THURSDAY, OCTOBER 10, 1907.

HIGHLAND SPORT.

The Wild Sports and Natural History of the Highlands. By Charles St. John. Pp. xx+314. (London: John Murray, 1907.) Price 2*s.* 6*d.* net.

THE appearance of a reprint of the ninth edition of "The Wild Sports of the Highlands," first published sixty-one years ago, is sufficient proof of the permanent merit of that delectable book, but hardly affords a pretext for a set review of one so well and widely known. More to the point, perhaps, to recall the personality of the author, with which his many readers are less familiar than they are with his writings. A great-grandson of Lord Bolingbroke, the Tory Minister of Queen Anne and Secretary of State to the Old Pretender, Charles St. John became a clerk in the Treasury in 1828, where he proved a distinct failure. His heart was in the open air; his uncle, the second Lord Bolingbroke, lent him a lodge in Sutherland, where he had the good fortune to win the affections of Miss Ann Gibson, a Newcastle banker, whom he married in 1834. His wife not only brought him some money, but hearty sympathy in his devotion to sport and natural history.

In these pursuits the St. Johns might have passed their placid lives known to few except shepherds, gillies, and such venturous sportsmen as had discovered the splendid resources of the moors of Moray and Sutherland, had not Cosmo Innes, Sheriff of Moray, made acquaintance with the recluse and become impressed with his knowledge of woodcraft and wild animals Why, he asked, did not St. John turn his abundant leisure to account by writing on his favourite subjects? St. John laughed at the notion, saying he was quite pleased if he could manage to reply intelligibly to his few correspondents; but in the end Innes persuaded him to try his hand, so that, during the winter of 1844–5, St. John composed a few little essays on sport and natural history. One of these, entitled "The Muckle Hart of Benmore," Innes shaped into an article for the *Quarterly Review*, which so much delighted the editor, Lockhart, that St. John, stimulated by an unexpected honorarium, set to work in earnest, and before his early death in 1853, at the age of forty-four, he had completed the work presently under notice, "A Tour in Sutherlandshire," two volumes, published in 1849, and "Natural History and Sport in Moray," published ten years after the author's death. Death is the crowning act of all field sports, and St. John was an adept in pursuit; but it was from the by-products, so to speak, of a day's fishing, shooting, or stalking that he drew keenest delight—the behaviour, the attitudes, the natural traits of beast and bird. He found out for himself many secrets which are now well known to every field-naturalist. Here is one, for instance, with which all gamekeepers are familiar, but the cause of which remains still to be elucidated.

"It is a curious fact, but one which I have often observed, that dogs frequently pass close to the nest of grouse, partridge, or other game, without scenting the hen bird as she sits upon her nest. I knew this year of a partridge's nest which was placed close to a narrow footpath near my house; and although not only my people, but all my dogs, were constantly passing within a foot and a half of the bird, they never found her out, and she hatched her brood in safety."

Here, again, is a note the truth whereof is slowly gaining ground, although it has had to fight its way to acceptance through half a century of incredulity.

"With regard to the mischief done by owls, all the harm they do is amply repaid by their utility in destroying a much more serious nuisance in the shape not only of the various kinds of mice, but of rats also; these animals being their principal food and the prey which they are most adapted for catching."

There has been a controversy in the *Scotsman* lately about the food of the water-ousel or dipper, opinion appearing to be equally divided upon the question whether that bird devours the spawn of fish. The late Prof. Newton, Frank Buckland, and other good observers stoutly defend the dipper against the accusation, but St. John entertained no doubt about its truth. It is certainly difficult to undersand how a carnivorous bird, searching for food at the bottom of the water, should be so discriminating as to reject the ova of trout and salmon and feed only on aquatic insects and their larvæ. Prof. Newton, however, wrote with much confidence on this subject.

"By the careless and ignorant it is accused of feeding on the spawn of fishes, and it has been on that account subjected to much persecution. Innumerable examinations of the contents of its stomach have not only proved that the charge is baseless, but that the bird clears off many of the worst enemies of the precious product."—("Dictionary of Birds," p. 668.)

On the other hand, St. John's adverse verdict does not seem to have been based on actual observation.

"The water-ousel is supposed to commit great havoc in the spawning beds of salmon and trout, uncovering the ova and leaving what it does not eat open to the attacks of eels and other fish, or liable to be washed away by the current; and, notwithstanding my regard for this little bird, I am afraid I must admit that he is guilty of no small destruction amongst the spawn. . . . Notwithstanding the bad name he has acquired with fishermen, I never could make up my mind to shoot him."

It is a pity that grave charges like this should be laid upon such slight evidence. It must be a very feeble or poor-spirited eel that cannot help itself to as much spawn as is good for it without employing the dipper as pioneer. The question ought to be settled once for all by examining the contents of the stomach of a water-ousel shot among spawning salmon.

St. John's pages well bear re-perusal. They are charged with the free air of the moor and the loch, and, greatly as nature students have multiplied since his day, none of them gives more direct insight than he does into the *vie intime* of wild animals.

SOCIOLOGICAL SCIENCE.

(1) *Sociological Papers.* Vol. iii. (1906). Published for the Sociological Society. Pp. xi+382. (London: Macmillan and Co., Ltd., 1907.) Price 10*s.* 6*d.* net.

(2) *Heredity and Selection in Sociology.* By G. Chatterton-Hill. Pp. xxxii+571. (London: Adam and Charles Black, 1907.) Price 12*s.* 6*d.* net.

(1) THIS volume is quite equal in interest to either of its predecessors. Among the papers which it comprises, those contributed by Dr. Archdall Reid and Mr. A. E. Crawley are of preeminent interest, owing partly to the merit of the papers themselves, partly to the discussions which followed, and the written communications elicited from English and foreign authorities. Dr. Reid took as his subject "The Biological Foundations of Sociology." The present evolution of civilised man is, he maintained, mainly against disease. Intellectual power in a nation depends almost entirely upon the environment of the individuals that make up the nation—in fact, upon education. Education ought to make the pupil think instead of overtaxing his memory. In particular, medical students should study heredity. Until doctors as a body are masters of what is known on this subject, the medical profession will never occupy the place that properly belongs to it. Dr. Reid's statement of his case was at once trenchant and guarded, and the criticisms fell mostly wide of the mark. But is there not, in addition to the evolution against disease on which he lays so much strees, a moral evolution going on? There is everywhere a great demand for honest men. Steadiness and trustworthiness are the qualities which modern civilisation most requires. In the lowest stratum of society, from which the casual labourers mainly come, such things are perhaps not important enough to have survival value. But in all the strata above the very lowest the qualities of steadiness and trustworthiness are those which pay, are those which enable a man to bring up a family; and men and women who are deficient in them sink lower or are eliminated altogether. Dr. J. L. Tayler's paper on the study of individuals (individuology) and their natural groupings (sociology) is to some extent an answer to Dr. Reid's. Instead of finding in disease an influence which strengthens the race, he holds that slums favour barbaric types, whereas with higher social conditions, while diseases testing physical endurance are destroyed by hygienic developments, others arise that test mental tenacity and strength.

Mr. A. E. Crawley's paper on the origin and function of religion is one of great interest. He holds that the problem of religion is a psychological problem, and that the general culture of the savage is entirely religious. Religion is a "psychic tone or temper or diathesis." The religious emotion consecrates all such elemental concerns as birth, puberty, marriage, sickness, death, and burial. It is, in fact, the "affirmation and consecration of life." Religion, therefore, rests on a basis of individualism, though the heightening of the individual life leads to an expansion of individuality, and so to sympathy and altruism.

In a written communication Prof. Starbuck points out that not only religion, but art, morality, and philosophy, heighten and deepen life. The feeling of awe in the presence of a supersensuous reality is an essential part of religion.

We have space for little more than a bare enumeration of the other papers:—"A Practicable Eugenic Suggestion," by Mr. W. McDougall; "The Sociological Appeal to Biology," by Prof. J. A. Thomson; "A Suggested Plan for a Civic Museum and its Associated Studies," by Prof. Patrick Geddes; "Sociology as an Academic Subject," by Prof. R. M. Wenley—an interesting account of sociology in America; "The Russian Revolution," by G. de Wesselitsky; "The Problem of the Unemployed," by Mr. W. H. Beveridge—a short, sensible paper followed by a discussion in which Mr. J. A. Hobson and Mr. Rider Haggard took part; "Methods of Investigation," by Mrs. Sidney Webb; "The So-called Science of Sociology," by Mr. H. G. Wells.

(2) From beginning to end this is a very interesting book. It is the result of much thought on great subjects, and it is written in clear and forcible style. But many of the questions discussed are highly controversial, and it is only to be expected that among competent critics there will be not a few who will come to different conclusions or who will remain unconvinced.

Part i. is introductory, and consists of a general account of evolution. The author is a strong believer in Weismann, whose doctrines he vigorously champions. The criticism suggests itself, that since it is a cardinal doctrine of Weismann, accepted unconditionally by our author, that, as soon as natural selection ceases to work, degeneration sets in, it would have been better to give more evidence of this from the organic world. On the other hand, too much, in the opinion of the present writer, is made of germinal selection—a hypothesis which rests on a very unsure foundation.

In part ii. we get to the heart of the book. Its title is "Social Pathology," and in it our author deals very ably with some of the most difficult problems of modern civilisation. Among the most civilised nations suicide, insanity and syphilis are increasing. There is, besides, much inverse selection, elimination, that is, of many who under more natural conditions would be best fitted to survive, while, on the other hand, an artificial environment brings about the survival of the weak and sickly. No doubt there is much reason for our author's somewhat desponding tone. But is not suicide, however clumsy its operation, one of the means by which the unfit are eliminated? And does not drink remove thousands of the most weakly before they have propagated their kind? Though it degrades the individual, does it not keep up the physical strength of the race? The survival of the weakly has undoubtedly a deplorable effect. Altruism and science strive to keep every child that is born alive until it attains to manhood or womanhood. Here is the fountain-head of the physical degeneration of civilised races. Still, Mr. Chatterton-Hill is, perhaps, over-pessimistic. There is still an enormous amount of elimination; not far short of fifty per cent.

of our population die before the average age of marriage.

The possible remedies for the diseases of our social system are discussed. The increase of suicide, we are told in the very interesting discussion of the subject, is due to want of integration. We live in an age of rampant individualism, for which, however, socialism supplies no remedy. Religion has not the hold on man that it once had. Family life is less strong than it was, and tribes and village communities are things of the past. Men make away with themselves because they have no strong ties and no strong interests. In times of political commotion there are fewer suicides, apparently because there is plenty to think about. To a great extent the theory of want of integration explains the facts. But is our author right when he maintains that Roman Catholicism is a stronger integrating force than Protestantism? Is not the form of faith rather a symptom than a cause? The most go-ahead races have seceded from the church of Rome. The Roman Catholic peoples are more primitive and less industrial; and in this, as in most social questions, there are many factors to be taken into consideration. But however much we may disagree with some of Mr. Chatterton-Hill's conclusions, the book is a book to be read. F. W. H.

OUR BOOK SHELF.

British Rainfall, 1906. On the Distribution of Rain in Space and Time over the British Isles during the year 1906. By Dr. H. R. Mill. Pp. 100+280. (London: Edward Stanford, 1907.) Price 10*s*.

THE present volume is the forty-sixth of this valuable and unique publication; it gives, in various forms, the results of observations made at 4267 points in the British Isles. The plan of the work is the same as last year, being divided into two parts:—(1) original papers and organisation reports, (2) monthly and yearly rainfall tables, particulars of wet periods, and observers' notes on the principal meteorological occurrences of the year.

Dr. Mill gives an interesting discussion of the great snowstorm of December 25–26, 1906, illustrated by two maps; one of these shows the rate of movement across the country with greater detail than has probably been previously attempted. The area covered by the storm extended from the north-west of Scotland to the English Channel, the advance being least rapid in the north, where it was 12½ miles an hour, and most rapid in the south, where it was about 19 miles an hour; a motor-car could have kept out of the storm without exceeding the legal speed limit.

The frontispiece is a coloured map showing very clearly the relation of the rainfall of 1906 to the average of 1870–99. Generally speaking, the fall over the whole country in 1906 was near the average; Scotland had a pronounced excess, and Ireland a scarcely less pronounced deficiency. The timely revision and publication of such a mass of materials is only rendered possible by the interest taken by the staff in the work and by some valued voluntary assistance. The usefulness of the undertaking is recognised by such public bodies as the Meteorological Committee, the Metropolitan Water Board, and others, who pay for the information they receive, but the main burden of expense has been hitherto borne by the observers and those interested in rainfall investigations. We agree with Dr. Mill in thinking that no piece of work of equal magnitude is done so cheaply.

Le Feste Giubilari di Augusto Righi. Pp. vi+143. (Bologna: Nicola Zanichelli, 1907.)

THIS little work is a *Festschrift* in honour of Prof. Righi, giving an account of the ceremony recently held to celebrate the completion of his twenty-fifth year of university teaching. This period really expired in 1905, but it was decided by the committee organising the *fêtes* to postpone the celebration so as to make it coincide with the inauguration of the new Institute of Physics at Bologna, which is placed under Prof. Righi's charge. The ceremony actually took place on April 12. Prof. Righi delivered his first lecture in the new building, choosing for his subject the "Hypothesis of the Electrical Nature of Matter." Prof. Blaserna, on behalf of the subscribers, then presented the lecturer with a bust of himself in bronze. Congratulatory letters and telegrams received from all parts of the world were subsequently read. The *Festschrift* contains Prof. Righi's lecture printed in full, together with all speeches, letters, &c., received; it is illustrated with many photographs of Prof. Righi and of the new institute. A complete list of Prof. Righi's scientific publications, numbering two hundred and seventeen in all, and a chronological review of his career are appended.

The Half-tone Process. By Julius Verfasser. Fourth edition. Pp. 348. (London: Iliffe and Sons, Ltd., 1907.) Price 5*s*. net.

THE author describes his work in a sub-title as being "a practical manual of photo-engraving in half-tone on zinc, copper, and brass, with a chapter on three-colour work." In preparing the new edition he has thoroughly revised the work, and added to it so that it describes as far as possible the making and proofing of half-tone blocks as at present practised. The subject is treated in a strictly practical way, obsolete methods and historical details find no place in it, nor does the author venture into the future. Apparatus that every worker must buy is not described with excessive minuteness, but such information as is necessary for using it to the best advantage is clearly set forth. No theoretical considerations are introduced, except in connection with such matters as the cross-lined screen and the management of electric arc lights, and then only in the simplest manner as being the best guide to the intelligent use of the apparatus. After ten chapters on appliances, the author describes with all necessary formulæ the operations of making the negative, printing, etching, finishing, mounting, and proofing the plates. The chapter on the three-colour half-tone process assumes a general knowledge of the principles involved, and refers only to the additional manipulation necessary. The two examples of three-colour work are not much credit to the process, but the other illustrations, which are numerous, are useful and good.

The Alphabet of the Universe: Notes for a Universal Philosophy. By Gurney Horner. Pp. 44. (London: Hayman, Christy and Lilly, Ltd., 1907.) Price 1*s*. net.

THE aim of the author of these "skeletonic and informal notes" is "to find the one objective 'Something'—a quest in which humanity has hitherto been baffled and defeated." He is so obviously convinced that notwithstanding "the failure of Plato, Aristotle, and all later philosophers," he has really solved "the problem of the *Method* of the Universe" that he may perhaps be forgiven for allowing his "epoch-making discovery" to be announced in language which inevitably prompts the cautious reader to assure himself

that he has not been entrapped by the advertisement of a new patent remedy. Mr. Horner appears to be entitled to the credit of having arrived twenty-five years ago at the now fashionable doctrine that man is essentially a behaving animal—or, as he expresses it, that "man's life is made up simply of a series of acts"—and of having anticipated the Pragmatists in the deduction "that acts form the only proper basis of philosophy." Unfortunately, he has shown in these pages no competence to construct upon this basis anything with which, even in these hard times, philosophy should be asked to allow her name to be connected.

The More Important Insects Injurious to Indian Agriculture. Memoirs of the Department of Agriculture in India, vol. i., No. 2, Ento. Se. Pp. 139+v; 80 figures. By H. Maxwell-Lefroy. (Pusa: Agricultural Research Institute, 1907.) Price Rs. 3.

THE above-named paper is a very excellent foundation for the young economic entomologist in India to work upon. The chief insects known to be injurious to crops in India are briefly described in systematic order.

The method of treatment of this subject is novel, and might well be copied by others compiling similar lists.

The technical name of each pest is given, and then one or two references of interest and a short, concise description of the insect follows. Short notes of the distribution, biology and food plants are appended, and finally the writer's opinion as to the status of the insect as a pest. A large number of the adults are figured, and in a few instances the larvæ also.

Showing the backward state of economic entomology in India is the fact that only four aphides are placed in this list. A sound foundation is, however, being laid, and we are glad to learn that a supplementary list is to follow when the material is available. In all 131 pests are dealt with, some of which are well known in Europe, such as the diamond-back moth, the turnip moth (*Agrotis segetis*), the large cabbage white, convolvulus hawk moth, the corn aphis, cabbage aphis, and thistle aphis. F. V. T.

LETTERS TO THE EDITOR.

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

The "Friar's Heel" or "Sun Stone."

IN an old number of *Notes and Queries* (4, v. 598) E. Dunkin asks "why the 'Friar's Heel' at Stonehenge is so named," and the only answer I can find in the bibliography of Stonehenge (*Wilts Archaeological Magazine*, vol. xxxii.) is as follows:—"It may have been called the Heel stone," observes Prof. Flinders Petrie, "from A.S. *helan*, to hide or conceal, just as a cromlech at Portisham, Dorset, is called the 'Hel-stone.'"

The word *Heal* or *Hele* is used in N. Wiltshire in this sense. "When the ground is dry and hard and the wheat when sown does not sink in and get covered up at once, it is said not to *heal well*" (Dartnell and Goddard, "Glossary of Wiltshire Words," 1893), but this meaning is more applicable to the cromlech than to the upright stone at Stonehenge.

Modern researches as to the date of the erection at Stonehenge point to a time when a Celtic word rather than an A.S. word would have been in use, and it has occurred to me that the word *Heol*, which is the Breton word for *the Sun*, may be an explanation of the name of the stone in question, as it is the stone used for the observation of the rising sun at Midsummer. It would be interesting to learn from Celtic scholars what equivalent Celtic word was in use in Britain when *Heol* was the word used in Brittany, and whether *Heol* or *Hel* would be the Cornish form of the Welsh word for the sun. The Rev. J. Griffith tells me "that *houl* is the oldest Welsh form of the word—then *heil*, and now in literary Welsh *haul*."

The foolish mediæval legend of the devil flinging the stone at a mocking friar and hitting him on the heel is evidently of very late date, but it is singular that a similar legend is attached to the "Hel Stone" in Dorsetshire, where the story is that the devil, playing at quoits in the island of Portland, flung the Hel Stone across to Portisham (see Hutchings' "Dorset," i., 554).

There is another Hel Stone near, so called in common with the cromlech at Portisham, and it stands in a small combe to the north of Long Bredy hut; it is a rude mass about 7 feet high and 7 feet wide, whilst the capstone of the cromlech at Portisham is 10 feet by 7 feet by 2½ feet (Warne's "Ancient Dorset," pp. 111–135).

By the time the legends of the "Friar's Heel" and Hel Stone were invented, the old language would have been a thing of the past, but possibly the old name lingered in the memory of men wholly ignorant of its significance, giving rise to the traditions.

October 4. T. STORY MASKELYNE.

The Double Drift Theory of Star Motions.

PROF. J. C. CHAMBERLIN'S planetismal hypothesis has given geologists a great deal of matter for thought, and on the whole the phenomena with which they are acquainted appear to fall into line when the earth is considered as a body that has always been solid. The cosmical aspect of the question, which Prof. Chamberlin introduced in advancing his hypothesis, geologists are unable to judge, and they are waiting until astronomers give them an opinion before adopting the hypothesis on the larger scale. On the planetismal hypothesis our stellar system is a disc the edge of which is the Milky Way; beyond lies another stellar system, the so-called nebula in Andromeda, for all the most distant stars in the neighbourhood of the nebula appear to be this side of the luminous disc. If our stellar system is of the same nature as that of the nebula in Andromeda, then it must be a spiral nebula with two equivalent arms originating from a central core and winding spirally round the centre in approximately the same plane. Suppose our sun had experienced a gravitational drag and was moving at a less rate than the general average of the other stars, or suppose its spiral course was steeper than the general average, and hence its angular velocity less, then an observer regarding the rest of our stellar system from our planet would see the stars near the centre of the spiral travelling in two directions, those on this side of the centre travelling from right to left, and those on the other side in the reverse direction. Is this not a possible explanation of Prof. J. C. Kapteyn's double-drift theory of star motions? It explains why the two systems travelling in opposite directions should be of equal composition and proportions, but it necessitates that in the region of the sky opposite to that in which the double drift has been observed the drift should be simple.

The explanation also presupposes that our stellar system was once more closely aggregated, and because there is no central core to our system it must be of less bulk than that of the nebula of Andromeda. The two stellar systems, once consisting of closely packed stars and more or less spherical, travelling in opposite directions and approaching each other within reach of the action of gravitation, would have experienced disruption, each throwing out equal equatorial prominences on the same principle as that which produces the tidal bulges. On the nearer approach of the two systems to each other, the smaller of the two, our stellar system, would have experienced the entire disruption which has reduced it to the tenuity which it exhibits, whereas the larger stellar system, the nebula in Andromeda, would have been enabled to keep its central core. ERNEST H. L. SCHWARZ.

Rhodes University College, Grahamstown, Cape of Good Hope, September 12.

The Origin of Radium.

IN an earlier communication to NATURE (September 26, p. 544) I mentioned some experimental proof which had been obtained of the existence in uranium minerals of a new radio-active element differing from those which have previously been identified. More conclusive evidence of the individuality of this new substance has now been obtained through the examination of the properties of its α radiation. The α rays which it emits are much more readily absorbed by aluminium than the α rays from polonium, with which it has been directly compared. Their apparent range in air determined by the scintillation method is less than 3 centimetres, and a more accurate determination is somewhat difficult, since it has not yet been found possible to obtain the new substance entirely free from thorium. Certain operations are now being carried out with considerable quantities of a uranium mineral containing no thorium which it is hoped will result in the separation of a highly active preparation of the new body free from other radio-active substances. The short range of the α particles is, however, sufficiently characteristic to serve as a definite means of identification.

The new substance also gives out a β radiation which is much less penetrating and more easily absorbed than that from uranium, the value found for the coefficient of absorption being about 1·8 for aluminium.

Experiments which have been carried out with the view of obtaining a quantitative separation of this new element from small quantities of very pure uraninite have given results which are in good agreement with one another, and which indicate that the activity of the new element in equilibrium with radium is about 0·8 of the activity of the radium itself with which it is associated. This is about the value to be expected if the new substance is intermediate between uranium and radium when the ranges of the α particles are taken into consideration.

The name "ionium" is proposed for this new substance, a name derived from the word "ion." This name is thought to be appropriate because of the ionising action possessed by this element in common with the other elements which emit α radiations.

BERTRAM B. BOLTWOOD.

Sloane Laboratory, Yale University, New Haven, Conn., September 21.

Excretion from Plant Roots.

THIS subject, discussed at intervals over the greater part of a century, has been recently revived. Mr. Pickering has suggested that the effect produced by one plant on another is probably due to the indirect action of bacteria. Dr. Russell attributes it to chemical changes in the soil, whilst Schreiner and Reed in America (Bulletin of the Torrey Botanical Club, June) and Mr. Fletcher in India have described experiments tending to show that some deleterious substance is excreted from the root. The questions incidentally raised by these several experimenters are not all identical, because, as Mr. Pickering points out, his work has to do with initial stages of growth, while that of others relates to subsequent development.

So far as *excretion* is concerned, it seems to be almost excluded as a possible explanation, because it would demand open orifices in the root which do not exist. There is nevertheless another line of thought which may have a more likely bearing on the subject. I refer to ionised changes such as occur when hydrogen chloride forms inside the red-blood corpuscle and sodium carbonate on the outside, or when sodium hydrate forms in the blood and hydrogen chloride in the stomach. Both these changes are due to the selective power of the living cell wall; and similarly it is probable that the cell wall of the root exercises a like property, and that the substances called plant foods do not pass into the root cell as such, but suffer change. Thus it is explained why the liquid outside the root becomes more basic, that on the inside more acidic (Hall and Miller, Proc. Roy. Soc., 1905).

May it not be equally possible that, owing to such changes, harmful substances may be formed in the soil solution?

J. WALTER LEATHER.

Agricultural Research Institute, Pusa, Bengal.

Pleochroic Halos.

IN the March number of the *Philosophical Magazine* I gave reasons for believing that the pleochroic halos of certain micas are referable to the radio-activity of the enclosures which are invariably associated with the halos. I cited in favour of this view the facts that all minerals definitely recognisable as forming the centres of halos are radio-active; that the perfect sphericity of the halo in a medium such as mica precluded any explanation involving diffusion or segregation of colouring matter, and that there was a very exact agreement between the known effective penetrability of α rays in media of this density and the maximum radius attained by the halo. I subsequently found, by examination of specimens kindly lent to me by Dr. Teall, that the same reasoning was applicable to halos formed in cordierite.

When first conceiving this idea, I started experiments on cleavage flakes of biotite to ascertain if halos could be induced by enclosing between the flakes specks of radium bromide. For some two months I kept these preparations under observation, but no change was apparent. They were then put aside in view of experiments which necessitated my abstention from any contact with radio-active preparations.

Within the last few days Dr. Teall has directed my attention to the (independent) work of O. Mügge, of Königsberg i. Pr., which appears in the July number of *Centralbl. für Min.*, in which a coloration was successfully induced in cordierite by application of radium, a coloration agreeing in properties with the halos in cordierite. This sent me back to my slides, and I find that a brown coloration has now developed around the larger radium specks. These stains have all the appearance of halos save that the radius is greater and the boundary less defined, differences at once explicable on the fact that the rays here travel in air before entering the mineral, and hence possess a greater, and at the same time a less sharply defined, range of effectiveness. The coloration is faintly pleochroic, the direction of greatest absorption agreeing with that of some naturally occurring halos present in the flakes.

There is, of course, nothing in these observations to prove that the effects observed are obtained in the precise manner in which radio-active enclosures appear to affect mica. It may be that sufficiently intense β radiation may produce effects which in the mineral are almost certainly referable to α rays. Still more protracted observations will be required to differentiate between the rays. However this may be, the cumulative evidence seems to leave no room for doubt that these extraordinary halos are indeed due to radio-activity. In these halos we have, I believe, the only instance so far observed in nature in which the presence of radium can be determined by direct eye observation of a radio-active effect.

J. JOLY.

Geological Laboratory, Trinity College, Dublin, September 30.

Apus cancriformis in Great Britain.

SINCE the publication of Baird's "Natural History of the British Entomostraca" (1850), no record of the occurrence of *Apus cancriformis* in the British Isles has, so far as I am aware, been published. Mr. Scourfield, in his "Synopsis of the British Fresh-water Entomostraca" (Journ. Quekett Micr. Club, [2], ix., 1904), remarks of this species:—"it is doubtful whether this ought to be included in any modern list of British Entomostraca."

It is therefore of great interest to know that *Apus cancriformis*, so long lost to observation, has actually reappeared in this country. It was found, during last month, by my friend Mr. Frank Balfour Browne, in some numbers in two small shallow pools on Preston Merse, near Southwick, in Kircudbrightshire. These pools, he believes, may be somewhat brackish, as they are probably occasionally covered by the sea. The specimens which he was good enough to send me were all females, mostly of a good size, and bearing eggs.

ROBERT GURNEY.

Sutton Broad Laboratory, Catfield, Great Yarmouth, October 6.

WHEN THE REINDEER LIVED AT MENTONE.[1]

OF all Quaternary sites associated with the remains of man none is more important than that constituted by the grottoes of Grimaldi. The deposits are of great depth, and rich in archæological and anthropological remains. They exhibit, moreover, a perfect continuity, and enable us to review in definite order the events of a remote and extended period. It is fortunate that the explorations were undertaken by such savants as Villeneuve, Boule, and Verneau, and that the results of their labour have been enshrined in so noble a work as that under notice. The book is in three folios; the first furnishes us with a full topographical description and historical account of the locality, which takes its name from Charles Grimaldi, Prince of Monaco, in the fourteenth century. The rocks which contain the caves are of superior Jurassic formation, and from their rose-red colour have been denominated the Baoussé Roussé, or Balzi Rossi. They originally projected as a V-shaped mass into the Mediterranean, the apex of the V being the Baoussé de Torre, at the foot of which are two caves, the Barma Grande and the Barma della Cippia di Ponte. On the western side of the projection, passing from the Baoussé de Torre, we meet in order La Grotte du Cavillon, La Grotte de Florestan, L'Abri Lorenzi, and La Grotte des Enfants. On the eastern side are La Grotte du Prince and two other caves of minor importance. The caves all open by high, narrow ogee mouths towards the Mediterranean (Fig. 1). They are filled with deposit to the height, in some cases, of 40 metres. In this deposit foyers can be recognised; a foyer is defined as a surface which, from the presence of cinders or products of industry, may be regarded as affording evidence of man's presence.

So far back as the middle of last century the caves were known to contain deposits of scientific value. "Some time before 1848" Prince Florestan I. of Monaco had dispatched a box of earth from one of the caves to Paris for examination. From that time onward numerous workers directed their attention to the caves, particularly Prof. Forel in 1858, and M. Rivière from 1871–1895. In 1882 Prince Albert of Monaco carried on investigations, and issued explicit instructions as to the methods to be employed, instructions which left nothing to be desired on the score of precision. During these excavations human skeletons were found, the first on March 26, 1872, by M. Rivière, in La Grotte du Cavillon, at a depth of 6·55 metres below a layer of stalagmite. The year following three skeletons were found in the Barma della Cippia di Ponte; in 1874 and 1875 two young skeletons were found in La Grotte des Enfants, and no less than seven were obtained from La Barma Grande.

Meanwhile, much discussion had arisen as to the age of the deposits. M. Rivière attributed them to the Quaternary period. M. Mortillet, on the other hand, regarded them as Neolithic, largely, however,

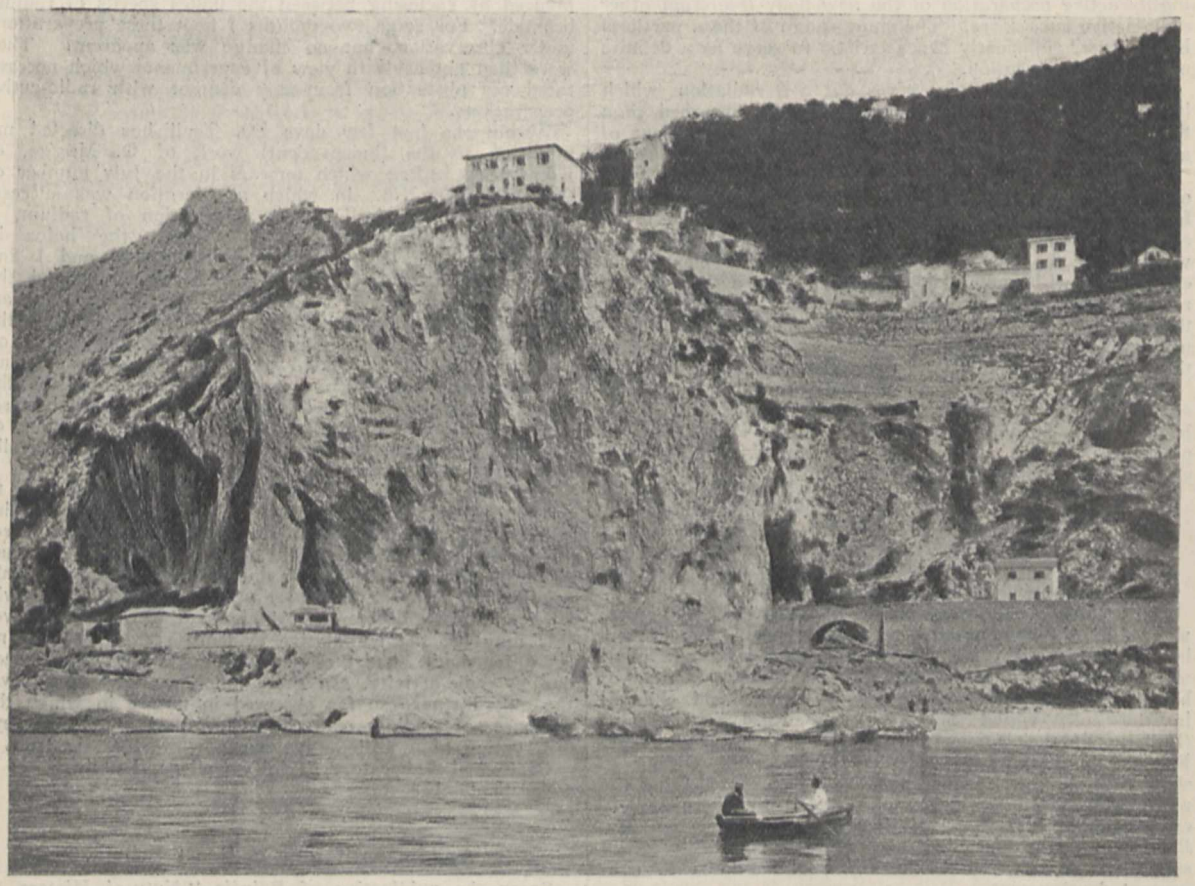

FIG. 1.—General view of the grottoes of Grimaldi. Seen from the sea.

[1] "Les Grottes de Grimaldi (Baoussé-Roussé). Tome i. Fasc. 1, Historique et Description. By M. L. de Villeneuve. Pp. 70. Tome i. Fasc. 2, Géologie et Paléontologie. By Prof. Marcellin Boule. Pp. 71–156+plates. Tome ii. Fasc. 1. Anthropologie. By Dr. René Verneau. Pp. 212+plates. (Imprimerie de Monaco, 1906.)

on the unsubstantial ground that the dead had been designedly interred. Three polished stone axes in the Genoa Museum from the collection of Prof. Pérès were believed to be derived from these caves. Rivière himself had obtained from this site a polished axe-head and a ring or disc *en jayet*. During the discussion it was shown that the axes in the Genoa Museum came from Nice, and there was strong probability that the axe and ring found by Rivière lay on the deposit rather than in it. All went to prove that further and more precise excavations were necessary before the age of the deposit could be definitely fixed. It is with these later investigations that the second and third folios are concerned.

The second folio is divided into three sections. In the first the various cave-beds are described with their petrographical characters; a list of the fossils found in each bed is given. The second section is concerned with the marine formations observed at the entrance and in the interior of the caves, and with the geographical changes which have taken place in the bed of the Mediterranean during Quaternary time. An interesting attempt is made to correlate the movements of the level of the Mediterranean with the movements of the ice, and to show that great glacial invasions are coincident with great positive movements of the sea, while interglacial periods correspond to negative movements. It is suggested that the negative movement of the Inferior Pleistocene was possibly able to re-establish relations between the large Mediterranean islands and the neighbouring continents, and that in this way may be explained the similarity in the contemporary fauna and palæolithic tools of south Europe and Africa. The third section of the folio is devoted to the study of the fossil animals which have been discovered during the excavations. It throws light on the fauna during successive periods, and discloses the danger of dating deposits from implements alone, for in these caves Moustiérien implements are found in association with a Chelléen fauna.

The illustrations, which form a very marked feature of the work, show sections of the caves, and clearly demonstrate the positions of the foyers and skeletons. The bathymetric charts of the Mediterranean are deserving of special mention.

The third folio is largely devoted to anthropology, but to some extent partakes of a *résumé*. The human skeletons are described in great detail, and are compared with each other, with Cro-Magnon Man, with the Negro, and with the European of to-day.

All the skeletons save two conform, with but slight variation, to the Cro-Magnon type. They resemble that type in stature, which is high, and in the shape of the skulls, which latter are dysharmonic, the crania being long while the faces are low and wide. The nose is leptorhine, depressed at the root, yet projecting sharply from the face. The orbits are rectangular and microseme; the supraciliary eminences are faintly developed; the mandible is robust, possessing a prominent chin. Certain negroid traits are noticeable in the skeletons; the proportions of forearm to arm, of leg to thigh, of lower limb to upper limb, resemble those found in the Negro and differ from those in the European. The two skeletons above referred to as not conforming to this type were discovered on June 3, 1901, in La Grotte des Enfants (Fig. 2). They were found at a depth of 8·5 metres, and are the most ancient human remains from these caves, although it should be remarked that a skeleton of the Cro-Magnon type was found in the same cave at a depth of 7·8 metres. The two skeletons were those of an old woman and a boy. The skulls are of the usual type in being dysharmonic, the cranium long, the face low and wide. The orbits are microseme, the forearm and leg relatively long. They differ from the type in stature, which is not high, in the nose being platyrhine, in the face being prognathous, with the chin *fuyant*. On these grounds the two skeletons are separated from the rest and regarded as constituting a special type—the Grimaldi type. Before accepting such a separation, it should be remarked that little importance can be attached to stature when one of the examples is a boy, the other an old woman. Again, the skulls were obtained in a more or less fragmentary state, and the platyrhinity and prognathism might quite easily be in part due to the reconstruction. Sex, age, and individual variation might also account for some of the difference. It is unfortunate that more examples—and those examples of adults—are not forthcoming.

FIG. 2.—Skeletons of an old woman and a boy, from La Grotte des Enfants.

One of the most remarkable features of the boy's jaws are the teeth, which form the subject of a special report by Prof. Gaudry.

It will be seen that the work is to an unusual degree exhaustive, and has been performed with an attention to scientific accuracy for which palæontologists cannot be too grateful. The observations are beyond dispute, and the theories advanced are suggestive and worthy of careful consideration. The work furnishes us with the most important collection of data as to the nature and habits of Quaternary Man, since the discoveries in the caverns at Spy. We know that Man, even in the Pleistocene, buried his dead, sometimes on intact foyers, sometimes in holes dug in the floor of the cave, sometimes in rude cists consisting of upright stones supporting horizontal flagstones. Frequently he buried them in beds of ologist iron. In the Barma Grande there is evidence of disposal of the dead by incineration. With the dead were buried such trinkets as necklaces, bracelets and anklets made of perforated teeth, shells, and vertebræ of fish.

As to the people who lived in these caves, we can with considerable confidence correlate them with the Quaternary hunters in the valley of La Vézère, with those whose remains have been found at Laugerie-Basse, Gourdan, Chancelade, and Cro-Magnon. It is probable, however, that the hunters of the Grimaldi Mountains were the earlier.

In conclusion, we can unhesitatingly state that the Grimaldi caves have furnished us with the most complete picture we yet possess of Man's life in Europe during Mid-Quaternary time. WILLIAM WRIGHT.

MEDICAL EDUCATION AND SOME OF ITS PROBLEMS.

BY a time-honoured ordinance, the opening of the medical session at the beginning of October is made the occasion for the delivery of inaugural addresses at the various schools of medicine. In London, medical education is in a somewhat transitional stage, and it may be interesting to inquire whether the addresses delivered shed any light on the problems that have to be solved. At the present time in London there is a need for concentration of the preliminary and intermediate studies, chemistry, biology, anatomy, and physiology, taken during the first two years of the curriculum, and until recently taught in every medical school. Now these are scientific subjects, and could more efficiently and less expensively be conducted in fewer centres with better equipped laboratories than has hitherto been the case. In this way it would be possible for some, at least, of the medical schools to devote all their energies and funds to the professional training of the last three years of the curriculum. Various plans have been suggested for effecting this. Some years ago, a scheme for a central institute at South Kensington for teaching the preliminary and intermediate subjects was inaugurated. It was an ambitious scheme requiring some 200,000*l.* for its realisation, and though in theory a good one, is probably not the best practical one for London. London is too large to have a single centre; and University and King's Colleges, and one or two of the medical schools, have definitely decided to continue teaching the preliminary subjects. Moreover, by a recent vote of the Faculty of Medicine of the University of London, the scheme of a Central Institute at South Kensington has been negatived, and the former policy reversed.

Another scheme is actually in being and seems to be working well, and might be extended; this is the drafting of the Westminster Hospital students to King's College, and of the St. George's Hospital students to University and King's Colleges, for the preliminary and intermediate studies. Speaking of this departure, Dr. Allchin, of Westminster Hospital, in his opening address at King's College, said:—

"When in 1899, after the report of Lord Selborne's Commission on a University for London, the medical demand for a re-constitution of the University took organised and coherent shape, the urgent need that there was for some concentration in medical teaching was always placed among the foremost arguments. The feeling generally among the medical schools at that time—or certainly of the great majority of them—was in favour of some scheme by which certainly the elementary subjects of the curriculum, and to some extent also the intermediate, should be taught at fewer centres, thus leaving the smaller schools at least, on whom the pressure of expenditure was relatively the greatest, free to devote their energies entirely to teaching the later subjects. But so far the University of London has utterly failed to bring about any concentration whatever during the seven years of its re-constituted existence, and, what is almost as serious, it has by the course it has followed converted what was seven years ago a widespread feeling among the metropolitan medical teachers of welcome towards the principle of concentration into one of very considerable hostility towards the principle, and has led to many of the schools resolutely opposing any coalescence. In 1905 a coalescence with regard to preliminary studies was arranged between the Westminster Hospital School and King's College, and has worked satisfactorily. I believe that if the University six or seven years ago, when the medical schools would, for the most part, have welcomed the principle of concentration, had exercised upon the different schools a wise and judicious pressure towards giving effect to this principle, much might have been done in this direction."

Certainly this scheme has much to commend it, and with some financial aid from the University it is difficult to see that an arrangement of this kind would be less efficient than a central institute; it would be far less costly than the latter, and, therefore, more likely to be in working within a reasonable time. The last is an element of some moment, for there can be no doubt that London has suffered by contrast with the splendid laboratories and facilities of the new provincial schools, and students in the London schools have diminished in numbers. Long as the five years' curriculum is for the pockets of those who have to pay the fees, it is none too long for the acquirement of the knowledge required for the pass examinations; in fact, it is the exception for a student to obtain a qualification under about six years. It has therefore been suggested that the curriculum might be lightened by relegating to the school science studies the physics, chemistry, and biology required. This plan commended itself to Sir Douglas Powell in his address at University College. He said:—

"I am myself decidedly of opinion that most, if not all, of the chemistry, biology, and physics required for the ordinary pass examination might, and should be, and in time will be, included in the public-school science studies, and be cleared off before the student enters upon the medical curriculum at all; so that the first two years of the student's time may be given up almost entirely to anatomy and physiology, including some comparative anatomy, so far as it may be illustrative of human anatomy, and some physiological chemistry."

Intimately associated with the question of medical education is that of qualifying examinations. In England, Scotland, and Ireland, there are no fewer than twenty-one bodies which have the power of granting degrees or diplomas qualifying to practise medicine and surgery, and there must of necessity be considerable variations in the standard of, and in the conditions of admission to, these examinations. To bring order out of chaos, the only practicable plan

would be the institution of a State examination, which everyone should be required to pass, irrespective of any degree or diploma he should otherwise obtain, as advocated by Dr. Ewart in his address at St. George's Hospital. The London students have a grievance in that the diploma of the Royal Colleges does not entitle the holder to an M.D. degree, and the University of London degree is comparatively inaccessible to the average student. To meet this difficulty, Dr. Allchin frankly contended that the University should grant a degree in medicine accessible under reasonable conditions to the average man, reserving for those who desired them honours examinations more stringent than the pass ones. Sir Douglas Powell also expressed his regret that the diploma of the Royal Colleges could not be signalised by some more definite designation than it now carries. He would make any further work beyond the requirements for the qualifying examinations more strictly post-graduate work. He says :—

"When a man has qualified in his first two years' subjects by passing the required examination, he would do well to proceed to a six months' or a longer course in those subjects for the higher university degrees, and when he has qualified in the second grade and obtained his licence to practise he may proceed to post-graduate clinical, pathological, or other research for his final examinations in those degrees or for the membership of the Royal College of Physicians or fellowship of the Royal College of Surgeons. A university degree and the higher grades of medicine and surgery should be regarded as something beyond and in a sense outside a qualification to practise—as an academic or other distinction for the attainment of which a man may take as long as he pleases, but for which certainly some additional work in each grade or period of his studies should be required."

There is a parallel to this in the case of veterinary medicine, in which the University degree does not take the place of the diploma of the Royal College of Veterinary Surgeons, as it is not a licence to practise, as was pointed out by Prof. Lander in his address at the Veterinary College.

Post-graduation study and research in medical subjects are essential if the practitioner is to keep abreast of recent advances, if the science of medicine is to advance, and the public health to improve. In London, with its seven millions of inhabitants, the supply of clinical material for teaching and research is unique, but there can be no question that it is not utilised nearly to the full extent. The West London Hospital, the London School of Clinical Medicine, the Polyclinic, and a few hospitals are doing excellent work in post-graduate teaching, but if London is to be, as it ought, a great centre for post-graduation work, there must be more coordination and concentration among the numerous special hospitals. The system which makes our hospitals and medical schools dependent on voluntary support has led to the founding of a number of hospitals for special diseases, widely scattered, and therefore largely unavailable for teaching purposes, draining the general hospitals of the particular cases they admit, and using up public subscriptions which might be better utilised. There can be no doubt, on the score of economy alone, that a combination between many of the special hospitals would be of advantage, a view which has been taken by the King's Fund. The poor-law infirmaries also are almost entirely unutilised, yet contain material of the utmost value for teaching and research. Sir Douglas Powell says :—

"I cannot but think further that some affiliative grouping of the great clinical hospitals about the three university centres would be of great value in point of view of financial economy and strength of teaching. It is very possible, too, that special hospitals and infirmaries might be more utilised than they now are for clinical teaching material, and especially for post-graduate teaching."

As regards research, the special hospitals, the poor-law infirmaries, and the hospitals of the Metropolitan Asylums Board offer unique opportunities for clinical and pathological investigation, but are almost unutilised in this respect, and the general hospitals are unable to do what could and should be done in this direction owing to lack of funds. Contrast this state of affairs with what obtains, say, in Berlin—the newest hospital, the Virchow Krankenhaus, has 2000 beds for all kinds of cases, its department for infectious diseases, its pathological institute, with scientific staff, and the research Institute for Infectious Diseases is close by and affiliated to it—and it must be admitted that London makes but a poor show.

In the teaching of hygiene and the necessary curriculum for the diploma in public health, concentration again is eminently desirable. At present nearly every medical school retains teachers, and the requisite expensive equipment, in each case for the instruction of but a few students.

SCIENCE IN THE EAST.[1]

AMIDST the crowded town life of England, physical science outside the laboratory seems to be becoming a thing of the past. The ordinary British physicist concerns himself with the eccentricities of radium, the cosmogony of the ion, and other matters which are at present but names of mystery to most people. The work of the Indian Survey carries with it the sense of open air and large areas. It deals with subjects which appeal, in part at least, to the intelligence of the average educated man.

A great magnetic survey has been in progress for some years. Up to the date of the report by Captain R. H. Thomas, observations had been made at 808 stations, and three more seasons, it was hoped, would complete the field work, except in so far as repetitions of observations might prove necessary or extensions into the hills might be found practicable. The main part of the magnetic report deals with the intercomparison of instruments, but there are also some data as to the diurnal inequalities of declination and horizontal force at several of the fixed observatories erected to assist in the survey work. These inequalities are based on five "quiet" days a month, but the non-cyclic change is not explicitly shown, and there seems no statement as to whether it has been allowed for. The difference between the values for 0 a.m. and 11 p.m. in horizontal force is suspiciously large.

Until the question has been actually investigated, it is unsafe to assume that diurnal inequalities from quiet days are really representative of the ordinary day; the part played by disturbance also varies largely from day to day. Thus, though the inequality data are of much intrinsic interest, it is impossible to say in advance what degree of utility they may possess for survey purposes. From the large differences between the inequalities at the different Indian stations, it is clear that problems of some difficulty will have to be faced when it comes to correcting the field observations for diurnal changes, regular and irregular.

Part ii. gives an account of pendulum observations made by Major G. P. Lenox Conyngham and his

[1] Extracts from narrative reports of officers of the Survey of India for the season 1904-5; prepared under the direction of Colonel F. B. Longe, R.E., Surveyor-General of India. Pp. 127. (Calcutta: Government Printing Office, 1907.) Price 2s. 3d.

party at ten stations, including nine nearly on a meridian passing through Darjeeling. The northmost station, Sandakphú, was at a height of 11,766 feet. The results of this and similar future work promise to be of much interest in connection with the theories proposed to account for the observed large deflections of the plumb line in India, and the deductions made as to the density of the material underlying the Himalayas. The observations at some stations had to be taken in a tent exposed to temperature changes, and one of the chief uncertainties was the determination of the proper temperature correction. Considering that the value of gravity at the base station at Dehra Dun—on which all the other Indian values depend—is arrived at by assuming for Kew the value 981·200 C.G.S., it does seem desirable that some British authority should exist possessing both the apparatus and the scientific knowledge necessary to determine the accuracy of such assumptions. In the meantime, practical geodetic science in the British Empire has to turn for guidance and inspiration to Potsdam, Vienna, or Washington.

Part iii. deals with the report by Mr. J. P. Barker on tidal observations and levelling operations. A good many data are given as to tidal constants at various stations, and there is interesting information as to the degree of accuracy of the predicted times and heights of low and high water. At the open coast stations in 1904 the mean error in the predicted times was only nine minutes, and the mean error in the predicted heights was less than 3 per cent. of the range; but in the riverain stations the errors were nearly twice as large, and there seems room for improvement.

Part iv. describes triangulation in Baluchistan, while part v. deals with survey operations of a rapid kind made with the Somaliland Field Force. The officer in charge of the latter, Captain G. A. Beazeley, and his assistant, Captain C. G. Hunter, evidently had a very stirring time.

One of the duties of the tidal officers seems to be the inspection of anemometers at tidal stations. At first sight the following information respecting the anemometer at Port Blair is rather startling (p. 91):—"On November 19, 1904, the velocity of wind registered . . . was 1112 miles, the greatest on record since December 1, 1897, on which day 918 miles was registered." The *day* is rather an unusual unit of time for velocities, and why the limitation? There are other instances where the method of presenting the facts might be improved upon, but fortunately the absence of a good English style does not necessarily imply a corresponding laxity in scientific accuracy. Another criticism that is likely to present itself to many readers is that the season 1904–5 is becoming now a little remote.

C. CHREE.

PROF. CHARLES STEWART, F.R.S.

ON Friday, September 27, Prof. Charles Stewart, conservator of the museum of the Royal College of Surgeons, died at the age of sixty-seven after a few weeks' illness, following some years of failing health.

Prof. Stewart was a native of Plymouth, where both his father and grandfather had been in practice. Following their example, he too entered the medical profession, being educated at St. Bartholomew's Hospital, and taking his M.R.C.S. in 1862. After some few years spent at Plymouth he returned to London, upon obtaining (in 1866) the post of curator of the museum at St. Thomas's Hospital. Later, in 1871, he became lecturer on comparative anatomy at the same school, and in 1881 joint lecturer with Prof. John Harley on physiology. He also for some years held the professorship of biology and physiology at Bedford College.

During this St. Thomas's period, Prof. Stewart accumulated, by incessant work as a teacher and museum curator, and mainly by direct observation, that vast fund of biological knowledge for which he was so well known, and of which he was so lavish to all who came to him for help in their difficulties. In the comparatively small museum at St. Thomas's, he perfected his natural talent for practical museum work, performing with his own hands all the processes necessary in the preparation and display of anatomical specimens, and gaining a thorough insight into all the minutiæ of museum management. At the same time, the variety of his teaching appointments, embracing anatomy, physiology, botany, and pathology, effectually prevented him from becoming narrow or specialised. Thus, when in 1884 the conservatorship of the Royal College of Surgeons' museum fell vacant, through the appointment of Sir William Flower to the control of the British Museum (Natural History), Prof. Stewart was singled out by his practical experience and wide attainments as Flower's natural successor.

Although during his twenty-three years of office at the College of Surgeons Prof. Stewart supervised and stimulated the growth of all parts of the museum, he made the object of his special care the improvement and completion of that section of the museum—"the physiological series of comparative anatomy"—in which are embodied John Hunter's philosophical researches into the normal processes of life. For the advancement of this great collection of adaptive modifications, Prof. Stewart laboured consistently almost to the day of his death, adding or planning new specimens, lecturing so long as health allowed, and finally editing, and in part writing, the first few volumes of a full descriptive catalogue.

The year after his appointment as conservator he was elected Hunterian professor of human and comparative anatomy at the college, and annually until 1902 gave series of lectures that reflected the work he was doing in the museum, and served as introductions to the several sections of the "physiological series." At this time he also delivered some "Friday evening" lectures at the Royal Institution, and was Fullerian professor of physiology there from 1894 to 1897. In his own way, Prof. Stewart was inimitable as a lecturer. He had an easy flow of language, delivered with a persuasive eagerness that compelled attention, and illustrated by wonderful free-hand drawings on the blackboard. The combined result was a picture, not easily forgotten, of interwoven word and line animated by a charming personality. Unfortunately, his lectures were delivered from the scantiest notes, so that little remains of his original researches except some few papers in the publications of the Linnean Society and in some microscopical journals which give but a feeble idea of his real powers.

Since 1866 Prof. Stewart had been a Fellow of the Linnean Society, and from 1890–4 held the office of president. He was also deeply interested in the Royal Microscopical Society, being one of its secretaries from 1878–82; and he was an original member, and for some years treasurer, of the Anatomical Society. He also was an ardent supporter of the Marine Biological Association. In 1896 he was elected to the fellowship of the Royal Society, and three years later was honoured by the conferment upon him of the degree of LL.D. *hon. caus.* by the University of Aberdeen.

In brief, Prof. Stewart was professionally a successful teacher, a great lecturer, and a master of all museum arts; personally he was the simplest and

kindest of men, unassuming to a fault, with a cordial detestation of everything false, presumptuous or sordid. His cheery, youthful manner and lively conversation endeared him to many, even of those who had not the privilege of seeing the deep sympathetic nature beneath.

NOTES.

AN extra meeting of the Chemical Society will be held in the theatre of the Royal Institution on Friday, October 18, at 9 p.m., when Prof. Emil Fischer, F.R.S., will deliver the Faraday lecture, entitled "Organic Synthesis and its Relation to Biology."

THE honorary secretary of the Hampstead Scientific Society informs us that, by permission of the London County Council, a meteorological station (in connection with the Meteorological Office and the British Rainfall Organisation, Camden Square) is to be established by the society at the flagstaff on the summit of Hampstead Hill. This being the highest point in the neighbourhood of London, some interesting records should be obtained. A small astronomical observatory is also to be placed at the same spot, which it is hoped may be of educational value to students and senior pupils of London County Council schools.

THE British military airship travelled on Saturday last from Aldershot to London at the rate of about twenty-four miles an hour, and after circling round St. Paul's Cathedral, headed against the wind on the return journey. Owing to the strong wind prevailing, the descent was made in the grounds of the Crystal Palace at Sydenham. The total distance covered was fifty miles, and the mean altitude was 750 feet.

AN exhibition is to be held at the Royal Horticultural Hall, Vincent Square, Westminster, on October 22–26, in connection with the *Model Engineer*, and will include a collection of engineering models of all kinds; electrical, optical, and scientific instruments; technical education apparatus; and lathes, tools, and workshop appliances. Popular scientific lectures and demonstrations will be given each day, and many of the models will be shown at work.

MR. F. WOOD-JONES, Harley Lodge, Enfield, informs us that on November 15, 1905, he set adrift several bottles from the Cocos-Keeling atoll, Indian Ocean (12° 04′ 24″ S., 95° 55′ 19″ E.), containing messages requesting that the finder would let him know the place and time of finding. On May 27, 1906, one was picked up on the coast of Brara, Italian Somaliland (1° 06′ 08″ N., 44° 01′ 52″ E.), and on July 11, 1907, another turned up at exactly the same spot. These facts point to a constant westward current in this part of the Indian Ocean. For both communications Mr. Wood-Jones is indebted to Captain Resident G. Piazza, of Italian Somaliland.

THE death is reported on September 22 of Prof. W. O. Atwater, of the Wesleyan University, Middletown, Connecticut. He directed from 1875 to 1877 the Connecticut Agricultural Experiment Station, the first institution of the kind in the United States. In 1888 he founded the experiment station of the Federal Department of Agriculture. Of late years he had directed the special investigations of that department into questions of nutrition. He was joint inventor of the Atwater-Rosa calorimeter for experiments on the metabolic changes going on in the human body; and was the author of a large number of articles and reports on physiological and agricultural chemistry. Prof. Atwater, who was sixty-three years of age, had been practically helpless since he suffered from a stroke of apoplexy two years ago.

NEWS has been received from Dr. Sven Hedin by the Simla correspondent of the *Pioneer Mail*, the communication being dated July 25, from the Mansarowar Lake. Dr. Hedin reports that this last journey from Shigatse to Tok-chen, on the lake, has been richer in results than his previous one from the Aksai Chin to Shigatse, as he has been almost the whole time in inhabited country. His message, of which the following is an extract, appears in the *Pioneer Mail* of September 20:—"The results are 1300 big pages in annotations, 203 sheets of maps, 410 specimens of rock in connection with geological profiles, 700 panoramas, twenty-six astronomical points, the meteorological journal continued three times a day, and passes and camps fixed by boiling-point thermometer; at every river crossing a detailed measurement of the volume of water—the Brahmaputra—has been measured at seven points, and most of the northern tributaries, as well as some of the southern; a collection of plants; a great number of sketches, especially types, the interior of temples, and landscape sceneries. One lake, Amtchok-Tso, has been carefully measured, and an isobathic map made. The height of many peaks has been measured with the theodolite at a couple of places; the height of old beach lines of lakes has been measured."

AN appeal for funds to secure the preservation of the "Sarsen Stones" on the Marlborough Downs known as the "Grey Wethers" has been issued jointly by the National Trust for Places of Historic Interest or Natural Beauty, the Wiltshire Archæological and Natural History Society, and the Marlborough College Natural History Society. These sarsen stones are, geologically, the hardened and solidified boulders of a stratum of Eocene sand formerly covering the chalk, which in the course of ages has been denuded of the softer portions. The stones vary in size from small boulders to masses of sixty or seventy tons. For many generations these stones, scattered widely over the downs, have been broken up and used for building and other purposes, mainly of a local character. As there is every probability that the work of breaking up the sarsens will be undertaken soon on a greatly extended scale, an attempt is being made to secure the preservation of some characteristic examples of the stones in their natural condition. The sum of about 500*l.* is asked for in order to purchase about twenty acres of land where there are many of the stones. If the money is forthcoming, characteristic examples of a unique geological phenomenon will be secured for the nation. The donations already received or promised amount to 164*l.* Subscriptions to the fund may be sent to Mr. E. Meyrick, F.R.S., Thornhanger, Marlborough, or to Mr. Nigel Bond, secretary, the National Trust, 25 Victoria Street, Westminster, S.W.

TO *Spolia Zeylanica* for August Mr. J. Llewellen Thomas contributes further particulars on hybridising the Ceylon jungle-fowl (*Gallus stanleyi*), a subject on which a note appeared in our columns last year. The new experiments demonstrate that in certain circumstances the hybrids with domesticated fowls are fertile, both *inter se* and with their parents, and under really favourable conditions it is surmised that complete fertility could be established. This being so, Darwin's argument from the infertility of the hybrids that *Gallus stanleyi* cannot be the parent stock of domesticated poultry no longer holds good. The difficulty, however, is to convert this negative evidence

into positive proof that the Ceylon jungle-fowl is entitled to occupy that position. An important point in the case is the fact that when domesticated fowls tend to revert to the wild type, the cocks develop red or brown (never black) breasts. As the Indian *Gallus bankiva* is black-breasted, the reversion is thus in the direction of the Ceylonese species, which has a reddish-brown breast in the males.

IT is a well-known fact that many lizards inflate the body, the region of the mouth, or special laryngeal sacs, for the apparent purpose either of frightening enemies or as a means of sexual attraction, or perhaps for both together. Examples of this are displayed by the inflation of the body in Lacerta and Phrynosoma, in the expansion of the frills of Chlamydosaurus, and the dilatation of the gular sacs of Metopoceros and other iguanas. Such effects might be enhanced, it is reasonable to suppose, by a swelling-out of the head and protrusion of the eyes. Such a function, according to Dr. H. L. Bruner in the *American Journal of Anatomy*, vol. vii., pp. 1–117, is, however, insufficient to explain the existence in the heads of both sexes of many lizards and snakes of an apparatus of muscles and vascular sinuses for producing excessive blood-pressure, and consequent swelling in this region. In lizards, at any rate, this mechanism is developed for the purpose of aiding in the shedding of the scales, and acts physiologically by accelerating lymph movements, and thus promoting metabolism, and mechanically by stretching the skin over the soft parts. This being so, the probability is that the same factor holds good in the case of snakes and tortoises. In some instances, however, the function may be modified for terrifying or sexual purposes, and it is probable that the ejection of blood from the eyes of the "horned toads" (Phrynosoma) is a special development of the same mechanism.

A GREEK pamphlet lately published at Athens (P. D. Sacellarius) under the title of "Αἱ τῶν Lamarck καὶ Darwin Θεωρίαι παρὰ τῷ Ἀριστοτέλει" gives an interesting account of various passages in the works of Aristotle which contain anticipations of modern observations and discoveries. The existence of a placenta in selachians and the sexual dimorphism of certain cephalopods were among the facts well known to the Greek philosopher, who also shows a considerable grasp of the phenomena of correlation, of the influence of external conditions on individual development, and of the rivalry between organisms in which the weakest goes to the wall. It is, however, rightly pointed out that Aristotle, though he had distinctly before his mind the principle of natural selection as propounded by Empedocles, deliberately rejected that principle as a factor in organic evolution. A passage from the "Physics," frequently quoted and almost as frequently misinterpreted, shows conclusively that Aristotle, though no theist, held firmly to the view that the scheme of nature is purposeful and rational; but adaptations, in his opinion, came into existence ready-made, and not by degrees. The difference between this latter position and that of Darwin is clearly emphasised in the present pamphlet, but even here the force of the argument in the passage we allude to does not seem to have been fully realised.

WE have received a reprint of the memoir (*Biometrika*, vol. v., part iii.) by Mr. J. F. Tocher on the anthropometric characteristics of the inmates of asylums in Scotland, based on data collected by a survey organised by Mr. Tocher under the Henderson Trust of Edinburgh. The characters observed and recorded were stature, head length, head breadth, and head height, hair colour, eye colour, and nose contour. The data are discussed very fully by Mr. Tocher, with especial reference to the methods of Prof. Karl Pearson; to those not familiar with his methods the memoir will prove somewhat difficult reading, the more so as Prof. Pearson's symbols are frequently used without definition. It is impossible to compare the measured characteristics with those of the sane, since no such survey of the sane population has yet been carried out; as regards hair and eye colour, however, comparisons can be made with the results of a survey of school children, and it appears that the sane and insane differ significantly, the latter being lighter eyed and darker haired than the sane population. The majority of the frequency distributions for measured characters are skew, but not more so than similar distributions, drawn from other sources, for the same characters of sane populations. The whole of the original individual data and measurements, concerning 4381 males and 3925 females, together with correlation tables, are given in an appendix.

THE publications of the Natural History Section of the Indian Museum, Calcutta, will in future consist of Memoirs, to be issued periodically, and of Records, which will contain shorter papers on zoology and the allied branches of anthropology, and will be issued, so far as possible, quarterly. The first two numbers of the Records contain many contributions of interest. Captain Lloyd describes a collection of the fauna of the Arabian Sea, which was made in the course of a voyage by the Indian survey ship *Investigator* between Aden and Muscat. Considering that this is new ground, the results are disappointing, only a small number of new specimens having been obtained; but the repeated recurrence of many of the species at different stations is remarkable, and the appearance of the giant isopod, *Bathynomus giganteus*, and the large bilaterally symmetrical hydroid, *Branchiocerianthus imperator* (here recorded for the first time in the Indian seas), is noteworthy. Mr. C. A. Paiva discusses the Hemiptera and Hymenoptera of the Himalayas, and Dr. Annandale, with the assistance of the Rev. T. R. R. Stebbing, continues his reports on the fauna of the brackish pools at Port Canning, to which Mr. R. Gurney adds some further notes on Indian freshwater Entomostraca. In part ii. the most elaborate papers are that of Mr. E. Brunetti on the revision of the Oriental Stratiomyidæ, and a report on a new large collection of batrachia, reptiles, and fish from Nepal and the Western Himalayas, by Mr. Boulenger, Dr. Annandale, and Mr. Regan. It is not difficult to explain the prevalence of malarial fever in Bengal when we learn that Mr. Chatterjee found within three hours no fewer than 250 specimens of the Anopheles mosquito in the rest-house at Port Canning. It has been suggested that this pest might be destroyed by admitting sea-water into the pools occupied by them; but while there are recorded instances of mosquito larvæ being found in salt water, it has now been ascertained that the brackish pools at Port Canning contain an abundant supply. Here at least petroleum is likely to hold its ground as a remedy.

A PRACTICAL article on pruning cocoa is contributed by Mr. W. Cradwick to the Bulletin of the Department of Agriculture, Jamaica (June and July), and the diagnoses of two new species of Comocladia are furnished by Dr. N. L. Britton. The report prepared by Mr. F. Stockdale

on cocoa-nut diseases in Trinidad, describing a root disease referred to a fungus Botryodiplodia, a leaf disease caused by a Pestalozzia, and a bud-rot disease, is also published.

THE third part of the first volume of the Proceedings of the Association of Economic Biologists is devoted to the papers presented at the meeting of the society held in Cambridge in January. The majority of the papers are represented by abstract or title, but the paper by Mr. E. S. Salmon on the American gooseberry-mildew is printed at length. The author refers to the spread of the disease, and its prevalence in parts of Worcestershire, where the County Council has been taking measures to stamp it out; also he points out the necessity for establishing a sub-department of the Board of Agriculture to look after the fruit industry.

THE latest number of the entomological series of Memoirs of the Department of Agriculture in India (vol. i., No. 5), for which Mr. E. E. Green and Dr. H. H. Mann are conjointly responsible, is devoted to the Coccidæ attacking the tea plant in India and Ceylon. Although thirty species are enumerated, only two or three have so far proved serious pests, but it is stated that with Coccidæ, even more than other phytophagous insects, every species must be regarded as a potential enemy, since, owing to some unforeseen change, dangerous multiplication may ensue. Two new species, *Chionaspis manni*, *Dactylopius theaecola*, and a new variety of *Tachardia decorella* are described.

COMMISSIONED by the New Zealand Government to undertake a botanical survey of the small island of Kapiti, situated in Cook Straits, Dr. L. Cockayne has compiled a highly interesting report describing the various plant formations, and enumerating the indigenous ferns and flowering plants. It is proposed to conserve the island as a sanctuary for native birds and plants, especially for species that are becoming rare. As a shelter for birds, and from an ecological standpoint, the forests are alike important. *Corynocarpus laevigata*, *Dysoxylum spectabile*, *Macropiper excelsum*, *Myoporum laetum*, and *Melicytus ramiflorus* are conspicuous trees. The northern rata, *Metrosideros robusta*, varies greatly, sometimes throwing out arches composed of aërial roots. Other species of Metrosideres generally form lianes, and among them *Metrosideros scandens*, but when growing in the open it assumes a shrubby habit. Allusion is also made to the marked heterophylly of *Lomaria filiformis*, to the cauliflory or production of flowers on the naked stems of several trees, and to many other interesting ecological features.

UNDER the title "Ombre sismiche e rimbalzi sismici," Prof. V. Monti has issued a pamphlet dealing with the phenomenon known as earthquake shadow. He finds that Mount Etna appears to have a protective effect in the case of earthquakes in Sicily, and that, wherever the focus may be situated, places lying on the further side of the mountain do not feel the shock, though others at a greater distance are shaken. Monte Cimone, in northern Italy, seems to exercise a similar protective effect, but the much higher range of the Gran Sasso d'Italia and Maiella has no influence of this nature. He rejects the explanation suggested by Prof. Rizzo in his study of the Calabrian earthquake of September 8, 1905, but offers none in its stead. We may remark that the term shadow is based on the supposition that earthquakes originate in areas of small dimensions compared to that over which they are felt; the term loses its significance if Major Harboe's suggestion of extended origins, noticed in NATURE of April 26, 1906, is accepted.

THE U.S. *Monthly Weather Review* for May contains a full translation, by Dr. O. L. Fassig, research director of Mount Weather Observatory, of M. G. Guilbert's principles of forecasting the weather, submitted to the international competition at Liége, organised in 1905 by the Belgian Astronomical Society, with the view of showing the state of our knowledge of that subject. The jury, which was composed of six well-known meteorologists, unanimously awarded the first prize to M. Guilbert, of Caen, whose forecasts were based upon conclusions drawn from the study of the relation of the theoretical to the actual wind. He claims to be able to predict with precision the displacements and variations of centres of high and low pressure for twenty-four hours in advance, and to foretell the inception and dissolution of storms. Dr. Fassig points out that the rules can readily be put to test, and that the paper should receive the careful consideration of all who make weather forecasts. The subject is referred to in the last Parliamentary Report of the Meteorological Committee, and a valuable discussion of the principles will be found in the *Archives des Sciences* for July, 1906, by M. Brunhes, chairman of the jury of award.

Science for August 30 contains the presidential address of Mr. F. T. Shutt to the section of agricultural chemistry at the meeting of the American Chemical Society held this summer in Toronto. Mr. Shutt's address deals mainly with the virgin soils of the new north-west, showing by analysis their richness in nitrogen, but pointing out how rapidly they become exhausted under the common system of growing successive wheat crops with an occasional bare fallow. He gives figures to show that twenty years of such cultivation has reduced the nitrogen content of the soil down to the depth of 8 inches by no less than 2206 lb. per acre, of which not more than 700 lb. has been obtained in the crop. Although no marked falling off in the yield of this soil is as yet apparent under proper cultivation, chemistry warns the cultivator that a great drop in fertility must inevitably take place unless something is done to replenish the nitrogen. This, Mr. Shutt points out, can be done by the growth of clover, and gives examples of the enrichment of the soil consequent upon the introduction of this crop.

MR. CHARLES A. CULVER, of the University of Pennsylvania, has undertaken a study of the relative efficiencies of the various types of receiving systems in use in wireless telegraphy, and the *Physical Review* for September contains an account of the first part of his investigations. Of the types tested, those consisting of one or more vertical wires are the most efficient, and it seems immaterial whether the component parts are connected together at the lower, upper, or both ends. Partial screening of the aërial produces little effect, while the resistance of the earth between the sending and receiving stations is of prime importance. From a consideration of his own results and those of others, Mr. Culver concludes that the theory of propagation of the waves through the surface of the earth accounts for more of the observed facts than the free ether-wave theory, although it does not at present account for several phenomena encountered in practical work.

REPRINT No. 40 from the Bulletin of the Bureau of Standards at Washington consists of an account of some preliminary measurements of the temperature and selective radiation of the filaments of various kinds of incandescent electric lamps made by Messrs. C. W. Waidner and G. K.

Burgess. They find that at temperatures about 1500° C. platinum departs farthest of all the substances tried from radiating as a perfectly black body, while carbon most nearly approximates to a black body. All the filaments used are thus selective radiators, and are more efficient luminous radiators than a black body, the order being for the same temperature—platinum, tantalum, tungsten, carbon. The superiority of tantalum and tungsten over carbon filament lamps is to some extent due to this fact, which is further emphasised by the higher temperature at which they can be worked, the light emitted varying nearly as the twelfth, while the energy supplied varies only as the fifth, power of the temperature.

THE Health Education League of Boston, Massachusetts, has sent us two copies of new booklets published in continuation of the series noticed in a recent number of NATURE (September 12, p. 508). In one of the booklets (No. 12) Dr. M. H. Bailey deals with "Emergencies," and in the other Miss A. F. Rogers and Dr. J. H. McCollom describe "Microbes: Good and Bad."

A SECOND edition of Prof. J. Reynolds Green's "Introduction to Vegetable Physiology" has just been published by Messrs. J. and A. Churchill. The price of the work is 10*s*. 6*d*. net.

A SECOND edition (third impression) of Mr. W. P. Workman's "School Arithmetic," which is a school course adapted from "The Tutorial Arithmetic," has been published by Mr. W. B. Clive.

WE have received from Mr. C. Baker, of High Holborn, London, the October issue of his classified list of second-hand instruments and of new pieces of apparatus recently introduced. The catalogue contains a description of more than a thousand pieces of apparatus, together valued at more than 6000*l*. Those who are contemplating the purchase of microscopes, telescopes, spectroscopes, and other physical apparatus would do well to examine this catalogue.

THE general committee of the Dr. Fream memorial fund has confirmed the following resolution, which was passed at a recent meeting and accepted by the Board of Agriculture and Fisheries:—"That the Fream Memorial Fund shall be invested in the name of the Board of Agriculture and Fisheries or of an official trustee selected by the Board, and shall be administered by the Board of Agriculture and Fisheries, and that the income shall be applied by way of a Fream memorial prize of books to be competed for in each year by students in the science of agriculture, and so that as long as an examination is held by the National Agricultural Examination Board for the national diploma in agriculture the prize shall be awarded to the person who obtains the highest marks in such examination." A sum of about 200*l*. is available for the purpose of the memorial.

PHOTOGRAPHERS will study with interest the new edition of the catalogue of photographic apparatus and materials recently issued by Messrs. Marion and Co., Ltd., of Soho Square, London. The full descriptions and carefully tabulated particulars as to sizes and prices contained in this well-illustrated list should render the choice of material easy and expeditious.

OUR ASTRONOMICAL COLUMN.

THE PHYSICAL NATURE OF METEOR TRAINS.—An interesting discussion of the nature of meteor trains is published in No. 2, vol. xxvi. (p. 95, September), of the *Astrophysical Journal* by Prof. C. C. Trowbridge. Prof. Trowbridge, believing that valuable information concerning the upper layers of the earth's atmosphere may be thereby deduced, has compiled a catalogue of observed meteor trains, and for several years has made a comparative study of the data, at the same time making a study of the phenomena of gas phosphorescence. The discussion of altitudes leads to the conclusion that there is a definite layer of the earth's atmosphere, probably some fifty to sixty miles high, where the conditions are favourable to the production of the peculiar glow constituting a meteor train. Prof. Trowbridge believes that the secondary appearance of duality, so frequently observed in meteor trains, is due to the probable tubular form of the trains. The train itself is probably a tube of gas and particles of meteor dust, rendered phosphorescent by some temperature or electrical effect produced by the meteor's passage. The rate of diffusion and the colour of meteor trains agree with similar phenomena observed in phosphorescent air in the laboratory.

THE PULKOWA ECLIPSE EXPEDITION TO TURKESTAN, JANUARY, 1907.—An interesting account of the expedition

Observing Station of the Eclipse Expedition at Ura-tyube, Russian Turkestan.

dispatched from the Nicholas Central Observatory, Pulkowa, to observe the eclipse of January 13, 1907, is given in No. 18, vol. ii., of the *Mitteilungen der Nikolai-Haupsternwarte zu Pulkowo*. The site chosen for the observation of the eclipse was near the small town of Ura-tyube, in the Samarkand district of Turkestan, and there the various instruments were erected on December 31, 1906. The accompanying illustration, reproduced from the *Mitteilungen*, gives some idea of the conditions under which the observers worked, and shows the instruments in position. The long tube on the left is the coronagraph of 5 inches aperture and 43·5 feet focal length, with which M. Hansky hoped to obtain photographs showing details of the inner corona and prominences; as may be seen, this instrument was pointed directly to the sun's place at the moment of mid-totality. With the photographic refractor of short focus, it was planned to obtain five photographs of the corona with various coloured screens and on different plates. In addition to these, an attempt was to be made to photograph the spectrum of the corona from C to the ultra-violet, and M. Hansky also proposed to carry out photographic photometric researches.

Heavy snowfall prevented this programme from being carried out on the day of the eclipse, but some interesting observations of the terrestrial colour effects and the shadow-bands were made. M. Hansky also discusses some

observations of the zodiacal light made by him whilst at Ura-tyube.

DANIEL'S COMET.—The spectrum of Daniel's comet (1907*d*) was photographed, with an objective-prism camera, at the Nice Observatory on several nights during July and August by MM. H. and L. Chrétien, and is discussed by the former in No. 13 of the *Comptes rendus* (p. 549, September 23). A prism of 62° was employed, mounted in front of an objective of 10 cm. aperture and 47 cm. focal length, the spectrum of Capella being photographed on each plate for the purpose of comparison.

The following sets of bands were found, quite sharp and easily measurable, on plates secured on August 16 and 18:—387·0, 388·2; 398·9; 401·2, 402·0; 411·1, 413·8, 419·0; 420·0, 421·3; 425·8, 427·5; 430·1, 431·6, 433·5; and 450·3, 454·2; those at 401, 426, and 450 are very similar in character. The spectrum of the tail comprises three groups of radiations, the mean wave-lengths of which are 401·6, 426·7, and 452·2 respectively. An examination of the plates shows that each of these is composed of two condensations, the separation of each couple being 1·9, 1·7, and 3·9 $\mu\mu$ respectively.

Mr. Gillman, of Aguilas (Spain), has forwarded to us another chart depicting the results of his eye-observations made on September 4, 5, and 11. On the last-named date he was able to trace the tail of the comet to a distance of about 17½° from the head in a direction a little north of west.

THE SPECTROSCOPIC BINARY α DRACONIS.—Since July, 1906, α Draconis has been under observation at the Dominion Observatory, Ottawa, for radial-velocity determinations, and in No. 4, vol. i. (p. 237, July-August), of the Journal of the R.A.S. (Canada), Mr. Harper discusses the observations, with those of other observers, and derives a set of elements for the orbit of this binary. The observed velocities range from −54 km. to +56 km., and Mr. Harper's elements are as follows:—period = 51·38 days, velocity of the system = −16·7 km., eccentricity = 0·42, longitude of periastron (ω), from descending node = 198°, T = 1906 July 11d. 0h., and semi-major axis = 30,057,900 km.

ENGINEERING AT THE FINSBURY TECHNICAL COLLEGE.

THE completion of a new wing of the City and Guilds Technical College at Finsbury was the occasion, on Wednesday, October 2, of a large gathering of distinguished members of the city companies to witness the opening ceremony. Mr. Baker, chairman of the Colleges Extension Committee, in inviting the Lord Mayor to declare the new wing open, gave an interesting account of the history of the City and Guilds of London Institute, which, founded in 1878 and incorporated by Royal Charter in 1900, has raised and expended nearly three-quarters of a million pounds for the promotion of technical education.

The growth of the Finsbury Technical College has for some years necessitated the work being carried on in three unconnected buildings, and in order to bring all departments under one roof, with greatly improved facilities for their work, the institute set aside 10,000*l.* from its reserve fund, and the Corporation and Guilds of London contributed an equal amount, while a generous friend of the college contributed 10,000*l.* for equipment. With this sum the committee was able to carry out a long cherished scheme of centralisation and extension, and it was particularly fortunate in having Sir William White as one of its number to advise on all matters relating to the engineering equipment. Mr. Baker also referred to the long and distinguished connection of Prof. Silvanus Thompson and Prof. Meldola with the college, and in conclusion expressed the pleasure of the company at the presence of the Lord Mayor and Sheriffs to open the new wing.

The Lord Mayor, who was received with great enthusiasm, then declared the building open, and delivered an address to the students on the development of character.

Mr. Yarrow, in proposing a vote of thanks, briefly referred to the advantages which the two-year course at Finsbury offered to students, especially those who had served an apprenticeship in an engineering works, and said that in his opinion the Finsbury Technical College fills a special need, which is not supplied by other existing institutions, excellent though many of these are.

Sir John Wolfe-Barry, chairman of the executive committee, seconded the vote of thanks, and after acknowledgment by Sir William Treloar the company proceeded to view the building. On arriving at the engineering laboratory, the Lord Mayor pressed a button, setting the machinery in motion, and afterwards made a tour of inspection with the company, which included Sir Edward Clarke, Sir William White, Sir John Watney (secretary of the institute), Sir A. B. W. Kennedy (president of the Institute of Civil Engineers), Sir Philip Magnus, M.P., Mr. A. C. Morton, M.P., Prof. Unwin, Prof. Dalby, Mr. T. H. Blakesley, Mr. Ralph Palmer, Mr. S. S. Gladstone, and Mr. Soper (assistant secretary of the institute).

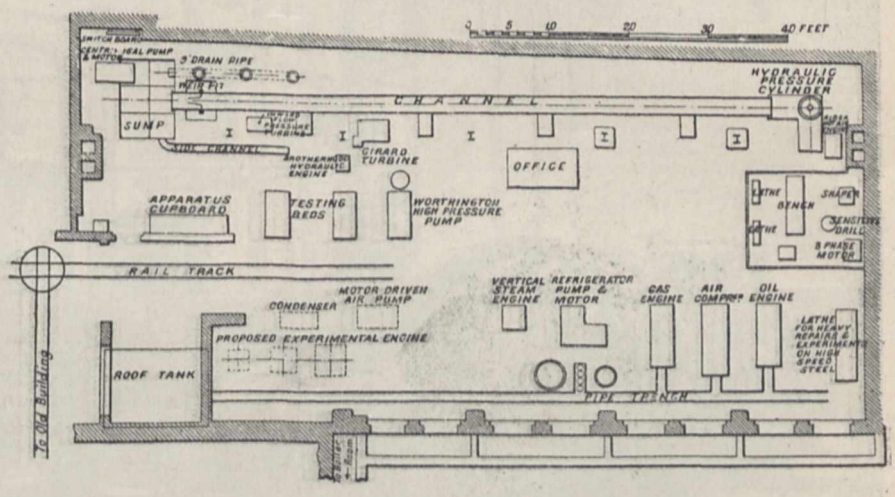

FIG. 1.—Plan of the Engineering Laboratory at the City and Guilds Technical College, Finsbury.

The engineering laboratory, shown on the accompanying plan, is about 100 feet long and 45 feet wide, and is a well-lighted room having walls faced with white tiles from the window levels, those below being brown glazed. Along one side a cast-iron channel of square section, 2 feet wide and 80 feet long, is sunk into the floor. This channel is free from end to end, so that, when occasion requires, the whole length can be utilised for experiments on towing, wave motion, and the like. There are also two smaller channels, parallel to the main one, for draining water into the measuring tanks without disturbing the main channel.

The measuring tanks are six in number, having a combined capacity of about 4000 gallons, and all the water collecting therein can be raised to a tank on the roof by a centrifugal pump delivering 200 gallons a minute against a head of 90 feet; the water is distributed anew by a 5-inch falling main and branches. The usual arrangements of weirs, float gauges, and the like are provided for measuring the water in the channel, and a Venturi meter can also be inserted in the pipe line.

At the other end of the channel is a hydraulic cylinder of special design, capable of giving horizontal and vertical jets up to 2 inches in diameter under any head not exceeding 300 feet. This cylinder is suspended by cross girders

over a pit for receiving the vertical jet, and the horizontal jet is directed along the main channel.

The equipment of hydraulic machinery also includes turbines of the Girard and Francis types, and a high-pressure pump for operating an experimental engine of the Brotherhood type.

The heat-engine equipment consists of a representative set of machines arranged along one side of the laboratory, and spanned by an overhead crane capable of delivering a load of 30 cwt. to a lathe at one end. The engines already installed comprise a 12 horse-power "National" gas engine, with special thermometer pockets in the cylinder walls, and arrangements for releasing and shutting down the valves at any moment. This engine can be run on town gas or on suction gas from a producer. A 6 horse-power oil engine has similar thermometer pockets and valve-releasing gear.

ton "Buckton" testing machine, a combined bending and twisting machine, and a number of other machines for small-scale experiments. A specially designed machine for compression up to fifty tons will also be installed.

The drawing office, over the engineering laboratory, is a well-lighted room 80 feet long and 34 feet wide, with accommodation for one hundred students.

The college workshops have been recently equipped with the most modern tools, and in addition a special shop for the construction and repair of apparatus is provided in the engineering laboratory. The new wing also contains a lecture theatre and rooms for the staff.

As will be apparent from this brief description, the equipment has been designed with the purpose of giving students a practical acquaintance with as wide a field of engineering as possible. All the machinery and apparatus are of moderate dimensions, easily handled by students

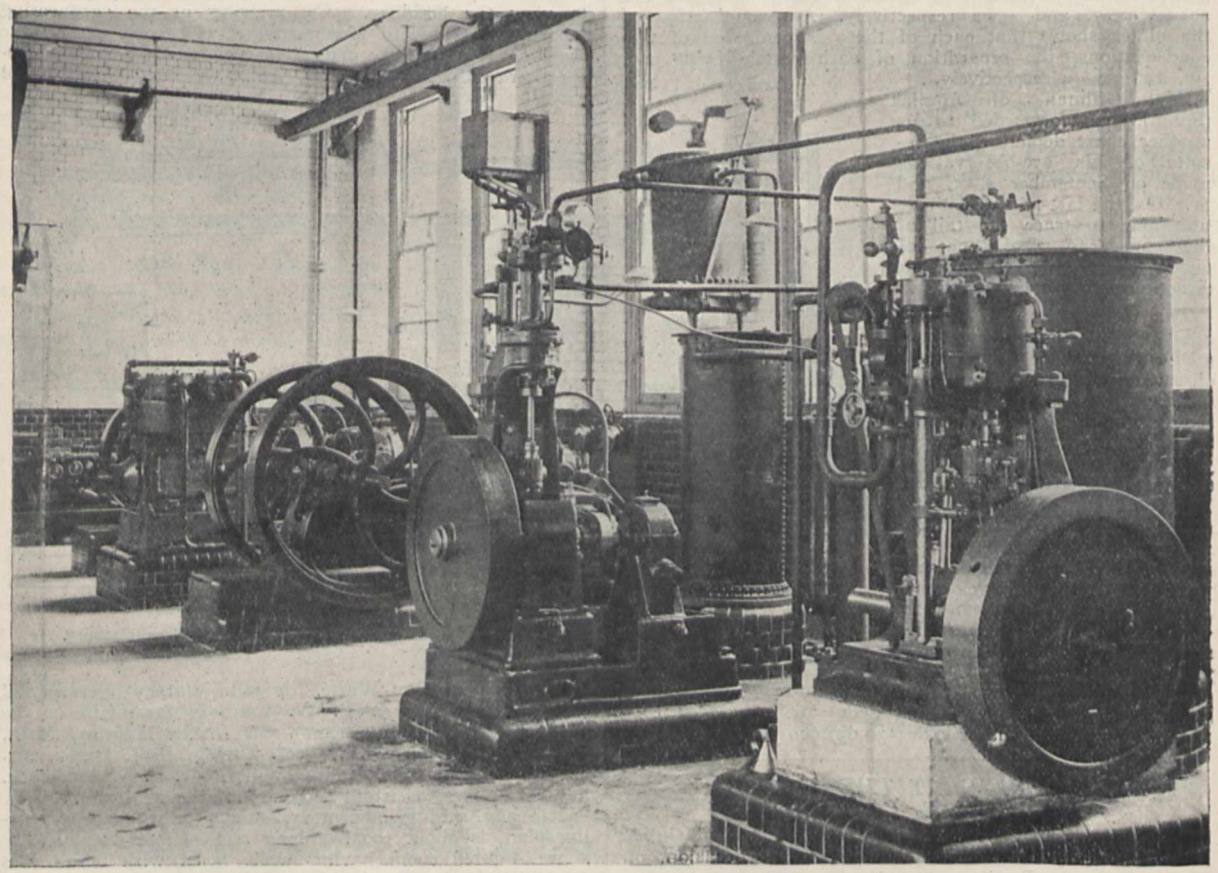

FIG. 2.—View of the Engineering Laboratory showing part of the Heat Engine Equipment.

An experimental "Linde" refrigerating plant is arranged to work with carbonic acid or ammonia by using interchangeable cylinders. The compressing pump is driven by a motor operating through a worm-wheel gear, so arranged that by disconnecting the pump coupling experiments can be made on the efficiency of worm gearing.

A small vertical steam engine, a petrol motor, a "Rider" hot-air engine, and a pulsometer pump are also included, while spaces are reserved for an experimental reciprocating steam engine of compound or triple expansion type, and an independent condensing plant to be installed at an early date. The steam-raising plant will consist of a Yarrow water-tube boiler, and a separately fired superheater.

An experimental compound air compressor, coupled directly to a motor, has been installed, and is fitted with special arrangements for experimental work. The equipment for testing the strength of materials includes a ten-

without excessive supervision, and at a small cost for running expenses.

While instruction, not research, has been the primary object, there is little doubt that in the future original work can be accomplished which will be of interest and value to the engineering profession. E. G. COKER.

FORTHCOMING BOOKS OF SCIENCE.

MR. SIDNEY APPLETON promises:—"A Book of Birds," by W. P. Pycraft, illustrated; "Minerals," by L. J. Spencer, illustrated; "Earthquakes," by Prof W. H. Hobbs, illustrated; "The Moon," by G. P. Serviss, illustrated; "The Warblers of North America," by F. M. Chapman and others, illustrated; "The Life and Habits of the Ants," by Dr. L. I. Dublin, illustrated; "Iron and Steel," by Dr. J. R. Smith, illustrated; "Gold," by Dr. J. R. Smith, illustrated; "The Horse: Ailments and

Accidents," by F. T. Barton; "The Dog, in Health, Accident, and Disease," by F. T. Barton, illustrated; "The Cat: its Care and Management," by Mrs. L. Williams, illustrated; and a new edition of "The Manual of Toy Dogs," by Mrs. L. Williams, illustrated.

Mr. Edward Arnold's list includes:—"From the Niger to the Nile," by Lieut. Boyd Alexander, two vols., illustrated; "Hydraulics," by F. C. Lea, illustrated; and "Wood: a Manual of the Natural History and Industrial Applications of the Timbers of Commerce," by Prof. G. S. Boulger, illustrated.

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Messrs. G. Bell and Sons' forthcoming books include:—"Darwinism To-day: a Discussion of Present-day Scientific Criticism of the Darwinian Selection Theories, together with a Brief Account of the Principal other Proposed Auxiliary and Alternative Theories of Species-forming," by Prof. V. L. Kellogg; "A Laboratory Outline of General Chemistry," by Prof. A. Smith; and "A Third Year's Course in Practical Physics," by James Sinclair, illustrated.

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Messrs. Whittaker and Co.'s announcements comprise :—"The Metric and British Systems of Weights, Measures, and Coinage," by Dr. F. M. Perkin; "Moving Loads on Railway Under Bridges," by H. Bamford; "Principles of Electrical Engineering (Direct Current)," by J. R. Barr; "Steel Works Analysis," by Prof. J. O. Arnold and F. Ibbotson; Whittaker's "Arithmetic of Electrical Engineering"; "Modern Practice of Coal Mining," by D. Burns and G. L. Kerr, parts ii. and iii.; "Electricity in Mining," by P. R. Allen; and "Advanced Text-book on Steam, Gas, and Oil Engines," by J. W. Hayward.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Public Orator, Dr. Sandys, spoke as follows on October 1 in presenting to the Vice-Chancellor the several recipients of honorary degrees on the occasion of the visit of the guests of the Geological Society of London :—

Dignissime Domine, Domine Procancellarie, et tota Academia.

Societatis Geologicae Londiniensis hospites, hesterno die ad nos paulisper advectos, omnes etiam nostrorum hospitum in numero libenter computamus; omnes, scientiarum in hac sede venerabili e tot orbis terrarum partibus praesentes, non sine fraterno quodam animi motu contemplamur. "Saxa et solitudines voci respondent": quanto magis nos, litterarum humaniorum et scientiarum amore imbuti, eorum adventu vehementer commovemur, qui scientia quadam admirabili praediti, etiam ex ipsis saxis rerum naturae veritatem extorquent! Hospitibus nostris omnibus patent hodie Musea nostra, patent Collegia nostra omnia, patent omnium corda. In hoc templo denique honoris, dum hospites nostros omnes, e tot terris advectos, ea qua par est observantia excipimus, nonnullos, gentis uniuscuiusque quasi legatos praecipuos, titulo nostro velut exempli causa decoramus, qui honos aliorum hospitum insignium praesentia illustratus, vestrum omnium plausu sine dubio comprobabitur.

(1) Christiania ad nos misit Universitatis suae Rectorem, geologiae professorem insignem, qui patriae in rupibus et metallis explorandis non sine laude iamdudum exercitatus, Norwegiae australis praesertim de saxis igneis praeclare disputavit. Iuvat videre virum patriae devotissimum, virum Regni novi senatoribus adscriptum, virum denique gentis totius Universitatis legatum auspiciis optimis nominatum.

Doctorum nostrorum in serie primus hodie incedit WALDEMAR CHRISTOPHER BRÖGGER.

(2) Assurgit deinceps Saxoniae explorator indefessus, Universitatis Lipsiensis professor eximius, qui Germania e septentrionali oriundus, palaeontologiae imprimis usus auxilio, Saxoniae in saxis serie perpetua ordinandis diu feliciter occupatus est. Idem geologiae in elementis enarrandis quantum excellit! Rerum naturae in penetralibus suo Marte explorandis quam fortis est! Rerum naturae in miraculis et observandis et explicandis quam subtilis!

Praesentatur vobis Regni Saxonici unus e Consiliariis, geologiae professor Lipsiensis, HERMANN CREDNER.

(3) Progreditur proximus Musei Bruxellensis curator sollertissimus, vir in palaeontologia vertebrata (ut aiunt) investiganda diligentissimus. Meministis arte quali, ossibus immensis ordine apto collocatis, bestiam illam immanem, Iguanodon Bernissartensem, in speciem suam pristinam restituerit, cuius effigiem accuratissime expressam, et zoölogiae in Museo nostro positam, Belgarum Regis liberalitati acceptam rettulimus.

Nostri in Regem illum animi grati testimonium hodie sine dubio libenter audiet unus e ministris eius fidelissimis, LUDOVICUS DOLLO.

(4) Francogallorum respublica maxima, vicinitatis vinculis nobiscum consociata, trans fretum angustum, nonnullis tam formidolosum, ad litora nostra legatum transmisit acceptissimum. Hospes autem noster, qui Normannorum in provincia superiore vallem quandam viridem olim ab oceano denudatam penitus perscrutatus est, in Instituto Catholico Parisiensi geologiam praeclare profitetur. Scientiae vero illius in Actis edendis diu occupatus, Scientiarum ab Academia, viri magni in locum, epistolarum minister perpetuus nuper est electus. Idem stili lucidi perspicuitate et verborum aptorum venustate insignis, opus ingens, summi laboris, summi acuminis monumentum, scientiae suae studiosis dedicavit, cuius in ipso limine professorem quendam Germanum, operis tanti aemulum generosissimum, aperte atque ingenue collaudat, qui, tempore eodem, laudis titulo eodem a nobis iure optima exornatur.

Laudis eiusdem socius merito declaratur ALBERTUS AUGUSTUS DE LAPPARENT.

(5) Germaniae quidem e legatis alterum hodie non sine dolore desideramus, Scandinaviae vero legatum alterum non sine gaudio salutamus. Salutamus professorem, cuius Regem illustrem inter doctores nostros iamdudum libenter numeravimus, cuius popularem insignem, Linnaeum, cum orbe terrarum toto nuper celebravimus. Hodie vero Florae antiquae potius quam hodiernae antistitem decoramus, qui scientiarum ardens amore, saepenumero etiam caeli arctoi frigora fortiter toleravit. Talium virorum auxilio vetera illa poetae Romani verba denuo vera redduntur :—

"Venient annis saecula seris,
Quibus Oceanus vincula rerum
Laxet, et ingens pateat tellus,
Tethysque novos detegat orbes,
Nec sit terris ultima Thule."

Interim velut ultimam Thulen hodie nobis repraesentat doctorum nostrorum illustrium in serie supremus, poli arctoi indagator audax, ALFREDUS GABRIEL NATHORST.

Mr. Augustine Henry, reader in forestry, will deliver his inaugural lecture in the Botany School lecture theatre on Tuesday, October 15, at 5 p.m.

On the nomination of the special board for mathematics, Dr. Glaisher has been appointed an elector to the Isaac Newton studentships until September 30, 1911.

OXFORD.—In the Convocation held on September 30 the degree of D.Sc., *honoris causa*, was conferred upon a number of distinguished foreign geologists who had attended the centenary celebration of the Geological Society, and also upon Dr. Ludwig Mond, who was nominated by the Chancellor for the degree at the last commemoration, but was at that time unable to attend. The following is the text of the speeches delivered by Prof. Love in presenting them for the degree:—

PROF. C. BARROIS.

Aristoteles auctor est ubi hodie terra sit fuisse pontum, ubi pontus terram. Has vicissitudines testantur ipsa e quibus terra constat elementa, *φωνήεντα ξυνέτοῖσι*, sed multorum operam rei ubique incumbentium requirentia ut recte intelligantur. Cum harum rerum investigatores unum in locum aliquando congregari soleant, quo melius quid profectum sit recognoscant, quid egendum sit deliberent, paucos ex eiusmodi conventu laudem singularem adeptos hodie ornat Academia nostra.

Inter Gallos qui geologiæ student fere illustrissimus est Carolus Barrois. Qui vir cum longos saxorum tractus scrutaretur, aliam superficiei structuram esse vidit, aliam medullarum: unde duo saxorum genera distinguere potuit, hæc ignea vi conflata, illa sub vadis, quibus Galliæ pars magna olim opplebatur, sensim concreta. Idem cretæ naturam rimatus, quæ apud nos et apud Gallos perexiguo freto divisos invenitur, nova indicia nactus est unde maris lati et profundi, quo utraque terra olim tegebatur, et incessum et regressum lentum ostenderet.

PROF. A. HEIM.

Qui hodie de vi occulta qua montium iuga super planitiem elata fuerint optime disserunt auctorem sequuntur Albertum Heim. Hic ille est Alpium suarum investigator qui, cum singulorum iugorum, e quibus hæc vasta compages constat, anfractus ramosque perlustrasset, terræ defectus quibus hæ regiones aliquando vexantur, concretas glaciei moles quibus superiora vallium obsidentur, prona montium obteguntur, diligentissime observasset, descriptionem Alpium tabulis pulcherrimis expressam confecit, laboris et fructum et testimonium non pœnitendum.

PROF. A. LACROIX.

Saxorum ignea vi conflatorum varia genera distinguere et quasi in classes distribuere potuit Alfredus Lacroix. Hic ille est qui quattuor abhinc annos monte Peleo vi immani convulso a Galliæ gubernatoribus eo missus est ut nubium ardentium naturam cognosceret: qua in legatione valde periculosa cum appropinquanti exitium flammæ minarentur, mariti virtutem æquavit coniux, quam honoris causa nomino, periculorum olim, nunc laudis socia. Ne multa. Felicissime rem egit vir fortis et sagax, qui harum nebularum natura bene explorata reversus est.

PROF. A. PENCK.

Intercessisse tempora quædam cum terra summo frigore oppressa fuerit nemo nescit. Ultimam quidem ex his quasi periodis, quæ una erat e pluribus quas hic orbis terræ passus est, ex quo animantium sæcula exorta sunt, plurimi pertractaverunt, nemo ex his qui hodie Europam incolunt melius quam Albertus Penck. Cum enim hac periodo exeunte hominem super agros caput extulisse constet, hic noster exstitit qui humani generis vetustatem ultimam illustraret, cum inter variarum gentium instrumentis lapideis utentium tempora et eventus quibus vasti Europæ tractus glacie purgarentur rationem intercedere doceret.

PROF. H. REUSCH.

De Scandinaviæ geologia optime egit Hans Reusch. Qui vir, cum in Norvegia saxa quædam invenirentur innumerabilibus ante sæculis mari terram operiente sensim concreta, deinde vi ignea adeo liquefacta et mutata ut nulla omnino animalium vestigia exhiberent, ipse rationes novas commentatus eiusmodi indicia deprehendit, unde saxorum ætatem colligere potuit. Ostendit etiam Norvegiam vastissimis glaciei molibus antiquitus fere obtectam esse, ex quo patet etiam in vetustate ultima magnis caloris et frigoris vicibus obnoxiam fuisse terram.

PROF. F. ZIRKEL.

Qui illud Scientiæ Naturalis genus pertractant quod ad metallorum saxorumque structuram pertinet Ferdinando Zirkel fere omnia accepta referenda censent, cum microscopo, ut cum physicis loquar, hac in re primus usus sit. Neque satis erat ei nova huic rei studentibus subsidia parare, ipse enim in hoc genere plurimum profecit, cuius doctrinam et peritiam testatur maximus ille de Petrologia liber luculentissime conscriptus.

DR. L. MOND.

"Magnum vectigal est parsimonia" dixit Tullius, quod etiam in Chemia valere sensit Ludovicus Mond. Cum enim id agunt chemici ut certum aliquod elementum a ceteris secernant, restant tanquam rediviva quædam, quæ saepe magni pretii sunt. Multos iam annos hic vir varios modos commentatus est, quibus corpuscula ab aliis spreta, tanquam inutilia, in usum converteret. Ita parcendo dives factus Scientiam Naturalem omni liberalitatis genere coluit. Maximum Londinii laboratorium Humphredo Davy et Michaeli Faraday, Chemiæ et Physicæ auctoribus clarissimis dedicatum, ædificavit et muneribus locupletavit: idem Societati Regali catalogum maximum, in quo omnia ab omnibus in quovis scientiæ genere his centum annis reperta continerentur, conficiendum et typis imprimendum curanti pecunia subvenit.

THE Association of Technical Institutions offers two prizes, each of 25*l*., for the two best essays, one on "The Bearing of Technical Education on Industrial Progress," and the other on "The Bearing of Technical Education on Agriculture and on Industries of a Rural Character." Particulars of the conditions may be obtained from Dr. Clay, Northern Polytechnic, Holloway, London, N.

A COURSE of eight lectures on "Certain Fundamental Problems in Physiology common to Animals and Plants" will be given by Dr. W. M. Bayliss, F.R.S., at University College (University of London) on Wednesdays, at 5 p.m., beginning October 23. The lectures are open to all students of the University of London; also to qualified medical men and to such other persons as are specially admitted.

PROF. W. C. MCINTOSH, F.R.S., professor of natural history in the University of St. Andrews, in July last presented the University museum with 3150 spirit preparations, large and small. The preparations consist of (1) a named series (about 1150 in number) illustrating the marine zoology of St. Andrews—the types of the "Invertebrate Marine Fauna and Fishes" of St. Andrews, 1875; (2) a glazed cabinet illustrating the development and life-history of the salmon of the Tay in ninety-five preparations; (3) a reference series (265 in number) from the trawling expeditions of 1884, each station showing both fishes and invertebrates; (4) a general zoological collection in spirit (consisting of about 1595 specimens), chiefly marine, from Shetland to the Channel Islands, but also including a considerable number of amphibians, reptiles, birds, and mammals; (5) forty-five typical botanical preparations, including a fine series of pitcher plants with their insects.

THE programme of day and evening classes at the Woolwich Polytechnic during the session 1907–8 has been received. The volume contains the usual syllabuses of subjects studied at the polytechnic, and particulars of the examination requirements of London University, Board of Education, and other examining bodies. We are glad to see here and there short notes as to the value of preliminary scientific education to the student of technology. Thus, it is pointed out that a sound knowledge of mathematics is the surest basis for satisfactory progress in mechanical and physical science. In the physical department, all students are required to attend both the lecture and the laboratory course in each class; and students of electrical engineering must attend classes in electricity and magnetism concurrently if they have no knowledge of the principles of electrical science. Systematic courses of study extending over three or more years are arranged in various branches of technology; and the time-tables of these courses should be useful as a guide to serious students. We notice the announcement that the governors are desirous that no young man or woman shall be deprived of the advantages of the instruction given in the polytechnic, on the ground of inability to pay the fees. The principal is authorised to admit students free who desire to attend any of the classes and to work steadily, but are unable to pay the necessary fees.

THE distribution of medals, prizes, and certificates to students of the Royal College of Science on Thursday last was made the occasion of several references to the charter of incorporation of the Imperial College of Science and Technology. The Dean, Prof. W. A. Tilden, trusts that by the end of the year everything will be ready for the transfer of authority which is to take place from the Board of Education to the governing body of the Imperial College on January 1 next. In his address to the students, Mr. A. H. D. Acland said that in the forwarding of technology this country has been lamentably backward. Scientific knowledge is at the very root of the prosperity of the Empire. If determined efforts are made a great national institution will be established of which the country will really be proud. Mr. Acland advised the students to do something to study the great masterpieces of the English language. He remarked that in later life, when they have to make reports, as all men in scientific life must do, they will often find that the study of the English language will not have been altogether useless, even at the present stage of their education. Mr. Acland also advised the students to travel when it is possible for them to do so. Scientific men do a great deal by their interchange of ideas between this and foreign countries to forward that which we all desire—international friendliness. Prof. Dalby, Dean of the Central Technical College of the City and Guilds of London Institute, referred to the union which is to take place between the three colleges; and Sir William White said that to put the charter in practical form it is necessary to recognise all that has been done in the past, to utilise fully all that exists, and to bring the whole of the higher technical instruction into one harmonious and sympathetic working whole.

A STRONG plea for the establishment of a university for Bristol and the West of England was made by Prof. F. Gotch, F.R.S., at the annual distribution of prizes to the students of the faculty of medicine of the University College of that city on October 1. Prof. Gotch pointed out that the geographical position of Bristol, her civic prosperity, and her educational institutions are such that there is no excuse for further delay. It is time for the city to realise that in higher education the organisation of her teaching resources is a matter of momentous importance, and that the way to attain this is to segregate all her scattered educational efforts in a university. Surely the citizens of Bristol are as enlightened and generous as those of Liverpool, Manchester, Birmingham, Leeds, and Sheffield; and the fact that the city has not also a university of its own must be because the difference between a college and a university is not understood. A university possesses greater educational stability, and, in consequence, greater educational efficiency. It segregates all the higher educational enterprises of the district, rivalry gives place to cooperation, general interest is thus awakened, and it is sustained by the knowledge that, having become a working partner in a great enterprise, it must at all hazards be made a success. The credit of the community is then at stake, thus ensuring its proper support; and since the enterprise has, from the educational point of view, attained a new level, it is viewed from a different and a higher standpoint. Another conspicuous feature of a university is the freedom which it enjoys. The possession of the power to give a degree carries with it a matter of enormous freedom. Collegiate teaching has to follow along lines prescribed by those bodies which give degrees, and such prescription stifles educational development, because the teacher has no voice in the matter. A further feature of a local university is the enlargement of the area of educational responsibility. The pride which the citizens of Liverpool and Birmingham have in their universities is due to their proprietary interest in them. A university would thus become the dominant educational force and pride of Bristol and all the surrounding district. The last feature of a university, as distinct from a college, is one which will in the end carry on its broad back all the others: it is prestige. So long as Bristol only possesses a college, she will from the standpoint of higher education have but little general prestige. The fault does not lie with the character of the collegiate teaching, the size of the buildings, or the equipment of the scientific laboratories. So long as the college continues to remain in its present condition, so long will it not only gain no prestige, but may begin to lose what prestige it now possesses. Those who take over wider university responsibilities are felt to be possessed by the spirit of the age, and are duly honoured, whilst those who hesitate to do so are felt to be without this spirit, and lose their position.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, received June 8.—"On Luminous Efficiency and the Mechanical Equivalent of Light." By Dr. Charles V. **Drysdale.** Communicated by Prof. Silvanus P. Thompson, F.R.S.

The paper first directs attention to the fact that the term luminous efficiency requires more rigorous definition. If Q is the total power consumption of the source, R the total radiation $= \int_0^\infty I_\lambda d\lambda$, and L the luminous radiation $= \int_{\lambda_1}^{\lambda_2} I_\lambda d\lambda$, the luminous efficiency is generally taken to mean the ratio L/Q. In many cases, however, the ratio L/R, which has been termed by Nichols the radiant efficiency, is determined. Neither of these definitions is entirely satisfactory from the practical point of view, as a source might apparently be of high efficiency if its radiation were confined within the visible spectrum, but near to either end of the spectrum, where the luminosity is low. A better definition is that of Dr. Guilleaume, which may be termed the reduced luminous efficiency L_λ/Q, where L_λ is the equivalent radiation of the most effective form required to give the same light emission. In order to obtain the latter quantity it is necessary to determine the mechanical equivalent of the most effective luminous radiation which is in the neighbourhood of $\lambda = 0{\cdot}54\ \mu$.

For the measurement of the mechanical equivalent a spectrum was formed by a carbon bisulphide prism, and a combined photometric and bolometric arrangement was made to enable the luminosity of any part of the spectrum to be measured, and the radiation to be compared with that from a glow lamp radiating a known amount of power. By means of a movable screen the radiation from the spectrum or from the source of radiation could be intercepted alternately, and the radiation from the comparison source altered until no effect was observed on

changing from the spectrum to the comparison lamp. This eliminated trouble due to drift. Measurements were made both with approximately monochromatic light in the neighbourhood of 0·54 μ, and in white light obtained by widening the slit until the whole of the light within the visible limits was collected at the bolometer. The result obtained for the mechanical equivalent was 0·06 watt per candle for the yellow-green light; for white light obtained from an arc the mechanical equivalent was 0·08 watt per candle, and from a Nernst filament as source 0·12 watt per candle, the latter result agreeing almost exactly with that obtained by Ångström for the light of the Hefner lamp. The ideal source of white light should therefore give somewhere about ten candles per watt, and a monochromatic yellow-green source nearly seventeen candles per watt.

June 13.—"On the Identification of Chitin by its Physical Constants." By Miss I. B. J. **Sollas.** Communicated by Prof. W. J. Sollas, F.R.S.

The determination of the physical constants of chitin forms a useful method of identifying it. The specific gravity of chitin from various sources approximates to the value 1·398, a number which represents the specific gravity of chitin precipitated from its solution in strong acid. The refractive index lies between the limits 1·550 and 1·557.

The bristles of Lumbricus, the pupal skin of Pieris and other Lepidoptera, the radula of Mollusca and the shell of Sepia, when freed from mineral matter and easily soluble organic substances, have specific gravities and refractive indices which lie between the same limits as those of chitin from various sources.

June 27.—"The Pressure of Bile Secretion and the Mechanism of Bile Absorption in Obstruction of the Bile Duct." By Dr. Percy T. **Herring** and Dr. Sutherland **Simpson.**

The authors find that the maximum pressure attained by the bile in obstruction of the common bile duct considerably exceeds the figures given by Heidenhain. In the dog, cat, and monkey the average maximum pressure reached in a number of experiments was 300 mm., measured in terms of the height of a vertical column of bile. The highest pressure recorded was 373 mm. bile in a cat.

When the common bile duct is obstructed the bile escapes from the liver by the lymphatics, and in the cat may be seen in the thoracic duct one hour after obstruction.

Evidence is adduced to show that the obstructed bile enters the intracellular plasmatic channels of the liver cells, and passes from them by the natural lymph flow into the lymph channels of the portal spaces. The mechanism of absorption lies in the liver cells, and is not an escape from interlobular bile ducts.

The intracellular plasmatic channels are held to constitute an intermediate system between the blood-vessels and lymphatics of the liver. The "vital" theory of lymph formation is supported.

"On the Relation between the Output of Uric Acid and the Rate of Heat Production in the Body." By E. P. **Cathcart** and J. B. **Leathes.** Communicated by Dr. C. J. Martin, F.R.S.

A diet containing no purine bases, free or combined, was taken by one of the experimenters in equal amounts every three hours during the day, and the output of uric acid during each of the periods of three hours was determined. In this way the average rate of excretion for each period of the day could be ascertained, as well as the daily total. Exposure to cold for about three hours with no voluntary muscular exertions increased the rate of excretion at the time and for some time after (in the first twenty-four hours nearly 50 per cent. above the mean calculated from sixteen successive days), whereas a similar exposure to cold counteracted by muscular activity increased it much less (in the first twenty-four hours about 15 per cent.), and muscular activity without the stimulus of cold (in heavy clothing) for the same length of time diminished it (in the first twenty-four hours about 30 per cent.). The conclusion pointed to is that the endogenous uric acid is in part, and it may be to a considerable extent, a product of the reaction of the body to loss of heat, and that this reaction consists in some form of activity distinct from voluntary movements of the muscles.

"Further Studies of Gastrotoxic Serum." By Dr. Charles **Bolton.** Communicated by Prof. S. Martin, F.R.S.

The serum referred to in this communication was prepared by injecting the stomach cells of the guinea-pig into the rabbit, the blood serum of the rabbit developing toxic properties for the guinea-pig's tissues.

It has been shown that the serum contains, not only a precipitin for stomach-cell proteid, but also separate precipitins for other body proteids. The actions of these precipitins overlap to some extent. There is no agglutinin for the stomach-cell granules, the agglutination which was found to occur being brought about by the precipitins.

The repeated injection of gastrotoxic serum does not produce chronic gastric ulceration, but immunity to the serum is established. The immunity is not only active, but the serum is able to confer passive immunity upon another animal. The tissues of the immune animal are still acted upon by the gastrotoxic serum in the test-tube, the immune substances being present in the blood serum of the animal.

It has been demonstrated that the necrosis of the mucous membrane of the stomach resulting from the injection of gastrotoxic serum is not directly caused by the serum, but is brought about directly by the action of the gastric juice. The cells are functionally damaged by the serum, which renders them susceptible to the gastric juice. The process is thus one of self-digestion. Hyperacidity of the gastric juice increases the tendency to this self-digestion.

Received July 20.—"A Preliminary Summary of the Results of the Experimental Treatment of Trypanosomiasis in Rats." By H. G. **Plimmer** and J. D. **Thomson.** Communicated by Sir Ray Lankester, K.C.B., F.R.S.

The experiments described were undertaken under the direction of the Tropical Diseases Committee of the Royal Society.

The strains of trypanosomes used were a nagana from the original strain brought to England, and a surra from Prof. Lingard in India. The nagana strain kills rats in an average time of 5·5 days, and the surra strain in 6·9 days.

Of drugs experimented with, fifteen chinolin compounds, dichlorobenzidine+acidH, trypanroth, arsenious acid, atoxyl, monophenylarsenic acid, nitrophenylarsenic acid, paratolylarsenic acid, and other arsenic compounds are commented upon, and their effects on the development and course of the diseases stated. Of all the arsenic compounds, and, indeed, of all substances tried singly, atoxyl had by far the most favourable action.

This is the most important substance, so far discovered, in relation to the treatment of trypanosomiasis. In nagana and surra atoxyl causes the entire disappearance of the trypanosomes from the blood, so that rats inoculated with the blood when it was microscopically free from parasites failed to take the disease; but the trypanosomes have invariably recurred, and death was only delayed for a period varying with the dose, and with the time of commencement of the treatment.

When atoxyl is given more continuously or more freely than is required, in cases in which there have been many recurrences, and probably under some other conditions of which we are ignorant, in a certain small proportion of rats so treated a race of trypanosomes is produced which entirely resists atoxyl, and continues to develop and multiply in spite of continued exhibition of the drug. This strain, when inoculated into fresh rats, retains its resistance to atoxyl. Ehrlich, who has produced such a strain in mice, calls them "atoxyl-fest," and we have obtained this atoxyl-proof variety of trypanosome in rats, both in nagana and surra.

In human trypanosomiasis the danger of the production of an atoxyl-proof strain will be at once apparent. For an account of the production and behaviour of these atoxyl-

proof strains, and for the results obtained with them, reference must be made to the original paper. Their importance and their bearing on the treatment of human trypanosomiasis by atoxyl is obvious.

Under the heading "Treatment with two or more Drugs," a number of tables are given showing the results of treatment with atoxyl and various mercury compounds, and atoxyl and iodipin. Of the mercury compounds used, the succinimide appears to be the best; it has the great advantage of being unirritating to the tissues, and it will mix with atoxyl without precipitation, and without interfering with the action of the latter.

The results with atoxyl and iodipin are sufficiently encouraging to suggest a further trial of this combination. Several of the animals treated are alive, and apparently well, some as long as five months after inoculation; the duration of the disease has been very greatly prolonged in the great majority of cases, and in some the authors have confidence that a cure has been effected.

PARIS.

Academy of Sciences, September 30.—M. Henri Becquerel in the chair.—Is the use of arsenious acid a preventative against trypanosomiasis? A. **Laveran** and A. **Thiroux.** The authors have repeated the experimental work of Loeffler and Rühs, and come to the conclusion that the use of arsenious acid for trypanosomiasis is not advisable, although in certain cases it may have a useful effect. It cannot be used like quinine against malaria, as the necessary doses of quinine in the latter case are small, not toxic, and can be administered without inconvenience during several months, whilst the doses of arsenious acid which must be administered, either in man or in animals, judging from the doses necessary with the guinea-pig, would be quickly followed by poisonous symptoms. In animals used for food, in particular, the prolonged use of arsenic would have the result of rendering the flesh poisonous.—Researches on the laws of action of light on glucosides, enzymes, toxins, and anti-bodies: Georges **Dreyer** and Olav **Hanssen.** The authors have examined the action of light on two glucosides, saponine and cyclamine; three enzymes, yeast, trypsine, and papayotine; two toxins, ricine and abrine; and one immuno-serum, coli-agglutinine. All these are weakened by the action of light, the ultra-violet rays retained by glass being the chief cause. The action progresses regularly under the action of continuous lighting, the change following very exactly the law of monomolecular reaction.—Transformers with magnetic leakage and secondary resonance for wireless telegraphy: MM. **Gaiffe** and **Gunther.**—Observations on the affinities and evolution of the Chicoraceæ: Léon **Dufour.**—The pluricarpellary origin of the pistil in the Lauraceæ: Marcel **Mirande.**—The function of the spleen in trypanosomiasis: A. **Massaglia.** Trypanosomes collected from the spleen present the same characters as those collected from other parts of the body. This virulence of the trypanosome does not disappear more rapidly in the spleen of animals killed by the trypanosome than in the blood of these animals, and the extract of the spleen does not destroy, *in vitro*, the trypanosomes. The course of the disease surra is the same in a dog from which the spleen has been removed as in the normal animal.—Researches on the chemical nature of the fundamental colouring material of the urine: S. **Dombrowski.** The urochrome is isolated from the urine by precipitation with copper acetate, and from its analysis is shown to contain carbon, hydrogen, nitrogen, sulphur, and oxygen. The sulphur is easily removed by alkalis; the presence of sulphur shows that this body is not derived from the coloured part of hæmoglobin or urobilin, as has been asserted up to the present.—Sodium chloride as a sensitising substance for vegetable ferments: C. **Gerber** and Mlle. S. **Ledebt.** Sodium chloride, in small proportions, accelerates the coagulation of milk by vegetable ferments. It determines the phenomenon when the ferment is present in too small quantities to act alone.

NEW SOUTH WALES.

Linnean Society, August 28.—Mr. A. H. Lucas, president, in the chair.—A preliminary record of the occurrence of Chlamydoselachus in the waters of New South Wales: D. G. **Stead.** The record was based upon portions of a specimen cast ashore some time since in Rose Bay, Port Jackson, comprising the skull and about 150 vertebræ. The specimen measured more than 10 feet in length. Only one species of the genus is known, *C. anguineus*, Garman, from the Sea of Sagami, Japan, as well as from deep waters in the vicinity of Madeira, the Azores, and the coast of Norway, while the length of the largest specimens hitherto known appeared to be about 5 feet.—The resistance of the vegetation of Australia to bush-fires, and the antiquity of the Australian aboriginal: Dr. J. B. **Cleland.** The object of the paper is to suggest that, if it can be proved that the vegetation of Australia has been modified in the course of ages so as to have become more tolerant of bush-fires, and as a result of the frequency of such fires, and if the frequency of such fires can be regarded as due mainly to the agency of man, then there would seem to be some grounds for attributing considerable antiquity to the presence of fire-producing man in that region, and therefore, presumably, to the ancestors of the vanishing aboriginal Australian.—The geology of the Warrumbungle Mountains, N.S.W.: H. I. **Jensen.** In this paper the physiography of the Warrumbungle Mountains district is described, and it is shown that many of its peculiarities are due to *arid erosion*. The mountains may be looked upon as forming a dissected lava conoplain surrounded by an arid erosion peneplain.

CONTENTS.

SUPPLEMENT.

SUPPLEMENT TO "NATURE."

DENATURED ALCOHOL.

Denatured or Industrial Alcohol. By Rufus Frost Herrick. Pp. x+516. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1907.) Price 17*s.* net.

THE tax-gatherer, nowhere a *persona grata,* by some strange irony of circumstance finds that one of the most convenient modes of raising revenue is to tax that which, proverbially speaking, maketh glad the heart of man. Nevertheless, this fact rather detracts from his general unpopularity than adds to it, at least with all right-thinking communities. For alcohol, unlike certain much-advertised pens, is not an unmitigated boon and a blessing; there are some people, indeed, who, if they had their way, would tax it out of existence altogether.

Without entering on the vexed question as to whether alcohol, in its manifold forms, is or is not of alimentary value, it is universally agreed that if articles of food and drink are to be taxed at all, human nature being what it is, there is no more convenient substance by which to raise a revenue than the spirit of wine. But the industrial value of alcohol is hardly less important than its potable value. It is the starting-point in the manufacture of a great variety of useful and beneficent products, and it has special merits as a fuel and as a solvent. The tax-gatherer-in-chief, that is the Chancellor of the Exchequer, of every civilised State is, therefore, confronted with the problem how to raise a due amount of revenue from alcohol without hampering or crippling those industries which need alcohol in their manufacturing operations. This country was the first to attempt to settle this difficulty by introducing the system of what is called "denaturing" the alcohol, that is, so treating it as to render it practically worthless as an article of drink, without materially impairing its application to industrial purposes or materially increasing its cost to manufacturers. The effective solution of the problem is by no means an easy matter. An efficient denaturant must fulfil certain necessary conditions. In the first place it must render the spirit nauseous, even when used in comparatively small quantity. Secondly, it must not be capable of being easily removed by distillation or by mechanical or chemical treatment; next, it must be capable of ready and certain detection, even if present in very small quantity; and, lastly, it must not affect the industrial value of the spirit. The ideal denaturant has not yet been found, but by general consent of all who have studied the question (and it has been inquired into and reported upon by the revenue authorities of nearly every country), the method suggested by the late Mr. George Phillips, and first adopted in Great Britain about half a century ago, has been found in practice to be on the whole the most convenient and suitable. It consists in adding to the spirits a certain quantity of wood-naphtha, or crude methyl alcohol, which, if containing a sufficient quantity of the associated pyroligneous products, renders the alcohol practically unpotable, except perhaps to the hardened dipsomaniac, who, like Porson, will drink even ink if it intoxicates, and who, to the extent that he is a curse to himself and society, must be treated by special means. Alcohol thus denatured, although not wholly released from revenue control, can be supplied for industrial use free of duty and without any charge to the user beyond the cost of "methylation."

With the spread of manufacturing industry, especially of chemical and pharmaceutical products, and in consequence of the increasing stress of competition, it was but natural that this question of the relations of alcohol to industry on the one hand, and to the revenue on the other, should be the subject of frequent inquiry, and for some years past an agitation was kept simmering in this country to effect the relaxation of the conditions under which duty-free alcohol may be employed in industry. It culminated in a departmental inquiry, and a considerable body of evidence was accumulated which had the unlooked-for result of entirely disproving the allegation that the attitude of the revenue authorities was in the least degree answerable for the position in this country of those industries which are concerned with, or are dependent upon, the use of alcohol. At the same time, the inquiry was not only of benefit to manufacturers in this country by opening their eyes to the real causes which affected their industries, but resulted in some substantial concessions to them. For although the contentions on which they originally based their demands were hardly supported by such evidence as they were able to adduce, it was found that the cost of "denaturing" might be materially reduced without risk to the revenue, and, what was of more importance to manufacturers, that the Treasury could afford to grant a considerable rebate to industrial alcohol. It is too soon, perhaps, to draw conclusions as to the operation of these concessions, or as to their commercial effect. It is, however, quite certain that if the results are not commensurate with anticipation, the fault will not rest with the inland revenue authorities.

All these matters are treated at length in the volume before us, which is, if we mistake not, the first treatise in our language on the subject to which it relates. Of course, much has been written on the methods of manufacture of alcohol, and Mr. Herrick's book contains little on this point which is not already familiar to distillers. Nor is it to be expected that what he has to say respecting the value of alcohol as an illuminant and as a fuel, or as a source of power, contains much original matter. But his compilation will be welcomed by all who are concerned in these subjects, and especially by those mechanicians who are interested in alcohol as a source of light and power. Mr. Herrick has been at some pains to put together all available information in the confident expectation that his countrymen will not be slow to turn it to account.

"It is the hope and belief of the author that we Americans can solve for this country the problem of Denatured Alcohol in such a successful manner that

all the world may secure, from the results we here attain, uses and benefits much greater than those heretofore achieved."

As America has only known anything of denatured alcohol since the beginning of this year, Mr. Herrick's anticipation has all the enthusiasm and optimism of inexperience. At the same time, we shall look with interest to the realisation of his belief. Meanwhile we commend his book to the attention of those older nations to whom the problem of denatured alcohol has been familiar for generations past, in the hope that their energies may be quickened and their inventive genius stimulated by its perusal.

WATER AND WATER POWER.

Hydraulics. By Prof. S. Dunkerley. In two volumes. Vol. i., Hydraulic Machinery. Pp. vii+343. (London: Longmans, Green, and Co., 1907.) Price 10*s.* 6*d.* net.

HYDRAULICS, the practical side of the science of hydrodynamics, is a subject of no little interest and importance, not only from a technical, but also from an historical point of view. The energy contained in running water was one of the earliest sources of power utilised for the service of man. Water-wheels date back to a remote age, and are no doubt coeval with windmills. It is interesting to note that water power and wind power share the unique distinction of being found in nature "ready made," in which respect they stand apart from other motive agencies, which have to be generated.

It is mainly within a comparatively recent period that the capabilities of hydraulic power for industrial purposes have been thoroughly and systematically exploited. No little of the initiative in this matter was due to the genius and enterprise of the late Lord Armstrong, whose inventive mind was, he tells us, first set to work in this direction on the occasion of a journey through the Craven district of Yorkshire in 1836. He was then struck by the large number of mountain streams descending the steep slopes of the hills and expending their energy to no apparently useful purpose. Applying himself to the problem with characteristic energy, he became the pioneer and founder of the modern system of hydraulic power transmission, which has had such an enormous vogue during the past fifty years; and although at the present time its popularity is threatened by the growing importance of its junior rival, electricity, yet there still remains a vast field of usefulness for it which it can never wholly lose.

Prof. Dunkerley is thoroughly qualified to deal with a subject of this kind, requiring, as it does, a combination of close mathematical reasoning with practical common sense. He divides his material into two volumes, the first of which, and the one now under review, is entirely concerned with the theory of hydraulics in its relation to machinery. Dealing primarily with fundamental principles, he lays down the laws which have been demonstrated by experiment, and then proceeds to describe the means of their practical application.

Admirable, however, as is Prof. Dunkerley's work in its general scheme, we find that it bears here and there several traces of a slight lack of care in preparation, and some mistakes (due most likely to an imperfect scrutiny of the proof-sheets) which it would be well to correct in future editions. In certain parts the book would appear to have been compiled somewhat disconnectedly, and without that sustained continuity of reasoning and progressive demonstration which constitute features of a scientific treatise no less essential than accuracy of detail and clarity of diction. The author frankly admits that one article (p. 192) is out of its proper sequence, and it seems to us that other sections might have been more advantageously arranged. For instance, we venture to suggest that it would have been preferable for article 62 to follow directly after article 34, to which it appertains, and there is no apparent reason why the frictional resistance of bends and elbows should be dealt with in widely disconnected sections on pp. 56 and 87.

Over and above some evident misprints of an ordinary type, one or two strange inaccuracies seem to have crept in. The rendering of Kulter for Kutter (the familiar name of the Swiss experimentalist, who with Ganguillet propounded the well known formula now commonly known as Kutter's formula) is surely a *lapsus plumae* of rather more than ordinary significance, seeing that it occurs no less than four times, and is nowhere given correctly. The formula for bends, quoted on p. 87 as that of Weisbach, and presumably covering the general case, is certainly incomplete, and should read:—

$$h_b = m \cdot \frac{v^2}{g} \cdot \frac{\theta}{\pi},$$

where, for circular culverts,

$$m = 0{\cdot}131 + 1{\cdot}847\left(\frac{r}{R}\right)^{\frac{7}{2}},$$

θ being the angle of deflection. Even supposing the expression intended only to apply to rectangular bends of circular section (which is not expressly stated, and cannot be strictly inferred), the essential power index is lacking.

We mention these points in no carping and fault-finding spirit, but simply by way of enabling such few blemishes as there are to be removed. It is infinitely more pleasant to direct attention to the really commendable features, which are not a few. A number of worked examples are inserted throughout the book. These have been so carefully selected, and are so eminently helpful, that the author is to be congratulated upon their introduction. Then, too, he has been at pains to choose for his illustrations instances of some of the more recent applications of hydraulic science to engineering and commercial operations, instead of confining himself to old-fashioned types. A predilection for naval appliances is no doubt due to his past association with the Royal Naval College at Greenwich. In chapter iii. there are very full details of the hydraulic gun brake and of the method of operating bulkhead doors. Other articles worthy of mention are those relating to the hydraulic ram

(pump), the Gutermuth valve, and the various adaptations of the centrifugal system of pumping, including the turbine. A good portion of the book is devoted to chronicling Prof. Osborne Reynolds's researches, including an article on the theory of lubrication. We do not notice any allusion to Prof. Hele-Shaw's experiments in stream line flow, but possibly this is reserved for the second volume, which is announced to deal with the resistance and propulsion of ships.

Altogether, there is a great deal to commend this book to students and others interested in the practice of hydraulics. The type is clear, the setting good, and the diagrams are very distinct. There is a large amount of new matter, and some old matter presented in a new light, and to those who are desirous of possessing a record of Prof. Reynolds's investigations, the volume forms a much readier source of reference than the original papers and the proceedings of various learned societies in which they are embodied.

COMPARATIVE ANATOMY OF THE LABYRINTH.

The Labyrinth of Animals, including Mammals, Birds, Reptiles, and Amphibians. By Dr. Albert A. Gray. Vol. i. Pp. x+198; 31 plates. (London: J. and A. Churchill, 1907.) Price 21*s.* net.

ONE turns away from the examination of this work with a mixed feeling in which admiration is tempered with disappointment. In the volume under review the author reproduces thirty-one excellent stereoscopic photographs of exquisite preparations of the inner ear of various species of mammals—structures which hitherto have been left unexplored owing to the grave technical difficulties involved in their preparation. These difficulties the author has overcome by the application of a new technique whereby the delicate and complicated membranous labyrinth is freed from its surrounding bone, and clearly exposed as a transparent body, perfect in form and texture. Besides the photographs of these structures, which are novelties to the anatomist, the author gives scores of accurate measurements relating to the fenestra ovalis, the semicircular canals, and the cochlea; careful records are given of the development of the perilymph system, of the degree of twisting of the cochlea, of the pigmented areas on the ampullæ and lamina spiralis, and of the form and size of numerous other structures. The technique, the industry, and the field of fresh observation compel our admiration; it is when one comes to consider how far this research has really advanced our understanding of the inner ear that a feeling of disappointment creeps in. What Dr. Gray has really succeeded in showing is, that the mammalian labyrinth—if the monotreme form be excluded—is almost identical in form and arrangement in all; the variations shown relate only to minor details. That is what one ought to expect, seeing how strictly the organ subserves the same function in all—at least so far as it serves as an organ of hearing. But as part of the mechanism of balancing and of orientation, one might expect a greater degree of variation in structure than Dr. Gray has actually found. In the case of the sloth the semicircular canals are certainly peculiar in form. From the data of comparative anatomy one is frequently able to obtain valuable suggestions of the functional meaning of obscure structures, but in this respect Dr. Gray's inquiries, so far as can be seen at present, are remarkably barren.

Dr. Gray is of opinion that many of his observations may afford indications of the relationship of one mammalian order to another. He divides the forms of cochlea into flat conical and sharp conical. To the sharp type belong the Carnivora and Rodentia, while Primates, Ungulata, Sirenia, Cetacea, Insectivora, and Cheiroptera possess the flat type; the Edentata show an intermediate form. Unfortunately one knows so little of the real meaning of the twisting of the cochlea tube that it is hazardous to say at present what importance should be attached to its form. Amongst marsupials, Dr. Gray found both forms of cochlea to occur. He is inclined to attach a taxonomic value to the size of the perilymph space in the semicircular canals, a wide space being, in his opinion, the primitive form. The seal, for instance, has a wide perilymph space, while the sea-lion, like the land Carnivora, has a very narrow one, from which he concludes that the seal must have branched off from the primitive Carnivora stock while this space was still wide, whereas the sea-lion dates his departure from the period at which this space had already diminished in the land forms. To estimate the worth of such an observation one wishes to be quite certain that the size of the perilymph space has no functional significance, and, secondly, that the wide form is really the primitive mammalian form. Man and all the monkeys possess an ample perilymph space, whereas in the lemurs it is of small size. The slow loris differs from the typical lemur in many points so far as regards the anatomy of the inner ear, but here again one wishes to know how much of this difference is really due to a difference in function, and how much is really due to a difference in descent.

While expressing an unqualified admiration for the results obtained by the application of Dr. Gray's technique, one must also admit that it is a technique with very serious limitations. The finer structures of the ear, the organ of Corti and the nerve-endings cannot be thus examined, and are only to be explored by the old, laborious and accurate method of sectional reconstruction. A. K.

BRITISH WILD LIFE.

The Woodlanders and Field Folk: Sketches of Wild Life in Britain. By John Watson and Blanche Winder. Pp. xii+304; illustrated. (London: T. Fisher Unwin, 1907.) Price 5*s.* net.

THE demand for books on country life and popular natural history (and from the number of volumes on these subjects issued nowadays from the press it may be assumed that such demand is large) is a healthy sign of the times. A *sine quâ non* with such books is, however, that they should be fairly accurate and reasonably up to date. Whether the volume now

before us fulfils these conditions we will leave our readers to judge for themselves after perusal of the following extracts and comments.

In the chapter headed, not very happily, "A Miniature British Fauna," it is stated (p. 109) that "British voles are diminutive beavers"; while on the next page we are told that there are three British species of these rodents—the water-vole, field-vole, and bank-vole. Now to call the water-rat, or water-vole, a beaver is bad enough, but to include the short-tailed field-mice, or field-voles, under the same term is a positive absurdity. With such lack of knowledge it is not surprising to find the authors completely ignorant of the existence of the Skomer Island and Orkney voles. Again, it is a little late in the day to refer (pp. 113–114) to the bank-vole as having only recently been recognised as a species, especially when mention is made of Yarrell's description of it "as lately as 1832." While excluding "voles," the authors class the dormouse among mice, stating that we have four representatives of that group—the dormouse, the harvest-mouse, the long-tailed field-mouse, and the house-mouse. What may be the authors' views as to the systematic position of rats we dare not venture to guess!

In connection with mice, we may refer to the statement (p. 109) that, "with one exception (the harvest-mouse), the long-tailed field-mouse is the smallest British mammal," the shrew-mice being totally forgotten! As regards the matter of sizes of animals the authors are, indeed, very casual, as on p. 249 they tell us that the rock-dove is the smallest of the British pigeons, although they include in that group the turtle-dove, as they likewise do the passenger-pigeon!

Other instances of carelessness or want of knowledge occur in the statement that the fur of the water-shrew is warm brown (p. 110), and the mention of silver fox where white fox is obviously intended (p. 37). If true, the statement that otters feed mainly on crayfish (p. 101) is new to us; while we are startled by the suggestion on p. 67 that British cuckoos occasionally incubate and hatch their eggs. In using the term loon (p. 206) to designate the grebes, the reader should have been informed that it is generally applied to the divers; or if that information was considered superfluous, it was surely unnecessary to suggest (p. 101) that most persons are ignorant of the fact that owls reject the waste portions of their food in the form of pellets.

Owing to its many errors the naturalist will be very disappointed with the volume; while the nature-student who desires to use it as a source of information will find that he has much to unlearn.

The illustrations of scenery and of nests of birds in their natural situations are for the most part good, and many of them excellent. As for the photographs of stuffed birds among pseudo-natural scenery, perhaps the less said the better; but if such artificial pictures are used, it would be well to see that the toes of the birds are made to grasp the boughs on which they are placed, instead of sticking out in an aimless manner, as in the photograph of the turtle-dove facing p. 252. R. L.

POPULAR ORNITHOLOGY.

(1) *Birds I have Known.* By Arthur H. Beavan. Pp. 256; illustrated. (London: T. Fisher Unwin, n.d.) Price 2*s*.

(2) *A Ready Aid to Distinguish the Commoner Wild Birds of Great Britain.* By David T. Price. Pp. 62. (London: Gurney and Jackson, 1907.) Price 1*s*. net.

(3) *Birds of the Countryside: a Handbook of Familiar British Birds.* By Frank Finn. Pp. xvi+190; illustrated. (London: Hutchinson and Co., 1907.) Price 5*s*. net.

(4) *The Useful Birds of Southern Australia.* By Robert Hall. Pp. xvi+306; illustrated. (Melbourne: T. C. Lothian, 1907.) Price 3*s*. 6*d*.

(1) THAT there is an increasing interest taken in wild birds by amateurs is abundantly proved by the steady stream of books on the subject intended for the use of beginners which issues from the publishers. Perhaps there is no better way of fostering their interest than relating one's lifelong experience of birds, and Mr. Beavan has done this very pleasantly in "Birds I have Known." Beginning with his childhood, when he lived in a "dreary London square" which could not repress his ornithological instincts—these finding an outlet in the parks, rare visits to the Zoo, and to Margate, where he made the acquaintance of a living gull—the author passes on to his schooldays. They were schooldays under the old, hard system. To read of them should make the modern boy contented with his lot, although he may perhaps long for the greater amount of liberty and the greater opportunities for training the powers of observation enjoyed by boys before games were put before everything else. But he will follow with delight the author's adventures in search of birds' nests, and his experiences with tame hawks and owls, &c. Later, in the holidays, this particular boy found his way to Leadenhall Market, with its then rich show of ruffs and reeves, avocets, godwits, and rare waterfowl, at which he used to gaze long and admiringly. Altogether the progress of the young ornithologist, with the real, keen love of birds in him, making the best of not very favourable conditions, is admirably traced. But the author soon went to sea, and succeeding chapters take us among ocean birds, and recount his experiences of birds "during many years in many lands and over many seas." Here he deals "with Nature like an open book," "uncomplicated by references to scientific theories as to the origin and distribution of species." And very good reading these chapters are, although home-staying bird-lovers may find their chief pleasure in those upon Cornish and London birds. But wherever made, the personal observations of a keen bird-man are always worth reading by his fellows, and really are a great help to the younger ones. Mr. Beavan has certainly known a great many birds. The frontispiece is a reproduction of one of Wolf's incomparably beautiful pictures of eagles. The rest of the illustrations seem to be original, but will hardly escape criticism to-day.

(2) Even nowadays, under the narrowing influence

of primary education and the counter attractions of cheap holiday outings and cigarettes, some of our ploughboys grow up knowing the names of nearly all the birds around them, without having even seen a book on the subject; and a generation ago such knowledge was general among them. But there are now many educated people, it appears, who would like to be able to recognise the birds they meet with, and having come to mature years without knowing anything about them, seek for a short, if not a royal, road to that knowledge. For them a pocket key has been cunningly devised by Mr. Price. In the second part will be found short descriptions of about one hundred of the commoner British birds, written specially for the observer with a field-glass, dealing therefore with habitat, flight, and characteristic habits rather than with details of plumage. In order, however, that it shall not be necessary to search this part of the volume from beginning to end in the process of identification, the first part has been devised. In this part—which might be called an index—under seven headings, each heading constituting a certain locality, and in two columns (for winter and summer), will be found lists of the species that are likely to be seen in such localities.

"By dividing these lists into groups according to the size of the species, and by adding a two-word description of each, it is hoped that but two or three species will remain as possibilities. The descriptions of these will then be found in the second part on the page indicated."

The idea has been very well carried out, and we are sure the little book will be a help to those for whose use it is intended; but we confess to having our doubts as to whether anyone who *wants* such a key for use in the field will ever know his birds as well as our ploughboys. The single illustration explains the meaning of the names of the different portions of a bird's plumage.

(3) Mr. Finn's stouter volume is also intended to help the beginner to identify birds, but the subject is dealt with more fully therein. It is a handbook, not a key, although the descriptions here again are of the bird as it catches the eye at a distance as well as close at hand—its general colour, shape, and peculiarities of motion and cry. The book is primarily intended to serve as a means of identification of the birds most conspicuous in life or literature, free or in captivity in this country; and the easiest method of learning to know birds, in the author's experience, is to identify those which first catch the eye, and then learn their relations. To this end he has arranged the species dealt with according to the circumstances under which they are likely to be first met with. As most of his readers will be more interested in "the bird in the bush" than in that in the hand, he has cut the descriptions of the species as short as possible, so as to facilitate identification. Here again the birds are grouped according to their locality, the chapters being subdivided in some cases for summer and winter. The complete and pleasing, though concise, account of the general life habits of the different birds (and the nesting habits of those that breed in this country) seems well calculated to help the novice to acquire the knowledge he desires. There are directions for encouraging the presence of desirable birds, by the provision of nesting-boxes, food, and water, as well as for the rearing up of orphaned or deserted young birds—directions which will, of course, be quite as useful for birds taken out of the nest. Finally, to give the reader some idea of classification, at the end of the book there are enumerated and briefly diagnosed all the natural families of birds occurring in our islands, even where these are only represented by casual stragglers.

For the dozen coloured plates we have the highest praise. Many of the black and white illustrations are most interesting and novel, *e.g.* one showing the peculiar appearance of pea-pods torn to pieces by haw-finches. But those of captive birds (so apt to look ragged and dejected) and stuffed groups are not always so happy. We hardly think the photographs of the "house martin," the missel thrush and field-fare can be much aid to identification, nor can we, by the way, fall in with the statement that the martin seems more common in England than the swallow nowadays. But we do not know where else you can get so many good and interesting bird-pictures for so little money.

(4) Those who are interested in the economic aspect of ornithology, especially the good, or harm, done by birds in the course of the satisfaction of their hunger, will profit by a perusal of Mr. Hall's careful treatment of the subject in his account of some of the birds of southern Australia. The book will be welcomed also by those who would like to get some idea of what manner of birds inhabit the far distant island continent, and learn something of their habits. There is, of course, a raven, crow, and kestrel, which for some reason, like the Americans, they will call a sparrow hawk. But the birds on the whole are so utterly different from ours that it comes as a surprise to find a meadow pipit of the same genus as ours, and it is interesting to compare the habits of the two birds. There are no less than six kinds of cuckoo in South Australia, but they do not call "cuckoo," and their notes do not in the slightest degree resemble those of our northern bird—they are described as high-sounding, as weird, and as melancholy. But these cuckoos are just as troublesome to their small neighbours, "upsetting hundreds of family arrangements." The pallid cuckoo chooses open nests like that of the fantail for this purpose; the other species distribute their favours among the wide, open, cup-shaped nests and those with a side entrance. The fan-tailed species and two bronze species choose 75 per cent. of dome-shaped nests, while the square-tailed cuckoo is content with 50 per cent., and the remaining half of open nests. The whole of the account of the cuckoos is most interesting, and the home life of some of our best-known cage-parrots may be learned in this pleasant little book. It concludes with some account of birds which have been introduced. The goldfinch and song thrush are naturally well spoken of; nothing bad is yet known there about the greenfinch or the skylark, and the blackbird's character is much what it

is with us. Few introduced species have succeeded in firmly establishing themselves, and not all of them have been a success in other ways. The starling has already taken to turning out of their nesting holes certain useful native species, and the author says "certainly a part of the cost of upkeep in every well-settled district will need to be expended on the annual subjection of sparrows and starlings." Altogether the acclimatisation of birds in Australia does not seem to have been attended with very encouraging results. The book is, of course, mainly intended for use in the colony. It is nicely illustrated.

O. V. A.

AN UNFREQUENTED ITALIAN COAST.

The Shores of the Adriatic; the Italian Side. By F. Hamilton Jackson. Pp. xiv+358; illustrated. (London: John Murray, 1906.) Price 21*s.* net.

OF the hundreds of English-speaking tourists who annually visit Italy, the great majority consider that they have "done" the Adriatic when they have seen Venice, while a few are attracted a little further afield by the curio shops of Ravenna or Rimini or the postage stamps of San Marino. In exploring the coast-line from Brindisi to Udine by gradual stages, omitting Venice, Mr. Hamilton Jackson has opened up a region practically unknown to English and Americans. There is a good deal of French, Italian, and German literature regarding this part of Italy of which a fairly long list is given in the preface, but English writings are few in number, and this circumstance alone would afford sufficient justification for the publication of the present book, if indeed any justification should be needed.

The district is one of great historical interest. It has been occupied by Greece and Rome, raided by Saracens and Turks, invaded by Gauls, and the southern part conquered by the Normans, of whose methods of strategy an interesting narrative forms part of the first chapter. It comprises the province of Apulia, the Abruzzi, the Marche, Emilia (Romagna), and Venetia. Geographically, the most important feature along the coast-line is the Monte Gargano, with its shrine of Monte Sant'Angelo, founded by Constantine. From its prominent position it was for a long time a Saracenic stronghold, and still retains its name of Monte Saraceno.

It is with the architectural beauties, in particular the churches, that this book mainly deals, and the illustrations are an important feature. In these days of "process blocks" line drawings come as a pleasant change and relief from the monotonous "half-tone" illustrations. Mr. Jackson has made use of both forms of illustration. A number of photographs, mostly taken by Mr. J. Cooper Ashton, are reproduced in the form of plates, while the illustrations in the text show the advantages of pen and ink sketches for bringing architectural details into due prominence. The dual mode of illustration has undoubtedly served another useful purpose. In the narrow streets of an Italian town there are many buildings which cannot possibly be got into the field of view of a camera fitted with even the widest angle lens, and we may be fairly sure that if the author had trusted to photography alone many of the choicest and most picturesque bits would never have figured in this book. Of the difficulties of taking photographs when boys will persist in standing in front of the camera we have an example on p. 165, while the arrival at Brindisi described on p. 33 gives a familiar instance of the way the English traveller is imposed on in Italy when he keeps to the beaten track. On the other hand, the author speaks warmly of the courtesy shown him by officials and others in regions where English tourists are practically unknown. As a set-off against this advantage, Mr. Jackson had to put up with somewhat rough and primitive accommodation in places, and his photograph of an interior under the title "Stable and house in one, Foggia," gives some insight into the insanitary conditions prevailing in many of these unenlightened little Italian towns.

Of the buildings of interest, the following rough summary may give some general idea:—At Bari, cathedral, church of San Nicola, with treasury, King Roger's Castle; at Bitonto, church of San Valentino; at Terlizzi, eleventh century church; at Giovenozzo Molfetto, Trani, Troja, Lucera, cathedrals; at Barletta, church of Santa Maria Maggiore; on Monte Sant'Angelo, the grotto church, with fine bronze doors dating from 1006; San Clemente in Casauria, church; Ascoli Piceno, Roman bridge and prison, churches of SS. Vincenzo and Anastasia, San Giacomo, San Francesco; at Ancona, arch of Trajan, cathedral of San Ciriaco, with beautiful panels, church of Santa Maria della Piazza; at Rimini, bridge of Augustus, church of San Francesco, castle of Sigismond Malatesta; at Ravenna, mausoleum of King Theodoric, cathedral, tomb of Galla Placida, church of San Vitale; at Pomposa, abbey church of Santa Maria, with great campanile; Chioggia, a picturesque town on two canals easily reached from Venice; at Treviso, cathedral; at Udine, cathedral and excursions to Cividale, with its picturesque bridge, castle, churches of San Martino and Santa Maria in Valle. It would be impossible to quote the author's descriptions of these and other objects of interest, but the above list will afford some idea of what there is to be seen by anyone who will follow in Mr. Jackson's footsteps, while the stay-at-home reader will certainly, as the author claims, by reading the descriptions and examining the figures, obtain an insight into Italian art which will be quite new to him.

A number of plans of churches and cathedrals are inserted in the text, in addition to the other figures. There is, however, one point which is too often overlooked by writers of books of travel. A map, however rough and sketchy, of the district traversed greatly adds to the interest. It is true that most people have a map of Italy in their possession, and it must further be admitted that the towns follow each other in fairly regular order along the coast, so that

the descriptions can be followed fairly well in any case. At the same time, a very useful purpose would be served by having a map in the book itself. If only on the ground of convenience, it would be consulted more frequently than an atlas, and the reader would acquire a better knowledge of the geography of the interesting and practically unspoilt towns that Mr. Jackson has so ably brought before our notice. This is the only fault, and that not a serious one, that can be found with this charming and delightful book. On the other hand, the vivid descriptions recall to our mind the bright colours of a southern town, the shouts and gesticulations of the populace, and last, but not least, the scent of burnt incense in the churches and the unsavoury odours of narrow Italian streets.

G. H. Bryan.

SCIENCE AND PRACTICAL BREEDING.

Farm Live Stock of Great Britain. By Robert Wallace. Fourth edition. Pp. xxxi+758. (Edinburgh: Oliver and Boyd, 1907.) Price 16*s.* net.

THIS edition of Prof. Wallace's handbook cannot fail to be of value to owners and to students of the history and management of stock. The illustrations are a special feature of the book; more than 400 of them are excellent reproductions of photographs, and had the animals been taken in a position which would admit of measurement, and a scale provided, the collection would have been of unique value.

After a chapter on wild cattle, in which the various herds recorded are referred to, and, where possible, described, there follow nine chapters on breeds of cattle. The origin and history of these breeds, their points, character, and management are well set forth; but what is of special interest is the attention devoted to variation, to the development of special qualities and of new types, to the influence of climate, and to the results of crossing. Chapters on the breeding and management of calves, on grazing cattle, and on the house-feeding of cattle follow, and this section concludes with two valuable chapters on dairying.

Pigs are somewhat perfunctorily dismissed in two short chapters.

Six chapters are given to the horse. Extinct and wild horses are briefly referred to, and a few inconclusive words said on the subject of the origin of our domestic breeds. Clydesdales and shire horses are more fully treated than are any of the other breeds, as must be expected in a book of this kind, but the space devoted to horses is meagre, and the treatment accorded them not comparable to that given to cattle and sheep.

On sheep there are eight chapters, in which the various breeds are separately and, as a rule, fully treated, while four short chapters contain advice as to the management of sheep, their feeding, the parasites which infest them, and the diseases from which they suffer.

The author claims in writing this book to have kept "in view not only the interests of one special breed, but also its connection with other breeds and the position it occupies in the great live stock economy of the country." This is a high aim, and, if he has not entirely succeeded, either to the satisfaction of certain special breeders or to that of the advanced student of live stock economy, his work is valuable, and will be of real service to those who follow him in their efforts to attain this end.

To readers of Nature it is to the first chapter in this book, on the principles of breeding, they will turn with special interest, and it is disappointing to find that the author has failed to give an account which adequately represents the results attained by modern scientific workers or the influence such work must exert on the future development of the breeding industry.

It is not from books, he says, that a student can learn to master the peculiarities of different breeds or the constitution of different animals; a long apprenticeship as a practical breeder is essential for such knowledge and for the success of the stock-owner. That is undoubtedly true, but one may surely have expected the professor of agriculture in Edinburgh to point out in his book that the scientific principles which govern the right application of all practical experience are of no less importance; to emphasise the fact that a scientific training which teaches the practical observer what to look for, how to sift his observations, how to apply his knowledge effectively, is necessary for the student of the subject, and a sound knowledge of the scientific principles of breeding essential for the highest success of the modern stock-owner. This omission is greatly to be deplored.

W. H.

A NEW DICTIONARY OF SOLUBILITIES.

Solubilities of Inorganic and Organic Substances. By Atherton Seidell. Pp. x+367. (London: Crosby Lockwood and Son; New York: D. Van Nostrand Co., 1907.) Price 12*s.* 6*d.* net.

DURING the thirteen years which have elapsed since the publication of Comey's "Dictionary of Chemical Solubilities," so great an activity has been shown in the determination of solubilities as to necessitate a new compilation of the data. As it is impossible to tell whether the solutions used in most of the earlier determinations were saturated in contact with a single definite solid phase, a considerable degree of uncertainty characterises such values. At the time when Prof. Comey's "Dictionary" was written it appeared inadvisable in the majority of cases to attempt to select from the discordant results of different observers the most trustworthy values for any particular substance, but the author of the present work points out that such a discrimination can now be made with advantage. In general, the values he gives were chosen by calculating the available determinations to a common basis, and plotting the data so given on squared paper. A comparison of the curves obtained, together with a consideration of the experimental

details, usually furnished clear evidence for a trustworthy selection.

One advantage of this system is that the results are expressed in a uniform manner throughout; usually the solubility is given for regular intervals and in terms of weight of dissolved substance per given weight of solvent or of solution. In all cases where it is possible, the nature of the solid phase is clearly defined.

The value of such a work of reference must be determined by two factors, its completeness and its accuracy. As regards the former, there is little doubt that great pains have been taken to search thoroughly the literature of the past twenty-five years; concerning the latter, an opinion can only be formed after the book has been for some time in constant use. It is to be regretted that more care has not been given by the author to his nomenclature. On the same page we have acetamide and acetamid; acetanilide, acetanilid; anilin and aniline. The names of many organic substances appear curiously disjointed; for example, Tri Chlor Acetic Acid, Di Phenyl Amine, Epi Chlor Hydrine. It is unfortunate that the author considered it advisable to give to substances the names "found in the original papers," because this has led to the introduction, for example, of such terms as toluyl acid, anis acid, and napthion acid for the well known toluic, anisic, and naphthionic acids. Phenyl thiocarbimide is found under the German disguise of "Senföl"; suberic acid is, however, given its correct name, and is not seen masquerading as "Cork acid."

In several cases it would appear that the author does not know the German equivalents of the names of very well known organic compounds; quinine and chinin are regarded as different substances, and the data given under these two headings are quite different, being derived from different sources. Glycollic acid is termed glycocholic acid. Misprints of names are numerous.

Such blemishes, occurring with extraordinary frequency, are very unfortunate in a book which must have involved great labour in its preparation, and is bound to be widely used. The author in his preface modestly craves "all indulgence for errors and omissions," thus in a manner disarming criticism. The value of future editions of this work will greatly be enhanced if the nomenclature be carefully revised.

W. A. D.

A TEXT-BOOK OF OCEANOGRAPHY.

Handbuch der Ozeanographie. By Dr. Otto Krümmel. Vol. i. Die räumlichen, chemischen und physikalischen Verhältnisse des Meeres. Pp. xv+526. (Stuttgart: J. Engelhorn, 1907.) Price 22 marks.

THE treatise on oceanography published in Ratzel's "Bibliothek geographischer Handbucher" in 1884 has remained the standard work on the subject. Few branches of science have made more progress, absolutely and relatively, during the last twenty years than those which concern our knowledge of the sea, and the book has been seriously out of date for a considerable time. A new edition is therefore practically a new book, and a new standard treatise on oceanography will be hailed with relief by every student of the subject who has toiled more or less successfully to keep up with the unfailing streams of original memoirs which have issued from almost innumerable sources in recent years.

Prof. Krümmel's new volume, issued in the same series, which is now under the editorship of Prof. Penck, takes the place of vol. i. of the older treatise, written by the late Prof. von Boguslawski. Its general scope is the same, inasmuch as it treats of the form and distribution of the seas and oceans, the formation and composition of deposits, and the physics and chemistry of sea-water, and leaves dynamical questions to be dealt with in vol. ii., which in the older treatise was written by Prof. Krümmel himself. But the arrangement of the different parts, and the space devoted to each, are, of course, widely different. A comparison of the two works brings out in an unusually striking manner the enormous advances which have been made in the comparatively short interval, and places in their proper perspective the great contributions made, amongst others, by Murray in the concluding volumes of the *Challenger* reports, by Pettersson, Nansen, the deep-sea and Antarctic expeditions and the cable-ships, and the smaller researches in home waters which have culminated in the institution of the International Council for the Study of the Sea. It may be added that a comparison also makes clear the immense complexity of many problems which once seemed comparatively simple, and the urgent need, on economic as well as scientific grounds, for continued independent and combined effort in exploration and research.

Detailed description of the contents of Prof. Krümmel's book is impossible in the space at our disposal. The author gives an account under each head of the methods of observation employed by the chief investigators, more particularly in the most recent work, states the quantitative or distributive results arrived at, and applies them systematically to the description of special phenomena or of special geographical divisions. The amount of labour involved by this method is, of course, enormous, and the compression of the results into a volume of 526 octavo pages has been done with masterly skill. Criticism is by no means wanting, and we note with satisfaction that Prof. Krümmel has been able to retain many of the earlier observations, which, with their obsolete methods and cruder equipment, have sometimes been regarded as unworthy of comparison with those of the high precision more recently attained. Controversial questions concerning the application of these observations to the discussion of dynamical questions will doubtless be dealt with in vol. ii., the publication of which we await with interest. For the present it suffices to record the debt which all oceanographers owe to Prof. Krümmel for placing at their disposal so vast and orderly a store of material.