THURSDAY, OCTOBER 26, 1905.

THE STUDY OF FISHES.

A Guide to the Study of Fishes. By David Starr Jordan. Vol. i., pp. xxvi+623; vol. ii., pp. xxii+599; with coloured frontispieces and 427 illustrations. (New York: H. Holt and Co., 1905.) Price 40*s*.

THIS beautiful work naturally invites comparison with the recently published seventh volume of the "Cambridge Natural History." Both actually cover the same ground, since both contain also an account of those invertebrates which, like Balanoglossus, Tunicates, and Amphioxus, claim the ambitious honour of a more or less direct ancestral position to the fishes.

It has been objected that the anatomical treatment, although good, exact, and up to date, takes too much space of the Cambridge volume, to the detriment of those more œcological questions which are of more general interest, and are, after all, as important as the structural detail, because they make up the life of the fish. The systematic account of the Teleostei, containing Boulenger's new classification, forms the main feature, rather stern, only here and there relieved by some interesting and little known information about habits, showing that want of space, not disinclination, has guided the author.

The author, who is president of the young and vigorous University at Palo Alto, in beautiful and exhilarating California, proceeds nominally upon the same plan, but its execution is totally different. With him the fish is alive, even the fossil. Having travelled much, he has fished with the Japanese, trawled in the vast Pacific, and the huge continent of North America is his special domain. He has collected much, and has observed more "in the good company of the woods and brooks."

"The man who kills all the trout he can, to boast of his skill or fortune, is technically known as a trout-hog. Ethically it is better to lie about your great catches of fine fishes than to make them. For most anglers, also, it is more easy."

The first volume begins with a popular account of the life of the long-eared sunfish. What is a fish? What is it like, and so unlike, to everything else? How does it breathe, see, move, adapt its coloration, and how does it breed? After we have caught it, and observed it in an aquarium, it is dissected, and the student is introduced to the morphology from a general point of view. The account which follows is neither stiff nor anything like exhaustive, but in about 100 pages enough is said to help the intending ichthyologist to an appreciation of the taxonomic importance of ichthyotomy and its salient problems. Many of our fundamental questions of vertebrate morphology find their solution in the fishes. The author devotes a whole and long chapter to the morphology of the fins, with a clear exposition of the vexed controversy whether the pectoral limb has arisen from a problematic lateral skin fold or from an organ like a gillarch, which already did exist, and required but a slight change of shape and function. The organs of respiration lead to a summary of the present state of our knowledge concerning air-bladder and lungs; the other organic systems follow suit. What the author has to tell us are all points which, although they can be studied elsewhere, could not well be omitted from such a work.

Not so chapters x. to xx. Postembryonic development, with the often most peculiar larval forms; instincts, habits and adaptations afford a rich field of observation, graphically described, with admirable illustrations. Witness the photograph of the tens of thousands of fishes which, having run up-stream to spawn after a rain, are left stranded by the falling water.

Protection by the spines, by the poisonous nature of the flesh, electric batteries, luminous organs, quaint nursing habits, are, of course, the stock in trade of any book on fishes. The angling apparatus of Lophius is such a feature, but it is not often that it is treated as follows:—

"In the large group of angler-fishes the first spine of the dorsal fin is modified into a sort of bait to attract smaller fishes into the spacious mouth below. This structure is typical in Lophius, where the fleshy tip of this spine hangs over the great mouth, the huge fish lying at the bottom apparently inanimate as a stone. In other related fishes this spine has different forms, being often reduced to a vestige, of little value as a lure, but retained in accordance with the law of heredity. In a deep-sea angler the bait is enlarged, provided with fleshy streamers and a luminous body which serves to attract small fishes in the depths. The forms and uses of this spine in this group constitute a very suggestive chapter in the study of specialisation and ultimate degradation, when the typical function is not needed or becomes ineffective."

This is truly observation and reflection combined, and the rendering of it is that of a thorough evolutionist who is in sympathy with his favourite class of creatures.

The colour of fishes is another fertile field, with sexual, nuptial, and protective changes. Perhaps in order to curb the ardour of those who see some special good or purpose in every pattern or colour, we are told that the brilliantly coloured fishes of the tropical coral reefs have no need of protective coloration.

The chapters on geographical distribution might well form an essay by themselves, since in them are interwoven lessons of natural selection, the effects of temperature, agencies of oceanic currents, the effects of the direction of coast-lines, and last, not least, the separation of faunas by isthmus barriers, notably those of Suez and Panama. Their far-reaching results are explained by an analysis of the Japanese fish-fauna in comparison with that of the Mediterranean and Central American waters. But whilst the methods of marine distribution and their final results are relatively simple, the fresh-water fishes provide stiffer problems, and some forty pages are therefore devoted to the ways and means, successes and failures, as exemplified in detail by the fauna of the North American continent. This makes fine and admirable reading, but it also shows the value, scien-

tific and practical, of well directed boards and commissions of agriculture and fisheries.

A long chapter on the history of ichthyology, enlivened by the photographic reproductions of several dozen of the more prominent workers in this field, and a chapter on the evolution of fishes since Ordovician times, bring us to the systematic part, which comprises the last quarter of the first and the whole of the second volume.

Here we have to find fault. There is no thorough classification or system. The table of contents of the chapters makes matters only worse. A single page with an outline of the arrangement would be a boon. The author is well aware of the uncertainty of the position of many of the groups, or of their claim to being natural assemblies at all. He never fails to point out how they may be supposed to be connected with each other, or that they are side branches of the ideal tree, but he too often assigns to his groups values or rank without reference to the next higher category of which they are meant to form part. The result of this treatment is bewildering to the reader unless he studies the whole work and abstracts from the many hints given a system of his own; and in this respect the book is truly a "Guide to the Study of Fishes," and not a categorical text-book.

The terms subclass, series, order, subdivision, are often used promiscuously, sometimes as a heading which differs in its meaning from that assigned to it further on.

This being a case of fault-finding, a matter of regret with a work which is otherwise so well done, so full of information, and opening out so many new vistas, let the reader try whether he can abstract from it a co- and sub-ordinated systematic arrangement.

However, perhaps the author did not intend to give a rounded-off classification. In many respects his views differ from Boulenger's system, and it may well be asked whether there is a single class of animals about the grouping of which there is general consensus. Leaving, therefore, this point, we cannot but admire the masterly manner in which the enormous class of fishes, recent and extinct, has been marshalled. Group after group is diagnosed, reviewed, discussed, figured, and endowed with never flagging interest.

"And with these dainty freaks of the sea, the result of centuries of centuries of specialisation, degeneration and adaptation, we close the long roll-call of the fishes." H. G.

THE FAR EAST.

The Far East. By Archibald Little. Pp. viii+334. (London: Frowde, 1905.) Price 7*s.* 6*d.*

OF late years the Far East is only far in actual distance; it is very near to our thoughts, while the ignorance regarding these lands is being very rapidly dispelled. At the present moment it is Japan that is attracting our attention; five years ago it was China, and probably in a few more years, now that the Russo-Japanese contest is concluded, China will again be the centre of interest. In his most interesting book, "The Far East," Mr. Archibald Little devotes more space to China than to Japan, having been himself for very many years a resident of the former country, and possessing a knowledge of the Chinese surpassed by no one. China stands now at the parting of the ways; for many years resolute in keeping out foreign inventions so distasteful to the old-fashioned mandarin, circumstances have proved too strong, and railways, the precursors of western life, are now being built or projected throughout the land. No one can foresee what changes twenty years will bring about in this vast country, a vastness which Mr. Little brings home to us by his diagrams and comparative tables.

To a lover of things historical, nothing can be more fascinating than to wander back through the long centuries to some thousands of years before the Christian era; and this it is necessary to do if one would study Chinese history. To compress this into a volume of reasonable size and yet to give a comprehensive account of each province is a difficult task, but Mr. Little's apology in his preface is unnecessary.

China naturally lends itself to the division, which is carried out in this book, into the northern, middle, and southern basins, with the four dependencies of Manchuria, Mongolia, Turkestan, and Tibet. Of these four dependencies, it is in Mongolia and Turkestan only that Chinese rule may be considered as firmly established; in Tibet the amount of power in the hands of the Chinese depends on the personal characteristics of the Tibetan Dalai Lama and Regent and the Chinese Amban; undoubtedly one result of Younghusband's mission to Lhasa has been to emphasise Chinese authority in the eyes of the Tibetans. Of Manchuria at the present moment it is unsafe to hazard an opinion, but everything points to its becoming once more a Chinese possession under possibly Japanese moral tutelage. A consideration of the two chapters on "Whilom Dependencies" leads naturally to a thought of how of late years the more outlying dependencies have been gradually lopped off, how the once mighty Chinese Empire has degenerated. Cochin China, Annam, Corea, as well as Burma (which does not enter into the scope of this book), all once paid tribute to China.

Siam, for many years in danger of being squeezed out of existence between two European Powers, has taken a new lease of life, and is now in a more prosperous condition than it has been for many years.

Japan might have many chapters written about it, but we have been lately so inundated with things Japanese that it is almost with a feeling of relief that we turn once more to the chapters on China itself. We would, in truth, most warmly recommend this book to anyone about to travel in the Far East, as well as to the stay-at-home reader, more particularly as regards China.

Take the northern basin. What more interesting to read about than Peking itself; Shansi, the province of coal and iron; Shantung, where the Germans at great cost are slowly developing their trade through Kiao Chau? What great river in the world has

changed its course as the Yellow River has? What other country in the world has built a Great Wall? We are accustomed to hear much of the peculation of the officials, but Mr. Little does not emphasise this; in many districts the officials are revered and beloved by the people.

Consider the Yangtse Valley, again, where ocean steamers can reach Hankow, where steamers with Mr. Little himself as their pioneer have reached to Chung King, and lately still further. This magnificent river will undoubtedly remain the great high road for commerce into Central China; but railways are and will be built to act as feeders to the main line, much to the profit of the shareholders and of the inhabitants, for Chinese are born traders, and already make use of the pioneer of Chinese railways—the line from Tientsin to Peking—in large numbers.

Finally, we have a vivid description of the southern basin, Canton, Hong Kong, and the provinces bordering on French territory. Yunnan, which adjoins our Burma, has a particular interest to Englishmen; but here, owing to our supineness in days gone by, we have allowed the French to get ahead of us with their railway, which will undoubtedly draw to itself all that is valuable of the trade of the province.

There was a time when many people thought that China would be divided among the Great Powers—that notion is exploded; then came that of spheres of influence—but we have seen this idea also put aside; the policy of the "open door" is all that remains.

We congratulate Mr. Little on having given us a most readable volume, full of information, and yet with that local colouring which is an essential for a book to command the attention of the general reading public.

ABSORPTION SPECTRA.

Handbuch der Spectroscopie. By Prof. H. Kayser. Vol. iii. Pp. viii+604. (Leipzig: S. Hirzel, 1905.)

WHEN Prof. Kayser published the first volume of his "Handbuch der Spectroscopie," he said that the third volume would be devoted to absorption spectra and cognate phenomena. He has, however, found it necessary to treat the subject in two volumes, the first of which contains the methods of investigation of absorption spectra, the variability of absorption, the connection between absorption and chemical constitution, and, finally, a list of all the measurements of the absorption spectra of inorganic and artificial organic substances. In the next volume the absorption of the natural colouring matters in the animal and vegetable kingdom will be described, together with the relation of dispersion and fluorescence to absorption and, lastly, phosphorescence. The present volume is peculiarly interesting, as it deals to a great extent with the application of spectroscopy to chemical and physicochemical problems.

In the first chapter Prof. Kayser deals with the apparatus and methods of investigation of absorption, and includes a discussion upon the nature and laws of absorption. It is well known that considerable confusion exists with regard to the terms used by various experimenters, as, for example, absorption-coefficient, &c. Not the least important section of this chapter is that in which the author discusses these and proposes a uniform set of definitions upon a proper physical basis. In the discussion of the nature of absorption, Prof. Kayser is perhaps a little obscure. He very properly divides absorption into two kinds, namely, the ordinary kind for which Kirchhoff's law holds, and the so-called metallic reflection for which the law does not hold. On p. 9 Prof. Kayser says, in referring to those bodies which show surface colour, *i.e.* metallic reflection, that these bodies show well marked absorption bands, and that the particular rays are wanting in the transmitted light, not so much because they are strongly absorbed, but because they are strongly reflected. This statement is rather misleading. The phenomenon of metallic reflection is shown by two classes of bodies, firstly, the metals which are perfect conductors, and, secondly, those substances which show surface colour and are not conductors, as, for example, the aniline dyes. Prof. Kayser's remarks, strictly speaking, only apply to the first group, *i.e.* the metals, because as these bodies are conductors the light cannot penetrate below the surface. In the case of the substances belonging to the second group the mechanism must be somewhat different. When a moderately dilute solution of an aniline dye, such as rosaniline, is examined by transmitted light, a very strong absorption band is developed in the green. No surface colour is visible, and undoubtedly the disappearance of the green rays is due to the absorption of these rays by the molecules of the dye. On the theory of resonance, the dye molecules vibrate in sympathy with the green rays and scatter the incident energy. If now the solution is concentrated, the absorption on the surface becomes greater, that is to say, the number of resonating molecules in the surface is increased, until eventually the scattering of the light becomes visible, and we have the surface colour of the same wave-length as the absorption band. It is not accurate to say that the light is reflected rather than absorbed, because in dilute solutions the rays penetrate to a considerable distance before being absorbed.

In the second chapter Prof. Kayser deals with the variation in the absorption spectra of substances with variation in the external conditions. Here he points out that the extraordinary changes undergone by absorbing substances with changes in the solvent, dilution, &c., show clearly what a mass of useless work on absorption spectra has been published owing to the observations having been made under very limited conditions. The most interesting section of this chapter is that in which the variations of the absorption spectra of coloured metallic salts with dilution change are discussed. A great many observations have been made by Ostwald and others upon the absorption of coloured salts and the results published in support of the ionic theory. Unfortunately, more recent experiments have shown that the absorption by the different salts of the same metal and that by the different salts of the same acid show small

but perfectly regular differences. The position of the absorption bands varies with the mass of the colourless ion, and certain other facts have been observed of the same character. Prof. Kayser reviews most carefully the whole of the evidence of absorption spectra that has been brought forward both for and against the ionic hypothesis; he finally concludes that Ostwald's theory, namely, that the behaviour of dilute aqueous solutions of coloured metallic salts is due to the colour of the ions, is untenable. Such an authoritative statement, based on experimental evidence, is very striking and worthy of careful consideration by physical chemists.

The third chapter has been written by Prof. Hartley, and deals with the relation between absorption and chemical constitution. It contains an excellent *résumé* of all the work which has been carried out, chiefly by Prof. Hartley himself, on the bearing of ultra-violet absorption to molecular structure. The value of this work is too well known to need emphasising here, and it is not too much to say that this is one of the most important branches of spectroscopy, and one that is certain to lead to results of far-reaching importance in organic chemistry.

The two last chapters deal in detail with absorption spectra; in the fourth chapter are described the spectra of many substances, selected either because they are of some practical use, or because they possess some special point of interest, while the fifth and last chapter contains an alphabetical list of all substances the absorption of which has been measured.

Of the great value of this book it is impossible to speak too highly; it is sufficient to say that it will rank as the standard work upon absorption. All who read it will appreciate to the full the great care Prof. Kayser has bestowed upon it and the immense labour involved in dealing with the mass of literature upon the subject. E. C. C. B.

OUR BOOK SHELF.

Identification por las Impresiones digito-palmares (La Dactiloscopia). By Dr. Alberto Yvert. Pp. 111. (La Plata: A. Gasperini, 1905.)

THIS work is the thesis presented by the author to the University of Lyons in order to obtain a doctor's degree in medicine. It deals, firstly, with the uses to which identification by means of finger-prints can be put by the detective, and shows how the fingers of the murderer leave their impression printed in the blood of his victim; while those of the burglar may be brought to light on the window through which he has passed, by the simple expedient of breathing on it, and may be indelibly recorded by means of hydrofluoric acid; and, lastly, the finger-marks of the forger may be revealed on the cheque which he has forged, by means of Mr. Forgeot's method. This last record is produced, first, by the sweat of the fingers that rest on the paper, which, when it evaporates, leaves an invisible print behind it in the salts which were contained in it. This may be made to appear by the application of an 8 per cent. solution of nitrate of platinum, which is affected by these salts in such a way that it blackens when exposed to light.

The author proceeds subsequently to the most important part of his work—a summary of the principal methods of classification of finger-prints. He commences with a somewhat inadequate description of the original system, which, as is well known, is that of Francis Galton; he then goes on to treat with much fuller detail some of the various systems which are based on it. Among these are included that of M. E. K. Henry, which has been adopted by M. Windt, chief of the Identification Service of the Police in Vienna; that of M. Pottecher, chief of the Immigration and Identification Service in Saigon; and of Señor Vucetich, director of the Identification Service in La Plata. It is the last system which is preferred by the author. It consists in dividing all finger-prints into four types, which he names as follows:—(1) *Arco*=arch; (2) *Presilla interna*=internal loop; (3) *Presilla externa*=external loop; (4) *Verticilo* or *Torbellino*=spiral. These terms are descriptive of the figures formed by the lines situated near the centre of the palmar surface of the distal phalanx of each digit. As all ten fingers are taken into account in the classification, and as each may be of any of the above four types, there are 4^{10} (=1,048,576) classes defined in this way. The minute details of the arrangement enable one to distinguish between different members of the same class.

The pamphlet concludes with a useful bibliography. E. H. J. S.

Science in South Africa: a Handbook and Review. Prepared under the auspices of the South African Governments and the South African Association for the Advancement of Science. Edited by the Rev. W. Flint and J. D. F. Gilchrist. Pp. x+489. (Cape Town, Pretoria, and Bulawayo: T. Maskew Miller, 1905.)

THOSE members of the British Association who were fortunate enough to visit South Africa this year cannot fail to have benefited by this useful and handsome volume. To those who were unable to accompany the association, but who take an interest in scientific work in South Africa, this "index book" will be a great boon. Of late years, South African scientific literature has increased at a great rate, but the material frequently lies scattered in numerous publications often difficult of access, while so many divergent opinions on the same subject have been expressed that the student is apt to be bewildered. From the present volume the *status quo* of scientific research in South Africa can be ascertained. A long-felt want is thus supplied, and if the scientific literature is to increase at the same rate in the future as it has in the immediate past, a year-book on similar lines would be of inestimable value.

The cost of publication of the present volume has been defrayed by the various South African Governments. In doing this they betray an enlightened policy, for there can be no question that it will direct attention to the vital importance of scientific knowledge in a country so vicariously treated by nature as South Africa, where the natural products are distributed in such a way that they can only be utilised by the application of the discoveries of modern science. To those so trained, South Africa becomes a land of fertile promise.

The present volume is arranged in eight sections, dealing with physical, anthropological, zoological, botanical, geological, mineralogical, economic, educational, and historical problems. The sections and subsections are the voluntary contributions of actual workers, to whom the editors have allowed considerable latitude as to the method of treatment. In some cases the subjects are dealt with historically, in others from the practical point of view. The volume contains numerous illustrations, among which

the handsome coloured plates of blue ground and diamonds of various shapes and colours, presented by Mr. Gardner Williams, stand out conspicuously.

While it is evident that much has been achieved, it is equally certain that in some branches only a start has been made. In fact, the dominant feeling produced by reading the several interesting articles is one that should inspire the greatest hope and enthusiasm among scientific students in this country and throughout South Africa. Here lie new worlds of unknown possibilities. As yet we stand only on the threshold. Far off glimpses of a wonderful country have been obtained, but it is the sight of a Kilimanjaro enshrouded in mist, not of the unclouded mighty mountain-mass. W. G.

Stone Gardens. By Rose Haig Thomas. Pp. xii and plates. (London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd., 1905.)

An old wall sheltering such plants as are accommodating enough to grow in such a situation is often a delight; but to undertake the formation of a "stone-garden" in the way suggested by the author is to run counter to all our notions of the amenity and purpose of a garden. Various "designs" are offered for adoption, such as a lyre-shaped outline made of paving stones with flower-beds representing the strings, and separated by narrow strips of stone.

Another design shows three snakes intertwined, each snake made of flat stones of a different tint from its neighbour. The spaces between the serpentine convolutions are filled in with flower-beds. Other designs are more appropriate to a formal or architectural garden.

Of course, there is no disputing upon points of taste, and each garden-lover must exercise his or her fancies according to circumstances and in obedience to individual proclivity. But if the designer intends to furnish a model for other people to adopt, then we expect there will be comparatively few garden-lovers who will share the author's taste or feel inclined to adopt her suggestions.

Be this as it may, the author gives very clear directions as to how her designs should be carried out, and very judicious instructions as to the plants to be selected and the method of planting them. Provided these be properly carried out, kindly nature will do her best to conceal the flags and stones, and if the author's designs are somewhat interfered with in the process, that will not be a matter for regret on the part of most garden-lovers. The work is in quarto, with fourteen designs in colour.

Oblique and Isometric Projection. By John Watson. Pp. iv+59. (London: Edward Arnold, n.d.) Price 3*s.* 6*d.*

In defining the forms and dimensions of solids by means of scale drawings, a very useful method in certain cases is that of metric projection whereby three systems of parallel edges of the solid are represented on paper by lines parallel to three axes drawn in arbitrarily selected directions, and to any three scales also independently chosen. The author deals only with isometric projection, and considers two cases, first, when the projection is orthogonal, secondly, when the projectors are oblique with the plane of projection taken parallel to a face of the solid, so that figures parallel to this face appear without distortion. The best part of the book is probably the chapter giving examples, mostly of joints in woodwork, used by the author in conducting classes in manual training; but it is doubtful whether it was worth while to publish a book of such limited scope.

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.*]

Eclipse Phenomena.

No opportunity for discussion was given at the Royal Society meeting last Thursday, but the following brief notes may be suggestive and possibly useful.

The particles in the corona which reflect solar light to us are presumably moving very fast away from the sun, and accordingly are illuminated by light of apparently extra-long wave-length. This light, thus lowered in refrangibility, they will emit; and inasmuch as they are probably moving at all sorts of speeds, we might expect that Fraunhofer lines would be encroached upon and blotted out from the resulting emission, especially as some particles would have a component of velocity towards us and others away from us.

If any of the particles are emitted with anything like the speed of some of those from radium, the maximum change of frequency to be expected would be great.

Particles illuminated by rays normal to our line of sight will send us a plane polarised beam, but when the illuminating rays are oblique to the line of sight, as may be the case from some of the longer streamers, then the polarisation would be only partial.

How far single electrons may be able to resist the forced vibrations of light-waves, and thus become themselves polarised sources, is a matter on which I hope to try some experiments. The illumination in which they are immersed near the sun is very intense.

The circular or ring appearance seen in the midst of the corona in some photographs, with geometric centre at a distance from the apparent centre of explosion, looked to me like a gigantic vortex ring. I see no reason why a sun-spot should not eject such rings occasionally.

OLIVER LODGE.

Geometry of Position.

In connection with the review of Mr. Wilson's recent book, on p. vi. of your supplement last week, may I direct the friendly attention of the reviewer and your readers to an old paper of mine in the *Philosophical Magazine* for November, 1875, where some of the theorems referred to are given. I myself have found a slight modification of the rapid system of writing chemical formulæ there advocated, extremely useful, and should like to advocate its use by elementary students of organic chemistry—but that is another matter. OLIVER LODGE.

October 20.

Eclipse Predictions.

The discrepancies referred to by Mr. J. Y. Buchanan (p. 603) as existing between the French and British predictions for the recent total eclipse of the sun are due simply to the fact that a different value of the moon's diameter is adopted in the Connaissance des Temps from that in the Nautical Almanac, the former being about 2″·7 greater than the latter. Hence the breadth of the zone of totality and the duration of totality on the central line are greater in the French than they are in the British ephemeris. But there is no occasion to impute mistake to the French calculators. They merely assume a value of the moon's diameter that is, in my opinion, too large for eclipse purposes. A. M. W. DOWNING.

October 20.

Chelifers and House-flies.

It may be that the view suggested in my letter to NATURE of August 31, that the association of the Chelifer with the house-fly is to the advantage of the former in providing it with a wider geographical distribution, is not sound. I believe it is, but at the same time admit that there is not sufficient evidence at present to prove that the association is of material advantage to the species.

The important point to determine, however, is whether

the Chelifer is or is not a parasite on the house-fly. It is fully recognised now that house-flies play an important part in the distribution of the germs of certain diseases that affect mankind. Any animal, therefore, that injures or destroys the flies may assist in checking the spread of disease. But if, as Mr. Pocock suggests, the object of the Chelifer is to feed upon the acarine parasites of its host, it serves rather as a friend than a foe to the fly, and should certainly not be called a parasite.

There is no anatomical reason for believing that the Chelifers that have been found on flying insects are specially adapted to a parasitic mode of life, nor is there any evidence that the house-flies they are attached to are infested with mites or any other skin parasites. If the Chelifers are not parasitic on the flies, and there are no mites for them to attack, how can the association of the two forms be accounted for otherwise than by the transportation hypothesis?

Since I wrote my last letter to you I have found that this matter has been most fully discussed by Mr. Kew in his article on Lincolnshire Pseudoscorpions in the *Naturalist* for July, 1901, and I would refer readers of NATURE who are interested in the subject to that paper for fuller particulars. SYDNEY J. HICKSON.

University of Manchester, October 21.

The Rudimentary Hind Limbs of the Boine Snakes.

IT is a well known fact that the pythons and boas and some allied forms among snakes possess rudiments of hind limbs, these vestiges—to quote Boulenger's "Catalogue of Snakes in the British Museum"—"usually terminating in a claw-like spur visible on each side of the vent." These structures are always mentioned in general works upon Ophidia, such as Hoffmann's account of the serpents in vol. vi. of Bronn's "Klassen und Ordnungen des Thierreichs," and Gadow's "Reptiles and Amphibians" in the "Cambridge Natural History." But in none of the three treatises to which I refer is there any further account of the "claws" or "spurs." It is merely stated that they are present. It is not mentioned in these works, nor in some others which I have consulted, that the claws in question offer valuable sexual characters by the aid of which individuals can be referred to their proper sex, at least in certain Boidæ. The fact that these characters have been so largely overlooked is perhaps due to the slight stress laid upon them by Duméril and Bibron (*Erpétologie Générale*, vol. vi., 1844), who, however, did direct attention to the occurrence of differences in these organs between the two sexes in a number of Boidæ. But they speak of the claws merely as being "d'une très petite dimension chez des femelles," and as "plus développès chez les males que chez les femelles." The first of these quotations refers to Eunectes, the second to Boa. The differences, however, in *Eunectes notaeus* are greater. In this southern anaconda, of which several specimens were lately deposited in these gardens by the Hon. Walter Rothschild, there is in the male a sharp curved claw turned downwards and ridged along its lower surface. In the female, on the other hand, the representative of this claw is not a claw at all strictly speaking—if, that is to say, we mean by a claw a nail-like structure which is curved and compressed and ends in a sharp point. In the female there is a straight, blunt, horny process distinctly unlike the sharp claw of the male. In two young examples of this anaconda, which are females, the same type of horny structure is found as in the adult female. In the allied genus Eryx there are still greater differences between the two sexes. FRANK E. BEDDARD.

Zoological Society's Gardens, October 18.

A Rare Game Bird.

MR. SAWBRIDGE (p. 605) has raised one of the most perplexing points connected with bird-migration. I cannot answer for the eastern counties of England, but here, in the south-west of Scotland, we are still further from the headquarters of the quail than he is. Fifty years ago quails bred regularly in western Galloway; as a boy I recollect that two or three brace were quite a common complement to a September bag. Indeed, when a "cheeper" or undersized partridge was shot, "Put it down as a quail!" was the usual comment. These birds gradually disappeared; the last that I myself shot was about the year 1868; but an odd one has been obtained here and there in the district ever since. One, I know, was shot last month in the neighbourhood of Newton Stewart, and was reckoned such a curiosity that it was sent to the bird-stuffer. I am sorry that I do not know whether it was a young or an old bird. Besides this, other instances, if I mistake not, have been recorded in the *Field* from different parts of the country.

As to the cause of the general disappearance of quails from this district, there have been many speculations, the commonest notion being that the supply is so heavily taxed in the Mediterranean region that few birds escape to the north. Truly, when one considers the enormous consignments of quails to London, Paris, &c., there is no reason for surprise that the migrants should dwindle in number.

I have a vague recollection of being told in boyhood that about the year 1838 there was a large influx of quails into Galloway, and that they had bred there ever since, but in numbers annually decreasing. It is conceivable that a storm-driven flock may have been carried out of their bearings, and, finding food abundant and climate endurable, if not altogether congenial, remained as colonists, but that our wet summers have proved adverse to their young being reared. The fluctuation in the stock of partridges caused by the character of different seasons is very remarkable, and evidently neither the numbers nor the constitution of our quails have enabled them to survive adverse conditions of temperature and rainfall. This makes the sporadic occurrence of individuals at long intervals all the more remarkable and perplexing.

HERBERT MAXWELL.

Monreith, Wigtownshire, October 22.

On a New Species of Guenon from the Cameroons.

A CHARMINGLY docile species of guenon, obtained by Cross, of Liverpool, from the Cameroons, in West Africa, and recently submitted to me for identification proves to be undescribed. I propose for it the name *Cercopithecus crossi*, in compliment to the courteous proprietor of that large and well known importing house of wild animals, and for popular use the same of *Cross's guenon*. The animal is a male, apparently nearly full grown, but not entirely adult, as the condition of its teeth indicate. It is very similar to *C. moloneyi* of Sclater, in general appearance, in having the broad rufous lower back, but differs in having a large and bushy pure white beard, white throat, and bushy whiskers of black hairs ringed with white; the band across the forehead deep black instead of fulvous; sides of head speckled black and white; underside of body sooty-black speckled with white; the tail not deep black except at tip, but speckled black and white like the upper part of the back; the black on the forearm externally does not extend to the shoulder, and not much beyond the elbow; the outer aspect of thighs is black slightly peppered with white; the inside of arms below the elbow black, higher up sooty-grey; inside of hind limbs sooty-black.

The top of the head is black, the hairs sparsely ringed with white; the face, cheeks, and ears quite nude and purplish black in colour; long superciliary hairs are present; the callosities are small and purplish sooty-grey in colour.

From *C. albigularis* (Sykes's guenon) the present species differs in wanting the yellowish wash on shoulders, fore and hind limbs, and in having a brindled and not a black tail. HENRY O. FORBES.

The Museums, Liverpool, October 12.

The Absorption Spectrum of Benzene in the Ultra-violet Region.

WE were glad to see in NATURE of October 5 a letter from Prof. Hartley in which he points out the near agreement between our measurements of the bands in the absorption spectrum of benzene and those made by Prof. Dobbie and himself. He also directs attention to the work of Friederichs, who, in the case of benzene vapour,

finds the position of these bands to be consistently nearer to the red end of the spectrum. The difference in the position of the bands in the spectrum of benzene vapour and of benzene in solution only proves, of course, the applicability of Kundt's rule. We are also pleased that Prof. Hartley has been able to see the second band on our list ($\lambda = 2656$), which, coupled with the fact that Friederichs has also measured it, we feel is a most important confirmation of our observations.

As regards the eighth band ($\lambda = 2330$) which has been measured in the absorption spectrum of benzene vapour by Friederichs (whose work we were, of course, unaware of when we wrote our paper), we have made a most careful search for it. We have re-examined our original plates and have taken several more photographs, but have been unable to find any trace of it. We must therefore conclude that it is absent from the spectrum of benzene in alcoholic solution.

There is one other point in Prof. Hartley's letter; he says we have overlooked some points of importance in his paper with Prof. Dobbie when we state that they only found six bands. It is quite true that in their paper Hartley and Dobbie refer in their table of measurements to another band of very short persistence which they mark as doubtful at 5 mm. thickness of N/10 solution, and very doubtful at 4 mm. thickness. In the letterpress, however, they speak of only *six* bands, and in all later publications benzene is stated to show six absorption bands. In the British Association report, and even in Prof. Hartley's paper to the Chemical Society on May 17 of this year, he speaks of six bands (*Chem. Soc. Proc.*, xxi., 167). We therefore assumed that Prof. Hartley, on further consideration, had concluded that this doubtful band was not a true benzene absorption band. As we ourselves had seen no trace of this band, we in our paper before the Chemical Society (*Trans. Chem. Soc.*, lxxxvii., 1332) stated that Hartley and Dobbie had found only six bands.

Prof. Hartley's ideas and work upon the absorption spectra of organic compounds in the ultra-violet are of the greatest importance; he was the first to show how the constitution of certain compounds could be established by this means. Prof. Hartley's method of "testing" a molecule by means of its absorption spectrum, we are sure, will prove of the greatest possible value in the hands of chemists.

E. C. C. BALY.
J. NORMAN COLLIE.

University College, October 12.

Action of Radium Salts on Gelatin.

HAVING occasion to give a demonstration of the properties of radium some little time ago, I determined to attempt the preparation of some of the organisms as described by Mr. J. Butler Burke.

The method employed was to sprinkle a few specks of the radium salt upon the surface of some sterilised gelatin contained in a test-tube, and then to await development. That did not take long. Almost at once a faint cloudiness appeared to start under the speck of salt which extended downwards into the gelatin, in some cases after twenty-four hours reaching the depth of one centimetre. No heating was required to bring about this "growth," which resembled to the unaided eye an ordinary mould. The experiment was made with radium preparation of varying degrees of activity, but it was soon observed that the degree of activity in the salt had little influence on the growth, a salt of radium barium bromide containing 1/1000 of its weight of active salt being nearly as efficacious as one containing 1/100. (The more pure specimens which I possess were too precious to experiment with.)

As the specimens used were composed chiefly of barium salt, it occurred to me that it might be interesting to try the effect of the pure barium salts on the gelatin. This was done, with the surprising result that the "growths" were just as easily obtained as with the radium preparation—or even more so. I have tested all the barium salts at my disposal, and find the following produce the effect:—Barium, oxide, dioxide, chloride, bromide, iodide, nitrate, acetate, tartrate, and sulphovinate, while the phosphate, carbonate, sulphate, and borate do not act. Thus the soluble salts are active, and the insoluble ones inactive.

The method adopted for the experiments was as follows:—Some clear gelatin was poured on to a glass slip and allowed to set. A tiny speck of the salt was placed on the gelatin and covered with a thin glass. This slip was then placed on the stage of a microscope and examined with a ½-inch power. At once the "growth" was seen to shoot out from the speck, and it appeared to consist of bubbles, some large, but most of them very small. Half an hour afterwards the speck had dissolved, leaving in its place a nebulous patch many times the size of the speck. The action of barium iodide is particularly rapid, while that of the hydrate is rather slow. I have tried uranium and thorium salts, both of which affect the gelatin rapidly, but do not produce the "growths." The action of these salts upon gelatin seems to point out an interesting field of inquiry, which I propose to follow.

W. A. DOUGLAS RUDGE.

Woodbridge School, Suffolk.

The Problem of "Shadow-bands."

SUBSEQUENTLY to the Algiers eclipse of 1900, it occurred to me that the "shadow-bands" visible at times of total solar eclipse might be merely another aspect of the "boiling" distortions of the sun's limb inseparable from daily observations. The last few years have therefore been employed by me in studying the characteristics of "boiling" with the view of making a direct comparison of evidences at the first opportunity. This opportunity presented itself in the recent total solar eclipse observed by me at Cás Catalá, in Mallorca, on August 30 last.

Employing "Carrington's method" of projecting the sun's image with a small telescope, the first observation made at about 10 a.m. recorded the existence of two distinct layers of cloud, the lower one travelling N.E. by S.W., and the upper one W.S.W. by E.S.E., giving confused and erratic "boiling." Further observations revealed an increased prevalence of the N.E. cloud system, but the drift from W.S.W. was still in evidence. At 11.35, however, it transpired that the W.S.W. system alone prevailed, and all trace of the drift from N.E. had abated. Continuing the observation without any relaxation throughout the phase of partial eclipse until within a few minutes of totality, I was able to ascertain that the "boiling" movements along the advancing limb of the moon were throughout absolutely in agreement in every particular with the movements of distortion affecting the still uncovered limb of the sun. Observations by projection were abandoned at 1h. 18·0m. for the purpose of securing a naked-eye view of "shadow-bands." A very successful view of these was secured. Their direction of flight determined on the spot, and afterwards corrected by Dr. Hunter, of Edinburgh, by the compass, proved to be W.S.W. by E.S.E. It is noteworthy that at Palma, where the eclipse conditions were marred throughout by the cloud bank that had threatened to overwhelm us at Cás Catalá (only four miles S.W. of Palma), the "shadow-bands" were observed to take a direction N. 30° E. by S. 45° W.

CATHARINE O. STEVENS.

Bradfield, Berks, October 20.

Rhymes on the Value of π.

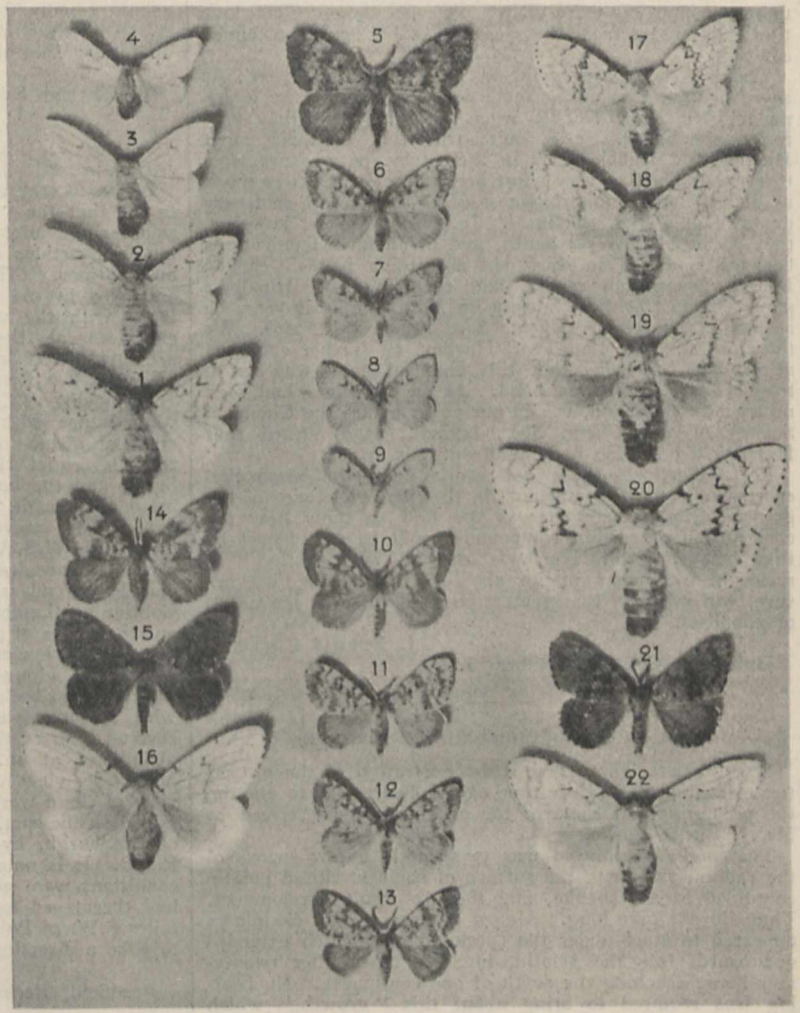
Now I know a spell unfailing,
3 1 4 1 5 9
An artful charm, for tasks availing,
2 6 5 3 5 8
Intricate results entailing.—
9 7 9
Not in too exacting mood,
3 2 3 8 4
(Poetry is pretty good),
6 2 6 4
Try the talisman.—Let be
3 3 8 3 2
Adverse ingenuity!
7 9

π.

EXPERIMENTS ON VARIATIONS OF LEPIDOPTERA BY ENVIRONMENT.

AN important addition to the numerous papers of recent years recording experiments as to the influence upon the forms of living beings of their environment has lately been published.[1] In this paper the inquiry is concerned only or chiefly with varieties in the pigmentation of Lepidoptera. The author enumerates as among the agents to which change in this pigmentation is to be ascribed "intensity of light, temperature, nutrition, humidity, dryness, electricity, and other meteorological phenomena." His references to the literature on these subjects are very useful. The suggestion that mechanical movement, jarring, of pupæ, might cause effects analogous to those of temperature is mentioned, but this has long since been abandoned. M. Pictet divides the variation of pigmentation into two opposite types, the one "albinism," by which red can pass into yellow and even into white, the other "melanism," by which red passes into brown and, as an extreme, into black; and this classification is kept in view all through the description of his experiments and their results. So is a theory which he puts forward, though with diffidence, that caterpillars in general were originally adapted to live only on certain special plants or trees, and afterwards, owing to finding themselves, as the result of migration or otherwise, where these were not to be had, adapted themselves to many other kinds, so as to become more or less polyphagous, still, however, in nature attaching themselves by preference to special food plants, called in this paper their normal or ancestral ones.

M. Pictet's treatment of this subject can be best illustrated by an extract:—"*Lasiocampa quercus*, known from the time of Linnæus as feeding almost exclusively on the oak, as indeed its name indicates, and the leaves of some trees and hedge shrubs, is now found frequently on ivy, poplar, sallow, birch, heath and arbutus." He does not always say what the normal food plant is, as in the case of *Phalera bucephala*, of which he states that it absolutely refuses to eat any but its normal food. In England it is found on lime, elm, willow, and many other forest trees at least as freely as on oak, and there is a record of a company found on laurel. Oak is given as the normal food of *Biston hirtarius* (found in England on a great variety of forest trees), gooseberry and spindle tree (*Euonymus europaeus*) as those of *Abraxas grossulariata*. In England this species is found in abundance also on blackthorn, &c., and it has of late years addicted itself to the *Euonymus japonicus*, an evergreen which became widely distributed in Europe during the last century. Though, as stated, it is left uncertain in some cases what M. Pictet considers the normal food plants to be, that creates little or no difficulty in appreciating most of his experiments, as the kinds of food plants which in these experiments were substituted for the foods well known to be usual were so different that they may certainly be distinguished as abnormal; for example, when walnut or laurel, or low plants such as sainfoin (*Onobrychis sativa*), dandelion, lettuce, or salad burnet (*Poterium sanguisorba*) are substituted for any of the ordinary forest trees.



FIGS. 1 and 5.—*Ocneria dispar*, typical form ♀ and ♂; 2–4, 6–13, 17, 18, fed on walnut; 14 and 16, fed on mespilus; 15, fed on dandelion plants; 20 and 21, fed on onobrychis; 22, fed on poterium plants.

Among the principal conclusions arrived at by M. Pictet are the following:—(1) Change of ancestral food plant is often a factor of variability. (2) In general, a food difficult to absorb and digest prevents the larva from developing within its usual period, and this longer larval period is associated with the shortening of the pupal period, and consequently with insufficient pigmentation. (3) Normal food plant in insufficient quantity has the same effects. (4) A food easy to take in (ingérer) and rich in nutritious elements accelerates the larval development, and thus reacts on the duration of the pupal period, which, being thus lengthened, a more intense pigmentation

[1] "Influence de l'Alimentation et de l'Humidité sur la Variation des Papillons." By Arnold Pictet. (*Mémoires de la Société de Physique et d'Histoire naturelle de Genève*, vol. xxxv., fascicule 1, June, 1905, pp. 46–127.)

ensues. . . . (8) The variations produced by food increase in intensity with each generation, and even arrive at such a point as to persist to a degree, by heredity, in the next generation brought up on normal food; when, in successive generations, the food plant is different, each kind of food plant impresses its characteristic effects on the imago. (9) After some generations on the abnormal food the insect becomes accustomed to it, and this brings about a return to the primitive type—sometimes, indeed, passes beyond it in the opposite direction.

The experiments which led to these conclusions extended over five years, from 1900 to 1904, and were tried on 21 different species and about 4695 individuals. The paper is illustrated by five plates containing eighty-one photographic figures, which are excellent, but uncoloured, so that they have not the advantage of showing the distinctive colour effects which enter into the verbal description of the results obtained. The course of experiment can only be briefly indicated here, having due regard to the exigencies of space, but I may select for reference some of M. Pictet's chief experiments on what was their principal subject, *Ocneria dispar*; on this species there were twenty-nine experiments upon 1568 individuals. In many of those tried on this and other species the differences from the normal, so far as they are shown by the plates, are not very distinguishable from those deficiencies in intensity and definiteness of marking and the dwarfing of size that one is accustomed to find when larvæ are bred on food that is insufficient or unsuitable, to put it in a popular form, are "half starved." It is right, however, to say that M. Pictet considers, as afterwards mentioned, that in those examples which he has selected for illustration as exhibiting the effects of abnormal food plants, walnut, onobrychis, &c., they are distinguishable from each other to such an extent that where larvæ have been fed for three successive generations on walnut, onobrychis, and oak respectively, the special influences of all three food plants can be seen.

In six experiments with *O. dispar*, walnut was given for one or more generations; in all these cases the wing expansion was considerably smaller than normal, in some cases not more than three-quarters or two-thirds of it. Where *O. sativa*, dandelion or *P. sanguisorba* was given the imagines were considerably larger than normal, but when in one or more of the succeeding generations walnut was substituted the size was immediately reduced, much as in the other six experiments. *Mespilus germanicus*, horse chestnut, white poplar, and sallow had effects very similar to those of walnut. In experiment (4), where oak in the second generation succeeded walnut in the first, there was a slight return towards the type, but when in the third generation walnut was again given, the failure in intensity of markings reached its minimum, there being scarcely a trace of colour; when, however, in the fourth generation oak was again given, there was a nearer return towards the type than the second generation showed. In other cases the "albinistic" influence of the walnut persisted in a very marked degree after two later generations fed on oak or on *O. sativa*. In such cases, also, where other food plants of the three different classes ("albinising," "normal," and "melanising") had been given in succession, M. Pictet considers that the special pigmentation effects of each of the three kinds of food plant are shown by the imagines of the latest generation. These are for walnut, ♂, pale yellow colour, two central lines partly obliterated, other markings less intense; ♀, wings slightly transparent, few markings on upper wings, more on lower; second generation, ♂, wings whitish, marginal band on all partly obliterated, transverse lines little visible; ♀, wings transparent, the V mark and the marginal dots alone appearing; for *O. sativa*, ♂, wings brown, zigzag, lines little noticeable, marginal band very dark, abdominal hairs greyish; ♀, on upper wings white zigzag lines strongly marked; for *dandelion*, ♂, very similar, only the lower wings of uniform dark colour.

M. Pictet arrives at the general conclusion that the "albinising" variations are caused by the larvæ having been fed on leaves presenting obstacles to nutrition, such as hard cuticle or felted underside, as in white poplar, and that, on the other hand, the "melanising" variations are caused by food presenting no such obstacles; thus the young leaves of laurel are not "melanising" as the old leaves are. So far as I am aware, M. Pictet's conclusion that a difference of food plant in one generation can cause a difference of facies in the imago, and one that persists for several generations, is not in accordance with views hitherto prevailing; its bearing on the question whether a quality thus acquired can originate a new permanent variety or species is, however, at least materially affected by M. Pictet's other position, that where several generations have been brought up on the abnormal food so as to become accustomed to it, they revert towards the original form, so that there would appear to be only a temporary disturbance in the colouring of the species.

All M. Pictet's figures of *O. dispar* are reproduced as illustrative of this notice; those numbered 13 (walnut, oak, onobrychis), 14, and 16 (onobrychis, mespilus) are relied on by him as showing indications of each of the different food plants supplied to them and their ancestors, that numbered 10 (walnut, oak, walnut, walnut) as showing reversion towards the original normal form when the larvæ have for several generations been confined to abnormal food.

With respect to M. Pictet's position that an inverse rate of development in the pupa is caused by lengthening or shortening the duration of the larval "diapause" or period of repose, his experiments favour that view; but it will hardly be accepted as of general application without further experiments.

There is a section on the influence of food on the colour of the larvæ in which M. Pictet states that such an influence is exerted, with observations tending to show that in some cases there is a relation between the colour thus induced in the larva and the colouring of the imago. There are also experiments from which he draws the conclusion that the kind of food influences the secondary sexual characters of the larvæ which are so marked in *O. antiqua*, &c.; this does not, of course, mean that it changes the sex as has been asserted; on that he makes the just observation that it is not sufficient to count the respective numbers of males and females among the perfect insects obtained, but account ought also to be taken of those that die, usually in large numbers, and the male sex may be much more capable than the female of supporting the "tribulations of life," among which, one may add, must certainly be included scientific experiments on their food.

The second part of M. Pictet's paper is devoted to the influence of humidity. Excessive moisture applied to young larvæ is largely fatal, but seems to have no effect on the perfect insects which survive, beyond slightly reducing their size. Older larvæ, *i.e.* (usually) for the period of eight or ten days before pupation, resist it perfectly, but give "aberrations," some of which are figured, such as are met with here and there in nature.

The paper is a valuable contribution of facts to the solution of questions of much interest, and M. Pictet's conclusions as to the causes of the results he describes are well worthy of the consideration that they will doubtless receive. It is to be presumed that he took all proper means to isolate the influences he applied from other influences, but his arguments would perhaps have gained in force if he had stated in detail what steps he had taken to ensure this isolation. For example, in his experiments on the colouring assumed by larvæ, though he is acquainted with the experiments of Prof. Poulton and others, showing the undoubted effect of a few coloured surroundings on the colouring of the larvæ of many species, it does not appear what precautions were taken to exclude the operation of such surroundings; nor in the experiments on the duration of the pupal stage when the larval "diapause" was shortened, or in the humidity experiments, does it appear that the temperatures during all the time of the pupal stage were noted; it is known that a very moderate difference in temperature will make a difference of many days in the duration of this period. One may venture to suggest, also, that in the continuation which it is hoped M. Pictet will make of his valuable experiments he will give as far as possible the whole number of the insects in the broods at their commencements and the whole number of perfect insects reared—in the great majority of cases only percentages are given; also that he will state whether the whole or nearly the whole of those reared were similar in appearance to those figured, and whether there was any considerable proportion substantially different.

There appears to be one error to which, as it has not the character of a mere slip, and therefore has a bearing on the arguments used, it is necessary to direct attention. The larvæ of the first generation of the year of *V. urticae* are at p. 94 mentioned as coming from butterflies which "have probably passed the winter in the chrysalis stage," and at p. 81 "certain Vanessas" are spoken of as being able to pass the winter in the egg, chrysalis, or winter stage. Surely *V. urticae* hibernates only as an imago, wherever there is a real winter, as is the habit of the Vanessas generally. Again, fifteen to twenty days is stated as the usual period of the larval life of *Argynnis paphia*; in England this hibernates as a very young larva, and feeds up, very quickly it is true, during April, May, and June, appearing as an imago in July or early August, and this is its usual habit on the continent of Europe.

F. MERRIFIELD.

CHEMISTRY IN THE SERVICE OF THE STATE.[1]

IN the year 1840, the Legislature made an interesting fiscal experiment. It repealed all previous enactments against the adulteration of tobacco, and permitted any ingredients, "except the leaves of trees, herbs, and plants," to be added to that article in the course of its preparation. The result was that tobacco speedily became grossly adulterated; in two years the consumption had decreased by more than a million pounds; and, since tobacco is a heavily taxed commodity, the Exchequer suffered severely. So serious a loss had to be promptly stopped; hence in 1842 the prohibition of adulteration was re-enacted. To help in making the prohibition effective, the Commissioners of Inland Revenue fitted up a small laboratory, the staff of which, consisting for some time of one person only, was occupied solely in detecting fraudulent additions to tobacco.

Such was the modest origin of the chief branch of the institution which now undertakes nearly all the analytical and consultative chemical work required by the various Government departments. Another branch, the Customs Laboratory, may be said to owe its inception chiefly to the Sale of Food and Drugs Act, 1875, which laid upon the Board of Customs the duty of supervising the quality of imported tea. The two branches were affiliated in 1894 under one head.

How considerable the business of the laboratory has now become may be gathered from the recently issued report of the principal chemist, describing the work of the department during the last financial year. From this it appears that the number of samples analysed in that period was no less than 138,508. Of these, 49,751 were examined in the Customs branch, and the remainder, 88,757, in the main laboratory at Clement's Inn Passage.

What, however, more particularly strikes one is the wide range of interests, both of the State and of the individual, which are touched at one point or another by the chemical activities of the department. We extract from the report a few notes which may serve to illustrate this, and to indicate the nature of the questions dealt with.

Dealing first with the Customs, the ultimate aim of the various analyses is, of course, to facilitate the just assessments of Customs dues. This, however, involves the testing of many articles which are not themselves dutiable. For instance, genuine cider is free of duty. A temptation is thus offered to an unscrupulous wine importer, since by labelling his wine as "cider" he may, if undetected, get it passed into the country without payment. As a matter of fact, out of 154 samples examined during the past year, 10 represented importations of so-called "cider" which was found to be chargeable as wine, and another had to pay duty as a spirit preparation. Again, crude methyl alcohol is admitted free, but if purified so as to be potable must pay the spirit duty. In 31 cases out of 256 the substance was, in fact, so pure that the full alcohol rate was levied.

As compared with the previous year, there has been a notable decrease in the number of certain beer, wine, and liqueur samples; this is attributed to diminished consumption of alcoholic beverages. On the other hand, samples of tea show a considerable increase—from 2345 to 3260—in spite of an augmented tea-duty. For various reasons, 316 of these specimens of tea were objected to, and 7 were condemned as unfit for human food.

Among other items of interest, we note that facilities are given by the Customs authorities for the utilising of waste tobacco in the preparation of sheep dips and similar articles. It appears that nicotine is supplanting arsenic as the active principle in such products.

The very high duty on saccharin—20*s.* per pound—involves, the principal chemist remarks, a careful outlook for this substance in the most unlikely places. 617 samples of articles which might have been vehicles for its fraudulent introduction were tested, and 55 of the number were charged the duty as being either saccharin or substances of like nature and use.

In the laboratory at Clement's Inn Passage, the business is classed as (1) Revenue work; (2) work for other Government departments; and (3) the analysis of samples referred by magistrates to the Government chemists in disputed cases under the Sale of Food and Drugs Acts. The examinations of excisable articles are devised to secure the revenue accruing from beer,

[1] "Report of the Principal Chemist upon the Work of the Government Laboratory for the Year ending March 31, 1905." Official Publication, Cd. 2591. Price 3*d.*

spirits, and tobacco. For instance, beer-duty is charged according to the specific gravity of the brewer's wort before fermentation, and this gravity is "declared" by the brewer himself. To test the accuracy of such declarations, 6370 samples of wort in various stages of fermentation were analysed, with the result that the amount of duty was increased in more than 10 per cent. of the cases. Again, on beer which is exported, "drawback" corresponding to the original duty can be claimed: to check the claims, samples of the beer are analysed; and during the year 2789 barrels were found to be not entitled to the drawback claimed. 813 samples of beer out of 6589 taken from publicans were shown by analysis to have been illegally diluted with water. Of so-called "temperance" drinks, about one-third of the whole number examined, 1011, contained alcohol in excess of the legal limit, the highest quantity being about as much as in ordinary light beer. Forty-four specimens of beer and brewing materials were found to contain arsenic in objectionable amount.

As regards spirits, it is noted that the exportation of medicinal tinctures, flavouring essences, and perfumes is increasing. So, too, is the use of denatured alcohol for industrial purposes, and of pure duty-free spirit issued to medical and other science schools.

Tobacco is examined chiefly to prevent an excessive admixture of water or oil; penalties were imposed in 87 cases of this kind during the past year, and also in other instances where glycerin and liquorice were unlawfully present.

Legal proceedings are necessarily a feature of the chemical control over dutiable articles. Penalties aggregating 507*l.* were imposed during the year in respect of offences proof of which depended upon the analytical evidence.

Much work, of very varied scope, is carried out for the Admiralty, the Boards of Trade and Agriculture, India Office, Post Office, War Office, and other State departments. Imported dairy produce, for instance, is analysed for the Board of Agriculture in order to check the importation of adulterated foodstuffs; 2468 such articles were examined in the year, of which 2110 were butter and 305 milk and cream. Boron preservatives and artificial colouring-matter are found to be common additions to the butter. The use of the preservative is increasing; but, as the principal chemist points out, there is a difficulty in restricting the admixture so long as a legal limit has not been fixed. In two other respects it would seem that the law might well be amended. Butter, about the purity of which there were grave doubts, and cheese containing merely nominal amounts of fat, had, "in the absence of legal limits," to be admitted into the country without objection; this seems hardly fair, either to the home farmer or to the consumer.

In connection with the testing of filters, a useful note of warning is given to the makers of these articles. The actual filtering material may be quite satisfactory, but as regards giving a sterile filtrate the whole apparatus is sometimes rendered useless by leakage of unfiltered water through faulty fittings.

For the Home Office an interesting series of lead-glaze samples was examined during the year. It may be remembered that cases of lead poisoning in the pottery industry had a few years ago become so numerous as almost to constitute a public scandal. Profs. Thorpe and Oliver, who were commissioned by the Home Secretary to investigate the matter, recommended, among other remedial measures, the substitution of lead silicates for the white lead then in general use as a glazing substance, on the ground that the silicate, properly compounded, would be almost insoluble in the acids of the gastric juice, and therefore far less poisonous than the easily soluble white lead. Based on this recommendation, a regulation was framed by the Home Office; it was, however, thought by the potters to be too stringent, and eventually the point was submitted to arbitration, Lord James of Hereford being umpire. His award was in the nature of a compromise giving the manufacturers greater freedom than under the original proposal. The conditions are set forth in the report, together with the results of the analyses of samples of glaze showing how nearly the manufacturers, in the first year's working of the new rules, have been able to keep their glazes within the specified limits. On the whole, the results are fairly satisfactory. Thus thirty samples were represented as "leadless," and all but four did, in fact, conform to the regulation.

The India Office requires the analysis of a great variety of articles, which are examined in order to ensure that goods supplied by contractors are actually what they purport to be. Metals and alloys, cements, chemicals, disinfectants, drugs, food preparations, oils, paints, and surgical dressings were among the supplies sent for analysis during the year; but how far they proved to be satisfactory is not stated.

In cases which arise under the Sale of Food and Drugs Acts there may be a conflict of testimony, and the magistrate may wish to have before him independent evidence upon the chemical aspects of the question. In such matters the Government Laboratory acts as *amicus curiae*, and examines a sample of the article in dispute which has been specially reserved for that purpose. Further, whether the magistrate wants it or not, either of the litigants can claim to have this reserved sample forwarded for analysis. This is an excellent provision, securing as it does a careful examination of the disputed points by chemists unconnected with either prosecution or defence, and detached from any local influences which might, however wrongly, have been alleged or suspected by an accused person to have been used against him. During the past year this provision has been taken advantage of in 109 instances. The net result of the references was to support the allegation brought against the article in the great majority of cases, viz. in 95 out of 105.

The report bristles with matters of interest similar to the foregoing. It is the record of a useful year's work.

ON THE ORIGIN OF EOLITHS.

THE more detailed paper by M. Marcellin Boule on the subject of the origin of eoliths (see NATURE, August 31, p. 438) has now appeared in *l'Anthropologie* (Tome xvi., p. 257), and was briefly noticed in NATURE of September 28 (p. 538). The paper is too long for us, with the existing pressure upon our space, to give a full translation of it, but the following are the principal new features in the extended essay. The velocity of the circumference of the wheels in the *délayeurs*, or vats, is stated to be about 13 feet per second, the same as the speed of the Rhone in times of flood. It will therefore be seen that these mixing vats are of an entirely different character from ordinary pug-mills, and that the motion of the water in them may be properly described as torrential. The author attaches no importance to the fact that some of the blows to the flints are given by the iron teeth of the suspended harrows, and states that most of the flints are reduced to the condition of rolled pebbles, identical with those to be found in all flint gravels, but that there are numerous examples of *retouches*, or secondary working. In illustration of this he gives photographic figures of eleven different specimens by which he contends that

the analogy of these flints from the cement manufactory near Mantes with the so-called eoliths from Tertiary beds is substantiated, and he regards it as undeniable that these Mantes eoliths have been produced, and are being continually produced, apart from the intention of any human being.

In conclusion, he directs attention to the importance of migration both in history and in the development of all fossil groups. Nothing, he says, proves that the evolution of the human species or genus took place in one particular spot. It is very possible that man appeared suddenly in this part of the world at the beginning of the Quaternary period, at the same time as the mammalian fauna of which he forms part, and which is very different from the last fauna of Pliocene times. As a palæontologist, he believes firmly in the existence of Tertiary man, traces of whom, he doubts not, will eventually be found in some part of the world; but for these to be indisputable, they must possess a very different value from that of the eoliths.

In addition to M. Boule's memoir, an important article has appeared in the *Archiv für Anthropologie* (Neue Folge, vol. iv., p. 75), "Zur Eolithenfrage." It is from the pen of Dr. Hugo Obermaier, of Paris, who has also visited the cement works near Mantes, and entertains views upon the subject almost identical with those of M. Boule. He begins with a historical sketch of the discoveries of eoliths in beds from the Oligocene downwards to the Quaternary, and then proceeds to describe and discuss the modern products of the *délayeurs*, of one of which he gives a section. The paper is illustrated by eight plates, six of which are photographic. The first gives eight specimens of reputed eoliths from Miocene beds at Duan, near Brou (Eure et Loire). The other five are devoted to examples from Mantes, not a few of which present the "hollow-scraper" notches so often seen on eoliths. The remaining two plates contain reproductions of wood-cut figures of eoliths from various localities, so as to afford means of comparison between the old and the new.

He directs attention to an admission of M. Rutot that the eolithic industry is confined to localities where two conditions exist, the one that there was an abundance of the raw material flint, and the other that there was a stream of water in the neighbourhood, conditions which, in a modified form, exist at Mantes.

Want of space precludes a longer notice of this interesting article. We may, however, quote Dr. Obermaier's words in a letter to the editor of the *Archiv für Anthropologie* (Neue Folge Corr. Blatt., July, 1905, p. 50):—"We have now an experimental proof that eoliths can be formed in a purely mechanical manner."

NOTES.

As already announced, the inaugural meeting of the British Science Guild will be held on Monday next, October 30, at the Mansion House, at 4.15 p.m. The Lord Mayor will preside, and will be supported, among others, by the Lord Bishop of Ripon, Lord Strathcona and Mount Royal, the Right Hon. R. B. Haldane, K.C., M.P., Admiral Sir Cyprian Bridge, G.C.B., General Sir Frederick Maurice, K.C.B., Sir John Wolfe-Barry, K.C.B., F.R.S., Sir William Ramsay, K.C.B., F.R.S., Mr. C. W. Macara, and Sir Norman Lockyer, K.C.B., F.R.S.

A MEETING of the general committee of the British Association will be held in the rooms of the Linnean Society, Burlington House, on Tuesday next, October 31, at 3 p.m., for the purpose of appointing officers for the meeting of the association to be held at York next year, and of deciding upon the place of meeting in 1907.

THE Paris correspondent of the *Times* states that M. Gérault-Richard proposes to ask the French Parliament to vote a credit of 100,000 francs (4000*l*.) for the investigation of the best means of combating tuberculosis. The Minister of Education, M. Bienvenu-Martin, has promised the support of the Government.

THE death is announced of Prof. DeWitt Bristol Brace, head of the department of physics in the University of Nebraska, and one of the leading physicists of the United States. He was in his forty-seventh year, and had just entered upon his nineteenth year of teaching in the University of Nebraska.

AN international exhibition in connection with ceramic industries, and with the manufacture of glass and crystal, will be held in 1906 from June to October at the Champs-Elysées and the Cours-la-Reine. Full information can be obtained from the director-general of the exhibition, 19 rue Saint-Roch, Paris.

WE learn from the *Pharmaceutical Journal* that the Heriot trust governors have decided to establish a laboratory at the Heriot Watt College, Edinburgh, for the study of bacteriology in its relation to various industries. The laboratory has been fitted with the best appliances, and the services of Dr. Westergaard have been retained to supervise it. The laboratory was formally opened by a lecture by Prof. Hansen on October 18.

A STRONG earthquake shock was felt in Constantinople on October 22 at 5.55 a.m. The disturbances, which lasted several seconds, appeared to travel from the north-east towards the south-west, and were accompanied by a rumbling noise. Earthquake shocks were felt at 2 p.m. on the same day at Batum, and between 2 p.m. and 5 p.m. at Kutais. An undulating tremor lasting forty seconds was also experienced at Sukhum-Kaleh.

A CONFERENCE of delegates from the corresponding societies affiliated to the British Association will be held in the rooms of the Linnean Society on Monday and Tuesday, October 30 and 31, under the presidency of Dr. A. Smith Woodward, F.R.S. Among the subjects to be discussed are "The Preservation of Native Plants," to be introduced by Prof. G. S. Boulger, and "The Law of Treasure Trove," which will be introduced by Dr. W. Martin. The delegates will visit the museum of the Royal College of Surgeons, and will dine on Monday evening as guests of the Royal Societies Club.

A REUTER message states that the Berlin Meteorological Observatory, which the Emperor recently opened in the presence of the Prince of Monaco, is fitted with all the latest appliances for meteorological research. The Emperor attaches great importance to the use of balloons in meteorology, so that an extensive balloon hall has been included in the building plan of the new observatory at Lindenberg, near Berlin. On the highest point of the plateau on which the observatory stands is a shed which can be turned to any point of the compass, and contains a cable drum driven by a small electric motor for hauling in kites, which are to be extensively used for meteorological purposes. Electric search-lights have also been installed for night observation. Another interesting feature of the new institute is the kite factory, where large kites, fitted with self-registering instruments, are made. The institute has its own establishment

where balloons can be filled, and it is the present intention of the directors to make observations with balloons every first Thursday in the month.

DR. BÁTHORI ENDRE, writing from Királyfalva, Hungary, informs us that the Bólyai international prize will be presented next December, for the first time, by the Hungarian Academy of Sciences. The prize is ten thousand crowns, and will be awarded every five years, in memory of John Bólyai, the celebrated Hungarian mathematician, to the writer of the best mathematical work in the same period of years. The committee concerned with the award of the prize met on October 11 in Budapest. The members of the committee are:—Prof. G. Darboux, Paris; Prof. F. Klein, Göttingen; Prof. G. König, Budapest; and Prof. G. Rados, Budapest. The names of two mathematicians were considered, viz. Prof. H. Poincaré and Prof. D. Hilbert. The committee awarded the prize to Poincaré, and at the same time expressed its acknowledgment and admiration of Prof. Hilbert's works. Profs. Darboux and Klein gave lectures in Budapest on the teaching of mathematics.

THE inaugural address of the Manchester Literary and Philosophical Society was delivered, on October 17, by Sir William H. Bailey, the president of the society. The address took the form of an interesting historical account of the society since its foundation in 1781, and included appreciative references to the work of many distinguished members whose names are to be found in early volumes of memoirs. The founders were the chief scientific men of Manchester. Among the honorary members were Erasmus Darwin, Dr. Franklin, Lavoisier, Dr. Priestley, William Roscoe, of Liverpool, the poet and grandfather of Sir Henry Roscoe, Dorning Ramsbottom, Josiah Wedgwood, and others. The chief tools of the workshops of the world, not only those where steam engines, locomotives, and steamships are built, but also of the textile factories of the world, were invented in Manchester or within thirty miles of it. The records of the society contain the names of many of these inventors who were members, for the men of Lancashire were the first to use steam power for spinning and weaving, and for punching, cutting, and shaping metal. Prominent among the inventors was that genius Richard Roberts, who was always in the front rank in advocating technical education. His chief inventions were the slide lathe, planing machine, and self-acting mule for spinning cotton. Then there was Nasmyth, the inventor of the steam-hammer, Sir William Fairbairn and Sir Joseph Whitworth. Finally, Sir William Bailey referred to the great work of the illustrious members Dr. Dalton and Dr. Joule, whose effigies in marble are in the entrance to the Manchester Town Hall.

PLANS have been formulated by Mr. Einar Mikkelsen, a young Dane, for an expedition to the Arctic regions, the objective being that part of the Polar Ocean which lies immediately to the west of the Parry Archipelago, north of Canada. Interviewed by a representative of the *Morning Post*, Mr. Mikkelsen gave an outline of his programme. He will be joined by Mr. Leffingwell, a young American geologist, and Mr. Ditlevsen, a naturalist, who, like Mr. Mikkelsen, accompanied Lieut. Amdrup to the east Greenland coast in 1900. It is proposed to start from Canada in the spring of 1906. Early in May the party hopes to reach the upper waters of the Athabasca River, by way of Edmonton, and to follow that stream, and the Slave and Mackenzie Rivers, down to the northern coast of the Dominion. It will be some time in July before the mouth of the Mackenzie River is reached. At the end of August a whaler, which will have been brought north especially for the use of the expedition, will be joined by the party. Geological and zoological investigations and study of the native Eskimo will occupy the time of waiting. At Cape Kellet it is hoped that winter quarters will be established. The winter is to be occupied with scientific investigations. The plan is that about the end of February the party, three white men, two Eskimo, and the dogs, shall start out from Prince Albert Cape in a N.N.W. direction, that is, more or less parallel to the mainland. Ten days, it is calculated, should see an end of the bad ice, and then Mr. Ditlevsen is to return, leaving Messrs. Mikkelsen and Leffingwell to continue the journey alone. They hope to keep on in the same direction as far as latitude 76° N., in about 147° west longitude, before turning south to reach the coast.

THE Tottenham Urban District Council has issued a public appeal for subscriptions for the purpose of furnishing a museum and for the donation of objects of interest. An opportunity occurred during the present year for securing a collection of minerals and other geological specimens for a nominal sum, and at the same time an offer was received from Mr. H. E. H. Smedley to lend his museum collection to Tottenham and to give his services as honorary curator. The council has accepted the offers. The cost of furnishing the museum is estimated at 250*l*. Any contributions in money, or suitable objects for exhibition, may be sent to the librarian at the Central Public Library, High Road, Tottenham.

THE increased sale of synthetic indigo promises, a writer in the *Journal of the Society of Arts* states, to destroy the old and important Anglo-Indian industry of indigo planting. Since 1895–6 the value of the exports has fallen from 3,569,700*l*. to 556,400*l*., and this is largely due to synthetic indigo. Of the indigo imports of Japan last year fully three-fourths was the artificial product, vegetable indigo being increasingly unsalable. In the United States the synthetic dye came on the market in 1898, and was held at 44 cents per pound, about the value of vegetable indigo on the indigotin basis. Now the price is down to 18 cents, and at this figure it is claimed to be much cheaper than the lowest obtainable values in any vegetable indigo. The artificial dye has already secured nearly 85 per cent. of the world's consumption, and the price of indigo has dropped about one-half. To-day Germany imports only small quantities of natural indigo, while her exports of synthetic indigo have increased enormously, and represented last year a value of 25,000,000 marks.

THE study of the zoology of the Philippines is being energetically carried on by the Americans, one of the latest contributions being the description of new Hymenoptera, by Mr. W. H. Ashmead, published in the *Proceedings of the U.S. Nat. Museum* (No. 1416).

THE Agricultural Society of Sapporo, Japan, is devoting its energies to the study of the insects of the country and the mischief they inflict on agriculture, forestry, &c. In the first and second parts of the second volume (the first volume being at present apparently unpublished) of the society's journal, of which we have been favoured with copies, all the papers except one are, for instance, devoted to insects and their life-history. The groups discussed include the Cercopidæ, or lantern-flies, the freshwater Hemiptera, and the bark-boring beetles of the family Scolytidæ. In the article referred to above, Mr. S. Hashimoto takes into consideration the composition of certain abnormal samples of milk.

THE papers in the *Zeitschrift für wissenschaftliche Zoologie* (vol. lxxx., part i.) include one by Mr. V. Widakowich on the structure and function of the so-called nidamental organs (that is to say, the glands which secrete the white and shell of the eggs) of the shark *Scyllium canicula*. In a second Mr. A. Reichensperger describes the anatomy of the living West Indian crinoid *Pentacrinus decorus*. A third, by Mr. O. C. Glaser, is devoted to certain features in the physiology of the American gastropod *Fasciolaria tulipa*, while in a fourth Messrs. Marshall and Dernehl commence a dissertation on the embryology and anatomy of the hymenopterous insect *Polistes pallipes*.

To the first part of the eightieth volume of the *Zeitschrift für wissenschaftliche Zoologie* Dr. O. Grosser communicates an interesting paper on the evidence that certain dermal structures or markings among vertebrates have a segmental origin. Among the features referred to are the transverse arrangement of the scaling on the under surface and sides of the body in lizards, and the transverse colour-bands on the bodies of the banded mongoose (*Crossarchus fasciatus*), the tiger, and the zebras. In regard to the scaling of reptiles, the author admits that the transverse arrangement is very probably a secondary feature due to adaptation to the movements of the body, while he adds that the evidence for the segmental origin of the transverse stripes in mammals is purely of a negative nature, and requires something much more definite in its favour before it can be accepted. It may be added that if this segmental origin of colour stripes be accepted, it at once cuts away the ground from those who regard it as a special protective adaptation.

WE have received the first part of a work, to be completed in six parts, price sixpence each, entitled "I go a-walking through the Country Lanes." No author's name appears on the title-page, but the text is stated to be compiled from the Rev. C. Johns's "British Birds and their Haunts." Each part is to contain reproductions from photographs taken by Mr. Reid, of Wishaw, the incomparable excellence of which needs no commendation on our part. The aim of the book is "to outline a walk in the country, and to describe and picture the habits of the birds and the animals that are to be seen." The photographs in some instances might have been made to convey more information. On p. 13 we have, for instance, a charming picture of a flock of sheep coming out of a field, to which the legend "changing pastures" is subscribed. It would surely have been just as easy to mention that these sheep, as shown by their white faces and long wool, are Leicesters, or some nearly kindred breed.

THE Selborne Society has issued an illustrated circular in which attention is directed to the objects coming within the purview of that body, and the privileges enjoyed by members. "Birds in the Field and Garden" is the title of an article in the October issue of *Nature Notes*, the official organ of the society, in which the nameless author, while admitting that a certain amount of damage is inflicted on fruit and other produce, maintains that, on the whole, the visits of birds are advantageous alike to the gardener, the fruit-grower, and the farmer. In connection with this subject, it may be mentioned that we are acquainted with certain gardens where, owing to the damage done to the buds by bullfinches and other members of the finch tribe, the whole of the gooseberry and currant bushes have been enclosed in wire netting with a mesh small enough to prevent the entrance of birds. The experiment has been carried on for two seasons with the most satisfactory results, and there has been no necessity to take any special steps to free the bushes from insects. Here, then, is a problem for those who urge that birds are essential to the gardener.

IN *Biologisches Centralblatt* for October 1 Mr. W. M. Wheeler, of the American Museum of Natural History, and Father E. Wasmann discuss the discovery of "temporary social parasitism" among ants, and the inductions to be drawn therefrom as to the origin of "slavery" among certain members of the group. Mr. Wheeler claims to have been the first to describe this temporary parasitism in a *Bulletin of the U.S. National Museum* issued in October, 1904; but the corollaries from this discovery and inferences in regard to the general origin of slavery among ants were not published by him until the middle of February of this year. In conclusion, the writer urges that none of the observations published by Father Wasmann during all the years he has been engaged in the study of ants "are sufficient to accredit him with the independent discovery of temporary social parasitism as a general and regular phenomenon among certain Formicidæ." In a reply to this article, Father Wasmann very candidly admits that Mr. Wheeler is fully entitled to the credit of this discovery, although he apparently does not accept certain other claims made by the American naturalist

"CAN fish hear?" is a question discussed by Dr. O. Körner in a special issue of the *Beiträge zur Ohrenheilkunde*, published to commemorate the seventieth birthday of Prof. A. Lucae. The question is provisionally answered in the negative, and for the following reasons. It seems that many fishes are able to perceive rapid, consecutive vibrations communicated to water, but that such vibrations are taken cognisance of by means of the so-called auditory organs is highly improbable. This is supported by the fact that single loud explosions in water were totally disregarded by fishes belonging to no less than five and twenty distinct species of fishes. Moreover, the circumstance that the presence of the senses of sight and touch is easily demonstrable in fishes renders it probable that the same would be the case with hearing if it existed. Finally, the fact that fishes, and apparently also such isolated forms in other groups as are deaf, alone among vertebrates possess no organs comparable to the Cortischian nerve-terminations renders it probable that these organs are alone capable of transmitting auditory vibrations, the hypothesis that such vibrations may be received by the vestibular apparatus not being at present substantiated.

WE have received part ii. of an illustrated catalogue of the ethnographical collection of the Sarawak Museum (Journal No. 43, April, Straits Branch, Royal Asiatic Society), by Mr. R. Shelford. This section deals only with the objects worn for decorative purposes by the natives of Borneo. The question of the relationship between magic and personal ornamentation has not been lost sight of, but many inquiries have elicited little information of importance. Kalabit youths when visiting new districts wear a necklace of decorative seeds as a charm against evil spirits, and Land-Dyak men wear a necklet of beads and canines of leopard and bear for a similar purpose; the beads are frequently regarded as charms against specific diseases. The leglets of finely plaited fibre so commonly worn were at one time employed as currency; the Kayans say they feel quite naked if they do not wear these leglets. The catalogue is very well done, and is illustrated by adequate plates. If the whole museum is treated in this way the catalogue will prove to be a very valuable record of the ethnography of Sarawak.

THE *Bulletin du Jardin impérial botanique de St. Petersbourg*, vol. v., part iii., contains a description of new lichens from Central Russia and Siberia, by Mr. A. Elenkin, and an account of the vegetation on the chalk cliffs in the basin of the river Choper, by Mr. W. Dubjansky.

IN his report for 1904–5, the curator of the botanic station in Dominica states that spineless lime plants are in great demand, but that he is unable to furnish an adequate supply, as the fruits contain very few seeds; also, owing to the labour involved, the supply of budded orange stock is limited. Other plants in request are cacao, rubber —both Castilloa and Funtumia—and ordinary limes. Judging from the manurial experiments with cacao, extending over three years, the application of phosphate and potash with dried blood may be expected to give substantial increases in yield, while mulching with grass has produced even better results.

THE Department of Agriculture for British East Africa has issued a leaflet on the cultivation and commercial products of the cocoanut. The industry is one that requires some capital, as the plants only come into bearing in the sixth year, and meantime the cultivator is dependent upon the maize, ground-nuts, or any other crop that he may grow between the trees. The most lucrative product in East Africa is *tembo*, a liquor obtained from the cut end of the very young flowering spike. The Department of Forestry in the same colony has also inaugurated a series of leaflets, the first of which deals with timber trees, including a juniper, a Podocarpus, *Pygeum africanum*, and *Allophylus abyssinicus*.

WE have received a pamphlet entitled "The Growth of Oak in High Forest," by Prof. W. R. Fisher, president of the Royal English Arboricultural Society, in which the author points out the desirability of having a model oak high forest as an adjunct to the forestry school at Oxford. In spite of the fact that oak forests and oak timber have played such an important part in the history of England, we have not at the present day a typical example of oak high wood, that is, an area where all stages from the seedling to the mature tree are represented. In the above pamphlet Prof. Fisher proposes to have a working section of the oak wood in Windsor Park set aside for this purpose. The area required, 1200 acres, could surely be spared for this important purpose, and the author clearly shows how the present crop could with time be replaced by a series of age classes representing all stages in the growth of the tree and the forest from the beginning to the end of the rotation. The financial returns would be vastly increased thereby, more than counterbalancing and justifying any small initial sacrifice. The scheme deserves every encouragement, and we trust will be looked upon with favour by those in authority.

ONE of the best concise accounts of the Liége International Exhibition yet published is contributed by Mr. L. Ramakers to the October issue of the *Engineering Magazine*. Some excellent illustrations are given of the mechanical, mining, and metallurgical features. Several large engines for operation with blast-furnace waste gas were shown, notably a 1200 horse-power four-cycle double-acting horizontal tandem engine for the direct driving of a rolling mill at the Cockerill works. Another gas engine shown by the same firm is a 500 horse-power four-cycle double-acting twin cylinder for operation with coke-oven waste gas. A gas-producer of novel type was exhibited by the Deutz Gas Engine Works, the fuel for which consists of brown-coal briquettes. The same firm showed an eight horse-power locomotive with a benzene motor.

FROM the Rationalist Press Association there come cheap reprints of "The Fundamental Principles of the Positive Philosophy" and of Haeckel's "The Wonders of Life." The former book contains a translation of the two introductory chapters of Comte's "Philosophie Positive," that is, the account of Comte's main theses, of the law of the three states of knowledge and the nature of positive philosophy, together with the fulminations against introspective psychology which are now completely out of date. Haeckel's work is a supplement to the "Riddle of the Universe," and discusses life, death, morality, and many other things.

OUR ASTRONOMICAL COLUMN.

THE RECENT LARGE SUN-SPOT.—The accompanying reproduction shows the form and extent of the large sun-spot group referred to in these columns last week. This photograph was taken at 12 o'clock noon on Thursday last, October 19, when the group was plainly visible to the naked eye. A rough measurement shows that the group was then more than 100,000 miles long and about 55,000

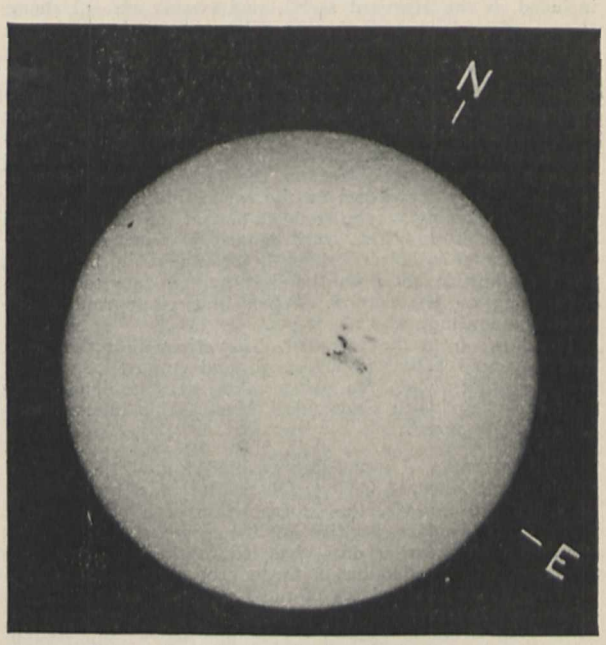


FIG. 1.—Photograph of the Sun showing the large group of sun-spots October 19, 12 o'clock noon.

miles across its greatest breadth. The smaller spot, seen in the N.W. quadrant, was of particular beauty, showing a very dark circular umbra surrounded by a symmetrical penumbra.

A second "naked-eye" spot having a large black nucleus was seen near to the eastern limb of the sun on Monday last. This is the second occasion during the present year that the sun has presented the unusual phenomenon of two naked-eye spots visible on the disc at the same time.

FURTHER RESULTS OF THE FRENCH ECLIPSE EXPEDITIONS.—Yet another batch of the preliminary results obtained by French expeditions during the recent total eclipse of the sun is published in No. 15 of the *Comptes rendus*.

Prof. Janssen, who was in charge of the expedition stationed at Alcosebre (Spain), describes the observations which were made and the instruments which were employed at that station, and separate reports are pre-

sented by M.M. M. Stefanik, G. Millochau, and J. J. Landerer, who were in charge of the several instruments.

The results, which are of only a preliminary nature, are too numerous to give in detail here, but all the observations, both visual and photographic, appear to have been successful.

M. E. Stephan, of the Marseilles Observatory, was placed in charge of one of the expeditions organised by the Bureau des Longitudes, and, accompanied by M. Borrelly, occupied the same station as Mr. Newall, at Guelma (Algeria).

The equipment of this expedition consisted of a telescope of 40 cm. aperture and an equatorial of 9·5 cm. aperture and 190 cm. focal length. A number of visual observations of the corona, the prominences, &c., were successfully made.

NOVA AQUILÆ NO. 2.—Circular No. 106 of the Harvard College Observatory describes the discovery and subsequent observations of Nova Aquilæ No. 2. The Nova was discovered on a plate taken with the 11-inch Draper telescope on August 18 for the Henry Draper memorial series. The spectrum, although faint, showed the lines Hδ, Hγ, 4272, 4646, and Hβ very broad and bright, Hγ and Hβ having accompanying dark lines on their more refrangible edges. The helium line 4646 is slightly stronger than 4272, and the whole spectrum closely resembles that of Nova Persei No. 2, as photographed on March 30, 1901.

Some two or three hundred plates of this region are included in the Harvard series, and twenty-nine of them, taken before August 18, have been examined, but no trace of the Nova before that date has been discovered.

Two photographs showing the region half a degree square around the Nova, taken on August 15, 1903, and August 31, 1905, respectively, are reproduced in the Circular, and on comparing them it is at once seen that the Nova does not appear on the former, although it is quite a conspicuous object on the latter plate; stars of magnitude 15·7 are shown on the earlier plate.

Prof. Pickering's tabulated statement of the observed magnitudes of the Nova from August 31 to September 22 shows that this object gradually decreased in brightness from magnitude 10·41 on the first named date to magnitude 11·23 on the second. When first photographed the Nova's magnitude was about 7·0.

It follows from the Harvard observations that the Nova first appeared between August 10 and August 18, but it is hoped that, when the plates taken at Arequipa during that period arrive at Cambridge (Mass.), this interval may be greatly reduced.

STAR WITH A LARGE PROPER MOTION.—The method employed at Harvard College Observatory for the detection of variable stars, viz. the superposition of a photographic plate upon a glass positive of the same region, photographed on an earlier date, has led to the discovery that the star A.G.C. 6886 has a large proper motion. Whilst thus examining two plates of the Large Magellanic Cloud, taken on April 11, 1898, and December 5, 1904, respectively, Miss Leavitt found that this star had moved appreciably during the interval, and a comparison of the positions given in several of the older catalogues compiled since 1825 confirmed the fact.

The discussion of the data obtained from the comparison showed that the annual proper motion in R.A. is −0·066s., in declination +1″·14, and along a great circle 1″·28.

The total number of stars shown on the original negatives is about 300,000, and it is probable that none of these, except A.G.C. 6886, has an annual proper motion exceeding three-quarters of a second (Harvard College Observatory Circular, No. 105).

OBSERVATIONS OF PERSEIDS, AUGUST.—The detailed results of the Perseid observations, made at the meteorological observatory at Pavia on August 8, 9, 10, and 11, are given in No. 8, vol. xxxiv., of the *Memorie della Società degli Spettroscopisti Italiani*.

On the night of August 8–9 seven observers recorded 153 meteors, and determined the trajectories of 23 of them. The maximum horary rate occurred between 0h. and 1h. (August 9), during which time 53 meteors were seen. On the succeeding night the watch lasted from 22h. to 3h. 7m., and the same number of observers saw 252 meteors, of which they recorded the paths of 28. The maximum rate occurred during the last hour, when 93 meteors were seen. The third night produced 264 meteors, and of these the seven observers recorded the trajectories of 18 during their watch of 4h. 56m. The maximum horary rate of the whole shower, as observed at Pavia, was recorded during this watch, when 100 meteors were seen between 2h. and 3h. on the morning of August 11.

Of the 669 meteors seen during the three nights, 27 were recorded as being brighter than, and 139 as being equal to, the first magnitude, whilst "swift" and "white" were the descriptive terms applied to the majority of them.

MATHEMATICAL AND PHYSICAL SCIENCE AT THE BRITISH ASSOCIATION.

THE great number of astronomers present during the South African meeting caused astronomy to play a larger part in the proceedings of the section than it has done in recent years, and many of the most important communications and discussions were on astronomical subjects. The number of papers on pure mathematics and on physics was relatively small.

Of the mathematical papers, one by Prof. Harzer on ancient Japanese mathematics was of special interest. Prof. Harzer finds on examining ancient Japanese records and works that several of the theorems discovered in Europe during the seventeenth century were known at least as early to Japanese mathematicians. As an example, the expansion

$$(\text{arc sin } y)^2 = \sum_0^\infty \frac{1}{\beta+1} \cdot \frac{2.4.6 \ldots 2\beta}{1.3.5 \ldots (2\beta+1)} y^{2\beta+2}$$

due to Kowa Seki (1642–1708) may be quoted.

Mr. M. Cashmore showed how chess magic squares, *i.e.* squares of numbers which add up to the same amount along every path across the square in the direction of a rook's, a bishop's, or a knight's move, can be constructed by superposing on each other two types of subsidiary squares, which can be formed by simple rules.

Prof. Perry gave an account of the approximate method he had used to determine the stresses which occur in a winding rope carrying a cage when the upper end of the rope is suddenly stopped.

Mr. H. G. Fourcade described his instrument for stereoscopic surveying. It consists of a photographic camera which may be fixed in turn at the two ends of a base line with its axis perpendicular to that line. In front of, and close to, the sensitive plate a *réseau* scale on a glass plate is placed, and is reproduced on the two photographs taken. The two are examined together in a measuring machine similar to that used in stellar photography, and by means of micrometer screws any portion of the picture may be made to appear in relief and coincident with an index. The distance of that portion from the base line may then be determined from the micrometer readings. Each determination takes about two minutes, and with a base of 300 metres the probable error does not exceed 1 part in 1000 for a distance of 10,000 metres, and is less for shorter distances.

Prof. Perry raised the question of the teaching of elementary mechanics, and pointed out that the average boy who enters a technical college is so badly educated that his first year has to be "wasted in the study of school subjects." Then three years are found to be insufficient to teach him "everything an engineer is likely to want in his profession," which many colleges foolishly attempt to do, and a fourth or even a fifth year is added. He urged that in teaching science to boys from nine to thirteen the methods of Mr. Barlow, of "Sandford and Merton" fame, should be followed, until they know something of levers, weighing and measuring, specific gravities, barometers and thermometers, and of electricity and magnetism. At the age of fourteen a boy should know elementary algebra and trigonometry, should be able to differentiate and integrate, and apply the calculus. The principles that if forces are in equilibrium their vector sum is zero, and the sum of their moments about any axis is

zero, should be presented to him from many points of view. Force should be taken as the rate of change of momentum. All these facts should be brought out and illustrated by experiment, and it should be the object of the teacher to turn out a pupil with a thorough grasp of mechanical principles, and not one crammed with formulæ which he soon forgets.

With the report of the Mathematical Association committee on the teaching of mechanics Prof. Perry is substantially in accord, although he differs from it in wishing to retain the term "centrifugal force" and to abolish the "poundal."

Lord Kelvin communicated a paper on the kinetic and statistical equilibrium of ether in ponderable matter at any temperature. If two small spheres, one covered with black, the other with white cloth, were placed in space at the earth's distance from the sun, the temperature of the black sphere would be greater than that of the white. If the spheres were at a distance from the sun 1000 times as great, and 999 other suns were scattered through space, all at about that distance from the spheres, the difference of temperature would be one-thousandth of the former difference. Dr. Chree has found, using thermometers, that in bright sunlight the difference of temperature is 1° C. to 3° C. On a starlight night we might therefore expect a difference of 0·001° C. or 0·003° C.

Dr. J. T. Bottomley described his experiments on the cooling of a lamp-blacked or silvered copper sphere in an evacuated spherical copper enclosure kept first at the temperature of liquid air, then, when the sphere has cooled, raised to the temperature of boiling water. Temperatures were observed thermoelectrically. The present results agree with those found previously by Dr. Bottomley, and do not support Stefan's law.

The writer reviewed the recent experimental work on the thermal conductivities of substances, and pointed out that the balance of evidence is in favour of many substances decreasing in thermal conductivity as their temperature is raised.

Mr. A. Word gave a *résumé* of the work done during the past year in the Cavendish Laboratory and elsewhere which justifies the conclusion that all substances are more or less radio-active.

Prof. Beattie described his observations on atmospheric electricity in South Africa, and his attempt to connect the observed conductivity of the air with other meteorological phenomena, an attempt which he considered had proved unsuccessful.

Communications on the meteorology of South Africa by Dr. Mill and by Mr. R. F. Rendall were read, and Prof. Beattie gave an account of the present state of the magnetic survey of the country, and exhibited charts embodying the results for the declination. Necessarily the work has had to be confined to positions near the railways, and it will be necessary to provide some means of extending the field of operations, especially along the western coast of South Africa. The association made a grant of 100*l*. towards the expense of this extension.

Great interest was shown in Sir David Gill's account of the geodetic survey in South Africa and the African arc of meridian. After the completion of the survey of Cape Colony and Natal in 1892, it became necessary to determine with greater accuracy the position of the twentieth parallel of longitude north of the colony at points where it formed the boundary of British and German territory. The work was placed in Sir David Gill's hands by the two Governments, and completed in 1903. At the same time, under the auspices of the Rhodesian Government, surveys of northern and southern Rhodesia were being carried out, partly in connection with the Anglo-Portuguese boundary. Since the war, surveys of the Transvaal and Orange River Colony have made steady progress, and the results so far obtained were embodied in the chart of South Africa exhibited by Sir David Gill. Throughout the work the bases taken were measured with the help of wires which were compared with a standard base 400 feet long before and after use. The discordance in the measurements of the Gwibi base of about 70,000 feet amounted in the aggregate to 1 part in 1·5 millions, and this was the base measured with least accuracy.

As a result, it appears that along the meridian of 19° east longitude the curvature of the earth agrees with that given by Clarke's elements, but along meridian 26° east, and more markedly along meridian 30°, this appears not to be the case. A definite settlement of the question will only be possible after the connection of the Rhodesian triangulation with that of the rest of South Africa, a connection which will entail a cost of about 1600*l*. When this has been achieved, Sir David Gill will have made one step more towards the carrying out of his scheme for a great African arc of meridian extending from the Cape to Cairo, and by combination with the Russian-Scandinavian arc, a great arc from the Cape of Good Hope to the North Cape. The scheme has the hearty approval of Section A.

It is somewhat remarkable that at Cape Town the section should hear an account of a geodetic survey of a country within the Arctic circle, but the details of the geodetic survey of Spitsbergen given by its director, Dr. O. Backlund, proved of great interest. It was undertaken by the Swedish and Russian Governments, was carried out on the same lines as that in South Africa, and has given results of a high order of accuracy considering the difficulties of work in such a country. The values of g found at some of the stations in the mountainous parts of the country come out in defect by two or three figures in the fourth place.

One of the most important communications to the section was that of Prof. Kapteyn on star streaming. Prof. Kapteyn finds that the stars, the proper motions of which relative to the solar system have been determined, fall into two groups, one in which the motions take place in the main parallel to a line joining the sun to a point 7° south of α Orionis, the other with its motions parallel to the line joining the sun to a point 2° south of η Sagittarii. If the motions of these two streams be referred to the centre of gravity of the whole of the stars considered, their directions must be diametrically opposite. One of the vertices of these motions in opposite directions Kapteyn finds is close to ξ Orionis, and both lie in the central line of the Milky Way. Prof. Kapteyn does not hold that all motions must be in this line, but that there is a great preponderance of such motions, and that motions oblique to it get fewer the greater the obliquity. At this stage of the investigation he wishes to stand until further knowledge of the motions of stars in the line of sight has been obtained spectroscopically.

Dr. A. W. Roberts gave an account of the observations he has made during the past five years on the light fluctuations of certain southern binary stars, especially V. Puppis. He has succeeded in reaching a high degree of accuracy, and has determined the orbital elements of six stars by means of his observations, using the relations given by Rambaut. He finds the masses of two of the six systems to be 60 to 300 times, and the densities 0·00002 to 0·36 time, those of the sun. The large masses are somewhat exceptional, and Mr. Jeans suggested that the light curves of stars of pear shape would be found to agree with the observations made by Roberts. In support of this, Mr. Jeans gave an account of his investigation of the condensation of a gas occupying initially the whole of space about centres at distances apart approximately equal to that from the solar system to the nearer stars, and with the mass at each centre of the same order as that of the sun. Any one of these nuclei might take a spheroidal, ellipsoidal, or a pear shape, or separate into two parts, according to its velocity of revolution.

Mr. R. T. A. Innes gave an account of the state of double star astronomy in the southern hemisphere, and pointed out the importance of bringing up the observations in the southern to the same state as those in the northern hemisphere. He considers the position and climate of Johannesburg offer exceptional opportunities for the work, and suggested the provision of a telescope by the Transvaal Government. Sir David Gill supported this suggestion.

Of shorter communications it is only necessary to mention a few, *e.g.* Prof. E. W. Brown's on the present state of lunar theory and the necessity of a new set of lunar tables, and Dr. Rambaut's on a new instrument for measuring stellar photographs, to show that in interest and importance the sectional work in South Africa in no way falls behind that of the meetings at home.

C. H. LEES.

CHEMISTRY AT THE BRITISH ASSOCIATION.

THE papers contributed to Section B at the meetings in South Africa were naturally more limited in number and in range of subject than is usual at ordinary meetings of the association, the majority of the communications having reference either to the chemical aspects of agriculture or to subjects connected with the gold extracting industry. On the other hand, a very active part in the work of the section was taken by the South African chemists, and, almost without exception, the reading of a paper was followed by an animated and interesting discussion.

At Cape Town, the first day of meeting was set aside for the discussion of agricultural and biochemical questions. As it had been arranged that the presidential address should be delivered at Johannesburg, its place was taken by Mr. A. D. Hall's report on recent developments in agricultural science, in which many subjects of special interest in South Africa were discussed. Dealing with the fixation of atmospheric nitrogen through the agency of bacteria, the author pointed out that a sharp distinction must be drawn between the use of pure cultures on old cultivated lands and in new countries, where leguminous crops are often being grown for the first time, and that the behaviour of the lucerne plant under bacterial infection in South African soils is worthy of careful investigation in view of its economic importance in all semi-arid countries. He directed attention to the need of a systematic series of soil analyses, with the ultimate object of making soil maps that shall be of service to the agriculturist, and indicated how much still remains unknown regarding the nutrition of plants and how great is the importance of research in the particular functions of the various constituents of the crop, as it is only through such knowledge that the quality of crops may possibly be influenced in desired directions. A brief discussion of the subjects of acclimatisation and cross-breeding brought to a close an address which aroused very great interest. Dr. Horace T. Brown then gave an account of his researches on the assimilatory processes of plants, in the course of which he described his method by which the assimilative power of leaves was measured for the first time under natural conditions. The quantity of carbon dioxide abstracted from the air by leaves of measured area was estimated in a special absorption apparatus devised for the purpose, and thus it was possible to deduce the amount of carbohydrate formed. The total solar radiation falling on the leaf was measured, and the proportion of the radiant energy of sunlight absorbed and transmitted by the leaf was also arrived at. The author's investigations showed that the rate of growth is not entirely dependent upon the amount of sunshine, but also on secondary causes. The business was brought to a close by a short paper by Dr. E. F. Armstrong on the *rôle* of enzymes in plant economy, in which the author directed attention to the fundamental similarity between the action of acids and that of enzymes, the distinction between them arising from the fact that enzymes act selectively in consequence of their power of associating themselves with the hydrolyte. The condition of the carbohydrate in solution is of primary importance, but this condition may to some extent be determined by the enzyme.

At the second day's meeting, Prof. H. B. Dixon gave a historical sketch of researches made on the propagation of explosions in gases, and discussed Berthelot's theory and his own "sound wave" theory on the mode of propagation. With the aid of the lantern he showed how he had followed photographically the flame from its initiation until the setting up of the detonation, and demonstrated the influence of the position of the spark and of the length of the column of exploding gases. He also described experiments now in progress on the specific heats of gases at high temperatures, and explained how the velocity of sound in a heated gas may be determined. In a second paper Prof. Dixon described the method he has devised for determining the atomic weight of chlorine by the direct burning of a known weight of hydrogen in a known weight of chlorine, the hydrogen, prepared by the electrolysis of barium hydroxide, being occluded in palladium, and the chlorine, prepared by the electrolysis of fused silver chloride, being weighed in the liquid state. The atomic weight obtained is higher than that of Stas, but in close agreement with the recent results of Richards. Messrs. G. T. and H. W. Beilby gave an account of their experiments on the influence of phase changes on the tenacity of ductile metals at the ordinary temperature and at the boiling point of liquid air. They showed that when a wire of ductile metal is stretched to four or five times its original length by drawing it through the holes of a wire plate all the ordinary traces of crystalline structure disappear, but the wire still consists of minute granules of the crystalline phase embedded in a matrix of the amorphous phase. By lowering the temperature of drawing, the mixture approaches more nearly to the homogeneous amorphous state. Observations were made at 15° and at −180° on wires of copper, silver, and gold, which had been as completely as possible converted into the amorphous phase by wire drawing at the ordinary temperature, and in every case the tenacity observed was higher than any recorded by previous investigators for equally pure metals. The wires broken at the ordinary temperature showed no general stretching, but at the boiling point of liquid air all the wires stretched about 12 per cent. Dr. A. Midlay recorded his determinations of the viscosities of liquid mixtures at the temperature of their boiling points, which were made in the expectation that viscosity curves would be obtained similar in form to the boiling-point curves. In the case of benzene and methyl alcohol, the viscosities of which at the respective boiling points are nearly the same, the expectation appears to be realised, but where the viscosities of the pure liquids at their boiling points are not the same certain complications are met with.

The third day of meeting at Cape Town was set apart for communications from local chemists. Prof. P. D. Hahn gave an account of the remarkable thermal chalybeate spring at Caledon, in Cape Colony. With the aid of a tabular statement of the purity ratio of the most famous chalybeate springs, he showed that the Caledon water holds with the water of Spa the first place, but he pointed out that while the waters of most chalybeate springs are very low in temperature, the Caledon spring is unique in so far that the temperature of the water at the eye of the spring is 49° C. Mr. C. F. Juritz stated that for various reasons very scanty attention has hitherto been paid to purely scientific chemical research in Cape Colony, and gave an interesting account of several investigations made in the Government laboratory under his direction. A chemical survey of the soils of the colony (at present suspended for want of funds) has resulted in the examination of an area of 27,000 square miles, on an average one sample being taken for every 60 square miles. A number of the fodder plants of the Karroo have been examined as regards their nutritive value, estimations of tannin in the barks of various trees have been made, poisonous principles have been extracted from some indigenous plants, and an alkaloid resembling quinine therapeutically, but differing from it chemically, has been extracted from the umjela or quinine tree, which abounds in the Transkei. Clays have been found in various parts of the colony some of which compare favourably in chemical composition with the best fire clays, and mineral pitch has been observed in certain localities. Dr. H. Tietz, in a paper on the character of Cape wines, explained that at the Cape grapes always become perfectly ripe, and thus contain more sugar and less acid than the grapes of the wine-producing countries of Europe. Notwithstanding this, a standing reproach against Cape wines is based on the contention that they contain more acid than European wines. The author investigated this matter on some 300 samples of different Cape wines, and found that the allegation cannot be upheld.

At Johannesburg the proceedings of the section were inaugurated by the delivery of the address of the president, which was of quite exceptional interest. It was followed by a paper by Mr. H. F. Julian, in which an investigation of the part played by oxygen in the dissolution of gold by cyanide solutions was described. The author arrived at the conclusion that free oxygen plays no primary part in the reaction, any assistance given being of a secondary nature, and that, as a matter of fact, it exerts a retarding influence. According to his experiments, while the balance indicates that free oxygen is of material assist-

ance, the galvanometer points to its presence hindering the dissolution of the gold; the cause of the disagreement between the instruments he attributes to the formation of local voltaic circuits. Mr. H. A. White gave an account of a series of experiments which showed that thiocyanates in presence of such oxidising agents as ferric salts attack gold with considerable ease, and that thiosulphates exert a similar but less powerful influence. These salts are present in ordinary working cyanide solutions, and the presence of gold in mine reservoirs and in the soil under residue dumps is probably connected with their occurrence. Experiments adduced by the author indicate that in well exposed dumps thiocyanates alone are of significance in respect to the observed solution of gold. A process of residue treatment, based on these facts, is resulting in the profitable extraction of a large proportion of the gold in certain of the residue dumps on the Rand.

At the second day's meeting, Dr. J. Moir discussed the law governing the solubility of zinc hydroxide in alkalis, and as the result of a quantitative research stated the conclusion that the phenomenon is essentially an equilibrium between alkali and zincic acid, which may be reached from both sides, and which depends solely on the concentration of the free alkali. It was also shown that no definite chemical compounds exist in the solution. Mr. G. W. Williams read a paper on the functions of the metallurgical laboratory, dealing with the uses of the laboratory for the testing of supplies and for purposes of research, and with the *personnel* and equipment of a suitable laboratory. He emphasised the necessity for a highly trained staff, and pointed out defects in the training given in the great English universities. In a valuable contribution, Mr. S. H. Pearce stated and discussed various economic problems in metallurgy on the Rand. Each stage of the whole process of gold extraction was considered from the economic as well as from the scientific standpoint, and the results of the practical experience of years were summarised in a very clear and judicial manner. Much technical information, of value to all interested in gold extraction, was given in this paper. Mr. R. L. Cousens gave an account of the experiments which led him to conclude that a radio-active substance is present in a certain ore discovered in the Transvaal. If a further examination of the material confirms his belief that the radio-activity of the ore is due to the presence of radium, the result will be of interest in view of the fact that uranium is not present in the ore.

The third day of the meeting was devoted to agricultural chemistry. The proceedings were opened by Mr. A. D. Hall, who discussed in greater detail some of the problems touched on in his address at Cape Town. In a paper on Pretoria rain, Mr. H. Ingle stated that the rain falling at Pretoria for twelve months from February, 1904, was collected, and its content of nitrogen, existing as nitrates, nitrites, and ammonia, determined each week. The results showed that the quantity of combined nitrogen brought down in the rain at Pretoria is considerably greater than the average amounts in Europe, amounting in twelve months to 7·07 lb. of nitrogen per acre as compared with the average of 3·84 lb. per acre at Rothamsted. In a second paper Mr. Ingle communicated the results of the analyses of some eighty samples of soils collected in various parts of the Transvaal, and drew a comparison between European and Transvaal soils, with special reference to the interconnection of their chemical composition and fertility as indicated by field experience. He showed that to take English standards in judging of fertility from chemical analysis may lead to erroneous conclusions in the case of tropical or subtropical soils, and that if there be a sufficient supply of water a soil of apparently poor quality, from analytical results, may yield luxurious crops under the favouring conditions of growth existent in the Transvaal. Mr. E. H. Croghan, in a paper on the fuel of the midland districts of South Africa, pointed out that a large proportion of potash is found in the excreta of sheep fed in this dry and treeless region, resulting from the composition of the bushes, the foliage of which constitutes the chief food of sheep and cattle. Owing to want of water for irrigation the farmer does not use sheep excreta for manure, but for fuel, and the ashes frequently accumulate near the homestead. Attention was directed to the economic value of these ash heaps, either as a manure or as a source of potassium carbonate. Reports were presented by the committee on wave-length tables of the spectra of the elements, the committee on the study of hydro-aromatic substances, and the committtee on the transformation of aromatic nitroamines.

SCIENTIFIC RESEARCH IN MEDICINE.[1]

THAT great benefits to mankind have followed the discoveries of recent years is obvious to all, especially with regard to the causes and prevention of yellow fever and malaria. Research is a word heard on all sides; it is the enemy of authority, that tyrannous spirit which has hampered progress and retarded the advance of scientific medicine for centuries. Experimental medicine is responsible for the greatest advances which have been made in our knowledge of the cause, prevention, and cure of disease. Most important discoveries have exerted but a slight direct influence at their inception; their full significance has remained hidden for a time. The majority of such discoveries has been made by those engaged in research in the realms of pure science. Pure science is unselfish; its aim is not profit, yet it is the forerunner of that applied science which is more obtrusively the "servant of man." If we study disease, we must do so for the sake of knowledge, the scientific spirit must enter into our work. The "practical man" may not appreciate such ideals, but he is ever ready to use the discoveries of science for his own ends. All are not born with the instincts of research, but there are many in whom they lie dormant, and it should be the function of educational institutions to detect and foster such men and lead them on to do the work for which they are adapted. But too often from mere lack of means such men drift away into other fields of activity. To carry on research successfully a man needs an assured income. Is it possible that those who are able and willing to help human progress can continue to ignore the devotion and self-sacrifice of such men as Lazear, Myers, Dutton, Plehn, and others who have laid down their lives in the study of tropical medicine? Medical research needs endowment, and it is grievous to see that in this country, where so much is done for charity, so pitiably little is done for the advancement of learning. To teach science as it should be taught in properly equipped and organised institutions is far more expensive in the case of medicine than in that of any other professional school. It does not suffice to build laboratories; they must also be provided with sufficient funds and equipment to enable them to become working entities.

Those who have watched the progress of the London School of Tropical Medicine from its inception have witnessed a struggle upward which is worthy of all praise. This, and the sister institution in Liverpool, are known throughout the world for the excellent work accomplished by the members of the teaching staff and by some of the students they have sent forth. The London School has a great mission to fulfil; it has to train men in the methods they will be called on to employ in many parts of the world, and to give them the latest and the best to take with them on their distant journeys. It is to be hoped that the public will second the noble efforts that have been made to establish a centre for the study of the diseases which affect the inhabitants of the tropical countries of this vast Empire.

The Trend of Recent Investigation.

A survey of recent work in tropical medicine shows us that investigation is chiefly being directed to the study of protozoal diseases. No advances of fundamental importance have been made with regard to malaria since the classical investigations were published with which the names of Ross and Manson, Grassi, Bignami and Bastianelli will ever remain associated. The earlier work has been confirmed and extended by many investigators. The prevention of malaria by means of mosquito destruction and other measures directed against mosquitoes has been tried in various localities, in some instances with success,

[1] From an address delivered at the opening of the nineteenth session of the London School of Tropical Medicine on October 11, by Dr. George Nuttall, F.R.S.

in others with doubtful results. This is, however, only what might be expected in view of the diversified difficulties which must necessarily arise.

There has been a veritable flood of malaria literature of recent years, including an annual volume of "Atti della Società per gli studi della malaria," the series commencing in 1900, which has come to us from Italy. Mosquitoes have received an immense amount of attention, after being much neglected in the past. The number of genera and species and their classification have become subjects to bewilder all but specialists.

The important discoveries on sleeping sickness ushered in by the researches of Castellani, a pupil of this school, have been confirmed and extended by Bruce and his collaborators of the sleeping sickness commission. The relation of the flies belonging to the genus Glossina to the transmission of the trypanosomes is being actively studied, and many important questions we must hope are nearing their solution in connection with this most fatal malady. A contribution has just come to hand from Gray and Tulloch with regard to the multiplication of the parasites in Glossina, indicating that the belief recently expressed is warranted, namely, that the parasites undergo a cycle of development within the insects. Of importance in their bearing on the question of the development of trypanosomes in other than their vertebrate hosts are the investigations of Schaudinn on *Trypanosoma noctuae* in Culex, those of Brumpt on certain trypanosomes of fishes which undergo their cycle of development in leeches, and those of Prowazeck on the rat trypanosome, which he has demonstrated undergoes development in the rat louse (*Haematopinus spinulosus*).

Of recent discoveries, the one which to me appears to carry the greatest weight is that of Novy and McNeal. They have been the first to obtain pure cultures of Protozoa, maintaining trypanosomes of different species alive *in vitro* for many generations. There is no telling whither the methods they have given us may lead; they directly stimulated Leonard Rogers to experiments wherein he succeeded, by an ingenious method of his own, in cultivating another protozoon, the Leishmania, obtained from cases of kala-azar.

The work on the tick-transmitted diseases known as the piroplasmoses (redwater, &c.) occurring in cattle, sheep, horses, and dogs has been pursued in various parts of the world with great activity. The results appear to me to indicate, what I believe also holds for human malaria parasites, that we shall in time learn to distinguish different parasites which we at present consider to represent single species.

The investigations of Dutton and Todd on tick fever in the Congo Free State, announced in February, have gone to prove that this disease is transmitted by a tick (*Ornithodoros savignyi*) after it has infected itself with blood containing the Spirochætæ. This has been confirmed by Koch, if we may rely on what has appeared recently in German newspapers. It is, however, quite premature to assume that African tick fever and European relapsing fever are due to one and the same species of Spirochæta; in fact, it is highly probable that this is not the case, although the report in question refers to the Spirochætæ as one species. In relapsing fever in Europe the bed-bug (Cimex) has long been suspected to be a carrier of the infective agent, a probability which was considerably heightened by Karlinski's observation of motile Spirochætæ in the bodies of the insects up to thirty days after they had fed on relapsing fever blood. Schaudinn, moreover, informs me that he has observed the multiplication of the *Spirochaeta obermeieri* in Cimex. These observations, following closely upon those published by Marchoux and Salimbeni, are of greatest interest and practical import. The last named authors demonstrated that a fatal disease of the fowl in Brazil is due to a Spirochæta which is transmitted through the agency of a tick (*Argas miniatus*), and this is capable of conveying the disease even six months after feeding on infected blood. These Spirochætæ multiply in the tick, and are present in large quantities in its body cavity throughout this period. These observations are very suggestive, since they demonstrate the long persistence of the parasites in their carriers, and render it probable that they will be found to be harboured much longer. Finally, the finding this year of *Spirochaeta pallida* in syphilis by Schaudinn and others in man, and by Metschnikoff and Roux in experimentally infected apes, cannot escape a passing notice.

It is of some interest to note that the close blood-relationship existing between the apes and man, demonstrated independently by means of the precipitins by Grünbaum and myself, served as a direct incentive for the experiments of Metschnikoff and Roux, Lassar, and Neisser, which proved that human syphilis is communicable to the chimpanzee and ourang outang.

Of interest has also been the further discovery this year of a number of new protozoal parasites in the blood of different animals, in addition to numerous new species of Trypanosoma. I refer to new forms called "Leucocytozoa" because they inhabit the white blood corpuscles of their vertebrate hosts. Leucocytozoa were first discovered by Bentley in dogs in India, and were described, without sufficient mention of this fact, by James. Another species has been found by A. Balfour in the rat (*M. decumanus*) in Khartoum; and lastly, W. S. Patton informs me that he has found a species in the squirrel (*Sciurus palmarum*) in India, and apparently observed developmental forms thereof in a louse. Balfour has, moreover, described a new Hæmogregarine occurring in the jerboa (*Jaculus jaculus*), and Graham-Smith in our laboratory has found another new endoglobular parasite in the mole. This by no means exhausts the "finds" of this year, but it will suffice to show that British workers are doing their share in furthering our knowledge in this regard.

Of the diseases due to Vermes I can say but little. The discovery of Catto's Schisostomum in this laboratory is familiar to you all. It is interesting to note, following on the experiments with *Ankylostoma duodenale* by Loos, proving that the embryo worm can infect by penetrating through the skin, that Boycott in London and Tenholt in Germany have confirmed the fact this year in two experiments conducted on medical men who volunteered for the purpose.

Again, it is apparent that the subject of immunity in relation to protozoal diseases is proving to be one of great difficulty, and the results hitherto obtained indicate that new methods will have to be devised if the problem is to be solved from a practical, and still more so from a scientific, standpoint. It is also obvious in this connection that the problems before us can only be solved by animal experiment, and this accentuates the need of our giving an increasing amount of attention to comparative pathology as we push on toward the alleviation of the ills to which our own flesh is heir.

Many matters have necessarily been left untouched, including even such important diseases as yellow fever and Malta fever, on which active work has been done. My object has been to seize upon a few salient facts with the view of showing how much has been accomplished within a short period, and how great are the opportunities of the workers in this school who are destined to labour in new fields in different parts of the world. Perhaps what I have said—in no spirit of presumption—will serve as an incentive to some of my hearers. Let me conclude with some wise words from the Talmud:—

> "The day is short and the work is great.
> It is not incumbent upon thee to complete
> the work, but thou must not therefore
> cease from it."

THE MECHANICS OF THE ASCENT OF SAP IN TREES.[1]

THE following remarks, relating to one of the most powerful and universal of the mechanical operations of organic nature, are based mainly on the numerous experimental results reported in Dr. A. J. Ewart's recent memoir.[2] Their chief object is to assert the view that we are not compelled to suppose the sap, in the column of vessels through which it rises, to be subject to the great actual pressure, amounting in high trees to many atmospheres, that is sometimes postulated. It is hardly

[1] By Prof. J. Larmor, Sec. R.S. Paper received at the Royal Society on June 29.

[2] *Roy. Soc. Proc.*, vol. lxxiv. p. 554; *Phil. Trans.*, B, vol. cxcviii. p. 41.

necessary to remark that the problem of the rise of sap is one of mechanics, in so far as concerns the mode of the flow and the propelling power.

Contrary to the view above referred to, it seems not unreasonable to consider that the weight of the sap in each vessel is sustained in the main by the walls and base of that vessel, instead of being transmitted through its osmotically porous base to the vessels beneath it, and thus accumulated as hydrostatic pressure.

We could in fact imagine, diagrammatically (as happens in ordinary osmotic arrangements), a vertical column of vessels, each provided, say, with a short vertical side-tube communicating with the open air, in which the pressure is adjusted from moment to moment, and yet such that the sap slowly travels by transpiration from each vessel to the one next above, through the porous partitions between them, provided there is an upward osmotic gradient, *i.e.* if the dissolved substances are maintained in greater concentration in the higher vessels.[1] This difference of density must be great enough, between adjacent vessels, to introduce osmotic pressure in excess of that required to balance the head of fluid in the length of the upper one, into which the water has to force its way. Thus, in comparing vessels at different levels, the sap must be more concentrated in the upper ones by amounts corresponding to osmotic pressure more than counteracting the total head due to difference of levels, in order that it may be able to rise. As osmotic pressure is comparable with gaseous pressure for the same density of the molecules of the dissolved substance, the concentration required on this view is considerable, though not very great.

Such a steady gradient of concentration could apparently, on the whole, become self-adjusting, through assistance from the vital stimuli of the plant, for concentration in the upper vessels is promoted by evaporation. Yet pressures in excess or defect of the normal atmospheric amount might at times accumulate locally, the latter giving rise to the bubbles observed in the vessels, through release of dissolved gases.

It may be that this assumes too much concentration of dissolved material in the sap, *as it exists inside the vessels of the stem*, to agree with fact. In that case the capillary suction exerted from the nearest leaf-surface might be brought into requisition, after the manner of Dixon and Joly, to assist in drawing off the excess of water from the vessels. The aim proposed in this note is not to explain how things happen, which is a matter for observation and experiment, but merely to support the position that nothing abnormal from the passive mechanical point of view need be involved in this or other vital phenomena.

As regards estimating the amount of flow, at first sight it may not appear obvious, *a priori*, that the transpiration through a porous partition or membrane, due to osmotic gradient, is equal or even comparable in amount to what would be produced, with pure water, by a hydrostatic pressure-head equal to the difference of the osmotic pressures on the two faces of the partition. But more exact consideration shows that, on the contrary, osmotic pressure is *defined* by this very equality;[2] it is that pressure-difference which would produce such an opposite percolation of water as would just balance the direct percolation due to the osmotic attraction of the salt-solution.

[1] Thus, in an ordinary osmotic experiment with a **U**-tube, the percolation of water through the plug gradually *produces* a difference of hydrostatic pressure on its two faces, which is *sustained* by the fixity of the plug itself, but would be at once neutralised if the plug were free to slide in the tube. This increase of volume of the salt-solution, by the percolation of pure water into it, is on the van 't Hoff analogy correlated with the free expansion of the molecules constituting a gas. It goes on with diminished speed under opposing pressure, until a definite neutralising pressure is reached, inaptly called the osmotic pressure of the molecules of the solute, which just stops it, while higher pressures would reverse it. The stoppage is due to the establishment of a balance between the amounts of water percolating one way under osmotic attraction, and the opposite way under hydrostatic pressure. The pressure established, *e.g.* in an organic cell immersed in salt-solution, is thus really the reaction which is set up against the osmotic process. That process itself is perhaps more directly and intelligibly described as the play of osmotic affinity or attraction, even though it must be counted as of the same nature as the affinity of a gas for a vacuum. *Cf. Proc. Camb. Phil. Soc.*, January, 1897, or Whetham's "Theory of Solution," p 109.

[2] See preceding footnote.

It would, however, appear that the great resistance to flow offered by what botanists call Jamin-tubes, viz. thin liquid columns containing and carrying along numerous broad air-bubbles, is conditioned mainly by the viscosity of the fluid, and involves only indirectly the surface-tension of the bubbles. In fact, the resistance to flow may be expected to remain much the same if each bubble were replaced by a flat solid disc, nearly but not quite fitting the tube. Its high value arises from the circumstance that the mass of liquid between two discs moves on nearly as a solid block when the flow is steady, so that the viscous sliding has to take place in a thin layer close to the wall of the tube, and is on that account the more intense, and the friction against the tube the greater. The increased curvature of the upper capillary meniscus of the bubble is thus merely a gauge of the greater intensity of the viscous resistance instead of its cause, and modification of the surface-tension cannot be involved as a propelling power. The experimental numbers given by Dr. Ewart show that, even where the vessels are largely occupied by bubbles, the greater part of the resistance to active transpiration still resides in the partitions between them.

If the osmotic gradient, assisted possibly by capillary pull at the leaf-orifices, is insufficient to direct a current of transpiration upward, *capillary* alterations inside the vessels, arising from vitally controlled emission and absorption of material from the walls, cannot be invoked to assist: rather it must be *osmotic* alterations from one vessel to the next, of, so to speak, a peristaltic character, that might thus come into play. But any such alteration (of either kind) will involve local supply of energy. Is there a sufficient fund of energy, latent in the stem, to provide permanently the motive power for the elevation of the sap? In what form could this energy get transported there? The energies of the plant-economy come from the sunlight absorbed by the leaves. The natural view would appear to be that the work required to lift the sap is exerted at the place where the energy is received, and that it operates through extrusion of water by evaporative processes working against the osmotic attraction of the dissolved salts; while the maintenance of equilibrium along the vessels of the balanced osmotic column, with its semi-permeable partitions, demands that an equal amount of water must rise spontaneously to take the place of what is thus removed.

The subject might, perhaps, be further elucidated by observation of the manner in which the flow is first established at the beginning of the season, or possibly by experiments on the rate at which water would be absorbed by a wounded stem high above the ground.

EXPERIMENTS WITH THE LANGLEY AËRODROME.[1]

THE experiments undertaken by the Smithsonian Institution upon an aërodrome, or flying machine, capable of carrying a man have been suspended from lack of funds to repair defects in the launching apparatus without the machine ever having been in the air at all. As these experiments have been popularly, and of late repeatedly, represented as having failed on the contrary, because the aërodrome could not sustain itself in the air, I have decided to give this brief though late account, which may be accepted as the first authoritative statement of them.

It will be remembered that in 1896 wholly successful flights of between one-half and one mile by large steam-driven models, unsupported except by the mechanical effects of steam engines, had been made by me. In all these the machine was first launched into the air from "ways," somewhat as a ship is launched into the water, the machine resting on a car that ran forward on these ways, which fell down at the extremity of the car's motion, releasing the aërodrome for its free flight.

In the early part of 1898 the Board of Ordnance and Fortification of the War Department allotted 50,000 dollars for the development, construction, and test of a large aëro-

[1] Abridged from a paper by Dr. S. P. Langley in the Smithsonian Report for 1904.

drome, half of which sum was to be available immediately and the remainder when required.

The flying weight of the machine complete, with that of the aëronaut, was 830 pounds; its sustaining surface, 1040 square feet. It therefore was provided with slightly greater sustaining surface and materially greater relative horse-power than the model subsequently described which flew successfully. The brake horse-power of the engine was 52; the engine itself, without cooling water, or fuel, weighed approximately 1 kilogram to the horse-power. The entire power plant, including cooling water, carburettor, battery, &c., weighed materially less than 5 pounds to the horse-power. Engines for the large machine and for a model of the large machine one-fourth of its linear dimensions were completed before the close of 1901, and they were immediately put in their respective frames, and tests of them and of their power-transmission appliances were begun.

A test of the quarter-size model in actual flight was made on August 8, 1903, when the machine worked most satisfactorily, the launching apparatus, as always heretofore, performing perfectly, while the model, being launched directly into the face of the wind, flew directly ahead on an even keel. The balancing proved to be perfect, and the power, supporting surface, guiding, and equilibrium-preserving effects of the rudder also. The weight of the model was 58 pounds, its sustaining surface 66 square feet, and the horse-power from 2½ to 3. This was the

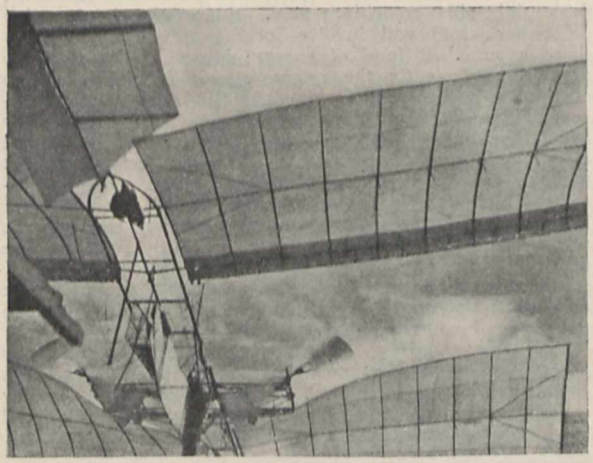


FIG. 1.—Reproduction of an instantaneous photograph, taken from the boat itself and hitherto unpublished, showing the aërodrome in motion before it had actually cleared the house boat. On the left is seen a portion of a beam, being a part of the falling ways in which the front wing was caught, while the front wing itself is seen twisted, showing that the accident was in progress before the aërodrome was free to fly.

first time in history, so far as I know, that a successful flight of a mechanically sustained flying machine was made in public.

Serious delays in the testing of the small machine were caused by changed atmospheric conditions, but they proved to be almost negligible compared with what was later experienced with the large one.

On October 7, 1903, the weather became sufficiently quiet for a test. In this, the first test, the engineer took his seat, the engine started with ease and was working without vibration at its full power of more than 50 horse, and the word being given to launch the machine, the car was released and the aërodrome sped along the track. Just as the machine left the track, those who were watching it, among whom were two representatives of the Board of Ordnance, noticed that the machine was jerked violently down at the front (being caught, as it subsequently appeared, by the falling ways) (Fig. 1), and under the full power of its engine was pulled into the water, carrying with it its engineer. When the aërodrome rose to the surface it was found that while the front sustaining surfaces had been broken by their impact with the water, yet the rear ones were comparatively uninjured. As soon as a full examination of the launching mechanism had been made, it was found that the front portion of the machine had caught on the launching car, and that the guy post, to which were fastened the guy wires which are the main strength of the front surfaces, had been bent to a fatal extent. The machine, then, had never been free in the air, but had been pulled down as stated.

On December 8, 1903, a test was made at Arsenal Point, quite near Washington, though the site was unfavourable. The engine being started and working most satisfactorily, the order was given by the engineer to release the machine, but just as it was leaving the track another disaster, again due to the launching ways, occurred. This time the rear of the machine, in some way still unexplained, was caught by a portion of the launching car, which caused the rear sustaining surfaces to break, leaving the rear entirely without support, and it came down almost vertically into the water.

Entirely erroneous impressions have been given by the account of these experiments in the public Press, from which they have been judged, even by experts, the impression being that the machine could not sustain itself in flight. It seems proper, then, to emphasise and to reiterate, with the view of what has just been said, that the machine has never had a chance to fly at all, but that the failure occurred on its launching ways; and the question of its ability to fly is consequently, as yet, an untried one.

There have, then, been no failures so far as the actual test of the flying capacity of the machine is concerned, for it has never been free in the air at all. The failure of the financial means for continuing these expensive experiments has left the question of their result where it stood before they were undertaken, except that it has been demonstrated that engines can be built, as they have been, of little more than one-half the weight that was assigned as the possible minimum by the best builders of France and Germany; that the frame can be made strong enough to carry these engines, and that, so far as any possible prevision can extend, another flight would be successful if the launching were successful; for in this, and in this alone, so far as is known, all the trouble has come.

The experiments have also given necessary information about this launching. They have shown that the method which succeeded perfectly on a smaller scale is insufficient on a larger one, and they have indicated that it is desirable that the launching should take place nearer the surface of the water, either from a track upon the shore or from a house boat large enough to enable the apparatus to be launched at any time with the wings extended and perhaps with wings independent of support from guys. But the construction of this new launching apparatus would involve further considerable expenditures that there are no present means to meet; and this, and this alone, is the cause of their apparent failure.

Failure in the aërodrome itself or its engines there has been none; and it is believed that it is at the moment of success, and when the engineering problems have been solved, that a lack of means has prevented a continuance of the work.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The number of first-year students matriculated on Saturday, October 21, was 1008. Last year at the same date the number was 884. With those matriculated during the Lent and Easter terms, the total for the civil year 1905 is 1039; but this number will be slightly increased, as several freshmen were unable to attend on Saturday. Hitherto the largest entry has been 1027, in the year 1890. The number of medical students is 117; there is also a large entry of engineering students and of candidates for the economics tripos.

The professor of mineralogy has, with the consent of the Vice-Chancellor, re-appointed Mr. A. Hutchinson, of Pembroke College, to be demonstrator in mineralogy and assistant curator for five years from January 1, 1906.

The special board for biology and geology has nominated Mr. F. A. Potts, of Trinity Hall, to use the university table at Naples for six months as from October 1, 1905.

A university lectureship in mathematics is vacant by the resignation of Mr. Jeans, who has accepted a professorship at Princeton University, New Jersey. The general board of studies will shortly proceed to appoint a lecturer to hold office from Christmas, 1905, until Michaelmas, 1910. The annual stipend is 50*l*. The lecturer will be expected to lecture on applied mathematics. Candidates are requested to send in their applications, with statements of the branches of mathematics in which they are prepared to lecture, and with testimonials if they think fit, to the Vice-Chancellor on or before November 6.

Science announces that New York University has received 5000*l*. by the will of the late William A. Wheelock.

SOME excellent views of the plant and equipment of the workshops and laboratories at Birmingham University are given in illustration of a series of articles by Mr. C. Alfred Smith in *Engineering*.

DR. ALEXANDER MCKENZIE, lecturer and senior demonstrator in the University of Birmingham, has been appointed head of the chemical department at the Birkbeck College in succession to Dr. John E. Mackenzie, who has accepted the appointment of principal of the Technical Institute, Bombay.

THE Ontario Government has selected, says *Science*, the following men to compose a commission to report on the proposed reorganisation of the University of Toronto:—Prof. Goldwin Smith, Sir William Meredith, Messrs. A. H. N. Colquhoun, Byron E. Walker, J. W. Flavelle, the Rev. Canon Cody, and the Rev. D. B. Macdonald.

THE classes in craft instruction in photography and process work at the Regent Street Polytechnic were inaugurated by a social re-union on October 17. We notice the time-table for the present session includes classes in practical and technical photography, studio operating, retouching, finishing in colours, photo-engraving, and in colour photography.

THE Bishop of Birmingham, delivering the presidential address to the members of the Midland Institute at Birmingham on October 13, took for his subject "What is an Educated Man?" He said the uneducated man is without an ideal, consciously held and deliberately striven after. He may be a specialist of trained faculty, but, if he has no general ideal enabling him to give his special subject its place in human progress as a whole, he remains a trained specialist rather than an educated man. The educated man knows something of modern scientific method and achievement. Then the world becomes to him the scene of great constant forces which admit of being guided and directed and combined to promote the purpose of human progress. A man to become educated need not have time to read much, if he reads the right books. He ought to know some one other language than his own, and enlarge his study in some other literature. A man who has read carefully any one of the works of Darwin will know what real scientific caution is, coupled with the widest power of hypothesis.

A COPY of the annual report of the Glasgow and West of Scotland Technical College has been received. The total expenditure to date on the site, building, and equipment of the first section of the new building, the memorial stone of which was laid by the King two and a half years ago, has been 163,060*l*.; the building and equipment fund now stands at 209,763*l*., of which 198,845*l*. has been received. The small balance available after payment of the liabilities already incurred is not sufficient to enable the governors to proceed with the remaining section of the building, but it is hoped that they will soon be placed in a position to complete the scheme originally proposed. In addition to the subscriptions to the building and equipment fund, the college will receive a legacy of 20,000*l*. under the will of the late Mr. James Donald, and also the residue of his estate. This welcome addition to the resources of the college is to be used in the development of the facilities already existing for the study of chemistry and mechanics. The scheme for the coordination of certain of the continuation classes conducted by the school boards of Glasgow and Govan with the corresponding classes in the college was in force during last session, but did not work so satisfactorily as was anticipated. The necessity for a closer linking together of the two systems was felt, and an officer of the college has been appointed as superintendent of the continuation classes concerned, whose principal duty is to keep in close touch with the teachers, both of the college and the school boards, and whose active mediation will, it is hoped, secure the carrying out of the scheme of work agreed upon.

SOCIETIES AND ACADEMIES.

LONDON.

Entomological Society, October 5.—Mr. F. Merrifield, president, in the chair.—Mr. E. **Harris** showed living larvæ of *Cordylomera saturalis*, taken from a log of mahogany imported from the Sekondi district of the Gold Coast, together with the perfect beetle, which was dead at the time the discovery was made.—Mr. A. T. **Rose** exhibited a remarkable melanic specimen of *Catocala nupta*, taken by Mr. Lewis in his garden at Hornsey, N., in September. The coloration of the lower wings was of a dull brown, and all the markings of the upper wings were strongly intensified.—Mr. N. H. **Joy** brought for exhibition Coleoptera taken during a three days' trip to Lundy Island in August, including *Melanophthalma distinguenda*, Con., a species new to Britain; *Stenus ossium* var. *insularis*, a variety apparently new to science; and *Ceuthorrhynchus contractus* var. *pallipes*, Crotch, peculiar to the island. One hundred and sixty-three species were taken on the island, about eighty of which are not recorded in Wollaston's and F. Smith's lists of Lundy Coleoptera.—Mr. A. **Sich** showed examples of *Argyresthia illuminatella*, Z., two of the four specimens taken near Hailsham, Sussex, on June 15 this year. They were beaten off Pinus, and until examined with a lens were supposed to be *Ocnerostoma piniariella*, of which species two were also exhibited for comparison.—Mr. W. J. **Lucas** exhibited the larva, cocoon, and the subsequent imago of an "ant-lion," *Myrmeleo formicarius*, from two Spanish larvæ given him by Dr. T. A. Chapman last autumn. The difference in size between the small larva and the large perfect insect was remarkable. He also showed a living ♀ of the rather scarce grasshopper *Stenobothrus rufipes*, taken in the New Forest at the end of August, and kept alive by feeding on grass.—Mr. G. C. **Champion** exhibited several examples of *Lymexylon navale*, L., from the New Forest, where it was not often found.—Mr. A. H. **Jones** showed series of *Lycaena argus* (*aegon*, Schiff.), var. *hypochiona*, taken on the North Downs this year, approaching the form of *L. argyrognomon* taken not uncommonly in the Rhone Valley. Together with these he had arranged for comparison typical British *L. argus*, L., *L.* var. *corsica*, from Tattone, Corsica, and a series of *L. argyrognomon*, Brgstr. (*argus*, auctorum), from Chippis, near Sierre.—Colonel J. W. **Yerbury** exhibited specimens of *Hammerschmidtia ferruginea*, Fln., from Nethy Bridge, the first authentic British specimens; also *Microdon latifrons*, Lw., a specimen of which, taken at Nethy Bridge June 18, 1900, he had wrongly identified as *M. devius*, and under this name it was recorded in Verrall's "British Flies"; and of *Chamaesyrphus scaevoides*, Fln., a single specimen swept on June 15 in the Abernethy Forest near Forest Lodge.—Mr. H. J. **Turner** exhibited series of four species of the genus Coleophora, *C. alcyonipennella*, *C. lixella*, *C. albitarsella*, and *C. badiipennella*, together with the larval cases mounted *in situ* on the ruined leaves of their respective food plants. He also exhibited living larvæ and their cases, of *Goniodoma limoniella* on *Statice limonium*, *Coleophora obtusella* on *Juncus maritimus*, and *C. glaucicolella* (?) on *Juncus glaucus*, found in the Isle of Wight.—Commander J. J. **Walker** read a paper by Mr. A. M. Lea entitled "The Blind Coleoptera of Australia and Tasmania," and exhibited specimens of *Illaphanus stephensi*, Macl., from Watson's Bay, Sydney, N.S.W., and *Phycochus graniceps*, Broun, and *P. sulcipennis*, Lea, from Hobart, Tasmania.

MANCHESTER.

Literary and Philosophical Society, October 17.—Sir William H. Bailey, president, in the chair.—The "shadow bands" seen during the total eclipse observed at Burgos, in Old Castile, on August 30: T. **Thorp**.—Inaugural address: the **President** (see p. 637).

PARIS.

Academy of Sciences, October 16.—M. Troost in the chair.—On the absolute desiccation of vegetable products: L. **Maquenne.** It is commonly assumed that when a substance has been heated in an air oven at 100° C. to 120° C. until its weight becomes constant, all the moisture has been driven off. The author shows that this is not the case for substances such as starch and flour. For complete drying, either a current of well dried gas must be passed over the starch at about 120° C., or it must be sealed up in a vacuum with a dehydrating agent for a long period.—Presentation of the twelfth volume of the "Mémorial du Dépôt général de la Guerre": Bouquet **de la Grye.** This volume includes the measurements of the new meridian of France from the bases of Paris, Perpignan, and Cassel. Attention is directed to the accuracy of the results obtained.—Preliminary note on the observation of the total solar eclipse of August 30 made at Guelma: MM. **Bourget** and **Montangerand.** Fifteen photographs were obtained during totality, different coloured screens being interposed. The plates are all good, and show excellent images of the corona and protuberances.—Observations on the total eclipse of the sun of August 30: J. Comas **Solá.** The observations, which were made at Vinaroz, included three photographs of the corona and of the spectra of the chromosphere.—On functions having a finite number of branches: Georges **Rémoundos.**—On the calculation of an arch in masonry: M. **Auric.**—On a phenomenon of cooling observed in silver wires plunged into water and through which electric currents are passing: E. **Rogovsky.** It is shown that the resistance of the wire depends on the magnitude of the current passing through it, this effect being due to the fact that all parts of the wire are not, under these conditions, at the same temperature. It is necessary, to obtain exact values of the resistance of wires in a liquid at the temperature of this liquid, to extrapolate from a series of observations made with different intensities of current.—On the functions of lightning conductors: G. M. **Stanoïévitch.**—The basic character of pyranic oxygen. Halogen compounds of dinaphthopyryl with metals and metalloids: R. **Fosse** and L. **Lesage.** The radical dinaphthopyryl, $-CH\begin{matrix}C_{10}H_6\\C_{10}H_6\end{matrix}>O$, although not containing nitrogen, forms a large number of double salts, examples of which with platinum, lead, iron, zinc, tin, bismuth, arsenic, and antimony are given in the present note.—On the development of amylase during the germination of seeds: Jean **Effront.** The sugar-forming and liquefying powers of malt do not develop at the same rate during germination, the former being the more rapid and reaching a maximum, whilst the latter steadily increases with the time of germination.—The measurement of the mechanical work obtainable from Limousin cattle: M. **Ringelmann.**—On a new flagellated parasite of *Bombyx mori* (*Herpetomonas bombycis*): C. **Levaditi.**

NEW SOUTH WALES.

Royal Society, September 6.—Mr. H. A. Lenehan, president, in the chair.—Reinforced concrete, paper iii.: Prof. W. H. **Warren.** The following matters were dealt with:—(*a*) The adhesion of cement mortar and concrete to steel. (*b*) The experimental determination of the neutral axis in a plain concrete, and also in a reinforced concrete beam, and the curves of strain for loads increasing from zero to the load producing fracture; the determination of the true form of the stress curve from the actual strain curve in a plain and in a reinforced concrete beam. (*c*) The safe working stresses and the fundamental equations recommended for the design of reinforced concrete structure.—The occurrence of inclusions of basic plutonic rocks in a dyke near Kiama: C. A. **Sussmilch.**

DIARY OF SOCIETIES.

FRIDAY, OCTOBER 27.

PHYSICAL SOCIETY, at 5.—The Theory of Phasemeters: Dr. W. E. Sumpner.—Apparatus designed for measuring the Coronal Radiation during an Eclipse: Prof. H. L. Callendar, F.R.S.

SATURDAY, OCTOBER 28.

THE ESSEX FIELD CLUB, at 6.30 (at the Essex Museum of Natural History, Stratford).—Straw-Plaiting; a Lost Essex Industry: J. Chalkley Gould.

TUESDAY, OCTOBER 31.

FARADAY SOCIETY, at 8.—*Discussion.*—Alternate Current Electrolysis: Prof. Ernest Wilson.—Alternate Current Electrolysis as shown by Oscillograph Records: W. R. Cooper.—Note on the Crystalline Structure of Electro-deposited Copper: Prof. A. K. Huntington.—Some Observations Respecting the Relation of Stability to Electrochemical Efficiency in Hypochlorite Production: W. Pollard Digby.

WEDNESDAY, NOVEMBER 1.

ENTOMOLOGICAL SOCIETY, at 8.

SOCIETY OF PUBLIC ANALYSTS, at 8.—(1) A Rapid Method for the Determination of Tin in Copper-Tin Alloy; (2) Water from the Simplon Tunnel: A. G. Levy.—Notes on (1) Dika Oil; (2) Suran Fat: J. Lewkowitsch.—The Determination of Oxygen in Copper: L. Archbutt.

THURSDAY, NOVEMBER 2.

CHEMICAL SOCIETY, at 8.30.—Solution and Pseudo-solution, part iv., Some of the Arsenious Properties of Arsenious Sulphide and Ferric Hydrate: E. Linder and H. Picton.—The Molecular Conductivity of Water: P. Blackman.—The Stereoisomerism of Substituted Ammonium Compounds: H. O. Jones.—The Influence of very Strong Electromagnetic Fields on the Spark Spectra of Ruthenium, Rhodium, and Palladium; J. E. Purvis.—Note on the Fluorides of Selenium and Tellurium: E. B. R. Prideaux.—The Constitution of Glutaconic Acid: J. F. Thorpe.—Some Alkyl Derivatives of Glutaconic Acid and of 2:6-Dioxypyridine: H. Baron and J. F. Thorpe.—Note on the Formation of β-Methylglutaconic Acid and of αβ-Dimethylglutaconic Acid: F. V. Darbishire and J. F. Thorpe.

LINNEAN SOCIETY, at 8.—Plant Ecology, interpreted by Direct Response to the Conditions of Life: Rev. G. Henslow.

RÖNTGEN SOCIETY, at 8.15.—The Ruhmkorff Coil: Prof. Wertheim-Salomonson.

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