THURSDAY, JUNE 7, 1917.

BOOKS ON CHEMISTRY.

(1) *Elementary Qualitative Analysis: A Laboratory Guide.* By Prof. B. Dales and Dr. O. L. Barnebey. Pp. vii+205. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 5*s.* 6*d.* net.

(2) *Laboratory Manual of General Chemistry, with Exercises in the Preparation of Inorganic Substances.* By A. B. Lamb. Pp. vi+166. (Cambridge, Mass.: Harvard University Press, 1916.) Price 1.45 dollars.

(3) *A Text-book of Organic Chemistry for Students of Medicine and Biology.* By Prof. E. V. McCollum. Pp. xiii+426. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1916.) Price 10*s.* net.

(1) ALTHOUGH the value of instruction in qualitative analysis is far more dependent upon the teacher than upon the text-books provided for the students' guidance, much useful assistance is to be gained from the latter if they are based upon a sound method of experiment and observation. From this point of view the "Laboratory Guide to Elementary Qualitative Analysis" by Prof. Dales and Dr. Barnebey merits the attention of teachers in this country. The book is designed for the use of students who have done a year's work in general chemistry. The principles of qualitative analysis as based upon the theory of electrolytic dissociation are dealt with in an introductory chapter, which should prove helpful to students in bringing their experimental work into line with their training in general chemistry. An outstanding feature of the details of qualitative analysis is that the reactions of the several groups of bases and acids are studied comparatively with each of the reagents employed, instead of by the more usual method in which the tests for each base or acid are dealt with separately. This method of treatment has distinct advantages, especially as a training in the methods of observation. The group-tables for bases are similar to those usually employed, but the scheme for the detection of acids is somewhat new and is based upon the precipitation of the silver salts in distinctly acid and in neutral or slightly acid solution respectively. The instructions are clear, concise explanatory statements add considerably to their value, and the purpose of qualitative analysis as a basis for the further practical study of chemistry is very satisfactorily explained.

(2) The object of Prof. Lamb's "Laboratory Manual of General Chemistry" is to widen the horizon of study of first-year university students who have had a previous training in chemistry at a secondary school, and at the same time to stimulate their further interest in important generalisations of the science by means of experiments of a less familiar kind than those with which they have been previously acquainted. With these aims in view a number of quantitative experiments are described requiring varying degrees of previous knowledge and experimental skill, together with a series of semi-quantitative experiments in the more elementary portions of physical chemistry. The directions for each experiment comprise suggested reading from some standard text-book, a discussion of the general principles involved in the experiment, directions for the actual manipulation, tests and questions. Appended to each of the instructions is a blank sheet for laboratory notes; these are to serve as the basis for a full and connected account of the work done, which is afterwards to be written up.

Such attempts to combine instruction in theory with details of experiment and series of questions in a laboratory text-book are seldom satisfactory in actual practice. They are apt to stereotype the teaching, to take too little account of the individual difficulties of students, and to absolve the teacher of his real responsibilities. The selection of the experiments and preparations is for the most part sufficiently wide to provide a useful curriculum, but the descriptive headings and discussions are in many cases considerably more advanced than the actual laboratory experiments. Also, a number of the exercises, such as the determination of the electrical conductivity of a solution, the preparation of hydrazine sulphate and of chloropentamine cobaltic chloride, are much beyond the knowledge and manipulative capacity of an average first-year student in this country.

(3) The importance of organic chemistry to students of medicine and biology fully justifies the publication of an additional text-book if it serves their special requirements satisfactorily and stimulates their interest in the subject. These objects are very successfully achieved by Prof. McCollum's book. The subject-matter is presented in a clear and attractive form, the sequence of the compounds described is chosen with care and with an advantageous departure from the usual order, and suitable prominence is given to the methods of preparation, properties, and synthetical relations of substances of biological and physiological importance. Details in regard to laboratory and technical processes are intentionally restricted. Whilst this is not necessarily disadvantageous, the danger of introducing "paper chemistry" is not altogether avoided, as in the scheme of oxidation of alcohol to oxalic acid (p. 201), in which the stages of oxidation represented are not in accord with experimental methods.

Theoretical studies such as stereochemistry are developed as individual compounds come under consideration, a method of treatment which should appeal to the interest of students, although it necessitates a considerable use of cross-references. The prominence given to Nef's views on divalent carbon is somewhat out of proportion to the space allotted to other and more fully established views on the structure of organic compounds. References to recent work are very suitably introduced, and the more special chapters included in the book, such as those on fats and waxes, the ureides, the pyrimidines, pyrazines, and purins, and the carbohydrates, are well adapted to their purpose.

C. A. K.

THEOPHRASTUS.

Theophrastus: Enquiry into Plants, and Minor Works on Odours and Weather Signs. With an English translation by Sir Arthur Hort, Bart. (Loeb Classical Library.) In 2 vols. Vol. i., pp. xxviii+475; vol. ii., pp. ix+499. (London: W. Heinemann; New York: G. P. Putnam's Sons, 1916.) Price 5*s.* net each vol.

ENGLISH botanists are under a great debt of obligation to Sir Arthur Hort for this edition of some of the principal works of Theophrastus, and they are also greatly indebted to Sir William Thiselton-Dyer for his labours in the difficult task of identifying the various plants named by the Greek botanist. Death alone prevents our adding another name to whom thanks are due, for the enterprise owes its origin to the suggestion of the late venerable Canon Ellacombe, who took the greatest interest in the preparation of the work. It is to be hoped that hereafter the other writings of Theophrastus will follow in a similar edition.

The primary classification of plants by Theophrastus is into four divisions, namely, trees, shrubs, under-shrubs, and herbs. There are other categories under which he gathers his species—some of a very artificial character, such as pot-herbs and coronary flowers. There are also glimpses here and there of his recognition of natural groups, and he is conscious that the grasses are closely related to one another. He knows the leguminous plants as a group, to which he frequently refers, and, what is remarkable, he is acquainted with the fact that a crop of such plants enriches the land. He recognises the conifers as a group and mentions them under that name.

The book contains a large amount of information, often of a vague and discursive and hearsay character, as to the localities where trees and plants grow, and the different effects of climate and situation. Theophrastus is often content to rest upon the reports of others, and many statements are introduced by such phrases as "They say," or "The men of Mount Ida say," or "The men of Macedonia say." One is inclined to think that he listened to reports from his numerous students and accepted them with little or no investigation.

The account of the collection of myrrh and frankincense and the other Arabian gums is very curious.

Incidentally the work throws considerable light on the traditional lore of the Attic gardeners, who were probably a pretty numerous class. They seem to have grown a large variety of pot-herbs, as well as flowers. The work also throws a curious light on the arts of carpentry and joinery, on the conversion of reeds into pipes, and on the development of the knowledge of drugs and the art of poisoning as well as of the administration of antidotes.

According to Theophrastus, the druggist is not far removed from the poisoner:—

Thrasyas of Mantineia had discovered, as he said, a poison which produces an easy and painless end; he used the juices of hemlock, poppy, and other such herbs, so compounded as to make a dose of conveniently small size, weighing only somewhat less than a quarter of an ounce. For the effects of this compound there is absolutely no cure, and it will keep any length of time without losing its virtue at all. He used to gather his hemlock, not just anywhere, but at Susa [probably a place in Arcadia] or some other cold and shady spot; and so, too, with the other ingredients; he also used to compound many other poisons, using many ingredients.... Now these things seem to have been ascertained better in recent than in former times. And many things go to show that the method of using the various drugs makes a difference; thus the people of Ceos formerly did not use hemlock in the way described, but just shredded it up for use, as did other people; but now not one of them would think of shredding it, but they first strip off the outside and take off the husk, since this is what causes the difficulty, as it is not easily assimilated; then they bruise it in the mortar, and, after putting it through a fine sieve, sprinkle it on water and so drink it; and their death is made swift and easy. (Vol. ii., IX. xvi. 9.)

In dealing with the sea-plants, there seems to be a suggestion of correspondence with plants on the land. This is implied by the names "sea-fir," "sea-oak," "sea-vine," and "sea-palm," and a "kind like dog's-tooth grass." There is a distinction between the sea-plants found near the shore and those of deeper waters, and these again are distinguished from plants which grow in rivers and marshes and lakes.

In conclusion, we can heartily recommend the book to all who are interested in the history of botany, or in the details of Greek life three hundred years B.C. E. F.

OUR BOOKSHELF.

Rivers as Sources of Water-Supply. By Dr. A. C. Houston. Pp. vi+96. (London: John Bale, Sons, and Danielsson, Ltd., 1917.) Price 5*s.* net.

A "COUNSEL of perfection" is for every community to obtain its water-supply from a source which, like Cæsar's wife, should be "above suspicion." But many communities have to depend upon a supply which falls short of this high standard. This is more particularly the case with reference to the London water-supply, which is drawn mainly from the rivers Thames and Lea; and it is with this supply that Dr. Houston deals in the book under review. The observations and experiments he records appear to establish the fact that considerably polluted river-water can be purified, on a large scale, to a satisfactory standard of safety. This finding is of prime importance, for, as the writer sets out, rivers are likely to be used to an increasing extent as sources of water-supply, seeing that other available sources of supply are limited, and that there is a considerable economy in the selection of river-water.

The subject-matter of the first three chapters

of this work formed three lectures which were recently delivered at the Royal Institute of Public Health, and the fourth chapter is upon the subject of sterilisation. This term is restricted in its application to the destruction of microbes causing epidemic water-borne disease; and the methods set out embrace the "excess lime" treatment (which is Dr. Houston's own suggestion) and the "chlorination" of water.

Some persons may consider that Dr. Houston takes too sanguine a view with regard to the safety of rivers as sources of water-supply. There can be no doubt, however, that the large amount of experimental work he has undertaken, notably that which illustrates the prime value of storage as a means of reducing the risk of water-borne disease, justifies his sanguine views. After all, where London has succeeded other towns can also succeed, always provided that in these other towns the same careful working is maintained by a well-trained *personnel* as is the case with London, and that a similar constant and scientific control of the state of the water is maintained. The danger is that these provisions may not always be made.

The American Indians North of Mexico. By W. H. Miner. Pp. x+169. (Cambridge: At the University Press, 1917.) Price 3*s.* net.

THE literature connected with the North American Indians is so extensive that a readable summary of it in a popular form was much needed for the use of European anthropologists commencing the study. In America, particularly among the descendants of the hardy frontier men, the question is attracting increased attention. This want is well supplied in this book. The advanced student will depend not only on the classical works of Bancroft, Schoolcraft, and Catlin, but also on the monographs published by the Bureau of American Ethnology and other societies which have been summarised, with the addition of much new matter, by Mr. F. W. Hodge in his excellent "Handbook of American Indians North of Mexico." The questions connected with the origin of these tribes still form the subject of controversy. The writer remarks that the general consensus of opinion during the last century is to the effect that, "with the exception of the Eskimo, the natives of America are wholly of one race and descendants from early emigrants from north-eastern Asia, and especially of Mongolian stock." But the movements of these people within the American continent have as yet not been definitely settled. The importance of linguistics for the settlement of these problems is fully recognised. The book, after a summary account of the environment, discusses the sociology of the tribes, and gives details of some members of the Plains Indians and those of the south-west. The culture of the Pueblos forms the subject of an interesting chapter. There is a good bibliography, and the book may be commended as a satisfactory popular introduction to the study of a remarkable people.

LETTERS TO THE EDITOR.

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The Origin of Flint.

MAY I ask you to publish the following notes on the origin of flint? I understand that a discussion of the subject has been initiated by those interested in the chemical and physical aspects of geology, and think that the facts cited below may be of interest at this moment.

I understand by the term "the origin of flint" an account or reasonable explanation of the formation of the nodules of black flint which occur so abundantly in stratified layers in the Upper Chalk of this country.

Some seventy years ago the view was put forward by the well-known naturalist Bowerbank—who was a special student of the sponges—that the flint nodules of the chalk were formed *in situ* in the depths of the sea by the silicification of sponges which already contained abundant siliceous spicules, and were, as it were, solidified by attracting to themselves additional silica from the sea-water. Silicification of wood—as in the case of some wooden piers erected in shallow seas—was known. The segregation of silica by the attraction for it of organic matter was a recognised fact. Similar segregation and formation of "concretions" of other chemical substances by other attractive nuclei was recognised. Thus lumps or small masses of clay were shown to have the power of attracting phosphate of lime, and so to give rise to those "phosphatic" nodules found at the base of the Red and Coralline Crag, and also at the base of the Cambridge Greensand, and in other positions where the bones of animals were accumulated and furnished phosphate of lime, which was first dissolved by the sea-water and then removed from it and held by the clay nodules.

From time to time other views were put forward as to the formation of the flint-nodules of the chalk *after* the deposit of the chalk yet whilst it was still beneath the sea and permeated by sea-water. It was held that the organic remains deposited in strata in the chalk sea-bottom exercised an attractive influence on the silica dissolved in sea-water, and so led to the replacement of the organic remains by solid silica. Later it became fairly certain that, as is the case with the Atlantic ooze, the chalk deposit contained originally about 10 per cent. of colloid silica in the form of spicules and skeletons of minute organisms, and it was held that this silica was dissolved by the permeating sea-water (whilst the chalk was still beneath the sea), and was then separated and deposited in the cavities occupied by sponges and other organic remains in stratified layers in the chalk.

It is difficult enough to find a parallel for this supposed deposit when the solid, fairly (though not completely) homogeneous character of the black chalk flint is borne in mind. It is remarkable that the flint deposited in these cavities shows little or no trace of onion-like concentric layering, such as characterises the agates formed in geodes of igneous rock. We also are met with a striking fact, namely, that the black flint is apparently micro-crystalline in structure, and that its behaviour when "weathered" is such as to lead to the inference that, although homogeneous to the unaided eye, it yet consists of minute particles of quartz (that is to say, crystalline silica of the same nature as rock-crystal) *cemented by colloid silica*, which latter dissolves to a certain extent in alkaline

water containing CO_2 in solution, and thus gives rise to the white crust of "decomposed" flint which forms the outer "cortex" of all chalk flints.

(1) A fact of capital importance, which must affect any theory as to the origin of flint, is that in many localities where a chalk escarpment can be studied it is found that extensive fissures traverse the stratified layers of chalk and flint nodules at a sharp angle, and are filled with a continuous sheet of black, tabular flint. Such fissures may be seen in the cliffs at Rottingdean, near Brighton, often cutting through a thickness of 40 ft. or 50 ft. of the stratified chalk obliquely to the plane of the strata, and from these fissures sheets of flint 3 ft. square and ½ in. to 1 in. in thickness can be readily removed. The size of these sheets of flint *in situ* is apparently limited merely by the vertical height and inward extension of the fissure. The occurrence of these deep and extensive fissures—mere cracks in so far as their width is concerned—filled with a continuous deposit of black flint, makes it certain that the flint was deposited *after* the fissuring of the chalk, and therefore, almost certainly, after the elevation of the chalk, and probably through the operation of fresh-water of atmospheric origin penetrating the porous mass of chalk after its elevation. It is improbable that the nodules of flint in the chalk have an origin different from that of the "tabular" flint of the fissures. I am not able myself to bring forward any parallel case of the filling of extensive cavities and fissures in a sedimentary rock by a dense chemical deposit. The formation of "septaria" in clay is a parallel on a very small scale. The student of mineral veins and deposits may perhaps be able to throw some light on the matter.

(2) A further fact of importance to any theory of the origin of flint is that the black colour of flint—yellowish- or greenish-brown in thin splinters—is probably due to carbon, though no explanation has been offered of the *uniform* association of this element with flint. The existence in the Upper Chalk of oblong cylindrical nodules of *perfectly colourless* transparent quartz, occasionally showing blue or orange-brown patches or "floating clouds" scattered in the clear colourless silica, is also well known. A fine collection of these has been bequeathed to the Woodwardian Museum, Cambridge, by the Rev. Marmaduke Langdale. They are deposited in cavities once occupied by peculiar sponges (Choanites and Ventriculites). But why they are free from carbon—if carbon is the cause of the black colour of black flint—is not explained.

In the spring of 1916 a combustion analysis of black flint was made in the laboratory of the Royal Institution at my request, under Sir James Dewar's direction. The result pointed to the presence of minute quantities of carbon in the flint. But a very remarkable result was also obtained which it is necessary to re-examine by employing black flint from various localities in such combustions. A definite quantity of *arsenic* was deposited in the combustion tube in the form of the well-known arsenical mirror. Care was taken to check this startling result by exclusion of the possibility of *accidental* impurity in the material used. But I have not been able myself to pursue the matter further, and mention it now under all reserve, in the hope that some expert chemist will inquire into the subject. I am afraid that Sir James Dewar, to whose kindness I owe this initial examination of the chemical constituents of black flint, will not be able to give the necessary time to it.

I may add that another matter inquired into at my suggestion was as to the amount of *removable* water present in normal chalk flint as quarried, and the percentage of its own weight of water, which carefully dried black flint can absorb, and the rate at which the water is absorbed; further, the variation in these amounts caused by variation of temperature, and the question as to whether a sudden raising or lowering of temperature causes the fracture of *wet* flint *more readily* than of *dry* flint. Experiments were also made as to the form of fracture caused by thermal changes in flint, with the view of determining whether the conchoidal fracture can be produced in flint by thermal change alone, without the previous creation of structural strain by a blow. Although I am not able to report the results of these experiments, I wish to bring the desirability of a thorough chemical and physical examination of black flint to the notice of others who may have facilities for carrying through such an examination which I do not possess. I trust that some such fortunate experimentalist will take up the chemical and physical investigation of flint, without delay, as a serious task. It will take perhaps years to complete, but will yield results of the highest value to geology and to other branches of science.

The occurrence of arsenic in chalk flints may be due to its presence in minute quantities in sponges, the peculiar smell of which in the living state is suggestive of the presence of an organic compound similar to the strongly odorous gas known as diethylarsine.

May 25. E. RAY LANKESTER.

Plated Teeth of Sheep.

THE subject of Mr. Beeby Thompson's letter (NATURE, May 31, p. 264) has been noted in various parts of Great Britain. Writing in 1684, Andrew Symson, minister of Kirkinner, records in his "Large Description of Galloway" that "in this parish [Glasserton] there is a hill called the Fell of Barullion, and I have been told, but I give not much faith to it, that the sheep that feed there have commonly yellow teeth, as if they were guilded."

In this matter the worthy minister was unduly sceptical. The Fell of Barhullion is on my property, and jaws of sheep fed thereon have been brought to me with the teeth thickly plated with iron pyrites. The rock of the district is Lower Silurian; in the softer parts (Moffat Shales) large nodules of iron pyrites are found. As there is wet peaty soil on parts of the fell there is no lack of humic acid.

HERBERT MAXWELL.

Monreith, June 2.

The Stability of Lead Isotopes from Thorium.

PROF. SODDY'S view (NATURE, May 24, p. 244) involves the disappearance from the 20 kilos of thorite (with which he worked) of some 150 grams of unstable lead and its conversion into (probably) thallium. There should be present in the thorite thallium to the amount of about 0·012 gram per gram of thorium.

Such a quantity should be easily measurable. If found to be present, support would be given to Prof. Soddy's suggestion. We are told that the thallium was present in amounts "that sufficed for chemical as well as spectroscopic identification."

There is some difficulty in understanding how two-thirds the ionisation of a ray, additional to the seven α rays which go to generate the thorium halo, can have left no trace upon the halo. But the range may have been such as to render this possible. It is improbable, however, that a further α-ray transformation of thallium can have occurred without affecting the ionisation curve to an extent which would be detectable when the halo is compared with the curve as determined from the seven known rays.

J. JOLY.

Trinity College, Dublin, May 29.

ANALYSIS OF THE MECHANISM OF SPEECH.

THE impetus which recent events have given to the study of spoken languages has brought with it a renewed interest in the scientific analysis of the mechanism of speech. He who wishes to learn how to speak a foreign language must necessarily devote much of his time to the acquisition of the pronunciation, and he will most easily learn to become proficient at this difficult art if he can ascertain precisely what he has to do with his speech-organs in order to speak correctly. The need for accurate information about speech movements has led to the development of that branch

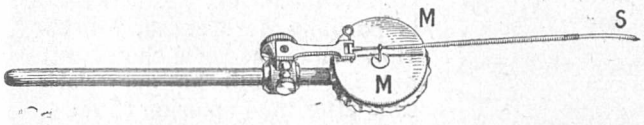

FIG. 1.—A Marey tambour. MM, the membrane; S, the style.

of science known as experimental phonetics—the branch of science which has for its object the accurate analysis of speech by mechanical means.

Among the numerous instruments which have been devised for speech analysis there is one of particular importance, known as the phonetic kymograph, and it is the object of this article to give a brief description of the nature and use of this apparatus.

The phonetic kymograph is essentially an application of the Marey tambour to linguistic purposes. The principle of this tambour is well known, and it is not necessary to describe it in detail. It will be sufficient to recall that it is a

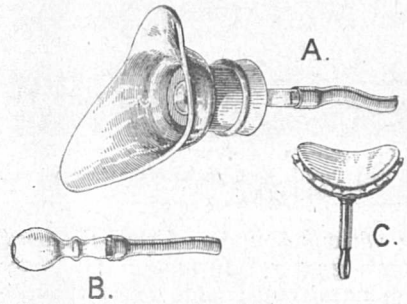

FIG. 2.—A, mouthpiece; B, nasal olive; C, larynx capsule.

mechanism by which vibrating air is communicated to an elastic membrane, and the vibrations of this membrane are in turn communicated to a very light needle or style (Fig. 1). The vibrations of the style are generally recorded on a revolving drum covered with smoked paper or some similar contrivance. Tambours may be of various sizes and materials. A very useful type is one in which the membrane is made of perished rubber, and measures 3 cm. in diameter.

Air vibrations set up by speech may be communicated to the tambour in three principal ways: (1) from the mouth, (2) from the nose, (3) from the outside of the larynx. A rubber tube is attached to the tambour, and at the end of this tube is fitted (A) a mouthpiece (into which the observer speaks), or (B) a nasal olive (which fits into one nostril), or (C) a "larynx capsule" (which is pressed firmly against the outside of the larynx). These appliances are shown in Fig. 2.

The complete apparatus is shown in Fig. 3, which is an illustration of a small portable kymograph. The diagrams in this article were made on the large kymograph in the laboratory of ex-

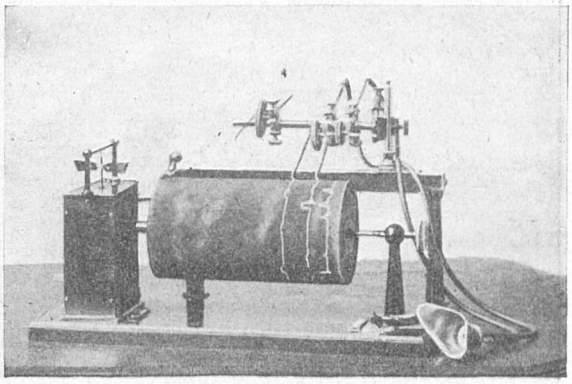

FIG. 3.—A small portable kymograph.

perimental phonetics at University College, London; the cylinder of this machine has a circumference of one metre and a maximum surface speed of 70 cm. per second.

The most useful single tracings that can be made on the phonetic kymograph are those which result from speaking into the mouthpiece. More detailed information may, however, often be obtained by taking nose and mouth tracings, or mouth and larynx tracings simultaneously, or by taking tracings of all three kinds at the same time.

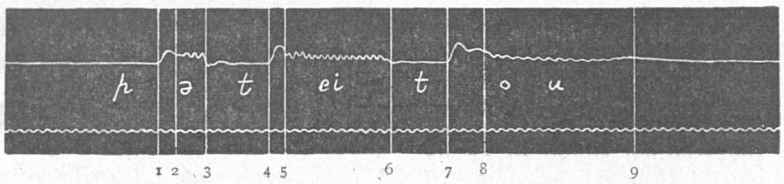

FIG. 4.—Mouth-tracing of *potato*.

The accompanying illustrations show the nature of kymographic tracings and the deductions which can be made from them. Fig. 4 shows a mouth-tracing of the English word *potato*.[1] The horizontal parts of the line show the places where no air issues from the mouth, *i.e.* the "stops" of the consonants *p*, *t*, and *t*. The three steep rises in the line mark the plosions of these consonants. The small waves are caused by the air set in vibration by the vocal chords when "voice" is produced; in this diagram they represent the vowels. The regular wavy line figuring in this and other illustrations is a time-measurer showing hundredths of a second.

Various features of pronunciation may be

[1] The lettering appearing in this and other diagrams is a phonetic transcription of the pronunciation (International Phonetic system).

studied from such a tracing as this. Such are: (1) the extent of "aspiration" of the plosive consonants (shown by the distances between the vertical lines 1 and 2, 4 and 5, 7 and 8); (2) the lengths of the vowels (shown by the distances between the vertical lines 2 and 3, 5 and 6, 8 and 9). The variations in the pitch of the voice may also be calculated to any degree of accuracy by measuring the voice vibrations in successive small intervals.

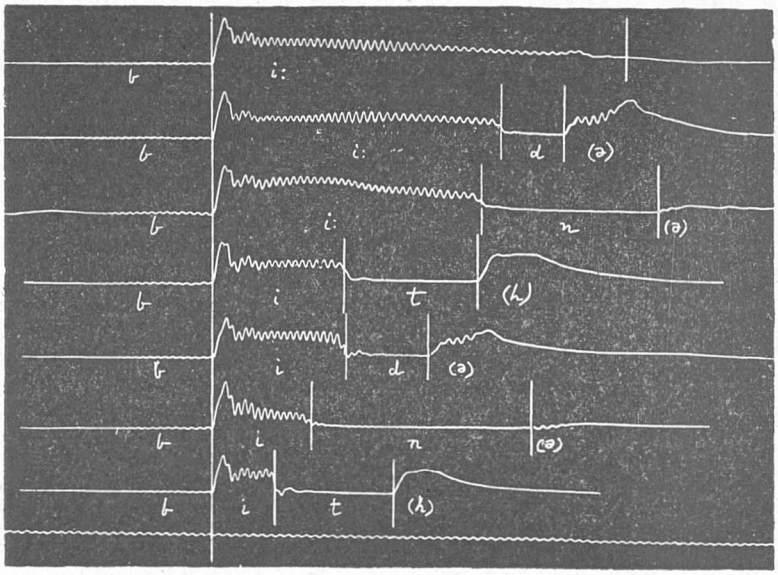

FIG. 5.—Mouth-tracings of *bee, bead, bean, beat, bid, bin, bit*, showing lengths of vowels and final consonants.

Fig. 5 illustrates the variations in length which English vowels undergo under certain conditions. The first four tracings show variations in the length of the English sound of *ee* as exhibited in the words *bee, bead, bean, beat,* and the remaining three tracings show similar variations in the length of the so-called "short *i*" in the words *bid, bin, bit.* It will be seen that the vowels in *bean* and *beat* differ from that in *bead* in somewhat the same manner as the vowels in *bin* and *bit* differ from that in *bid.* It will also be observed that the so-called "short" vowel in *bid* is just about the same length as the so-called "long" vowel in *beat.* (Ignorance of the fact that the vowels in words like *beat, late,* are much shorter than those in *bead, laid,* is the cause of noticeable mispronunciation on the part of many foreigners.)

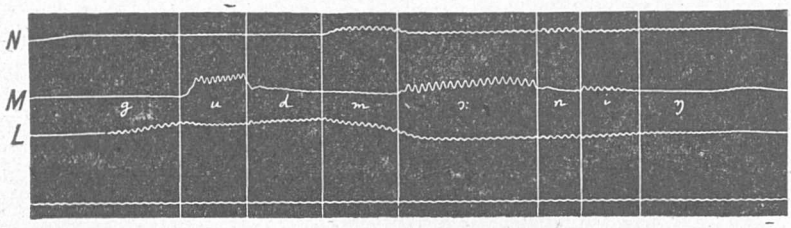

FIG. 7.—Simultaneous nose, mouth, and larynx tracings of *good morning* (as said on parting).

Fig. 6 shows (A) a mouth-tracing of the word *play* said by the writer, (B) a mouth-tracing of the same word said by a Flemish-speaking Belgian with a bad accent. It will be noticed that the Belgian mispronounced the *l* by making it completely voiced; in normal English this *l* is partially devocalised, *i.e.* the vibration of the vocal chords does not begin until an appreciable time after the explosion of the *p*.

Fig. 7 is a record of *good morning* (as said on parting), in which tracings of the nose, mouth, larynx, and a time-measurer have been taken simultaneously. The points at which the various sounds begin and end are clearly seen from the nose and mouth tracings. (This is where kymographic tracings have an advantage over enlargements of talking-machine records.) The distances between the vertical lines show the lengths of the various sounds. From the nose-tracings we may gather information as to the extent to which nasal consonants exert a nasalising influence on neighbouring vowels. The larynx-tracing shows vibration-waves throughout, since every sound is voiced; this would be the most convenient curve to use for the purpose of calculating pitch.

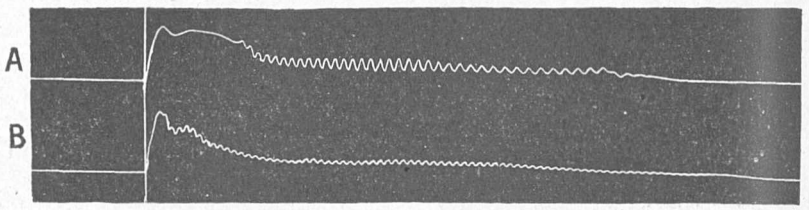

FIG. 6.—A, mouth-tracing of *play* as said by the writer; B, mouth-tracing of the same word mispronounced by a Flemish-speaking Belgian.

Fig. 8 shows mouth-tracings of the English *buckle* and the French *boucle*. Two important differences will be noticed in regard to the consonants: (A) the English *l* is voiced, whereas the French *l* is not; (B) in the French word the *k*-sound is held on about twice as long as it is in the English word. The smallness of the voice-waves in the French

word is due to the fact that the record is of a lady's voice.

The above short account of the phonetic kymograph will give some idea of the scope of the apparatus. It will be seen that the instrument is chiefly useful (1) for detecting the presence or absence of voice, (2) for detecting the presence or absence of nasality, (3) for measuring the lengths of sounds, and (4) for calculating the pitch of the voice.

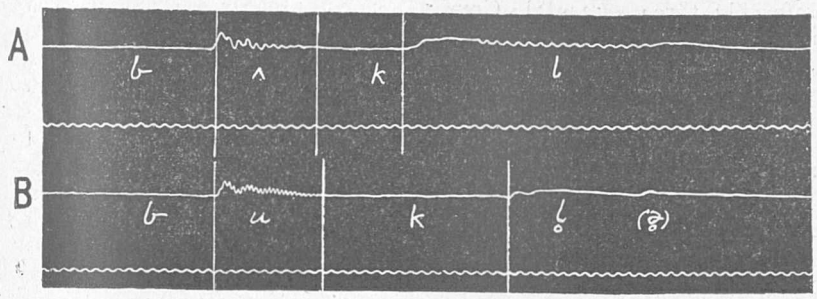

FIG. 8.—A, mouth-tracing of English *buckle* (male voice); B, mouth-tracing of French *boucle* (female voice).

DANIEL JONES.

A UNIVERSITY DEGREE IN HORTICULTURE.

THE University of London has, at the suggestion of the council of the Royal Horticultural Society, established a B.Sc. degree in Horticulture. Syllabuses for internal and external students have been drafted, and the University has under consideration the recognition of the Royal Horticultural Society's school and research station at Wisley as a school of the University.

There can be no question that, if university degrees are to be given in technical subjects, the case for a degree in horticulture is a good one; for horticulture connotes not only an industry and an art, but also an applied science.

First of all, however, it is a craft, and, like all crafts, it depends for its successful pursuit on the exercise of practical skill. Therefore, an academic recognition of proficiency which does not carry with it a sure indication of craftsmanship is not only useless, but also pernicious.

The proposed degree in horticulture, if the spirit of the regulations which govern it is observed, makes adequate provision for the requirement of technical expertness. A candidate for the internal degree, besides matriculating and passing the Intermediate Science Examination, must pass the Preliminary Examination for the National Diploma in Horticulture before he proceeds to the Final Examination. This examination, established by the Royal Horticultural Society with the approval of the Board of Agriculture, is an adequate elementary test of practical knowledge and ability. Furthermore, during the final course candidates are required to perfect their knowledge of practical horticulture, and the sciences which are prescribed in the course of study are to be taught with definite reference to horticulture.

If, therefore, a student follows this course at a horticultural college, there is but little danger that general science, botany and chemistry and entomology, will divert unduly the student's interest from horticulture. The Bachelor of Science in Horticulture would thus be possessed of a fair knowledge of science, and would also be a proficient practical horticulturist, able to dig and trench, plant and prune, bud and graft at best as well as the average gardener. If this prove, in fact, to be the case, both science and horticulture will gain. For at present there is a deep gulf fixed between the science and practice of horticulture. The well-trained man of science, say the Part II. Tripos man, has become too specialised in habits of work, too much a victim of the laboratory habit, to be willing to spend a year or so working with his hands on the land.

For these reasons it may be hoped that the establishment of a degree in horticulture will be of no less benefit to potential botanists and agricultural chemists than to professional horticulturists. In the case of botany, at all events, it may reasonably be asserted that much of the botanical ritual observed in our university laboratories is outworn; and although we are not confusing botanists with gardeners, we are confident that, if botanical students were to spend half as many hours working in the garden as they now spend with microscopes and microtomes, they would become better botanists.

From yet another point of view the degree in horticulture is to be welcomed. Tropical horticulture is in many cases more akin to horticulture than to the agriculture practised in this country. The Empire has great need of men to aid in developing its resources. The old class of administrator—the man who could administer anything about which he knew nothing—has been found out. The war has weighed him in the balances and proved him wanting. The new class of administrator must be a new kind of practical man—"a hewer, not a heaver, of things." By providing a course of training in the practice and science of horticulture, the University of London has made a contribution towards meeting the need for this new class of practical men.

This will only be the case, however, if the University insists upon satisfactory practical training for all candidates for degrees in horticulture, and not from internal students only. Unfortunately, the regulations for the external degree in horticulture provide for no *training* in practical horticulture, nor, to be fair, does it

provide for *training* in anything else. This omission can satisfy only those who believe that ability to pass an examination is sufficient evidence of training. External students are required to pass an examination in practical horticulture. The test lasts one day only, whereas not fewer than two days, and preferably three, should be spent by the student in demonstrating his skill in practical horticulture. Unless the examination is so arranged as to secure that every recipient of the degree has a sound knowledge of practical horticulture, the establishment of a degree in this subject will do more harm than good.

CONTINUATIVE EDUCATION IN FRANCE.

ENGLAND is not the only Allied country that is thinking of putting its educational house in order, even before the end of the war. Our good neighbour France is engaged on a similar project. Thanks to the kindness of M. Maurice Roger, one of the leading specialists on technical education in France, the present writer is able to give a brief account of the French proposals, which, in the light of Mr. Fisher's somewhat tantalising treatment of the subject, cannot fail greatly to interest the English public.

The Bill before the French Chamber is essentially a consolidating measure, while at the same time it introduces the principle of compulsion, the attempt at voluntary continuative education having failed to produce adequate results. Hitherto commercial and technical education have formed the subject of one law, agricultural of another, and physical training of a third. All three laws have passed one or other of the two Chambers. The new proposals will co-ordinate the three laws in one in order that the education of the future student may be similarly co-ordinated.

The aim of the education will be alike economic and civic, and the physical education will, in the case of the male student, lead up to military training. The unskilled, as well as the skilled, employee must attend these schools, which are not to be schools for workmen, but schools where workmen, especially the unskilled, may increase their economic productivity. It is significant to note that, in spite of the centralising traditions of French education, the classes are to be organised in accordance with local or regional needs, under the guidance of local committees for each commune. When the commune is a large town like Paris or Marseilles, the unit chosen seems very suitable, but in the case of the small village it is certainly not large enough. Such committees are to be composed of town and district councillors, doctors, official members, representatives of chambers of commerce and agricultural societies (very strong and influential bodies in certain parts of France), and delegates from associations of employers and trade-unions and various other important local societies. Above them will be a county council committee, and at the top a central committee to exercise a general oversight and control. Two stages of study are mapped out; the first is up to seventeen for boys and sixteen for girls.

Curiously enough, the recent English Departmental Committee on Juvenile Education in relation to Employment after the War also recommended two stages, but the first in the English proposals extends only to sixteen years of age. In this first period in the French scheme the obligatory subjects are French, history and geography, physical exercises, science applied to agriculture, industry, commerce, and navigation, or domestic economy, comprising practical work in each case. A minimum of fifty hours is assigned to general education, 150 to professional, and 100 to physical, the last being allotted to Sunday. This makes 300 hours, as against 320 suggested by the English committee, which proposes a minimum of only about fifty hours a week for physical exercises.

The second stage is from seventeen to twenty years of age for young men and sixteen to eighteen for girls, compared with sixteen to eighteen for English students. French, conferences on history, geography, civics, common law, and political economy are assigned a minimum of 100 hours, and the same amount is to be devoted to gymnastics and the preparation for military service. For girls the place of the latter is taken by manual work, hygiene, and some notions of medicine and child-rearing.

Existing technical, commercial, and higher elementary school buildings are to be utilised so far as possible for giving continuative education. The more technical subjects will be taught by professional teachers, but elementary-school teachers will be largely used for the more general parts of the course. To enable them to give the extra time out of school, the ordinary day-school hours will be shortened by half an hour, and the summer holidays increased to two months. If more than 200 teaching hours of continuative education are required of them they are to receive extra pay. It is very significant to note that private schools will be allowed, under certain conditions, to provide continuative education.

CLOUDESLEY BRERETON.

NOTES.

THE list of honours conferred on the occasion of the celebration of the King's birthday on June 3 includes the following names of men known in scientific circles:—*Baronets:* Sir Thomas Elliott, Deputy-Master and Comptroller of the Mint (retiring); Sir Robert Hadfield, F.R.S., past-president of the Iron and Steel Institute and of the Faraday Society; Mr. James Knott, formerly president of the Institute of Marine Engineers; Sir Philip Magnus, representative in Parliament for the University of London since 1906; the Right Hon. T. W. Russell, Vice-President of the Department of Agriculture and Technical Instruction for Ireland; Dr. Frederick Taylor, president of the Royal College of Physicians. *Knights:* Prof. W. J. Ashley, professor and dean of the faculty of commerce at Birming-

ham University; Mr. Graham Balfour, secretary to the Staffordshire Education Committee; Mr. F. H. Barker, for his work in the development and adoption of the Parsons steam turbine throughout the principal countries of Europe; Prof. T. Kennedy Dalziel, professor of surgery, Anderson's College, Glasgow; Dr. T. Gregory Foster, the provost of University College, London; Dr. R. T. Glazebrook, F.R.S., director of the National Physical Laboratory since 1899; Mr. Robert Jones, lecturer on orthopædic surgery, Liverpool University, and inspector of military orthopædics, A.M.C.; Mr. William Peck, director of the City Observatory, Calton Hill, Edinburgh; Prof. E. C. Stirling, professor of physiology in the University of Adelaide; Mr. H. F. Waterhouse, dean and lecturer on anatomy at Charing Cross Medical School. *K.C.B.*: Dr. H. F. Heath, secretary of the Department of Scientific and Industrial Research. *K.C.M.G.*: Dr. R. A. Falconer, president of the University of Toronto. *C.M.G.*: Mr. R. C. Allen, Director of Surveys and Land Officer, Uganda Protectorate; Mr. T. Hood, Director of the Medical and Sanitary Service, Nigeria; Mr. F. E. Kanthack, Director of Irrigation, Union of South Africa. *C.I.E.*: Lt.-Col. D. W. Sutherland, principal, and professor of medicine, Medical College and School, Lahore, Punjab; Mr. Taw Sein Ko, superintendent, Archæological Survey, Burma. *Kaisar-i-Hind Medal:* Capt. R. H. Bott, professor of surgery, Medical College, Lahore, Punjab.

WE regret to announce the death, on June 2, of Dr. W. H. Besant, F.R.S., fellow of St. John's College, Cambridge, in his eighty-ninth year.

WE notice with regret the announcement of the death on May 29, at seventy-five years of age, of Sir William D. Niven, K.C.B., F.R.S., late director of studies, Royal Naval College, Greenwich.

ACCORDING to the *Electrician* it is proposed to change the name of the Canadian Society of Engineers to the Canadian Institution of Engineers, and to enlarge the scope of the society by the admission of electrical, chemical, mining, and mechanical engineers.

MR. STEPHEN PAGET is collecting notes for a book on the life and work of the late Sir Victor Horsley, and he asks friends, colleagues, and patients of Horsley to send him any letters which may be used for the purposes of the book. Great care will be taken to return all letters, which should be sent to Mr. Paget at 21 Ladbroke Square, W.11.

MR. J. RAMSBOTTOM, of the Department of Botany, British Museum, has been appointed protozoologist to the medical staff at Salonika. The trustees of the museum have accepted Miss Lorrain Smith's offer to act as temporary assistant in charge of the fungi during Mr. Ramsbottom's absence and to deal with inquiries relating to this group of plants. Miss Lorrain Smith has been associated with the department for many years, especially in connection with the revision and completion of Crombie's "Monograph of British Lichens," the second volume of which (by Miss Smith) appeared in 1911; the second edition of vol i., which will bring the whole work up to date, is now almost complete.

A PARAGRAPH has appeared generally in the daily Press relating to a new and wonderful explosive of American origin "so powerful that five grains, its inventor claims, would blow the largest building in the world to pieces." One must conclude that the accident which led to the discovery yielded only minute quantities, or the United States might have been disintegrated! Sensational statements of this description may appeal to the public imagination, but it must be remembered that some of the most highly explosive substances are inapplicable by reason of the difficulties and risks of manufacture, of their sensitiveness, and of our inability to control the explosion. If the new "Terrorall" is even one-thousandth as powerful as stated it by no means follows that it will prove of service in the war.

AT the aniversary meeting of the Linnean Society on May 24 the following were elected officers and council for the ensuing year:—*President:* Sir David Prain. *Treasurer:* Horace W. Monckton. *Secretaries:* Dr. B. Daydon Jackson, E. S. Goodrich, and Dr. A. B. Rendle. *Council* (in addition to these officers): Mrs. Agnes Arber; E. G. Baker; Prof. W. Bateson; E. T. Browne; R. H. Burne; Sir Frank Crisp, Bart.; A. D. Cotton; J. Groves; Miss G. Lister; Gerald Loder; Prof. G. E. Nicholls; Prof. H. G. Plimmer; Dr. D. H. Scott; Dr. A. E. Shipley; and Lt.-Col. J. H. T. Walsh. The president handed to Mr. T. G. White, secretary of the Agent-General for New South Wales, the Crisp award and medal to be forwarded to Dr. Robin John Tillyard, of Sydney University; and presented to Mr. H. B. Guppy the Linnean gold medal awarded to him for his services to biology.

IN a recent note (NATURE, May 24, p. 250) we directed attention to the renewed audibility in the south-eastern counties of the gun-firing on the Western front. We have received another account from Dr. H. S. Allen, who, from the porch on the south side of Cressington Church, Surrey, heard very distant gun-firing at 11.30 a.m. on May 28. "The church is two miles south of Surbiton, and stands on a slight eminence from which an uninterrupted view of the North Downs is obtained. There were light, variable breezes from the south-east. The reports followed one another at irregular intervals, but the average time between successive reports was about three seconds." According to Sir Douglas Haig's report, there was "considerable artillery activity on both sides during the day south of the Scarpe and in the Ypres sector."

BY direction of the War Cabinet, Dr. Addison, the Minister of Munitions, has made arrangements for the appointment of an interdepartmental committee to prepare a scheme for the establishment in London of an Imperial Mineral Resources Bureau:—(*a*) To collect information in regard to the mineral resources and metal requirements of the Empire, and (*b*) to advise what action, if any, may appear desirable to enable such resources to be developed and made available to meet requirements. The members of the committee are as follows:—Sir James Stevenson, Bt. (chairman), Mr. C. L. Budd, Sir A. Duckham, Prof. W. R. Dunstan, Mr. C. W. Fielding, Mr. J. F. N. Green, Rt. Hon. Lord Islington, Mr. L. J. Kershaw, Sir T. Mackenzie, Hon. Sir G. H. Perley, Mr. W. S. Robinson, and Rt. Hon. W. P. Schreiner. The secretary to the committee is Mr. Oswald C. Allen, and all communications on the subject should be addressed to him at the Ministry of Munitions, Whitehall Place, S.W.1.

UNDER the title, "Rhubarb and Red Tape," the *British Medical Journal* for June 2 makes the following remarks upon the suspension of the *Kew Bulletin*:—"Our contemporary, NATURE, published on May 24 an interesting and timely article on rhubarb, intended by its author for the *Kew Bulletin*, the publication of which the Government in its wisdom has decided to suspend. The official explanation given

for this paltry piece of economy is that 'it has been ruled that the *Kew Bulletin* is not essential, and its publication has therefore been suspended' owing to the shortage of paper. The small amount of paper needed to secure the continued publication of so useful a periodical, which serves as a link between scientific and economic botany, could well be spared by a trifling reduction in the waste of paper in a single Government department. Lop-sided actions of this sort bring our Government into contempt, and indicate a narrowness of outlook threatening the future of the country."

SIR ERNEST SHACKLETON has returned to this country after lecturing in Australia and America on his return from the Antarctic. In a brief interview he gave to Reuter's Agency Sir Ernest said that much scientific work had been done despite the disaster to the expedition and the failure of the plan to cross Antarctica. He confirms the opinion held by all who know the Weddell Sea that it is the worst sea in the world for ice congestion and pressure. The most interesting statement he made, however, was with regard to Morrell Land, or New South Greenland, which is supposed to project northward from Antarctica into the Weddell Sea. Since Morrell, in 1823, sighted part of the coast-line of this land no voyager has definitely seen it, but, on the other hand, no one has been able to sail over its supposed position, while circumstantial evidence is strongly in its favour. Sir Ernest claims to have sailed over and so proved its non-existence. It would be most interesting to have further details, with latitude and longitudes, so that this problem can be definitely cleared up. Morrell may have been a little wrong in his longitudes, but it will be surprising if no land exists in the western part of the Weddell Sea.

THE letter on "Plated Teeth of Sheep," published in NATURE of May 31, has brought us a copy of a paper "On So-called Gold-coated Teeth in Sheep," by Prof. A. Liversidge, formerly professor of chemistry, University of Sydney, read before the Royal Society of New South Wales on June 7, 1905. Prof. Liversidge received the lower half of a sheep's jawbone, the teeth of which were more or less completely encrusted with a yellow, metallic-looking substance, but more like iron pyrites (marcasite) or brass than gold. He found that the incrustation readily came off in scales when even lightly scratched with the point of a penknife. The surface of the tooth under the scale was found to be black, but apparently not decayed; the thickness of the deposit was apparently less than 1 mm. The scale partly dissolved in dilute acid. The residue consisted of filmy organic matter, still possessing a metallic sheen, although white in colour instead of yellow. When heated on platinum foil the scale blackened, partly fused, and left a white residue soluble in dilute hydrochloric or nitric acid. The residue contained phosphoric acid. and apparently consisted mainly of calcium phosphate. Under the microscope the scale was seen to be translucent and of a pale brownish colour, and under a ½-in. objective it was seen to be made of thin layers, but with no recognisable organic structure. Prof. Liversidge concluded that "the metallic lustre is due to the way in which the light is reflected from the surfaces of the superimposed films. The incrustation on the teeth is apparently a deposit of tartar, and perhaps partly due to superficial decay of the tooth."

THE Royal Academy of Sciences and Letters of Denmark has announced the subjects on which it invites memoirs, with a view to the award of its medals and prizes. The subject in history, for which the prize is the academy's gold medal, is the origin and development of alchemy among the Greeks, based on the examination of Greek literature. In astronomy the society's gold medal will be awarded to the approved memoir on the distances of stars of spectral class N (Secchi's Type IV.), their distribution in space, and the determination of their velocities. For the academy's gold medal in physics the subject is an experimental research on the transparency and electrical conductivity of thin metallic films, special importance being attached to the determination of the thickness of such films. The prize of 800 crowns arising out of the Classen legacy is offered for the approved memoir on the light thrown on the habitats and the immigration into Denmark of weeds, especially those of cultivated areas, by palæontology and history, and by the study of the various means and routes of the migration of these plants. In all these cases memoirs must be sent in by October 31, 1918. The prize of 800 crowns derived from the Thott legacy is to be awarded in connection with a subject announced in 1914, namely, a description based on existing literature, as well as on personal research work, of the facts which ought to be taken into account in drying seeds, special attention being given to the kinds of direct interest to Danish agriculture. These memoirs are to be sent in by October 31 next. The essays may be written in any one of seven specified languages, including English, and are to be sent to Prof. H. G. Zeuthen, secretary of the Academy.

A STATUE of the eminent chemist, Prof. Marcelin Berthelot, sometime professor at the Paris School of Pharmacy, was unveiled in Paris on May 21. We reprint from the *Chemist and Druggist* the following interesting account of the ceremony given by its Paris correspondent:—"The Sorbonne, as the home of the faculty of sciences and the heart of the Latin Quarter, was appropriately chosen for the function, which marked the close of the Exhibition of 'School and War,' organised by the French Teaching League. The great amphitheatre was filled to suffocation, and on the platform were the representatives of official and intellectual France—M. Raymond Poincaré and his Ministers of State, the Paris Municipal Council, and the teaching staff of the University. The speakers were the head of the College of France (to which Berthelot was attached), the Prefect of the Seine, the President of the Municipal Council, the Director of the French Academy, the Vice-President of the Italian Senate, and others. There was a war-time note in many of the speeches. M. Armand Gautier, the chosen orator of the Academy of Sciences, told how during the 1870–71 siege of Paris he met Berthelot returning from a visit to the outposts, where he had accompanied a French general. The *savant* had shown the soldier how the defence of the city could be improved; the general had hesitated for fear of reprisals, not wishing to provoke the enemy to bombard Paris. Shortly after, the Latin Quarter was shelled, and the College of France and the Museum were damaged. M. Painlevé, Minister of War, referred to the same epoch. Not only did Berthelot show how chemical substances could be synthesised, but 'he dared to apply scientific methods to these explosives, the violence and terrible rapidity of which seemed to defy all control, but of which the artilleryman must understand the laws the better to regulate and subjugate.' It was 'his long and obstinate research into the problems of waves of explosion which led up to M. Vieille's discovery of smokeless powder.' The speeches terminated, the official *cortège* proceeded to the statue hard by—the work of M. René de Saint-Marceaux. When this was unveiled the Paris school children and the Cadet Corps—some thousands of

young people in all—marched past the monument of the *savant* and patriot."

THE importance of ethnobotany, a new field of research which, if investigated systematically, will yield results of great value both to the ethnologist and the botanist, is now fully recognised, particularly in America. The questions with which the ethnobotanist deals are: the primitive ideas and conceptions of plant life; the effects of a given plant environment on the lives, customs, religion, thoughts, and everyday practical affairs of the people studied; the use of plants for economic, magical, or ceremonial purposes; how far their knowledge of plant life extends; the study of plant names as a branch of the local folklore. The methods and results to be gained from this field of investigation are fully explained in Bulletin No. 55 of the American Bureau of Ethnology, entitled "Ethnobotany of the Tewa Indians," by Messrs. W. W. Robbins and J. P. Harrington and Miss Barbara Freire-Marreco, which supplies a useful introduction to this new field of research.

THE Journal of the Academy of Natural Sciences of Philadelphia, second series, vol. xvi., part iii., is devoted to a report, printed in a style which few societies in this country can rival, compiled by Mr. C. B. Moore, on some aboriginal sites on Green River, Kentucky, and on the Ohio and Mississippi. Some of these implements supplied curious objects made of deer's antlers, hooked at one end, and having a cavity in the other, in which fragments of asphalt were found, apparently intended to fix something introduced into the cavity. There is some doubt as to the object for which these articles were intended. Possibly the hooked implements were used as netting needles, while others of a different form were "sizers," used for spacing the meshes of the nets. The cavity may have held some decorative object. The full collection of photographs appended to this report will doubtless soon lead to a final settlement of the use of these implements.

Abstracts of Bacteriology is the title of a new publication issued bi-monthly under the editorial direction of the Society of American Bacteriologists, the first number appearing in February. The purpose is, as the name implies, to review current literature on bacteriology in all its various branches, and a journal of this kind will be very welcome now that German periodicals of a similar character are difficult to obtain and are tabooed by many. A list of periodicals to be reviewed is given, and comprises some 650 titles. We predict a cordial reception for this new aid to bacteriological research. The British publisher is the Cambridge University Press, Fetter Lane, London, E.C.4.

WE have received a copy of the May issue of the *Veterinary Review* (vol. i., No. 2), a new periodical devoted to veterinary science and practice. It contains a review of the present state of knowledge of specific polyarthritis, an infective disease of the joints attacking foals. The remainder of the issue is devoted to abstracts of publications, which seem to be well chosen and will be very useful, and to notes on books and a bibliography of veterinary publications (thirty-four pages). The *Veterinary Review*, which is edited by Dr. Charnock Bradley, is published quarterly by Messrs. W. Green and Son, Edinburgh, at an annual subscription of 10s. 6d.

THOUGH much has been written on the fur-seal of the Pribilof Islands, Prof. G. H. Parker, in the *Scientific Monthly* for May, has contrived, in a most admirable summary of the life-history of this animal, to add many new and important facts. Not only from the commercial, but also from the zoologist's point of view, it is fortunate that the largest existing herd of fur-seals is that which breeds on the Pribilof Islands, for these now belong to the United States, which came into possession of the islands with the purchase of Alaska from Russia in 1867. When in 1910 the lease to the North American Commercial Company expired, the Government abandoned the leasing system and took over the management of the herd to avert, if possible, the steady decline in its numbers. This decline was due, not to the regular killing on land, but to pelagic sealing resulting in the slaughter of from 60 to 80 per cent. of females, the pups of which, as a consequence, were left to starve. To save the herd pelagic sealing was forbidden, and later all killing on the islands was banned, except of such animals as were needed to furnish food for the natives until the end of the 1917 season. This, Prof. Parker considers, was a mistake, since it has encouraged the undue increase of "bachelors," which disturb the harems of the breeding bulls. These "bachelors," he contends, should be thinned by taking toll of three-year-old males, the skins being then at their prime. The average life of the fur-seal appears to be from twelve to fourteen years. But while the bulls do not begin to breed until they are six or seven years old, the females are sexually active for almost twice that period. Hence the advisability of reducing the number of "bachelors."

THE "Book of the Madras Exhibition, 1915–16," contains a report of a lecture by Mr. Jas. Hornell dealing, among other things, with the question of pearl culture in Indian seas. The author believes that a great natural pearl fishery must always be a rare and fortuitous occurrence. There will always be series of bad seasons, and now and then a successful one. The natural factors which produce these good and bad seasons are so powerful that man's interference seems to be unavailing, and further expenditure of money is regarded as useless. There are, however, very encouraging results with respect to the artificial culture of true pearls, and the production of induced pearls is already a growing industry in Japan. Small spherules of mother-of-pearl are carefully inserted between the mantle lobe and shell of the mother mollusc, and after a period of about two years a marketable pearl has been formed. This is, at best, only a three-quarter pearl, and the imperfect side must be completed by cementing on a convex flake of mother-of-pearl. Therefore the gem cannot be used as a unit for stringing, but it can be utilised wherever there is intricate mounting of some kind. Mr. Hornell refers to a process of his own whereby true pearls, absolutely flawless and spherical, can be produced. So far he has obtained pearls of microscopic size only, but this is due to the limited time of growth in the conditions of his experiments. Indian waters, he points out, are more suitable for such processes than Japanese waters, for in the former there is no winter pause of growth.

IN the *Journal of Agricultural Research* (vol. vii., No. 7) A. C. Baker and W. F. Turner give a full account of the rosy apple aphis (*A. malifoliae* or *A. sorbi*) in which some new facts of importance may be found. The authors confirm previous statements that plantain is the alternate host of the insect. Another common British aphid, *Macrosiphum granarium*, is described, with excellent figures, by W. J. Phillips in No. 11 of the same volume. This latter number contains also an account of *Syntomaspis druparum*, a

chalcid which, instead of adopting a parasitic mode of larval life, lays eggs in apple-seeds, within which the grubs feed. N. E. McIndoo discusses in No. 3 of the same volume the effects of nicotine as an insecticide. He finds that the spray solutions neither pass into the air-tubes nor penetrate the cuticle and skin, but the fumes traverse the air-tubes and are distributed to the tissues, killing insects by paralysis, due to structural changes in the nerve-cells.

AT a meeting of the American Institute of Electrical Engineers in November last Prof. J. B. Whitehead, of Johns Hopkins University, gave an account of a new form of voltmeter he has developed for measuring potential differences up to 150 kilovolts. The complete paper appears in the April Journal of the Franklin Institute. The instrument depends on the constancy of the electric field at which the corona discharge is formed between a wire and a cylinder along the axis of which the wire is placed. In that reading to 100 kilovolts the wire is of nickel-plated tool steel 0·6 cm. diameter and about 150 cm. long. It is surrounded by a perforated cylindrical electrode 30 cm. diameter and 90 cm. long. Both wire and cylinder are enclosed in a cylindrical vessel in which the pressure of the air can be varied from 40 to 140 cm. of mercury. The potential at which the corona forms at the surface of the wire appears to be independent of the frequency when alternating currents are used, and to be uninfluenced by the presence of moisture in the air. It is a function of the radii of the wire and outer electrode, and of the pressure and temperature of the air. The formation of the corona is detected either by an electroscope or a galvanometer connected to the outer electrode, or by a telephone with its transmitter inside and its receiver outside the containing vessel.

THE estimation of toluene in crude petroleum was the subject of a paper read before the Institution of Petroleum Technologists on May 15 by Mr. S. E. Bowrey. It is pointed out that, whilst the process of cracking increases the percentage of aromatics in the oil, there is a serious loss of oil by carbonisation. The experiments were therefore limited to the crude oil. After carefully examining the method of fractionation and of extraction by sulphonation and nitration, all of which possess serious disadvantages, Mr. Bowrey eventually adopted the method of extraction by liquid sulphur dioxide at low temperatures as affording the most satisfactory results. The process is carried out in the following manner:—The crude oil is first distilled and the distillate collected up to 150°. The latter is then freed from unsaturated hydrocarbons by shaking with 90 per cent. sulphuric acid, and afterwards with alkali and water. The purified spirit is then extracted with successive quantities of liquid sulphur dioxide at −35°, and the combined extract carefully fractionated with a special form of fractionating apparatus. In this way a series of fractions is obtained from which the percentage of benzene, toluene, and xylene can be estimated, and the quantities are further controlled by a specific gravity determination. Each of the steps described has been carefully tested by the use of artificially prepared mixtures of light petroleum and the three aromatic hydrocarbons, and the results, considering the difficulties of the problem, appear to be very satisfactory.

A SHORT paper by Prof. K. C. Browning, of Colombo, on "The Detection of Traces of Mercury Salts for Toxological Purposes" (Journ. Chem. Soc., vol. cxi., p. 236) describes a process whereby the detection of this element can be carried to a point comparable with that reached in the case of arsenic. The method consists in depositing the mercury on a cathode of gold foil, and then vaporising it in a vacuum tube, where its presence is detected spectroscopically. Under these conditions one part of mercuric chloride in 1000 million parts of solution can be detected. Attempts to concentrate liquids containing minute traces of mercury are usually futile, on account of the volatility of the metal and its compounds; in such cases it is better to use a large volume of well-stirred liquid and rely exclusively upon electrolysis for concentration.

IN the issue of the *Engineer* for May 18 there is an interesting account of the very important hydro-electric power supply undertaking for Bombay known as the Tata power scheme, by which energy is supplied to Bombay over a distance of some forty-three miles. The source of the power is three artificial lakes, or reservoirs, in the Western Ghauts, known respectively as Lake Lonawla (986 acres), Lake Walwhan (1535 acres), and Lake Shirawta (3174 acres). They stand in order of elevation, commencing with the lowest, which exceeds 2000 ft. above sea-level, and they are capable jointly of storing sixty thousand million gallons of water. The district in which the "lakes" are situated is remarkable for its heavy rainfall. During monsoons the precipitation is extraordinary, as much as 546 in. (45½ ft.) having fallen in the catchment area during a single monsoon, of which quantity 440 in. (36⅔ ft.) fell within thirty-one consecutive days. The "lakes" have been formed by the construction of dams, which, though not of remarkable height, are certainly of unusual length. The shortest is 1900 ft. long, and the longest no fewer than 8000 ft.—just above 1½ miles. All the dams are built of masonry, with coursed faces and rubble hearting. The Shirawta and Walwhan Lakes are connected by a tunnel in hard trap-rock, 5000 ft. in length. The waterways are designed for a water capacity of 120,000 h.p., with a maximum velocity of about 5 ft. per second. Sufficient capacity is provided in the forebay to keep eight turbines, each of 11,000 b.h.p., working at full load for 1½ hours. The length of pipe line from the forebay to the power-house is 13,000 ft., and the difference in level is 1725 ft. The plant was formally put into service in April, 1915.

Engineering for May 18 contains an illustrated account of a new 15,000-kw. three-phase turbo-alternator recently erected at the Chelsea power station of the Metropolitan District Railway. It is of interest to note that only ten years ago builders were considered greatly daring in constructing turbo-generators of 5000-kw. capacity at 1000 revolutions per minute. Improvements in generator details have been responsible for this notable advance. In view of possible changes in the boiler plant at Chelsea, the new machine was specified to be capable of working with steam at 200 lb. per sq. in. (gauge) and 600° F., but to run its trials at 185 lb. per sq. in. (gauge) and 500° F., giving a superheat of 125° F. only. These test conditions give a steam consumption of about 7 per cent. more than if the tests had been carried out at the higher pressure and temperature. The results under these test conditions, with a vacuum of 0·75 in. absolute back pressure, are as follows:—

Percentage of economical output	50	75	90	100	120
Steam consumption, in lb. per kw.-hour ...	12·9	12·2	11·95	11·8	12·3

The makers are Messrs. C. A. Parsons and Co., Ltd., of Newcastle; Messrs. Merz and McLellan have acted as consulting engineers, and have conducted the tests.

OUR ASTRONOMICAL COLUMN.

PARALLAX OF BARNARD'S "RUNAWAY" STAR.—In the Journal of the British Astronomical Association for April, it is stated that Prof. Schlesinger, of Allegheny, has found a parallax of 0·52″, and a proper motion in R.A. of −0·73″ for the "runaway" star discovered by Prof. Barnard (NATURE, vol. xcviii., p. 196). Dr. S. A. Mitchell's value for the parallax is 0·47″, and that found at Yerkes Observatory by Dr. Lee is 0·55″. The true value is evidently very close to half a second. The star thus appears to come second to α Centauri in point of distance, but is the nearest known star which is visible in our latitudes.

DISTRIBUTION OF STARS OF TYPE O.—The important investigations of Prof. Charlier on the distribution and motions of stars of type B (NATURE, vol. xcviii., p. 116) have been extended to stars of type O by W. Gyllenberg (*Arkiv för Matematik*, vol. xi., No. 28). The general principle of the method is that if the temperature and radius be supposed constant for a given class of stars, the distance of each individual star is given by $r = R.10^{0·2m}$, where m is the apparent magnitude, and R is the distance corresponding to apparent magnitude zero. In general, R is determined from the proper motions and radial velocities, but alternative methods have been employed by Dr. Gyllenberg for stars of type O (Wolf-Rayet stars). The extension in space and the velocity distribution show a close relation to the B stars, as would be expected if the two classes are contiguous in the spectral sequence. The absolute magnitude of the O stars is −2·78, this being the magnitude at a distance of 1 siriometer (= 10^6 astronomical units). This result is in close agreement with Charlier's value −2·45 to −4·78 for the successive sub-classes of the B stars. The O stars, however, show a much larger extension than those of type B in the galactic plane. The density of O stars in the neighbourhood of the sun is 0·0000176 per cubic siriometer.

A similar investigation for A stars has been made by K. G. Malmquist, and for F stars by C. F. Lundahl.

THE MINIMUM RADIATION VISUALLY PERCEPTIBLE.—The recent results of Ives with regard to the least quantity of radiant energy capable of producing the sensation of light (NATURE, vol. xcviii., p. 216) have been further investigated by Prof. H. N. Russell (*Astrophysical Journal*, vol. xlv., p. 60). As before, the metre-candle is taken to be of stellar magnitude −14·18, while a source emitting light of wave-length 0·55 μ, and appearing like a star of the 6th magnitude, is regarded as radiating energy at the rate of $1·35 \times 10^{-8}$ ergs per sec. per sq. cm. The modified factors are those referring to the diameter of the pupil of the eye, and to the stellar magnitude of the faintest visible object. Steavenson's estimate of 8·5 mm. is adopted for the former, and the limiting magnitude is now taken to be 8·5, from observations made by H. D. Curtis and the author. Since a star of magnitude 8·5 gives only one-tenth as much light as one of the 6th magnitude, it follows that the amount of energy which would enter the eye from a light source of maximum efficiency, and of magnitude 8·5, is $1·35 \times 10^{-8} \times 0·57 \times 0·10$, or $7·7 \times 10^{-10}$ ergs per sec. This is regarded as the best available approximation to the true *minimum visibile*. According to this estimate, the minimum perceptible radiation corresponds to the reception by the eye of about 200 elementary quanta of radiation per second, or of one erg in forty years.

WHALEBONE WHALES OF NEW ENGLAND.[1]

WITH a record of many previous American authors who had studied the whalebone whales of the eastern shores of the United States, it was no easy task for Mr. G. M. Allen to produce anything novel in this monograph. Yet the systematic manner in which he has handled the whole subject, from synonymy to enemies and parasites, renders the memoir both interesting and instructive, especially in connection with the habits, appearances in life, disposition, food, breeding, commercial value, parasites, and capture.[2] Some general questions are also dealt with, such as the notion of Ryder, the late able investigator of the fishes, that the tail-flukes of whales probably represent degenerate hind feet, not the whole limb, as Gray and some earlier authors held; whereas Owen, Huxley, Flower, Parker, and Claus were of opinion that the whole hind limb was (externally) suppressed or atrophied, and that flukes and dorsal fin had been secondarily added. The author's countryman, Gill, also thought that the flukes were derived from the greatly hypertrophied integument of the hind limbs, analogous to the hind limbs of the eared seal, whilst the osseous elements have been atrophied, basing this supposition on the fact that the dorsal and ventral vessels are distinct, and that the *crus*, when present, is in the line of the flukes.

On the shores of New England (that is, from the Bay of Fundy to Rhode Island, or thereabout) six well-known forms occur, viz. the Atlantic right whale (*Eubalaena glacialis*, Bonnaterre), the common rorqual (*Balaenoptera physalus*, L.), the "sei," pollack, or Rudolphi's whale (*B. borealis*, Lesson), the great blue whale, or Sibbald's rorqual (*B. musculus*, L.), the little rorqual, or piked whale (*B. acutorostrata*, Lacépède), and, lastly, the humpback whale (*Megaptera nodosa*, Bonnaterre).

The author takes each species in succession, and deals with it systematically, structurally, and under the other heads already noted. Thus, under the Atlantic right whale, which probably sweeps from pole to pole, the vestigial femur, with its ligamentous rod (tibia?), and the occasional double-headed first rib are noted. It is lively when harpooned, rolling over and over so as to wind the line round its body, and, it may be, upsetting the boat and injuring its crew, or in its active movements striking the boat with its "bonnet" (a process at the tip of the snout). Its numbers have diminished since the early settlers peopled these shores (1620), though they were numerous in 1700, when twenty-nine were killed in one day. Now they are scarce. Its migrations northward and southward, its food (chiefly Thysanoëssa and Calanus), and its breeding are described. In clearing up the synonyms of the next species, the cosmopolitan common rorqual, the author has done good service; and he appears to agree with Kükenthal that it is the third finger which is absent in the *manus*, and not the thumb, since two branches of the median nerve go to the space between the second and third digits. The only trace of a hind limb is a papilla on each side of the anus in the fœtus. In addition to the movements recorded, this finner, in a calm and glassy sea, when reconnoitring, will quietly push its head nearly horizontally out of the water and examine, for instance, a boat with its occupants, and then slip underneath

[1] "The Whalebone Whales of New England." By G. M. Allen. Memoirs of the Boston Society of Natural History, vol. viii., No. 2, pp. 107–322, 16 plates and various text-figures. (Boston, September, 1916.)

[2] The American records of stranded as well as captured whales are creditable so far as they go; but the recently instituted system of notification by the British Government, acting through the staff of the British Museum, is more trustworthy.

almost without a ripple. A fishery for these whales began in 1810, and in 1887 a single ship captured about fifty in a year. The fishery continues still, the whole carcass being utilised, the flesh for feeding cattle, and part of it and the bones forming manure.

Rudolphi's rorqual, again, is rare, and its oil contains less stearine than in other whales. The baleen, however, is the finest of the series, and many of the blades are pure white. Sibbald's rorqual is likewise rare, and goes under the name of the "sulphur-bottom whale," though there is no ground for such a term from its actual coloration. Its fingers are indicated externally in the flipper, even in the fœtus, and the skull has a broader rostrum, agreeing in this respect with the small finner. Little is known of the age of such huge whales, yet the occurrence in the Antarctic seas of giant forms, approaching 90 ft. in length, of a species apparently identical with this would appear to support the view of long life. The small finner or little piked whale is not uncommon, but the author, in mentioning the plicæ of the throat, does not allude to their forking. He found this whale occasionally "breaching"—that is, leaping clear of the water—and that no "spout" was visible, thus in both features differing from the British representatives. Its food on the shores of the United States is chiefly capelin and herrings. Scammon described another closely allied species, viz. *Balaenoptera Davidsoni*, which the author rightly ignores. It refers only to the foregoing. In his account of the last species, the humpback whale, he gives a careful description of the coloration of the flippers (called "fins" throughout the memoir), the upper surface being chiefly white, but that the extent may vary with age, that of the Scotch example harpooned in the Tay in 1884, and described by Struthers, being entirely white. These huge organs (about 12 ft. long and 9 in. thick in a 40-ft. whale) are supposed by the author to be used for swimming, but in the example from the Tay they were used for sounding, especially when efforts were made to drive it on the beach. This form has a rudimentary femur. The vigour and tenacity of this whale and its frequent leaps during its gambols are remarkable. On the whole, the external characters, and even the internal and external parasites of these American Cetaceans, conform to the conditions found in our own waters, a result to be anticipated in forms possessing a range so extensive.

The memoir is illustrated by sixteen excellent lithographic plates and several text-figures, efforts being made even to show the fimbriæ on the edge of the powerful flukes of the humpback whale, but the small outline in this and other cases falls much short of the condition in Nature. Various tables of measurements and records of captures are also interpolated in the text. The Boston Society of Natural History and the painstaking author are to be congratulated on this monograph, which places in the hands of the public a succinct yet comprehensive account of each form occurring in the waters of New England.

W. C. M.

COMMERCIAL AERONAUTICS.

THE lecture delivered on May 30 at the Central Hall, Westminster, by Mr. Holt Thomas, on "Commercial Aviation," should awaken a considerable amount of interest in the commercial possibilities of aircraft after the war. The lecture was in effect a prelude to the meeting of the Civil Aerial Transport Committee, of which Lord Northcliffe is chairman, which has recently been mentioned in these columns. The serious consideration of commercial aeronautics will involve a great deal of scientific work, since the machines which will be necessary for commercial transport will differ in many ways from the types which have been developed to meet the demands of war. Speed will still be an important factor, though not of such paramount importance as in the military aeroplane. Mr. Holt Thomas pointed out that an aerial mail to Paris could be worked profitably at a charge of one halfpenny per ounce, the time of transit being about three hours, and this one instance is sufficient to show the great advantages which aerial transport could confer upon modern commerce. The influence of winds would necessarily render such a mail service more erratic than those now in operation, but the greatly increased speed would more than compensate for this, especially in the case of journeys which now involve both land and sea transport. The question of passenger conveyance is much more complicated than the establishment of aerial mails, as it will be necessary to design machines to give a reasonable amount of comfort to the passengers, especially on the longer journeys. Such difficulties of design are by no means insuperable, and it is practically certain that passenger services will be established in the near future, especially to places not easily served by railway. As Mr. Holt Thomas remarked, the aeroplane could be used to develop outlying places until they grew sufficiently large to warrant the construction of a railway line. The aerial mail will probably come first, owing to the obvious benefits such a rapid service would bring, and to the fact that it would not involve any radical changes in the design of the necessary machines.

Mr. Louis Coatalen, the well-known designer of the Sunbeam Company, delivered an interesting lecture on "Aircraft and Motor-car Engine Design" on May 16 before the Aeronautical Society. He commenced by pointing out the wide differences between the aeroplane engine and the type of engine previously developed for motor-cars. The chief desiderata in the aeroplane engine are lightness and the ability to work continuously at maximum power, and these considerations scarcely affect the design of the car engine at all. The engines designed for racing cars are much more nearly analogous to the aircraft type, and the lecturer remarked that the experience gained on such racing engines was of great value in the early days of aeronautics. The extent to which design had progressed was illustrated by the fact that in two years the weight of aeroplane engines had been reduced from 4·3 to 2·6 lb. per horse-power, and that without sacrificing trustworthiness. The question of valve design received a good deal of attention, the lecturer stating that in his opinion the best arrangement was to use two inlet and two exhaust valves, and to place the sparking-plug in the centre of the cylinder head. Coming from such an experienced and successful designer as Mr. Coatalen, the paper is full of valuable information, and should be read by all who are interested in light petrol motors, whether for aviation or for other purposes.

THE PAST WINTER.

WITH the publication of the Monthly Weather Report of the Meteorological Office for April observations are now complete for the five months December, 1916, to April, 1917, which embrace the abnormally cold and wintry period experienced generally over the British Islands. Temperature results are given in great detail in the reports, and the data afford a most thorough examination of the exceptional character of the weather.

Cold conditions set in towards the close of November and continued until nearly the close of April. The report for December shows a deficiency of temperature everywhere in the British Islands, except at

most places in the north of Scotland, where the average excess was about 0·5° F. At Bath the deficiency amounted to 5°. January had a deficiency over the whole of the United Kingdom, the defect being greatest in the midland, southern, and western parts of England and in Ireland, exceeding 5° in a few places. February had a slight excess of temperature in the Shetlands, Orkneys, and Hebrides; elsewhere it was deficient, the deficiency exceeding 7° at Hereford, and being more than 5° at many places in different parts of England and at a few places in the south of Ireland. March had a deficiency of temperature over the entire area of the British Islands, exceeding 5° at some places in the midland and eastern districts of England. April was everywhere cold, the deficiency of temperature exceeding 5° in many parts, and amounting to 6·6° at Aspatria, in Cumberland.

London is represented by eight stations, including Greenwich and Kew Observatories. The mean temperature, the arithmetical mean of the maximum and minimum readings, from the eight stations for the five months December, 1916, to April, 1917, is 38·0°, which is 3·6° below the average for the whole period. The highest of the several means for London was 39·3° at South Kensington, the observing station of the Meteorological Office, and the lowest Hampstead, 35·9°. The mean of the minimum, or night, readings at Hampstead was below the freezing point in each of the months from December to March, and in April the mean minimum was 33°. At Greenwich the mean of the maximum for the five months was 43·3°, the mean of the minimum 32·3°, and the mean was 37·8°, which is 3·8° below the normal. The means for January and February were both 35·3°, and April, with a mean of 42·7°, had a deficiency of 4·5°, the greatest deficiency from the normal in any of the five months. The mean temperature for the five months was 0·2° higher than for the corresponding period from December, 1890, to April, 1891, and it was 0·1° lower than for December, 1878, to April, 1879, the next lowest mean since 1841, and 0·2° lower than from December, 1844, to April, 1845.

Taking six representative stations in the midlands, for the five months the mean temperature was 36·8°, and the difference from the normal was *minus* 3·9°. At Brighton the mean temperature was 38·6°, a deficiency of 3·9° from the average. In Dublin the mean temperature for the five months was 40·0°, and the deficiency 3·5°; at Jersey 40·7°, and deficiency 4·2°. Three representative stations for Scotland give the mean temperature 37·9°, and the mean deficiency from the average was 2·3°.

Meteorological information from western and northern Europe shows that other parts were similarly affected with prolonged cold.

Dr. Mill, of the British Rainfall Organisation, in a letter to the *Times* of June 4, directs attention to the month which has just closed as being the warmest May at Camden Square, London, since the establishment of observations in 1858. He gives the mean temperature on a Glaisher stand as 59·1° F., or 5·1° above the average, whilst April was just 5° below its average. At Camden Square, May, 1868, had a mean temperature 58·9°, a trifle cooler than the recent May, and it was followed by a very hot summer. Dr. Mill quotes several warmer Mays according to the old London records, and mentions that only in 1809 did an extremely warm May follow, as this year, an extremely cold April. At South Kensington, the observing station of the Meteorological Office, the mean temperature in a Stevenson's screen for May was 59·6°. The Greenwich observations give 58·8° in 1841 and 1848 as the previous highest May temperatures, from maximum and minimum readings, since 1841, and in 1893 the mean was 58·4°. In 1908 at Greenwich the mean temperature for April was 44·3°, which is 4° below the average, whilst that for May was 56·7°, or 3° above the average. The following summer was by no means fine or hot. CHAS. HARDING.

THE COOLIDGE X-RAY TUBE.

THE Coolidge X-ray tube has been on its trial in this country during the last two years, and it may be said with some confidence that it has gone a very long way towards justifying the claims which have been made concerning it. Whether the tube be judged from the laboratory or from the clinical point of view, it marks a new era in the history of the X-ray tube. There is now to the hand of the experimenter or of the radiologist a source which provides him with a beam of X-rays which can be varied in the course of a few seconds, as regards both quality and output, over a very wide range; such radiation, moreover, may be repeated with certainty.

The work of Sir E. Rutherford and his colleagues, which was directed to find the shortest wave-length of the radiation emitted by the Coolidge tube, disclosed the fact that a limit was set to the penetrating power of this radiation when the potential difference between the terminals of the tube was about 150,000 volts. The Coolidge tube can be run at a higher working voltage than the ordinary X-ray tube owing to the absence of any measurable quantity of gas within the former, and the range of radiation emitted by it extends rather further into the region of the shorter wave-lengths than is obtained with the older type of tube.

There is a considerable clinical use of such very penetrating rays, which are rather more penetrating than the γ rays from radium-B, but less so than those emitted by radium-C. The difficulty of protecting those who apply such radiation is considerable, but the necessity for so doing is no less urgent than it is apparent, and we are glad to see that prominence is given to this question in a descriptive leaflet of the Coolidge tube, dated October 31, 1916, issued by the British Thomson-Houston Co., Ltd.

This memorandum contains a description of the tube, its mode of construction, and the methods which are now generally employed in its manipulation, both for radiographic and for radio-therapeutic work.

Considering the ease with which the Coolidge tube may be manipulated, and the short time which is required by anyone conversant with X-ray matters to acquire the necessary technique, it must be inferred that the only hindrance to its more general adoption in this country is the high cost of the tube.

The Coolidge tube may perhaps be looked upon as the most successful practical application which has yet been made of the classical work of Prof. O. W. Richardson on thermionic currents. We trust that the British Thomson-Houston Co., Ltd., which states that it is the owner of the English patents of this tube, will be instrumental in putting the Coolidge X-ray tube within the reach of a wider public than exists to-day.

THE ROYAL OBSERVATORY, GREENWICH.

THE report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, was presented at the annual visitation of the Observatory on June 1. A few of the matters dealt with in the report are here summarised.

The catalogue of stars down to 9·0m. on the B.D. scale between the limits of 24° and 32° of north declination has been completed by the determination of

the proper motions of about 12,000 stars. These have been obtained by comparison of the Greenwich positions with those given in the catalogues of the Astronomische Gesellschaft and the earlier catalogues of Bessel and Lalande. For the latter catalogues systematic corrections were determined for each separate night's observations.

A determination of the mean parallax of stars of different magnitudes has been made from these proper motions and published in the Monthly Notices of the Royal Astronomical Society. The results confirm very closely the formula given by Kapteyn. It is hoped to communicate to the society a short discussion of the proper motions with reference to star streaming. The publication of these summaries of results by the Royal Astronomical Society is specially valuable because of the delay in the printing and publication of the catalogue itself.

During the year 222 photographs were taken with the Cookson floating zenith-telescope, 216 for latitude groups and six for scale determination. The measurement of the photographs to the end of 1916 is completed, and the results for the variation of latitude for 1916 were communicated to the Royal Astronomical Society, and published in the Monthly Notices for March, 1917.

Throughout the year the 28-in. refractor was at the disposition of M. Jonckheere. Fifty-nine new close double stars were detected, making 259 since October, 1914. Up to November 22, 1916, the observations mainly consisted of the measurement and verification of stars discovered to be double since 1905, the date to which Mr. Burnham's catalogue extends. Since November 22 the programme of work has comprised (1) the measurement of stars from Burnham's General Catalogue which had been previously observed at the Lille Observatory, and (2) the re-measurement of double stars in vol. lxi. of the Royal Astronomical Society's Memoirs. Altogether 604 double stars have been measured during the year. Of these stars—

213	have a separation	under	2″.
156	,,	between	2″ and 3″.
132	,,	,,	3″ ,, 4″.
62	,,	,,	4″ ,, 5″.
41	,,	greater	than 5″.

The catalogue of double stars discovered since 1905 has been published by the Royal Astronomical Society in vol. lxi. of the Memoirs.

With the Thompson equatorial, in accordance with the programme of previous years for the determination of stellar parallax, a first exposure has been made on eighty-six plates, and a second one on 154 plates. At the request of Dr. de Sitter the series of photographs commenced at the Cape Observatory for the determination of the constants of the four Galilean satellites of Jupiter has been continued at Greenwich.

With the astrographic equatorial during the year 109 plates have been taken on thirty-five nights for the determination of proper motion by comparison with earlier plates. Of these nine have been rejected; eighty-five plates, of which fifty-two have two fields on them, have two short exposures, usually of 4m. and 2m.; fourteen have a single exposure of 12m.; one is for focus of the instrument.

The plates with short exposures are being compared in the duplex micrometer, but only for the stars contained in the *Bonn Durchmusterung*. The plates with longer exposures are being compared with earlier plates—usually chart plates—by Mr. Innes at Johannesburg, using a blink microscope. With the duplex micrometer 177 pairs of plates have been measured during the year. From the results obtained all proper motions greater than 10″ a century and many smaller ones are being determined. Simultaneously the proper motions of the brighter stars are being determined by comparison with earlier meridian observations.

In the year ended May 10, 1917, photographs of the sun were obtained on 208 days. Photographs have been received from the Royal Observatory, Cape of Good Hope, and supplementary photographs have been received through the Solar Physics Committee, from Dehra Dûn, India, in both cases to the close of the year 1916. Two days in 1916 still remain unrepresented, viz. June 19 and September 29. From 1910 to 1916 inclusive there are only two other days unrepresented in the combined series of photographs for measurement, one in 1911 and one in 1912.

The mean daily spotted area of the sun continued to increase during the past twelve months, and there is no indication as yet that the maximum has been reached.

The mean values of the magnetic elements for 1916 and five previous years are as follows:—

Year	Declination W.	Horizontal force (C.G.S.)	Dip
	° ′		° ′ ″
1911	15 33·0	0·18549	66 52 6 (3-in. needles)
1912	24·3	0·18548	51 46 ,, ,,
1913	15·2	0·18534	50 27 ,, ,,
1914	15 6·3	0·18518	49 27 ,, ,,
			51 13 (inductor)
1915	14 56·5	0·18508	51 50 ,,
1916	46·9	0·18494	52 45 ,,

It will be noticed that the annual diminution of declination increased considerably about 1910, its average value from 1900 to 1910 being 4·9′. The horizontal force, which had been increasing since measurements at Greenwich were begun in 1846, reached a maximum about 1910, and is now diminishing. The dip, which has been diminishing since measurements were begun in 1843, appears also to have recently reached a turning point. There were no days of great magnetic disturbance in 1916, but three were classified as of lesser disturbance.

The principal features of interest in the meteorological conditions at Greenwich during the year ended April 30, 1917, are:—(i) The continued cold weather from December to April—the latter month had a mean temperature 1° lower than any other April since 1841; and (ii) the general deficiency of sunshine.

The scientific work of the observatory has necessarily been somewhat curtailed, but it has been found possible to keep up all observations of the sun, moon, and planets; sun-spots; latitude; magnetic and meteorological registers—observations which would otherwise have been permanently lost.

One special piece of work to which a good deal of attention was devoted this year was the preparation of magnetic charts. In 1912 it was arranged that the compilation of the Admiralty charts of magnetic variation, hitherto undertaken by the Compass Department, should be transferred to the Royal Observatory. A card catalogue of magnetic declination data from all parts of the world was formed. From this and published data of various surveys the charts for 1917 have been prepared during the past year. They are now in course of publication by the Hydrographic Office.

RESEARCHES ON KALA-AZAR.[1]

I HAVE chosen the subject of twenty years' research on kala-azar for the main portion of my address to-night, both because of the great importance of this disease in a large area of India, and also of the ignorance of the general public regarding it. Most people have fairly definite ideas about malaria and

[1] From the presidential address delivered to the Asiatic Society of Bengal on February 8 by Sir Leonard Rogers, F.R.S.

cholera, but few have any regarding the far more deadly and insidious kala-azar, which, on account of its extremely high mortality and the painfully lingering nature of the disease, is without doubt the most terrible scourge occurring in India. It is now more than twenty years since I was fortunate enough, when with less than three years' service, to be selected to carry out the second investigation of the Assam epidemic of kala-azar, and it has never ceased from that time to occupy my thoughts, although my opportunities for continuing my researches on it have sometimes been more limited than I should have liked. Fortunately, I have been able to discover how to prevent the spread of the disease, and also independently to find a cure for it. The time, therefore, seems to be ripe for giving a brief popular summary of the progress which has been made in our knowledge of kala-azar through the researches of the last twenty years, which has resulted in a very great degree of success as regards both the prevention and the cure of the disease, although some links in the chain of infection still remain to be forged.

In the first place, I wish to remove a misconception which I find is commonly prevalent among the public, namely, that kala-azar and black-water fever are the same disease, or at least intimately related. It is true that some years ago a high medical authority did make such a suggestion on theoretical grounds, but I do not think any medical man now holds that view. As a matter of fact, it would be difficult to imagine two more widely different conditions than the lingering kala-azar and the short, sharp, black-water fever complication of malaria, which ends in death or recovery within a very few days. That black-water fever is but a complication of malaria is a view with which I am in agreement. But the differentiation of kala-azar from chronic malaria was not possible before the discovery of a distinct parasite in the former in 1903, and up to quite recently it remained very difficult on purely clinical grounds in many cases. It is, therefore, not surprising that the two were for long confused even by research workers, including myself in my report of 1897 on the Assam epidemic, and a little later by such a great authority on malaria as Sir Ronald Ross, who proved malaria to be mosquito-borne.

It is generally known that kala-azar spread through Assam for a number of years, causing a great mortality; but it is difficult to convey to those who have not seen its effects anything like an adequate idea of the terrible nature of the affliction. At the time of my investigation in 1896–97 the disease was at its height in the Nowgong district, the population of which in the decade 1891–1901 actually showed a decrease of 31·5 per cent., against an increase of 9 to 16 per cent. in the more easterly unaffected districts. Large areas of land fell out of cultivation, and even at the headquarters town of Nowgong land absolutely lost its value, being quite unsaleable. When the tea-gardens became infected in this district, and accurate figures were available, it was found that the mortality in several hundred carefully treated cases varied from 90 to 96 per cent.

But I must pass on to show you some photographs of cases taken during my investigation. The first group was taken in the Nowgong dispensary, and the second in that at Mangaldai. Both show the great emaciation contrasting with the tumid abdomens due to great enlargement of the spleen, and often also of the liver, while the skin becomes darker and more muddy, which, according to some, gave rise to the term kala-azar or black fever. Now it will no doubt occur to many of you that you have seen precisely similar cases in malarious areas round Calcutta, and you will ask, How do you differentiate between kala-azar and chronic malaria? That, indeed, was the problem which confronted me in Assam, with the added difficulty that the disease was spreading and causing an awful mortality such as malaria was not known to do in Lower Bengal, and that the people themselves had no doubt that the disease was an infectious one, though malaria was not believed to be so at the time of my investigation, which, of course, was several years before the mosquito-borne theory of malaria was established. In fact, there were at that time two rival theories regarding kala-azar: one that the disease was malarial, and therefore could not be infectious; and the other that it was infectious, and therefore could not be malarial, so must be some undescribed disease. I early set to work to find out if kala-azar was infectious. I found that the disease always began in a village through an infected person coming to reside there, the next to be attacked being those living in the same house as the infected visitor. This naturally led me to suspect that the disease was not malarial, yet I frequently found malarial parasites in the blood (it was not then known that in malarious parts many apparently healthy persons harboured malarial organisms in their blood), and, search as I would, I could find no differentiating point from malaria. I therefore visited Sylhet, to the south of the Khasia Hills, where kala-azar was then unknown, and there found cases of malarial cachexia which in every respect, including investigations of the blood changes, resembled kala-azar of the Brahmaputra Valley, except that they were much more chronic and sometimes lasted as many years as epidemic kala-azar did months. With the boldness of comparative youth I therefore declared the spreading kala-azar of Assam to be an epidemic infectious form of malaria, corresponding in some respects with the well-known Mauritius malarial epidemic of 1877. We shall see presently that I was partly wrong and partly right in coming to this conclusion.

However, I was not content with merely theoretical considerations, but strove for practical results from my inquiries. I therefore sought for more accurate data on the tea-gardens, which had become badly infected in the Nowgong district, and on which I investigated many cases with the help of my friend, Dr. Dodds Price, who has a unique experience of kala-azar and has rendered me the greatest possible assistance throughout a number of years. I ascertained that on one of his gardens so many deaths had occurred from kala-azar that two hundred new coolies had to be imported at one time. He had already independently recognised the infectiousness of the disease before I went to Assam, and had arranged for separate coolie lines to be built to prevent as many as possible of the new coolies going into the infected houses of the old lines. Only one hundred and fifty could be accommodated in the new lines, so fifty had to go into the old ones. On learning this, I at once set to work to ascertain the results of this important measure, and we found that in the course of two years no single case of kala-azar had occurred in the new lines (and the same was true eighteen years later), while no fewer than 16 per cent. of the new coolies living in the old infected lines were already dead of the disease, although the two sites were only about two hundred yards apart. This experience led me to urge moving out all the healthy people from the infected lines into new ones, taking none from infected houses, segregating the remaining infected families, and destroying the old houses. The results were so successful that the plan was repeated by Dr. Price on other gardens, and in 1913, during a visit to Assam in the Puja vacation, we worked out the results of eighteen years' experience. This may briefly be summarised by saying that the dread disease had been

completely stamped out of ten coolies' lines, in one of which three-fifths of the whole population had the disease in their households, while the new lines had afterwards remained free from the disease in every case, namely, from twelve to eighteen years in five of them, and for shorter periods in the others, no recurrence having ever taken place where Dr. Price had been able to get his orders carried out by the garden managers to prevent any infected person being allowed to live in the new lines. That this success was not due to the decline of the disease in the Nowgong district was clear from the fact that on two gardens where he could not get the managers to adopt my measures the disease was still present at the time of my 1913 visit, having persisted on them for twenty years. When it is stated that the population of the new kala-azar-free lines in 1913 amounted to 6727 souls, and that the deaths from kala-azar alone in the old lines before removal had amounted to 1393, or no fewer than 207 per mille, more than one-fifth; that the loss would have continued indefinitely, as shown by the fact that the disease remained present for twenty years on two gardens where the plans were not adopted; and that coolies cost about Rs.200 a head to recruit by the time they reached Assam, the saving to the tea industry in this one district alone must have amounted to lakhs of rupees. I am glad to be able to say that the industry has shown its gratitude in a very practical way by promising Rs.20,000 a year for five years for investigations in connection with the School of Tropical Medicine

The more difficult question remained as to whether anything could be done to check the spread of the disease up the Brahmaputra Valley. On turning once more to the map, you will see that the only traffic eastward is along the narrow strip between the hills and the Brahmaputra River, which also has comparatively few inhabitants. I found it to be free from kala-azar in 1897, so recommended that steps should be taken to stop infected people from passing up into the Golaghat subdivision of the Sibsagar district, and that if any villages became infected in Golaghat the segregation measures should at once be carried out and the healthy people moved to a new site. This was actually done later with success, and as the epidemic has abated in Nowgong, although sporadic cases remain, there is good reason to hope that the main danger has been averted and the eastern part of the valley saved from devastation little, if at all, less disastrous than the war itself. A recent investigation by Major McCombie Young, Sanitary Commissioner, Assam, has shown that the disease remains in a sporadic form in just those parts of Assam which I found to be infected with the epidemic twenty years ago—an important point I shall return to presently. Before leaving this part of the subject let me emphasise the fact that all the above practically important prophylactic measures were worked out as a result of my epidemiological studies before we had any accurate knowledge of the true nature and causation of the disease, so that, however wrong my theories proved to be, I have the satisfaction of knowing that my earliest important investigation in India led to much saving of life and suffering, which has always been a greater satisfaction to me even than the making of purely scientific discoveries without much practical value.

In the meanwhile, my theory that kala-azar was an epidemic malaria, although supported by the high authority of Sir Ronald Ross, was criticised by others, and Dr. Bentley, on the strength of what ultimately proved to be erroneous blood tests made at Kasauli, declared the disease to be an epidemic of Malta fever, but at the same time brought forward some strong arguments against the disease being malarial. While opinions were thus divided in India, researches on two other continents led to a solution of the difficult problem—so closely is scientific thought all over the world united by medical literature at the present day. In Africa the late Dr. Dutton, the most brilliant worker yet produced by the Liverpool School of Tropical Medicine, discovered a trypanosome in the blood of a patient suffering from a fever, which was later proved by Sir David Bruce to be the early stage of the deadly sleeping sickness. Sir William Leishman then recorded having found some minute bodies in the spleen of a soldier who died in England of a fever contracted in Dum Dum, and suggested that they were degenerate trypanosomes. Lt.-Col. C. Donovan, of the Madras Medical College, immediately announced that he had independently found the same bodies some months before, and added the important fact that they could be obtained by spleen puncture during life, thus disproving Leishman's theory that they were degenerate trypanosomes. Donovan also suggested that the so-called malarial cachexia and kala-azar might also be due to this parasite. Leishman and Donovan were therefore the joint discoverers of the parasite of kala-azar which is called after them, and I am glad to say that the Asiatic Society has been the first to recognise the importance of Donovan's work by electing him to our fellowship last year, although it is but a small recognition for such an important discovery. The way was now cleared for more rapid advance, and Dr. Bentley and myself independently found the same parasite in epidemic kala-azar in Assam, and I also found it in cases in the north-west of the Dinajpur district, where the disease had been known as kala-dukh. Thanks to the kindness of the physicians of the Medical College Hospital in 1904–5, and especially to Surgeon-General Harris, I was able to investigate scores of cases of what had hitherto been always regarded as malarial cachexia, with the result of showing that a large proportion of them were kala-azar.

These observations established the important fact that a sporadic form of kala-azar is widely prevalent in Lower Bengal, and I found it to be exactly similar to the cases I had formerly studied in Sylhet. The mystery of the nature of kala-azar was thus cleared up, the destructive Brahmaputra Valley wave having been an epidemic form of the disease which is epidemic in Lower Bengal and Sylhet; so that, although I was wrong in regarding it as malarial, I was correct in saying it was an epidemic variety of the disease I had found in Sylhet, which had always been regarded as malarial cachexia, but which we now know to be sporadic kala-azar. As special skill and laboratory facilities are required for demonstrating the parasite of kala-azar, while the treatment of kala-azar is different from that of chronic malaria, it still remained a matter of great practical importance to solve the century-old problem of finding a simple clinical differentiation between kala-azar and malarial cachexia. Only in January I recorded the results of three years' investigation of this problem in the Medical College Hospital, thanks to facilities kindly afforded me by my medical colleagues, which has, I believe, resulted in a simple and practical solution of this difficulty, and will enable the curative treatment I shall come to presently being successfully used by the general practitioner, even in places remote from laboratories.

The discovery of the parasite of kala-azar in 1903 placed me in a position to study it with the view of ascertaining its life-history, and so to obtain a clue to the mode of infection. In the following year I was

fortunate enough to succeed in cultivating this protozoal parasite in test-tubes under certain conditions and in watching the minute spleen form develop into a long flagellate organism resembling one of the stages of a trypanosome, but which further study showed to belong to the closely allied herpetomonas. This discovery gave the required clue to the nature and probable life-history of the parasite, as similar organisms are found naturally in the digestive canals of certain flies, indicating that the infection is probably insect-borne. I spent the next year in studying the conditions favourable to the growth of the parasite in cultures, and for reasons into which I have not time to go I came to the conclusion that the homely bed-bug is the carrier of the disease. The fact which had by this time been established by Dr. Dodds Price, that two to four hundred yards is a sufficient distance to remove healthy lines from infected ones, is sufficient to exclude a flying insect such as a mosquito. At this time Major Patton, of the Bacteriological Department, was placed on special duty to work at the subject in Madras. After some two years' work he obtained a development of the parasite up to the flagellate stage in the digestive canal of bed-bugs fed on kala-azar patients with the parasites in their blood. Lt.-Col. Cornwall has recently confirmed these experiments, and although the final proof of communicating the disease by means of infected bed-bugs has not yet been furnished (experiments on human beings, such as were carried out in the case of malaria, not being justifiable in the deadly kala-azar), still the evidence incriminating these insects is sufficiently weighty to make it desirable to wage war upon them wherever the disease is present. Coco-nut oil applied to the runs of the bugs on walls, and to the buttons of mattresses, etc., where they often hide, is a useful measure for this purpose. As these insects can live for months without food, the way in which the infection clings to houses is well explained on my theory that they are the carriers of the disease.

Lastly, I come to the most important discovery regarding kala-azar, namely, that of a trustworthy cure of this formerly very deadly disease. Antimony preparations have proved to be of value in trypanosomiasis, and nearly two and a half years ago I decided to try intravenous injections of tartar emetic in kala-azar. Unfortunately, just at that moment I had no clinical facilities for testing my idea, and for six months I carried about sterile capsules of tartar emetic without being able to use them, a disability which will end when the Carmichael Hospital for tropical diseases is opened. Eventually I obtained the facilities I required, and soon saw reason to believe that the drug was proving effective. Imagine my disappointment when I read that two Italian doctors had recorded successes in the treatment of the African form of kala-azar with the very drug I was using in Calcutta, although the fact that I had independently discovered the treatment will save some of the credit for the Indian Medical Service. At any rate, I am now in the happy position of being able to say that, thanks to the kind help of Capt. H. N. Hume and Lt.-Col. O'Kinealy, no fewer than twenty-five consecutive cases of kala-azar, including three children, have been successfully treated in the European General Hospital by this method, and the most deadly disease of India, if not of the world, has now been largely conquered, as regards both prevention and cure, perhaps more completely than any other highly lethal disease known, as a direct result of the researches of the last twenty years.

In conclusion I cannot resist this opportunity of pointing the moral, namely, that no greater benefit can arise than from successful medical research, and that no better use can be made of wealth than in endowing such research for the benefit of the present and all future generations. Bengal, and I would add Bihar, have already nobly responded to my appeal for endowments for the Calcutta School of Tropical Medicine, and when the terrible war is over we hope to have at least nine research workers in the new laboratories, instead of one poor man with routine professorial duties devoting such time as he can snatch to medical research.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. A. E. Shipley, F.R.S., master of Christ's College, has been elected Vice-Chancellor for the next academical year.

OXFORD.—A decree passed by Convocation on June 5 provides for the suspension of the Romanes lectureship until October 9, 1917, the moneys consequently undisposed of to be transferred to the Emergency Relief Fund of the University.

On the same day statutes passed Congregation empowering the board of the faculty of medicine to recognise certain examinations in natural science, and providing for the further promotion of higher studies in the University, with special reference to the proposed new degree of Doctor of Philosophy. The statutes respecting boards of electors to professorships were amended in some particulars.

Mr. T. R. Glover, fellow of St. John's College, Cambridge, has been appointed Wilde lecturer in natural and comparative religion for three years from October 10, 1917.

Prof. Emile Boutroux, Membre de l'Institut de France et de l'Académie Française, has been appointed Herbert Spencer lecturer for 1917.

Two courses of free public lectures have just been commenced at the School of Oriental Studies, London Institution, Finsbury Circus, E.C.2. One course, on "Religion in India and China," is being delivered by Dr. T. W. Rhys Davids, and the remaining lectures will be given on Tuesdays, June 12, 19, and 26; the other course, on "The Way to Buddhahood," by Prof. de la Vallée Poussin, is being delivered on Thursdays, June 7, 14, 21, and 28. The lectures begin at 5.30 in each case.

THE President of the Board of Education has appointed a Departmental Committee to inquire into the principles which should determine the construction of scales of salary for teachers in elementary schools, due regard being had to locality, duties, qualifications, sex, and other considerations consistent with the organisation of the teaching service throughout the country, on a system conducive to the efficiency of national education. The committee will be at liberty to illustrate any system of scales which it recommends by such specific sums of money as it thinks fit; but it is not asked to consider the question of the amounts by which existing scales of salary should be improved in particular areas, or the sources from which the amounts required for that purpose should be provided. The members of the committee are:—Sir H. L. Stephen (chairman), Miss M. M. Allan, Mr. J. W. Alsop, Dr. H. B. Brackenbury, Miss I. Cleghorn, Mr. C. W. Crook, Mr. W. R. Davies, C.B., Miss I. A. Dickson, H.M.I., Mr. A. J. Flavell, Mr. H. Mellish, Mr. H. Pearson, Mr. A. R. Pickles,

Mr. W. Pullinger, Mr. F. Roscoe, Mr. T. H. J. Underdown, Miss Hermione Unwin, the Rev. D. H. Williams, with Mr. A. H. Wood as secretary, to whom all communications should be addressed at the office of the Board of Education. Mr. Fisher intends also to deal with teachers in secondary, technical, and other schools by a further reference to a second committee connected with this committee in respect of both constitution and functions.

AN illustrated brochure entitled "Women on the Land" has been issued in which a description of the training of women and girls for agricultural and market-garden work at "Craigendowie," Broughton, near Preston, is given. Under the Lancashire committee a month's training was provided for, but Mrs. Ritchings, who has undertaken the work of training the girls on her own estate, has wisely continued the course of instruction for a second month. The number of students taken at one time is about twelve, and probably it is possible to give much more thorough instruction in the use of tools with a small number of students than with the unduly large numbers which are sometimes crowded for a month into training centres. Although none of the women students at "Craigendowie" had had previous experience of agricultural work of any kind, the results seem to have been very successful, and the women have been drafted out to situations in Lancashire and Cheshire. The reports given by various training centres and the accounts received from farmers, which have been published from time to time in the *Journal of the Board of Agriculture*, show clearly that women are capable of doing valuable work on the land, provided that the farmers will give them a fair trial and a certain amount of preliminary instruction of a clear and practical kind. With the care of dairy cows and other stock women seem to have been particularly successful, though they have carried out satisfactorily almost every type of agricultural work. In view of the necessity for increased cultivation, the demand for women's work on the land will rapidly increase during this year, and it is of the greatest importance that it should be satisfactorily met. Training schools have fortunately been established in many counties, and if women can be assured of suitable accommodation and adequate wages, large numbers will doubtless take up an employment which has been re-discovered as healthy, interesting, and absolutely essential to the welfare of the nation.

BOOKS RECEIVED.

Three Lectures on Experimental Embryology. By Dr. J. W. Jenkinson. With a Biographical Note by Dr. R. R. Marett. Pp. xvi+130. (Oxford: At the Clarendon Press.) 7*s.* 6*d.* net.

A Sketch Map of the Linguistic Areas of Europe. (London: E. Stanford, Ltd.) 2 guineas.

The War and the Nation: A Study in Constructive Politics. By W. C. D. Whetham. Pp. viii+312. (London: J. Murray.) 6*s.* net.

Rings for the Finger, from the Earliest Known Times to the Present. By Dr. G. F. Kunz. Pp. xviii+381+illustrations. (Philadelphia and London: J. B. Lippincott Co.) 28*s.* net.

The Home and the Family: An Elementary Textbook of Home Making. By Profs. H. Kinne and A. M. Cooley. Pp. vi+292. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 3*s.* 6*d.* net.

Fresh-water Wonders and How to Identify Them. By J. H. Crabtree. Pp. 64. (London: C. H. Kelly.) 1*s.* 3*d.* net.

DIARY OF SOCIETIES.

THURSDAY, JUNE 7.

ROYAL INSTITUTION, at 3.—The Art of the Biographer: A. C. Benson.

LINNEAN SOCIETY, at 8.—The Hooker Lecture on The Natural Classification of Plants: Prof. F. O. Bower.

CHEMICAL SOCIETY, at 8.—The Constitution of Internal Diazo-oxides (Diazophenols). Part ii.: G. T. Morgan and H. P. Tomlins.—The Determination of Ozone and Oxides of Nitrogen in the Atmosphere: F. L. Usher and B. S. Rao.—Thiocarbamide and Esters: J. Taylor.—The Phosphates of Calcium. Part iv. The Basic Phosphates: H. Bassett, jun.—Preparation of Secondary Arylamines free from Primary Amines: J. Thomas.—Some Double Compounds of Ferric Chloride with Ethers: A. Forster, C. Coope, and G. Yarrow.—The Absorption Spectra of some Polyhydroxyanthraquinone Dyes in Concentrated Sulphuric Acid Solution and in the State of Vapour: D. B. Meek.—Action of Acetaldehyde Ammonia on Quinones: P. C. Ghosh.—The Exact Determination of Morphine in Complex Mixtures. Part i. A Collection and Revision of Data: A. Tingle.

FRIDAY, JUNE 8.

ROYAL INSTITUTION, at 5.30.—Industrial Applications of Electrons: Sir J. J. Thomson.

ROYAL ASTRONOMICAL SOCIETY, at 5.

PHYSICAL SOCIETY, at 5.—A Bridge Method of Comparing Fixed Inductances: T. Parnell.—The Radiation from Loaded Antennæ: Van der Pol.—A Demonstration of a Method of Preventing Sparking at a Rapid "Make and Break": Dr. A. Griffiths.

SATURDAY, JUNE 9.

ROYAL INSTITUTION, at 3.—The Electrical Properties of Gases: Sir J. J. Thomson.

ARISTOTELIAN SOCIETY, at 8.—(At Cambridge.)—The Conception of a Cosmos: Prof. J. S. MacKenzie.

SUNDAY, JUNE 10.

ARISTOTELIAN SOCIETY, at 8.—(At Cambridge.)—Symposium: Are the Materials of Sense Affections of the Mind?: Dr. G. E. Moore, W. E. Johnson, Prof. G. Dawes Hicks, Prof. J. A. Smith, and Prof. James Ward.

THURSDAY, JUNE 14.

MATHEMATICAL SOCIETY, at 5.30.

FRIDAY, JUNE 15.

INSTITUTION OF MINING ENGINEERS, at 11 a.m.—The Spontaneous Firing of Coal: Dr. J. S. Haldane.—The By-product Coking Process, its History, Development, and Application: E. Bury.—Acetylene Mine Lamps: W. Maurice.

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