articles in Quain's "Dictionary of Medicine," of which he was formerly the assistant editor.

MR. FRANK N. MEYER, a botanical expert on the staff of the American Department of Agriculture, was recently found drowned in the Yangtse River. For nearly ten years he had travelled as an explorer through China, Turkestan, and Siberia, and had introduced into the United States hundreds of species and varieties of Eastern plants.

THE death is announced, in his eightieth year, of Dr. George M. Searle, of Washington, D.C. Dr. Searle graduated at Harvard in 1857, and shortly afterwards entered the service of the U.S. Coast Survey. He next became assistant professor of mathematics in the U.S. Naval Academy. In later life he devoted himself especially to astronomy. He established the observatory in the Catholic University at Washington, where for several years he held the chair of mathematics.

WE regret to note that the *Engineer* for July 26 records the death on July 18 of Mr. Edmund Herbert Stevenson. Mr. Stevenson, who was sixty-five years of age, was responsible for the design and execution of many gas, water, and drainage works, and was joint author of books dealing with legislation affecting gas and water undertakings and with the water supply of the metropolis. He was a well-known expert witness, and a member of the Institution of Civil Engineers.

THE death occurred on July 26, in his sixty-fourth year, of Mr. Henry R. Knipe, who produced a sumptuous volume about twelve years ago entitled "Nebula to Man." The work was an attempt to sketch in rhyme the evolution of the earth on the nebular hypothesis, the subsequent sea and land movements, and successive appearances of life, as revealed by the geological strata. It was embellished by a remarkable series of illustrations of prehistoric scenes and creatures, fourteen reproduced in colour and seventy-seven by the half-tone process, and all of them by artists distinguished for their skill in portraying such subjects.

WE have just learned that Prof. Vladimir Amalitsky, of Warsaw, died suddenly at Kislovodsk, in the Caucasus, on December 28, 1917. Born in Volhynia in 1860, Prof. Amalitsky completed his education at the University of Petrograd, where he made a special study of geology under Prof. Inostransev. Early in his career he was appointed professor of geology and palæontology in the University of Warsaw, and he eventually became director of the Polytechnic Institute in the same city. With the aid of his accomplished wife, he devoted himself to the study of the Permian rocks of Russia, and will always be remembered by his discovery of the great deposits of fossil reptiles in the cliffs of the northern Dvina. During 1899 and 1900 he excavated from these deposits numerous skeletons of Pariasaurus, Dicynodonts, and Theriodonts, closely resembling those from the Karoo formation of South Africa; and with them he found abundant remains of the typical Glossopteris flora. For several years Prof. Amalitsky superintended the preparation of the fossil skeletons in the museum of the University of Warsaw, but, unfortunately, they still remain undescribed. With Mme. Amalitsky he paid repeated visits to the British Museum, where he spent many months in special studies, but his only detailed publications were on the Permian fresh-water bivalved shells. These small fossils, however, proved to be of exceptional interest, and in a paper read before the Geological Society of London in 1895 Prof. Amalitsky showed the close correspondence between the Permian species of Russia and the Karoo species of South Africa. Just before the outbreak of war he had arranged for one of his students to visit the British Museum to prepare himself for monographing the Russian Permian reptiles, but in the circumstances the work had to be postponed.

DR. A. D. BEVAN in his presidential address to the American Medical Association (see *Science*, June 21, p. 597) gives a good account of the organisation of the American medical profession for purposes of war. Surg.-Gen. Gorgas, who did such splendid work in Panama, is the chief of the American Army Medical Service, and he has enlisted to help him those who in civil life are recognised leaders in their special fields of work—men like Profs. Welch and Vaughan, Dr. de Schweinitz, and scores of others. There are in the United States more than 145,000 men and women practitioners, so that there is ample *personnel* to draw from. For an army in the field 10 per cent. of its numbers will be in the medical department. Thus for an army of 3,000,000 some 300,000 officers and men are required for medical and sanitary work, of whom 25,000 will be qualified physicians and surgeons. Already 25,000 medical practitioners have gone into the medical departments of the American Army and Navy, and it is proposed to raise the number to 30,000 this year.

PROF. HENRY LOUIS stated in his presidential address to the Society of Chemical Industry, at the recent meeting in Bristol, that the chemical industry in this country has been in some respects practically stationary during late years, and that this fact is most noticeable in the failure to take advantage of modern mechanical methods of handling large bodies of material; that, in other words, not sufficient has been made of the application of modern engineering methods to the chemical industries. As he points out,

the difficulty lies in finding men who are equally conversant with the chemical problems to be solved and the engineering facilities available for their solution. A man with an adequate training both in chemistry and engineering is required. Such a man, and no other, has the right to call himself a chemical engineer. These men do exist in this country to-day, notably Sir George Beilby and Sir Dugald Clerk, but there are very few of them, and undoubtedly one of the most pressing problems which will have to be solved is the securing of an adequate supply of chemical engineers to maintain and develop the great industries of the country. Prof. Louis—who, by virtue of his position and his work, is associated more with the mining and metallurgical than with the chemical industries—devoted his address mainly to a consideration of the nature of the principal problems that a chemical engineer is called upon to conduct, and illustrated it by reference to a process which, though metallurgical in name, is chemical engineering in fact, namely, the hydrometallurgical extraction of gold by the cyanide process. The magnitude of this industry may be gauged from the fact that the Witwatersrand alone cyanides more than two and a quarter million tons of ore per month. This process has developed slowly from quite modest beginnings a quarter of a century ago. It has now reached a very high pitch of perfection.

THE report of the council of the Association of British Chemical Manufacturers was presented at the second annual general meeting of the association, held on July 11. Dr. C. Carpenter, who was in the chair, referred to several matters of public interest in the course of his remarks in moving the adoption of the report. Progress has been made with the Directory, the bulk of which is now in the printers' hands. The Directory will be printed in English, French, Italian, Spanish, Portuguese, Russian, and Japanese, and will thus provide for a very comprehensive circulation throughout the markets of the world of information relating to British manufacture in connection with chemical products. A very useful system has been put into operation for placing at the disposal of members of the association a good deal of information available at the Department of Overseas Trade and the Foreign Office. In dealing with the question of industrial alcohol the association has been very helpful. When it is remembered how long it has taken to educate the Government on the technical questions connected with the use of alcohol in chemical manufacture, it will be realised that a great advance has been made in the acceptance of the recommendations of the alcohol committee of the association. An information and statistical bureau has been established with the view of avoiding overlapping and waste of time and energy in research and manufacture. The council has supported the efforts of the Chemical Society in establishing a comprehensive library of chemical technology. With regard to the difficult problem of the dyes industry, Dr. Carpenter thinks that the course followed in 1915 in developing the explosive manufactures of the country, viz. to use all and everybody, great and small, in order to get all working in the direction of making up the shortage, is the right one; and that the concentration of the work in the hands of only a few firms, as appears to be the present policy in dealing with the dye situation, will not produce such a measure of national success as if all the resources of the country are utilised. Lord Moulton has accepted the position of president of the association. Mr. R. G. Perry, C.B.E., has been elected chairman, in succession to Dr. C. Carpenter, and the Rt. Hon. J. W. Wilson has been elected vice-chairman.

IT was recommended by the Imperial War Conference held in London last summer:—"That it is desirable to establish in London an Imperial Mineral Resources Bureau, upon which should be represented Great Britain, the Dominions, India, and other parts of the Empire." The importance of the matter has been urged on several occasions in the columns of NATURE (see, for example, the issues for October 5, 1916, and September 13, 1917). By direction of the War Cabinet, the Minister of Munitions, in May, 1917, appointed an Inter-Departmental Committee to prepared a scheme for the establishment of the proposed Bureau. After consideration of the report of this Committee the Government instructed the Minister of Reconstruction, in consultation with the Secretaries of State for the Colonies and India, to give effect to the recommendations of the Imperial Conference and the findings of the Committee. It is now announced that the Bureau will be incorporated by Royal charter, and the governing body, which will be under the presidency of the Lord President of the Council, will consist of the following:—Chairman, Sir Richard Redmayne, K.C.B.; nominated by the Canadian Government, Dr. W. G. Miller; Commonwealth of Australia, Mr. W. S. Robins; New Zealand, Mr. T. H. Hamer, of the High Commissioner's Office; Union of South Africa, the Rt. Hon. W. P. Schreiner, C.M.G.; Newfoundland, the Rt. Hon. Lord Morris, K.C.M.G.; India, Mr. R. D. Oldham, F.R.S.; nominated by the Secretary for the Colonies, Dr. J. W. Evans; nominated by the Minister of Reconstruction (in consultation with the Institution of Mining and Metallurgy, the Institute of Metals, the Iron and Steel Institute, and the Institution of Mining Engineers), Mr. W. Forster Brown (Mineral Adviser to H.M. Woods and Forests), Prof. H. C. H. Carpenter (president of the Institute of Metals), Dr. F. H. Hatch (member of the Mineral Resources Advisory Committee of the Imperial Institute), Sir Lionel Phillips (lately Director of the Mineral Resources Development Department, Ministry of Munitions), Mr. Edgar Taylor (ex-president of the Institution of Mining and Metallurgy), and Mr. Wallace Thorneycroft (president of the Institution of Mining Engineers). Mr. Arnold D. McNair has been appointed secretary. All communications regarding the Bureau should be addressed to the Secretary, Imperial Mineral Resources Bureau, Holborn Viaduct Hotel, E.C.1.

AMONG the recent additions to the Municipal Museums, Hull, we notice the collection of birds' eggs, land, fresh-water, and marine shells, all from Lincolnshire, formed by the late John Beaulah, of Ravensthorpe; also two very large narwhal tusks, and an excellent model of the railway engine *Victoria* and tender, dated 1859, which was shown at the Great Exhibition in 1861, bequeathed by the late H. Astropp.

MR. A. J. LOSEBY, the veteran Registrar of the Market Bosworth County Court, has sent us a copy of his work entitled "The Great Hereafter and the Road to Perfection" (London: A. H. Stockwell, price 1s.). Though the subject lies outside the usual range of this journal, we cannot help remarking on the manner in which the elemental aspirations of humanity are dealt with in these blank-verse narratives, which maintain a high level by their dignified simplicity. The story of the triumph of motherhood in the midst of horrors that creep upon a flaming world is Dantesque without being imitative.

THE Museum Journal of the University of Pennsylvania (vol. viii., No. 4, December, 1917) is devoted to an account by Mr. C. S. Fisher of the work done by the Egyptian expedition at Memphis financed by

Mr. Eckley B. Coxe, jun. Portions of the palace of Meremptah have been excavated with important results. On the daïs where the king's throne stood were found four large panels, each containing a bound captive—a negro, a Libyan, a Sardinian, and a fourth not yet identified. In the stratum assigned to Ahmose II. there was found a cache of gold and silver jewelry. At Dendereh was discovered a necklace composed of selected amethysts and carnelians, the large beads bearing the name of Sesostris I. (B.C. 1980–35) inscribed upon them.

IN *Folklore* (vol. xxix., No. 1) Mrs. M. A. Holland, in a paper entitled "The Influence of Burial Customs on the Belief in a Future State," examines Sir James Frazer's well-known paper, "On Certain Burial Customs as Illustrating the Primitive Theory of the Soul" (Journal of the Anthropological Institute, 1885). The author examines this theory from the pre-animistic point of view, and discusses certain customs associated with burial and the modes adopted by early man for the disposal of the corpse. As an illustration of the method of inquiry, she inquires why, according to Plutarch, an exile, reported to be dead, for whom funeral ceremonies have been performed, may not re-enter his house through the door, but must find a way through the roof. The hitherto accepted explanation is that he is still officially dead, must be considered a ghost, and as such it is physically impossible for him to cross the threshold, which has been rendered ghost-proof by a mystic barrier of fire and water. But the more primitive motive may have been that he was regarded as uncanny because, officially speaking, he had been once dead, and so must not be given the chance of contaminating a holy place like the threshold. The paper gives a good *résumé* of the more recent views on animism, and deserves study.

SINCE the house-fly has been clearly recognised as a great danger to the health of the community much attention has been paid to a study of its habits, and particularly to the conditions which are favourable for breeding. One aspect of the subject—the over-wintering of the house-fly—is dealt with in an article by Mr. R. H. Hutchison in the *Journal of Agricultural Research* (vol. xiii., No. 3). The conclusion of the author, after about three years' experimental work on the subject, is that there is no evidence to show that house-flies persist as adults in houses or stables from November to April, for a temperature lower than 32° F. is fatal if continued for any length of time. On the other hand, if flies find access in the autumn to buildings such as restaurants, where insufficient attention is given to the disposal of kitchen waste, they will continue breeding throughout the winter. In such cases the flies present in March or April, which are the offspring and not the survivors of those which found their way into such places in the preceding autumn, will escape on warm days and produce the hordes which appear late in May. From experiments with larvæ and pupæ, and from the fact that house-flies do not appear in large number until late in May, the author concludes that only a small percentage of the larvæ present in manure-heaps in the autumn live through the winter to give rise to adults in the spring. These conclusions emphasise once more that the proper disposal of kitchen waste is the only effectual method of attacking the house-fly.

MR. R. S. LULL (*Amer. Journ. Sci.*, vol. xlv., p. 337, 1918) describes under the new name Laoporus a number of quadrupedal tracks from Carboniferous strata in the Grand Cañon of the Colorado River. In referring some smaller impressions to Exocampe, a genus known in the Trias of Connecticut, the author remarks that these tracks are surely not reptilian, nor are they proved to be amphibian. He places them in Williston's Protopoda, a group so far known only by its footprints.

THE subject of the deposition of flint is further pursued by Mr. R. S. Dean in reference to the Missouri cherts (*Amer. Journ. Sci.*, vol. xlv., p. 411, 1918). It is urged that the association of carbon dioxide with the silica hydrosol in the presence of calcium carbonate leads to the formation of an acid carbonate that becomes readily dissociated. Calcium ions thus arise and precipitate colloidal silica, with greater effect than the hydrogen ions of less valency that are formed from the dissociation of carbonic acid. Experiment shows that without carbon dioxide a colloidal silica solution may remain stable in the presence of ground calcite for more than a year, while the presence of carbon dioxide promotes precipitation in an hour. In Mr. Dean's experiments actual silicification of the calcite did not occur, but in this matter the author regards time as an important factor.

THE Agricultural Statistics of India (vol. i.) for 1915–16 were published early this year by the Government Printing Office, Calcutta. Considerable progress has been made since 1906–7; the total number of bovine livestock has increased by 60 per cent., and is now 149 millions; the totals for "cultivable area" and "net area cropped" show a steady increase. The areas devoted to cotton and jute suffered a decline (exceeding 25 per cent.) from the previous year, probably caused by a fall in price due to the war. On the other hand, the area under indigo (chiefly in Madras Province) was more than doubled. It is reported that the official trials of the yield of the various crops indicate a general increase in the yield per acre since 1911–12; in the case of sugar-cane in Bengal the increase exceeded 16 per cent. The increased cotton yield in Sind (more than 20 per cent.) is ascribed to the use of Egyptian cotton-seed.

IRON, though a common component of thermo-couples, has the disadvantage of oxidising rapidly when exposed to temperatures beyond 500° C. It would be possible (according to O. L. Kowalke, in American Electro-chemical Society Proceedings, October, 1917) greatly to extend the use of iron in thermo-couples if a method could be devised of protecting it from oxidisation by a covering which would not appreciably affect the e.m.f. This result is achieved by "calorising" the iron, *i.e.* forming on its surface a coating of a rich alloy of aluminium. Iron so treated can be exposed to temperatures as high as 1000° C. without oxidising. Tests show that calorised iron when used with constantan gives the same thermo-e.m.f. as ordinary iron, and has a longer life.

IN the *Cairo Scientific Journal* (vol. ix., No. 101, 1917) is a paper by the late Sir Armand Ruffer on the use of natron and salt by the ancient Egyptians. Natron is a natural soda deposit consisting of impure sodium carbonate and bicarbonate, and the question of its use for the embalming of mummies by immersion in a natron bath, as indicated by Herodotus, has been investigated by chemical and microscopical methods. In the result it is agreed that salt and natron were used by embalmers, but no evidence was found that the bodies were placed in a natron bath or a salt bath. It is not intended to deny that the accounts given by Herodotus are correct; indeed, they are corroborated in some of the other details, and

bear the stamp of truth, but it appears certain that no bodies prepared by the method Herodotus describes have been found so far.

ACCORDING to the *Scientific American* for June 22, the American Government has received thousands of suggestions for the protection of sea-going vessels from attack by submarine. Often the same suggestion is made by many different inventors, the great majority of whom show a lamentable ignorance of the conditions which prevail at sea. Seven devices are illustrated, four of which consist of padding for the hull, which would either increase the resistance of the ship and diminish its speed greatly, or would be carried away by the first heavy sea. Another device deflects the torpedo below the keel, the inventor not appearing to know that it would be fired by the deflection. The other devices are for preventing the sinking of the vessel after she has been struck, and involve either an inner hull or a series of air-bags which can be pumped up and pulled under the side of the vessel struck. Would-be inventors of devices for this purpose might save themselves and the Government Departments much trouble by consulting this article.

ATTENTION may be directed to a very useful article by Dr. P. E. Spielmann in the *Chemical Trade Journal* for July 6 and the three previous issues, giving a summary description of the constituents of coal-tar and their properties. A large number of substances has been found in coal-tar—from three hundred to four hundred, of which about one hundred and fifty have been determined quantitatively and ninety definitely isolated. On a large scale only four are separated as the pure individual substances, namely, benzene, toluene, naphthalene, and phenol, though others, such as xylenes, cresols, and the hydrocarbons of solvent naphtha, are used in considerable quantities in the form of mixtures of their homologues. The article, which is based upon a German account with additions and modifications, is designed to give a general survey of the lesser-known as well as the more valuable substances obtainable. By reason of the exploitation of the coal-tar industry in Germany the minute examination of the constituents of tar has so far been due largely to German chemists. The results obtained are of great value, and it is hoped that detailed and difficult work of this kind will in the immediate future be carried on in this country, since our chemists are fully capable of doing it. In any case, the information collected will prove serviceable.

THE first of a series of articles on time studies for rate setting on machine tools appears in *Industrial Management* (*The Engineering Magazine*) for June. The author, Mr. Dwight V. Merrick, has had exceptional opportunities of studying this important subject. Some nineteen years ago he became associated with Dr. Taylor, and for the last fifteen years has specialised on the taking of time studies and the setting of tasks and rates. He also possesses the faculty of setting down in clear, concise style the knowledge he has gained during lengthy investigations, and his articles can be recommended confidently to any who wish to become further acquainted or to make personal experiments with Dr. Taylor's efficiency methods. Full instructions are given for the practical carrying out of time studies and for the analysis of the results. The matters dealt with include:—(*a*) Study of the work and conditions that influence its performance; (*b*) analysis of the work into its elements; (*c*) observing and recording the elapsed time for the performance of each of the elements; (*d*) study and analysis of the records obtained in (*c*); (*e*) determining a just time for the performance of each of the elements; (*f*) preparing from the time-study records an instruction card, including the determining of an allowance for fatigue and unavoidable delays. The first article includes formulæ and a set of interesting graphs giving the "variation allowance," *i.e.* the additions that must be made to the actual sum of the unit times in order to take care of the factors that slow down work. Fatigue is one of the major factors, and its influence is relatively diminished as the percentage of handling time is lessened for the complete cycle of operations. Those interested will find a great deal of valuable practical information in these articles.

SIR WILLIAM RAMSAY before his death had compiled a biography of Dr. Joseph Black, whose fundamental experiments on chemical combination and on heat made a lasting impression on science. This volume, with an introduction by Prof. F. G. Donnan on Sir William Ramsay himself, illustrated by sundry reproductions and portraits, is now in the press, and will be published by Messrs. Constable. Besides an account of Dr. Black's life and work, there are some of his letters and descriptions of academic life in Glasgow and Edinburgh of the eighteenth century.

MESSRS. J. WHELDON AND CO., 38 Great Queen Street, W.C.2, have shown enterprise in issuing a catalogue, called by them a "War Economy" catalogue, of books relating to botany likely to be of especial interest and service at the present time. It contains some 2000 items, arranged conveniently under the headings of Agriculture, Husbandry, and Gardening (general subjects), Cereals and Bread, the Flower Garden, Forestry, Timber, etc., Fruit and Fruit Trees, Grape Vine, etc., Grasses and Forage Plants, Herbals, Hybridity, Heredity, etc., Orchids, Vegetable Gardening, Economic Botany, and Medical Botany. It will doubtless appeal to many readers of NATURE. Copies are obtainable from Messrs. Wheldon for the sum of twopence.

OUR ASTRONOMICAL COLUMN.

THE NEW STAR IN AQUILA.—The decline of the new star appears to be proceeding very slowly, the brightness on July 27 being still about equal to that of the neighbouring 4th magnitude star θ Serpentis. The visual spectrum, as observed by Prof. Fowler, has shown but little change during the past fortnight. The bright lines of hydrogen and the band λ 464 were very conspicuous throughout this period when observations were possible, and the green line about λ 501, which is possibly identical with the chief nebular line, was of nearly the same brightness as H_β. Three fainter lines in the yellow, about $\lambda\lambda$ 588, 576, and 568, also remained visible.

THE GENERAL MAGNETIC FIELD OF THE SUN.—The results of a further investigation of the Zeeman effects due to the general magnetic field of the sun have been given by Messrs. Hale, Seares, Van Maanen, and Ellerman (*Astrophys. Journ.*, vol. xlvii., pp. 206–54). The photographs were taken in the third order of the 75-ft. grating spectrograph in connection with the 150-ft. tower telescope at Mount Wilson. With the aid of suitable polarising apparatus the observations are reduced to the measurement of line displacements, but these are so minute, and the lines so wide in comparison with their shifts, that definite evidence of the reality of the displacements has been established only after very great labour. It is satisfactory to find, however, that the twenty-six additional lines which

have been observed to give measurable displacements confirm the earlier results, and seem to place beyond reasonable doubt the conclusion that the sun behaves approximately as a uniformly magnetised sphere, with a polarity corresponding with that of the earth. The deduced values of the field-strength in Gaussian units at the sun's magnetic pole range from 9·9 to 54·7, but it is shown that, in general, the values corresponding with a given line-intensity are approximately equal. For iron and chromium, at least, there is a rapid decrease in field-strength with increasing line-intensity, and, in view of Mr. St. John's conclusion that lines of increasing intensity represent successively higher levels in the solar atmosphere, it would appear that the strength of the sun's general field falls off rapidly with increasing elevation above the surface. The part of the field at present accessible to observation lies within the bounding surfaces of a thin shell in the solar atmosphere about 150 km. in thickness. The anomalous behaviour of certain lines which fail to show displacements has not yet been completely explained, but the lines in question may possibly originate outside the effective field.

THE SPECTROSCOPIC BINARY BOSS 1082.—This star, of magnitude 5·3 and type G5, was found to have a variable velocity by the observers at Mount Wilson. The orbit has now been computed by Mr. J. B. Cannon from forty-two photographs of the spectrum taken at the Dominion Observatory, Ottawa, during the years 1916, 1917, and 1918 (Journ. R.A.S. Canada, vol. xii., p. 210). The elements of the orbit, with their probable errors, are as follows:—

$P = 121$ days	
$K = 28{\cdot}19$ km.	$\pm 1{\cdot}2$ km.
$e = 0{\cdot}019$	$\pm 0{\cdot}042$
$\omega = 285°$	$\pm 42{\cdot}68°$
$\gamma = -40{\cdot}47$ km.	$\pm 0{\cdot}81$ km.
$T = $ J.D. 2,421,137·55	$\pm 14{\cdot}26$ days
$a \sin i = 46{,}900{,}000$ km.	
$m_1^3 \sin^3 i = 0{\cdot}28 \times$ sun	
$(m_1 + m)^2$	

MARINE BIOLOGY IN THE UNITED STATES.

UNDER the direction of Dr. A. G. Mayer, the Department of Marine Biology of the Carnegie Institution of Washington continues to carry out researches of great value, and vol. xii. of the Papers from the department, issued March, 1918, fully maintains the high standard of previous volumes. From the point of view of general interest, perhaps the most striking paper is Mr. E. W. Gudger's account of the habits of the gaff-topsail catfish (*Felichthys felis*), a large catfish which is found at Beaufort, North Carolina. In this species the ova, which are very large, being as much as 1 in. in diameter, are carried in the mouth of the male parent until the larvæ are hatched, and the young are retained in this situation for some considerable time until the yolk-sac has been absorbed. The largest number of eggs found in the mouth of any one male was fifty-five, and numbers above twenty were quite frequent. The habit of oral gestation in catfishes of various species and from many different geographical regions has, of course, long been known, but the carefully ascertained details recorded in the present paper will be much appreciated by field naturalists.

Mr. Gudger also contributes a memoir on the Barracuda (*Sphyraena barracuda*), a well-known West Indian fish of fierce and voracious habits, which is much used as a food-fish. In the course of this memoir considerable space is devoted to a discussion of the occasionally poisonous character of this fish. As is well known to West Indian residents, although the flesh is generally a perfectly wholesome article of diet, occasional specimens are met with which when eaten cause serious illness, with symptoms which are considered distinct from those of ptomaine poisoning. Although the author has been at some pains to collect all the literature dealing with this poisoning, he has failed to find any modern scientific account by a medical writer, and it would appear to be a matter which calls for a thorough investigation by those interested in tropical disease. The fact of the occurrence of these cases has been quite familiar to medical practitioners in the West Indies for many years, but, judging from the information in the present memoir, little progress has been made in discovering the cause of the trouble.

Another paper dealing with fishes is one by Mr. C. F. Silvester on fishes new to the fauna of Porto Rico. As a result of a three weeks' visit to the island the author obtained eight species which he regards as new to science, and the present communication is devoted largely to a detailed description of these, illustrated by excellently coloured figures.

Miss E. G. White deals with the origin of the electric organs in *Astroscopus guttatus*, and gives a valuable survey, with a very complete bibliography, of the whole question of the electric organs of fishes, which should be very useful to anyone seeking information on this subject.

Dr. Mayer himself contributes two short papers of considerable importance. The first describes a series of experiments on toxic effects due to high temperature, in which a number of reef-corals were kept in warm ocean-water for sixty minutes in the dark, and the temperature was found which was just sufficient to kill the coral. The author concludes that "it seems possible that death from high temperature may be due to the accumulation of acid (possibly H_2CO_3) in the tissues, the rate of formation of this acid being related to the rate of metabolism of the tissues. Thus animals of the same class having a high rate of metabolism, as measured by oxygen consumption, are more sensitive to heat and to CO_2 than those having a low rate of metabolism." Dr. Mayer's second paper is a short note, in continuation of previous work, on nerve-conduction in diluted and in concentrated sea-water, the Scyphomedusa (*Cassiopea xamachana*) being the animal used in the experiments, and the salinities employed ranging from 18·13 to 60·96 per thousand.

Mr. J. F. McClendon writes an important paper on "Changes in the Sea and their Relation to Organisms." Adopting the most refined modern methods of analysis, he has studied a number of physical and chemical problems which have a direct bearing on the life of the plants and animals of the sea. Amongst the problems dealt with are ocean currents, oxygen tension in sea-water, and the chemical precipitation of calcium carbonate in sea-water, his observations on the last-named being particularly suggestive.

Mention must also be made of Mr. S. C. Ball's observations on the migration of insects to the Rebecca Shoal light-station, an isolated station 105 miles from the mainland of Florida and 95 miles from the coast of Cuba. Mosquitoes and house-flies are the insects chiefly discussed, and some striking figures are given which have an important bearing on the problem of insect migration. Other papers are on amphibians and reptiles from Porto Rico and the Virgin Islands by H. W. Fowler, and on the botanical ecology of the dry Tortugas by H. H. M. Bowman. Dr. Mayer is to be congratulated upon a most interesting and important volume. E. J. A.

GYPSUM IN SOUTH AUSTRALIA.

SOUTH AUSTRALIA possesses extensive deposits of gypsum, and the technical importance of this mineral, when of a sufficient degree of purity, has led the State Department of Chemistry to undertake an investigation of the deposits and of their possible applications. The results of the inquiry are contained in Bulletin No. 7 of the Department, the author of which is Mr. D. C. Winterbottom. The bulletin has been extended to form a monograph on the subject of gypsum, although it is admitted that, owing to the difficulty of procuring the original journals in Adelaide, the references to previous work are incomplete. Nevertheless, much interesting information has been collected and brought into a convenient form, so that the publication has considerable value, apart from the special descriptions of local conditions.

The most important deposits occur in the neighbourhood of Marion Bay and Cape Spencer, in the hundred of Warrenben, at the south end of Yorke Peninsula. These are gypsum lakes, dry in summer but covered with water in winter, the mineral forming a compact layer of translucent crystals, resting on a floor of hard limestone. The layer varies from 6 in. to 4 ft. thick, but in one of the lakes a thickness of 8 ft. is attained, although the greater part of this, being below water-level, has not yet been worked. The water of the lakes being a strong brine, the mineral as quarried contains salt, most of which washes out when the broken mass is exposed to the weather in the stock pile for a few months. In addition to these massive deposits, sandhills occur at Lake Fowler, in the hundred of Melville, Yorke Peninsula, which are entirely composed of flour and seed gypsum, some of the quarry faces being from 60 ft. to 80 ft. in height, whilst the mineral extends below the present floor-level. Flour and seed gypsum are widely distributed throughout the State, largely in the arid regions, but these deposits have been little worked owing to the difficulties of transport.

The workings in the hundred of Warrenben are already fairly extensive, and modern methods of quarrying, blasting, loading, and shipping are employed. Whilst the inferior qualities, including those which occur in the form of flour and seed, may be used as fertilisers, only the purer mineral has been converted into plaster of Paris, this being its most important technical application. Attempts had been made to manufacture plaster in Australia for many years, but without much success, and until recently the Australian requirements have been supplied by importation from Germany and the United States. Several companies have been formed since the outbreak of the war and are successfully producing plaster. There are now two plaster mills in South Australia, two in Victoria, and one in New South Wales, all using South Australian gypsum. Both the rotary calciner and the kettle process are in use, and a preliminary washing of the crushed rock is necessary in order to remove soluble impurities and fine, slimy calcium carbonate. Organic matter is always present, and greatly influences the quality of the product, since a pure white plaster is desired for most purposes, and the whiteness is readily destroyed by even slight charring of organic impurities. Such charring is most serious in the kettle process, as in this case the material is not reground after calcination; whilst plaster made in a rotary calciner, although darker at first through local overburning, loses its colour in the subsequent regrinding. On the other hand, overburning is more easily avoided in the kettle process, and it appears to yield a product with a more uniform rate of setting. Tables are given in which a large number of Australian and imported plasters are compared in regard to setting-time, colour, mechanical strength, and other properties, the chemical analyses being also included. Experiments in the preparation of plaster from seed and flour gypsum are described, and recommendations as to the precautions to be taken to ensure a good and uniform product are made. Given sufficient care in manufacture, the Australian deposits are quite capable of yielding plaster of the highest quality. Charred organic matter and hygroscopic salts are the most deleterious impurities.

In view of the absence of deposits of sulphur or of high-grade pyrites from South Australia, the possibility of using gypsum as a source of sulphuric acid is discussed. Many processes have been patented, but none has so far emerged from the experimental stage, although the preparation is quite feasible, and may, in the face of the necessity for obtaining sulphuric acid from local sources, prove to be of some importance.

THE CLAIMS OF GERMAN IRONMASTERS.

SIR ROBERT HADFIELD has done the nation excellent service by issuing a translation of the report of the general meeting of the Association of German Ironmasters held in April last. The report gives an account of the discussions at the meeting and of the speeches made at the dinner which followed it; there appear to have been only two papers submitted, namely, "The Share Borne by the German Ore-bearing Beds in the Maintenance of the Home Iron and Steel Industries" and "The Reserves of Coal in Germany as Compared with the World's Reserves"; these are given in the report only in brief abstract, but their tendency can be well gathered from the discussion upon them. The whole of the second paper may probably be looked upon as summarised in the one sentence, "Germany in any case is the coming country in Europe"; it may, however, be noted that the author of that paper looks upon the coalfields of Belgium and Northern France, now in German hands, as valuable pledges to be used in the ultimate peace negotiations. Another speaker emphasises the impossibility that a nation with a production of twenty million tons of coal (*i.e.* France) should be able to conquer Germany with its production of more than 300 million tons; he must rate the intelligence of his audience very low if he thinks that it will not carry this comparison far enough to add the coal production of Britain and of the United States to that of France. Where would his comparison stand then?

The second paper constitutes a variant upon the theme which we have heard before: the imperative need that the French Briey and Longwy iron-ore fields should be retained in German hands, being the "essential natural requirement," in view of future wars of the German Empire—"Empire that has been attained by blood and maintained by blood," as one of the speakers at the dinner called it. Of course, the demand for the retention of these iron supplies is masked by the pretext that it is put forward in the interests of the German working-man; no hint is given that it is the vast profits to be derived from these rich iron-ore fields that the German ironmasters have all along had in view. No one who knows anything of German economics can doubt that this war could never have been begun had it not been for the willing concurrence of the great German ironmasters—and the price that they demanded for their assistance has now been made plain. Moreover, if it be true, as rumour persistently

asserts, that the Kaiser's interest in the great Krupp ironworks is not a purely platonic one, pursuit of material gain may have proved nearly as powerful an incentive as autocratic ambition; and to these ignoble motives millions of human lives have been brutally sacrificed. H. L.

VIBRATIONS OF TALL CHIMNEYS.

FROM the point of view of stability, measurements of the vibrations of tall chimneys are important, especially in a country like Japan, which is subject to severe earthquakes. Experiments on three chimneys of concrete reinforced by steel rods are described in a valuable paper by Prof. Omori, published in the Bulletin of the Imperial Earthquake Investigation Committee (vol. ix., 1918, pp. 1–29). One of these chimneys, erected by the Kuhara Mining Co. at Saganoseki, is the tallest in the world. It is 550 ft. in height, 42 ft. 8 in. in diameter at the base and 27 ft. 5 in. at the top, the thickness of the wall being 29½ in. at the base and 7 in. at the top. The total weight of the structure, including the foundation, is 9500 tons, and the pressure of the shaft on the ground below is three tons per square foot.

When the chimney was finished measurements were made on five days (December 22–26, 1916) by means of two horizontal vibration recorders fixed to the top of the wall. The wind at the top attained a velocity of 24 metres per second on the first day, and the high value of 35 metres per second on the last; on the three intervening days it never exceeded 7 metres per second. With the latter velocity the vibrations of the chimney were insignificant, but they increased rapidly with the strength of the wind, the range (or double amplitude) being 20 millimetres in the direction of the wind and 186 millimetres at right angles to it. The period of the vibrations was almost constant, and varied from 2·52 to 2·58 seconds, the maximum acceleration on December 26 being 565 millimetres per second per second, or nearly one-third more than that of the semi-destructive Tokyo earthquake of 1894. Prof. Omori notices that the period of vibration is distinctly greater than that of the strong vibrations of a great earthquake (which is usually from 1 to 1½ seconds), and concludes that, in a district such as Saganoseki, in which the earthquakes are by no means violent, the effects of wind-pressure are likely to be more important than those of earthquake motion.

VIBRATIONS: MECHANICAL, MUSICAL, AND ELECTRICAL.[1]

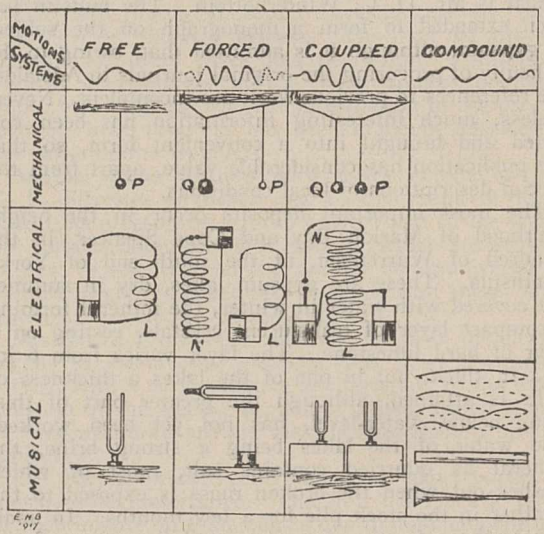
I.—*Introductory Survey.*

THE subject of vibrations is a large one. It comprises a great variety of to-and-fro motions, and these may be executed by diverse systems at widely differing rates. Near one border of the subject lie phenomena so simple that a child may grasp their leading features. Near the opposite border there are phenomena of exceeding complexity, and their full solution is still awaited.

It thus appears that parts of the subject are too elementary and familiar for detailed treatment here, while others may be not yet ripe for general description. But between these extremes there are portions or aspects of the subject that may prove both interesting and practicable.

To indicate and locate a few such portions, a brief survey of the subject was then taken. Many ways of classifying vibrations are available. But without aiming at logical precision, a somewhat rough method was considered convenient. Thus, since a vibration is a to-and-fro motion, the various types of such motions may be placed in columns. Secondly, since these motions are executed by some physical systems, the various systems may be placed in rows or lines. This gives the subdivision shown in Table I.

TABLE I.—*Typical Vibrations.*



Neither the columns nor the rows need stop just where they do in this table, for the subject extends further in each direction. Moreover, each column and row admits of further subdivision, so that the ramifications of the subject are almost beyond enumeration. But, as it is, it serves to locate the portions to which chief attention was directed. These were examples of two or more associated vibrations, whether forced, coupled, or compound.

II.—*Forced and Coupled Vibrations.*

Forced and *coupled* vibrations must be distinguished from each other and from the simplest class of all, called *free* vibrations. To do this, pass along the first row in Table I., taking the cases of the pendulums there shown.

If a pendulum-bob is pulled aside and let go, it returns towards its zero position under the combined effect of gravity and its slant suspension. On reaching the zero position with a certain velocity, it overshoots the mark because the bob has inertia. Thus a free vibration is set up. This may continue until slowly extinguished by friction, which is operating all the time to diminish the swings. Next, let the point of suspension of a pendulum be moved slightly to and fro by periodic forces. Then the pendulum would be set in vibration and kept going. Further, the motions would settle down to a quite definite amplitude and phase. These are *forced* vibrations. Their amplitude would depend upon that of the point of suspension, and also on the *tuning*. By tuning is meant the degree of agreement between the period natural to the pendulum and that of the forces applied to it. The closer the tuning between them, the better the response. Upon the tuning depends also the *phase* of the forced vibrations. When the forces alternate appreciably more slowly than the vibrations natural to the pendulum the two are almost in like phases. But when the forces alternate more quickly than the pendulum the latter swings almost in opposite phase.

This change of phase of forced vibrations was illus-

[1] Abstract of a discourse delivered at the Royal Institution on Friday, March 8, by Prof. Edwin H. Barton, F.R.S.

trated by three pendulums, all hanging from the same tightly stretched horizontal cord. One pendulum had a heavy bob, and by its swings moved the stretched cord. It thus acted as *driver*, and applied forces to the other two pendulums, which had light bobs, and so were easily *driven*. Of these pendulums one was shorter and one longer than the driver. They soon settled to opposite phases after the heavy bob was set in motion. *Resonance curves* showing the varied responses of such driven pendulums as the tuning is altered were then thrown on the screen.

In the cases just dealt with the light bob is set in motion at the expense of energy taken from the heavy one. But on account of the great disparity of the bobs, this loss entailed no appreciable diminution in the vibrations of the heavy bob or driver.

Consideration was next given to the case where equal bobs hang from a tight cord. While both pendulums are hanging at rest one bob is struck. Its vibrations disturb the other pendulum and set it in motion. But, obviously, while the driven pendulum gains an amplitude equal to that first possessed by the driver, the driver itself would have lost all its motion. The other then becomes the driver in turn, and transfers its energy back to what was originally the driver.

This palpable surging of the energy to and fro between the two pendulums marks them as showing what may be called *coupled* vibrations. In both cases the action of the driver on the driven is recognised. But in the case of coupled vibrations the *reaction* of the driven on the driver is palpable and recognised also, whereas in what are called forced vibrations this reaction is undiscernible or ignored.

In the case of coupled vibrations just shown the vibrations of each pendulum seem quite simple, but slowly and alternately wax and wane in amplitude—that is, they exhibit what are termed "*beats*." But it is well known that beats may be heard when two musical tones of slightly differing pitch are sounded together. Further, the number of beats per second is the difference of the frequencies of the two tones. Thus the waxing and waning vibrations of either pendulum may be regarded as the superposition of two simple vibrations of slightly different periods.

The next case studied was that of two precisely similar pendulums connected by hanging one from the bob of the other. One bob being started by a blow, it appeared to execute simple vibrations. The other moved with a pause or twitch instead of in simple fashion. Further, neither pendulum showed the waxing and waning of amplitude which was so marked in the other case where both hung from a stretched cord.

The questions which now naturally arise are:—(*a*) Why this contrast? and (*b*) Can the gap be bridged? The solution is simple. The difference in appearance is only a matter of different ratios of periods of the superposed vibrations, and this, again, is due to different values of the *coupling*, to borrow a term from electrical theory. We have changed suddenly from a very loose to a very tight coupling. We consequently passed at a bound from periods nearly equal (giving a slow waxing and waning) to periods the ratio of which exceeds 2 : 1 (involving the pause or twitch); for the theory shows that as the coupling increases the ratio of the periods increases also.

It is accordingly of interest to change the coupling gradually and so bridge the gap between the two motions which seemed so unlike. This was done by the cord-and-lath pendulum, in which the cord pendulum is suspended from an adjustable stud on the lath pendulum. When the two suspensions are near together, the value of the coupling is almost equal to the fraction of the lath-length at which the cord is attached. When this fraction is unity, as in the case of one pendulum hanging from the bob of the other, the coupling has the value $1/\sqrt{3}$, or 58 per cent. nearly. (These simple relations are for equal bobs and equal pendulum lengths.)

III.—*Electrical Vibrations, Forced and Coupled.*

On passing along the second line of Table I. it was noted how the various types of electric vibrations may be obtained and the striking analogy to them presented by the mechanical cases already considered.

Any electrical circuit containing a capacity and an inductance may exhibit electrical vibrations. For the fundamental electrical conditions are there present, just as the mechanical ones were in the case of a simple pendulum. If the condenser is charged by a suitable means, the quantity of electricity so displaced is urged to flow back again round the circuit by the electromotive force of the charged condenser. If the resistance of the circuit is small enough, the electromagnetic inertia (measured by the inductance) ensures that the current shall still flow after the condenser is discharged. Thus its charge is reversed. So the vibrations continue until the energy is dissipated by the resistance of the circuit. These are *free* electrical vibrations.

As an example of forced electrical vibrations we may think of a circuit with capacity and small inductance (like that of a Fleming cymometer) placed not too near to a circuit of similar frequency, but with much greater inductance. Then the cymometer will respond to the vibrations of the other—*i.e.* it will execute *forced* vibrations. These will not appreciably diminish the vibrations of the main circuit.

But let two electrical vibration circuits of comparable inductances and periods be placed together and started, then there is not only the action of the driver, but also a distinct *reaction* of the driven on the driver. Hence, as the vibrations of one circuit start those of the other, the latter by their growth check the former, causing them to die away. Thus there may be an interchange of energy between them. This, as we have seen with pendulums, corresponds with the superposition of vibrations of slightly differing periods, provided the action and reaction are small and the interchange slow. Further, it is known that if two such circuits are closely coupled, these two periods differ more widely. Hence a third circuit (say a cymometer) responding to either of them may detect these separate periods by giving a resonance curve with two humps instead of one.

IV.—*Traces from Coupled Pendulums.*

It has been seen that there is a certain general analogy between mechanical and electrical vibrations, whether free, forced, or coupled. The question now arises as to whether this analogy may reach or approach a quantitative exactness in all or any respects, and whether it can be utilised in any way.

Various mechanical vibrating systems differ widely. Some resemble the electrical case very closely, but none appears to be completely and exactly analogous to them in every detail. Indeed, the electrical case seems to be slightly simpler than any mechanical analogy yet put forward. But the differences are small, and the mechanical analogy may be highly useful as affording visible and tangible illustrations of those subtle electrical vibrations which can be neither seen nor handled. Especially is this the case if the model is readily adjustable to represent the various relations of the constants concerned and can be used for any initial conditions. Thus from such analogies some benefit may accrue to the non-mathematical student. But perhaps the highest advantage is realised only by those who combine the mathematical with the

experimental study, and grope after the ideal model which shall represent exactly the electrical or other phenomena in question. But, whatever the uses of

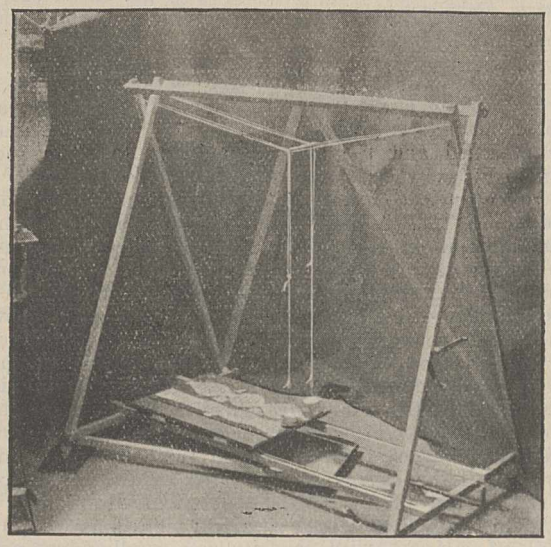


FIG. 1.—Coupled pendulums.

such models, certain it is that their design and study have appealed to many eminent men of science. In this connection it may suffice to mention Faraday, Maxwell, Lord Kelvin, Lord Rayleigh, Sir Oliver Lodge, Sir Joseph Thomson, Profs. J. A. Fleming, T. R. Lyle, of Australia, and W. S. Franklin, of America.

For either quantitative work or mere illustration the usefulness of such a model is much enhanced if its vibrations leave traces. This is easily arranged by letting the bobs carry funnels of sand under which a blackboard moves uniformly at right angles to the direction of vibration. In the portable apparatus shown in Fig. 1 the pendulums are of the double-cord type, and allow both traces to be obtained simultaneously and thus record the relation of amplitude and phase for each pendulum.

With this apparatus the coupling can be varied at will, and easily adjusted to any desired value from 1 per cent. to 60 per cent. or more. The greater the droop of the bridles, the greater the coupling, the quantitative relation being simple. It is noteworthy that for equal bobs and pendulum lengths a 60 per cent. coupling gives superposed periods as 2 : 1, just as in the electrical case for equal periods. Indeed, with any specified coupling the ratio of period is the same for this mechanical case and for the electrical one. The masses of the bobs and the lengths of the pendulums are adjusted at pleasure, and the initial conditions may be anything that is desired. (Simultaneous traces with this apparatus were then obtained, others exhibited, and photographs of a number thrown on the screen. One set of traces illustrated the *rapidly damped* vibrations of the *quenched spark*, and the corresponding *almost undamped* vibrations on the *antenna* in this system of wireless telegraphy.)

With equal bobs and equal lengths, the coupling being small, each pendulum exhibits in turn the same maximum and the same minimum as the other. With small couplings, equal lengths, but bobs as 20 : 1, the case of forced vibrations is approached. That is to say, the heavy bob loses but little amplitude, while that of the light bob grows from zero to its maximum. With bobs as 5 : 1, the heavy bob loses appreciably, while the light one proceeds to its maximum.

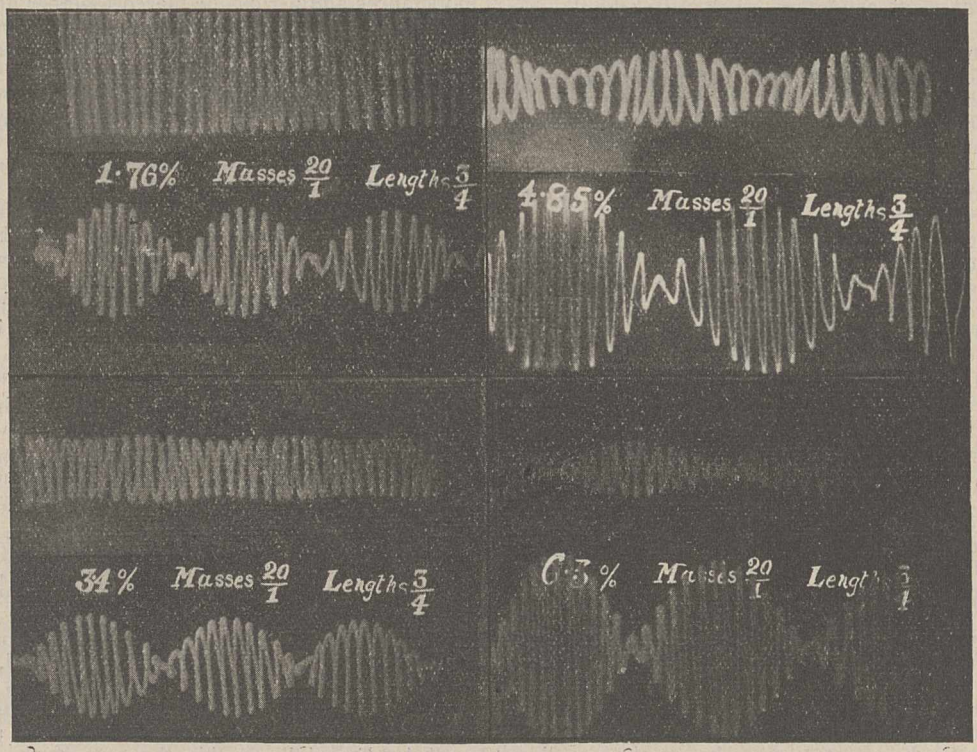


FIG. 2.—Vibration traces of coupled pendulums.

As the coupling increases from zero, the ratio of the periods of the superposed vibrations of the coupled pendulums usually increases continuously until it equals or exceeds 2 : 1. When, however, both lengths and masses are unequal, the *short* length having the *heavy* bob, a new feature appears. As the coupling gradually increases from zero, the ratio of the periods at first *diminishes*, reaches a *minimum*, and then *increases*. Thus the number of vibrations in a beat cycle at first *increases*, reaches a *maximum*, and then *decreases*. These special effects are shown in Fig. 2. They were theoretically predicted and then experimentally confirmed. The maximum number of vibrations in the beat cycle occurs for the highest coupling shown in the figure, viz. 6·3 per cent. The details as to bobs, lengths, and couplings are all indicated in the figure. The able collaboration of Miss H. M. Browning in this work was gratefully acknowledged.

(*To be continued.*)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

GLASGOW.—The Ferguson fellowship in applied chemistry, founded this year, is in the gift of the trustees of the Ferguson Bequest Fund, and is of the annual value of 200*l.*; it is ordinarily tenable for two years, subject to the fulfilment of the prescribed conditions. Candidates must be graduates in science of the University of Glasgow who have completed the curriculum for a degree in applied chemistry, or have taken chemistry as a principal subject in the Final Science Examination for a degree in pure science. The fellow is required to devote himself, during the tenure of his fellowship, to research in relation to some branch or branches of applied chemistry approved by the fellowship committee. His work may be carried out at the University, the Royal Technical College, or elsewhere, as the fellowship committee may direct. Candidates for the Ferguson fellowship for 1918 should, in the first instance, send their names to the registrar of the University early in the first term of the session 1918–19.

Science announces that gifts to Yale University in the past year and credited as endowment made a total of 256,000*l.* From time to time gifts have been announced, but the new items included 20,000*l.* as the Earl Williams Fund from Mrs. J. H. Williams for the benefit of the University Press, and 80,000*l.* from William L. Harkness as a building fund.

PROF. T. BRAILSFORD ROBERTSON, professor of biochemistry and pharmacology in the University of California, has been appointed professor of biochemistry in the University of Toronto. Prof. J. J. R. Macleod, professor of physiology and biochemistry in the Western Reserve University, has been appointed professor of physiology in the same University.

IN view of the practical impossibility while the war continues of holding the A.M.I.E.E. examination and of candidates having the requisite time to prepare for or undergo examination, the council of the Institution of Electrical Engineers has decided to suspend temporarily the institution rules in regard to examination. The greatest care will, nevertheless, be exercised by the council to ensure that only candidates possessing the qualifications laid down in the articles in respect of training and experience are admitted to associate membership.

ON Speech Day at King's School, Canterbury, on July 24, Mr. A. Latter, the headmaster, announced that as a permanent memorial to their son, William Frederick Drughorn, an old King's scholar, killed in action, Mr. and Mrs. J. F. Drughorn proposed to endow the school with laboratories, to be known as the Drughorn Science Buildings, at a cost of 25,000*l.*, subject to arrangements being made for outside students to have access to them. Mr. Drughorn, he said, wishes "to encourage scientific education in the country, and hopes that the scheme will be a means to our future defence against a repetition of the peaceful scientific invasion of our present unscrupulous enemies, to whom these buildings will be closed."

AT the ninth biennial vacation course, which meets in the Oxford School of Geography on August 1–16, special attention is being devoted to some geographical aspects of the Empire, while both in the lectures and in the practical geography classes (for the study of climate, land-forms, the home region, and exploration) various general problems are to be discussed. Excursions to places of geographical interest in the vicinity of Oxford have been arranged. The course is specially designed to be of service to teachers both in secondary and in elementary schools. Earl Denbigh is to lecture on "German Aims and the Causes of the War." In addition to the members of the staff of the Oxford School of Geography the lecturers will also include the Master of Balliol, Prof. F. Haverfield, Prof. C. Grant Robertson, Prof. Grenville A. J. Cole, and Prof. P. M. Roxby. Particulars of the course may be obtained from the Secretary, School of Geography, University of Oxford.

A COMMITTEE entitled the Officers University and Technical Training Committee has been appointed "to advise the Board of Agriculture, the Board of Education, the Ministry of Labour, and the Ministry of Pensions upon such courses of education and training as it may be desirable to arrange for the benefit of officers and ex-officers of H.M. Forces and men of like standing, particularly with the view of fitting them for suitable employment after the war; to consider any general questions arising in connection with such education and training, and when necessary to advise individual officers as to suitable courses of training." Among the members of the committee are:—Capt. W. D. Ross, University of Oxford; Mr. H. A. Roberts, University of Cambridge; Sir William Collins, University of London; Sir William Ashley and Prof. W. Ripper, Universities of Birmingham, Durham, Leeds, Liverpool, Manchester, and Sheffield; Principal E. H. Griffiths, Universities of Wales and Bristol; Mr. F. Wilkinson, Association of Technical Institutions; Mr. W. A. Nicholls, Workers' Educational Association; Mr. C. B. L. Tennyson, Federation of British Industries; Mr. Howard Martin, Surveyors' Institution; Sir Charles Bathurst, M.P., Central Chamber of Agriculture; and Mr. A. M. Samuel, Association of Chambers of Commerce. Lt.-Gen. Sir Alfred Keogh is the chairman of the committee, and the secretaries are Mr. G. H. V. Sutherland, of the Board of Education, and Mr. F. J. Bullen, of the Appointments Department, Ministry of Labour.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, July 8.—M. P. Painlevé in the chair.—The president announced the death of Charles Wolf.—G. **Bigourdan**: Notice on the life and work of Charles Wolf.—G. **Humbert**: The representations of an integer by indefinite, ternary, quadratic forms.—C. **Richet**, P. **Brodin**, and Fr. **Saint-Girons**: The effects of isotonic intravenous injections in hæmorrhage. From experiments on dogs in cases of grave hæmorrhage the authors recommend extensive intravenous

injections. The percentage of red corpuscles is lowered, but the mass of the blood is increased.—G. A. **Boulenger**: The relations of ontogeny to taxinomy in Batrachians.—MM. **Dimier** and J. **Bergonié**: The search for the guinea-worm by radiography. This parasite can be detected by the X-rays.—R. **Jonckheere**: Observations and identification of the new star in Aquila. Observations of magnitude were made on June 8, 9, 10, 11, and 12. The new star has been identified with one recorded on photographs taken at Johannesburg (August, 1910) and at Algiers (August, 1909, and June, 1895).—A. **Véronnet**: The maximum temperature of a star undergoing condensation.—A. **Leduc**: The density, compressibility, and atomic mass of argon. The numbers for density and atomic mass do not differ appreciably from those given by Ramsay and Travers.—Q. **Majorana**: Experimental demonstration of the constancy of the velocity of light emitted by a moving source. The source of light was a rotating mercury arc, with a peripheral velocity of 90 metres per second, and the light was examined by a Michelson interferometer.—P. **Weiss**: A property of ferro-magnetism.—P. **Boucherot**: Calculation of the propagation of alternating currents on long lines by the separation of the real and reactive powers.—E. **Bélot**: The experimental reproduction of mountain folds on the hypothesis of a horizontal displacement of the internal layers.—L. **Gentil**: The extension into Andalusia of strata in the province of Cadiz.—P. **Wintrebert**: The disjunction of the nervous and muscular functions at the period of latent automatism in the embryos of *Scyllium canicula*.—H. **Marichelle**: The theory of vowels and its applications to auditive re-education.—E. **Maignon**: The influence of the species of animal on the toxic power and mode of utilisation of the food proteins. The foods employed were white of egg, casein, and meat-powder; the effects on the dog and white rat are compared.—P. **Portier** and H. **Bierry**: The importance of the ketonic function in metabolism. Ketone formation by symbiotes. The pentoses (arabinose and xylose), the hexoses (glucose, levulose, galactose, sorbose), the bioses (saccharose, etc.), and certain polyalcohols (glycerol, mannite) are, in suitable media, attacked by symbiotes, giving, besides other products, acetyl-methyl-carbinol, $CH_3.CO.CH.(OH).CH_3$.—M. **Heitz-Boyer**: The mechanical reduction of fractures.—M. **Quénu**: Remarks on the preceding communication.

PETROGRAD.

Academy of Sciences, November, 1917.—V. L. **Bianchi**: Fundamental conceptions of zoogeographical divisions.—M. N. **Rimskiĭ-Korsakov**: Note on the aquatic Hymenoptera in the collections of the zoological museum of the Russian Academy of Sciences.—A. A. **Markov**: Generalisation of the problem of the successive exchange of balls.—O. **Kuzeneva**: List of the plants collected by the expeditions for exploring the basin of the Zeja, in the Amur province.—V. I. **Palladin** and V. P. **Illĭuviev**: The formation of zymase in plants.—K. M. **Derĭugin**: Obituary notice of the zoologists V. Ja. Lazdin and N. V. Prosvirov, killed in the Pamirs in 1916.—E. H. **Rosenthal**: Magnetic observations made in the Baltic governments in the summer of 1914.—N. M. **Krylov**: Various generalisations of the method of W. Ritz, and certain questions connected therewith.—V. A. **Steklov**: Remarks on quadratures.—N. I. **Andrusov**: The geological structure of the bed of the Straits of Kertch.—L. Ja. **Sternberg**: The Chinese heavenly twins from the point of view of comparative ethnography. (A reply to the article by V. M. Alekséjev: The immortal doubles of China and the daos with the golden toad.)—P. B. **Struve**: Preparatory studies on the history of political economy in Russia. I. To what school of economics did Henri Storch belong? II. History of political economy published in 1836 by Helmuth Winter, professor at Kazan University. The conception and the problem of commercial politics.—A. F. **Zaicev**: M. N. Katkov's views on Russia's commercial policy during the period 1860–80.

BOOKS RECEIVED.

The Main Currents of Zoology. By Prof. W. A. Locy. Pp. vii+216. (New York: H. Holt and Co.)

The Theory of the Relativity of Motion. By R. C. Tolman. Pp. ix+225. (Berkeley: University of California Press.)

Electrical Experiments. With 52 Diagrams and Full Details of Apparatus and Method of Procedure in about 80 Exercises. By A. Risdon Palmer. Pp. xii+115. (London: T. Murby and Co.) 1*s*. 6*d*. net.

Magnetic Measurements and Experiments. With 52 Diagrams and Numerous Fully-worked Examples. By A. Risdon Palmer. Pp. 124. (London: T. Murby and Co.) 1*s*. 6*d*. net.

The Statics of the Female Pelvic Viscera. Vol. i. In which the Evidence of Pathology, Phylogeny, and Ontogeny, and Clinical Investigation, etc., is Surveyed. By Dr. R. H. Paramore. Pp. xviii+383. (London: H. K. Lewis and Co., Ltd.) 18*s*. net.

The Strategic Geography of the Great Powers. Based on a Lecture Delivered during 1917 to Officers of the Grand Fleet and to the British Armies in France. By Dr. V. Cornish. Pp. viii+114. (London: G. Philip and Son, Ltd.) 2*s*. net.

The Life of Sophia Jex-Blake. By Dr. Margaret Todd. Pp. xviii+574. (London: Macmillan and Co., Ltd.) 18*s*. net.

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MACMILLAN AND CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.

Telegraphic Address: PHUSIS, LONDON.
Telephone Number: GERRARD 8830.