THURSDAY, JANUARY 8, 1903.

FIRE PREVENTION.

Facts on Fire Prevention. Edited by Edwin O. Sachs. 2 Vols. Vol. i., pp. xxvii + 219; vol. ii., pp. vi + 226. (London: Batsford, 1902.)

THERE is so much solid matter in these works and such an amount of detail beyond the scope of an ordinary review that at first sight it seems difficult to summarise the whole; but an effort may be made to bring out the essential points sufficiently to indicate the general purport of the important subject dealt with in the 445 pages and the numerous illustrations contained in the two volumes under notice.

The principle adopted by the British Fire Prevention Committee is to give actual results of a number of practical investigations into materials and systems of construction, without commenting on or recommending any individual material or method, leaving entirely to those interested in buildings to judge for themselves as to how far such materials or methods accord with their individual requirements or specific works.

Of this principle as here enunciated almost in the Committee's own words, entire approval may be accorded; but when they go on to add that the adoption of remedies for existing defects can only be attained by the aid of legislation, meaning, of course, additional legislation, a totally new subject comes under consideration, on which it is necessary to join issue.

A careful study of the existing building laws, at least in London, goes to show that what is wanted is not so much new legislation as the faithful, firm, honourable and scrupulous execution of the present laws.

In short, it comes to this. The laws have been carefully thought out and, though not perfect, are quite sufficiently clear to justify responsible public bodies in carrying them out with strictness; but the responsible bodies are timid, not to say cowardly or worse, and the result is that everyone who chooses to fly in the face of the legal ordinances obtains some sympathetic approval from the general public and, what is much more unfortunate, occasional specific support from certain members of the public body charged with the duty of carrying out the orders of the legislature.

One of the most extraordinary and discreditable characteristics of our time is that every public body from the highest to the lowest now seems to contain a few members whose boast it is to oppose in every possible way the known intentions of the legislature, even in the special matters which the legislature has delegated to their charge.

This may seem to be a digression from the subject, but a brief explanation may be offered.

In America, the building laws are absolutely perfect. Even the Code Napoléon, the most complete of all, and, in fact, the model of all, was not more perfect, if there can be degrees in perfection, and yet in America, with an expenditure on fire appliances unparalleled elsewhere, the losses by fire are so heavy as to bring fire-insurance companies almost to despair and outlying communities occasionally to ruin.

It is not too much to hope that the time is coming when we can look with confidence and satisfaction to the honourable and rigid execution of our existing laws—in short, to the honesty and courage of those responsible for carrying out the duties which they have undertaken.

This is a point on which it is necessary to express a disagreement from the views of the British Fire Prevention Committee.

The Committee says that the Building Act of the Metropolis requires material revision and that opportunity should be taken to restrict change of purpose in buildings from that for which they were originally constructed; but to a thoughtful and experienced reader of the existing laws, it would appear that all such subjects have been sufficiently dealt with, and that it only requires honest and straightforward action on the part of the executive to carry out the undoubted intentions of the legislature.

This seems to be the great difficulty, the only real difficulty, at the present time, but it is very serious.

Consideration for interested individuals appears to be greater than consideration for communities, and all the weaker members of public bodies seem to lean towards concessions and immunities, although their position and sworn acceptance of duty to carry out existing laws admit of no mitigation or modification.

If ever there are found men in this country, as it may be assumed there will be in time, determined to carry out faithfully and rigidly the laws under which they are embodied, a great change will be observed; until then we must wait and hope, but we do hope with confidence.

The practical methods of testing building materials and modes of construction adopted by this Committee are most complete, and the results are consequently trustworthy.

In "Facts on Fire Prevention," it is stated that for the reduction of loss by fire two remedies are to be found—one, better building construction, the other, more efficient methods of extinguishing fires—and with the latter the present work is stated "to have nothing to do on this occasion," a wise limitation on the part of those concerned, as it is highly improbable, indeed almost impossible, that they can have had experience in the difficult business of extinguishing conflagrations.

The following tests are selected from the very large number detailed in the books:—

"*A Floor of Solid Wood Beams.*

"*Object of Test.*

"To record the effect of a smouldering fire of twenty minutes' duration at a temperature not exceeding 500° F., followed by a fierce fire of one hour gradually increasing to a temperature of 2000° F., followed suddenly by the application of a stream of water for five minutes and the consequent rapid cooling.

"The area of the floor was 100 or 10 × 10 superficial feet, and it was loaded with 20lbs. to the square foot.

"*Summary of Effect.*

"The under surface of the wood beams was charred to an average depth of two inches, but beyond this no damage was done."

This was a very instructive test, and another making a comparison between doors of different material and construction gives some important results :—

"*A Wood Door covered with Tinned Steel Plates.*
"*An Iron-framed and Panelled Door.*
"*Object of Test.*

"To record the effect of a fierce fire of one hour gradually increasing to a temperature of 2000° F., followed suddenly by the application for five minutes of a stream of water and consequent rapid cooling.

"The door-openings were approximately 3ft. 9in. by 7ft. 3in., and the doors hung to open inwards—that is towards the fire.

"*Summary of Effect.*

"The wood door covered with tinned steel plates remained in position, but was much buckled and bulged, and the upper part gradually inclined inwards to a considerable extent, permitting the passage of flame. The first spurt of flame over the top of the door was seen after five minutes.

"The iron-framed and panelled door remained in position, but became red hot, buckled and warped considerably together with its rebated frame. The upper corner on the lock side gradually inclined inwards to a considerable extent, permitting the passage of flame. The first spurt of flame was seen after twenty minutes."

The two volumes under consideration contain the following numbers of tests, all of the same elaborate kind as the two selected for quotation, and with excellent illustrations showing the construction of the objects tested and the appearance presented after the tests :—Floors 11, ceilings 2, partitions 11, materials 1, doors 23, glazing 8, fire-curtains 3, making in all 59.

The Fire Prevention Committee intimates that

"In order to ensure the steady continuation and development of its investigations, it is absolutely necessary that it should receive every possible support from public authorities, learned societies, the professions interested, and above all from that great community of industrial firms primarily affected by fire."

It may be hoped that this kind of support will in some manner be afforded, but it has to be remembered that the kind of bodies appealed to can never be expected to move quickly and that some interference on their part would be inevitable ; so that on the whole it may be doubted whether it would have been possible for the Committee within the space of five years, which it gives as the period of its existence, to provide the large amount of information contained in these volumes, if it had been hampered with the collaboration of any external influence.

The volumes under consideration contain much valuable and trustworthy information on a subject quite unknown to the general public and only imperfectly known to many so-called experts, of whom some have taken up one branch, some another, but very few have mastered the details of all.

In conclusion, it may be stated that the volumes entitled "Facts on Fire Prevention" should prove of great assistance to all who have to deal with the preservation of life and property from fire. EMERITUS.

TWO BOOKS ON IMMERSED SHIPS.

Aërial Navigation : a Practical Handbook on the Construction of Dirigible Balloons, Aërostats, Aëroplanes and Aëromotors. By Frederick Walker, C.E. Pp. xvi +151. (London : Crosby Lockwood and Son, 1902.) Price 7*s.* 6*d.* net.

Submarine Warfare, Past, Present and Future. By Herbert C. Fyfe. With an Introduction by Admiral the Hon. Sir Edmund Robert Fremantle, G.C.B., C.M.G., and a Chapter on the Probable Future of Submarine Boat Construction by Sir Edward J. Reed, M.P. Pp. xxviii + 332. (London : Grant Richards, 1902.) Price 7*s.* 6*d.* net.

THE problems dealt with in these two books have a certain similarity in that in each case the ship, or to use a more general term, the machine or contrivance, has to navigate wholely immersed in the medium for which it is designed, and this similarity is not disturbed by the condition that the submersible may have also to navigate on the upper surface of the sea, for the balloon, and especially the flying machine, equally has to start and to finish at the lower surface of the atmosphere.

There is also a similarity in the two books. The price of each is the same, to wit 7*s.* 6*d.* Here the similarity ends. It would be difficult to find accidentally thrown together two works which might have so much in common, but which make so violent a contrast.

The aërial book is disappointing, to say the least. A large part is taken up with descriptions and illustrations of the schemes of the hopeless crank. These are described as seriously as the few attempts which have been made by engineers and others on sounder lines, and the reader is left without guidance as to how much is worthy of sober consideration. An appearance of precision is imparted by the introduction of a large number of formulæ and of tables calculated from them the accuracy of which it does not seem necessary to examine. It is a little remarkable that with such an extended title the author should not have thought the names of Lilienthal and of Pilcher worth mentioning. The dreariness of this practical handbook is slightly relieved by some diagrams of the machine of Santos Dumont and by quite a nice frontispiece showing the rounding of the Eiffel Tower.

In his "Submarine Warfare," Mr. Fyfe has in effect collected and produced a series of essays, partly historical, partly mechanical and partly of more general interest, on the submarine from different points of view. This is not a text-book in any sense of the term, but a work which anyone of wide interests will read with pleasure. It is not necessary to begin at the beginning and read solidly through lest anything should be lost which would make subsequent chapters unintelligible. The reader may pick and choose first whichever chapter most takes his fancy. The illustrations are numerous and excellent.

There has been considerable doubt in this country whether the submarine will be found a valuable weapon in war, *i.e.* valuable to those who use it, or whether when the time comes to put it to serious trial it will be found more dangerous to the crew than to the ships which it is attacking. It is certain that until very recently this was

a very general opinion here, even though we knew that in France especially the development of the submarine and submersible was being very seriously pursued, and that the trials excited the enthusiasm of the public.

Now, however, that we know that our Government is quietly making its own experiments with submersibles built in this country, and that we have an introduction and a chapter in the book under review written by men of such repute as Sir Edmund Fremantle and Sir Edward Reed, in which the writers show that they are fully alive to the progress and to the great possibilities as well as to the present limitations of this new weapon, we can no longer affect to despise the armed and diving boat, but must at least prove, using the best skill we possess, what is possible both in the way of offence by and of defence against so terrible a weapon. Sir Edward Reed, after referring to the difference in density of the two media water and air, goes on as follows :—

"But it is in the face of this initial and enormous difficulty that the aëronauts of to-day have apparently persuaded themselves that they can successfully float their balloon-ship in mid-air and propel it, not only against the rapid tides of the air in which it floats, but also drive it at a good additional speed. When men are to be found capable of committing their fortunes, and even their lives, to navigation of this kind, it is not surprising to find that the far easier problem of navigating the seas beneath the surface has won the attention and the effort of enterprising men. They certainly have chosen, if the humbler, also the more promising and practical field of operation. I doubt not that they have likewise chosen the more fruitful field."

Passing over a long but interesting chapter on the morality of submarine warfare, we come to one on the mechanism of the submarine which perhaps more than any deals with the numerous scientific problems that arise. One of the troubles of the immersed ship which is not felt on the surface is the terrible effect of a small change in the position of the centre of gravity. For instance :—

"The Nordenfelt boats were certainly not successful in discharging torpedoes, for as a general rule they as nearly as possible stood up vertically on their tails and proceeded to plunge to the bottom stern first on these occasions."

By allowing the torpedo tube to fill with water immediately after the discharge, this difficulty is reduced, but it is almost wholly removed by the invention of Mr. Drzewiecki, who has contrived a clamp to hold a torpedo securely outside the boat, by which it can be turned in any direction from the inside and then be liberated by the pressure of the moving water. As the torpedo has a density nearly that of water, its liberation does not affect the stability of the ship. It has been tried with success at Cherbourg.

Even though the mechanical problems are perfectly solved of the different stabilities, of propulsion, of air maintenance, of torpedo discharge and of rising and of plunging, but not below the fatal depth, there remains the horrible fact that under water a ship is blind. When at the surface or awash, the bearings of the enemy may be taken from the cupola, and after plunging, the compass or the gyroscope alone remain to give the sense of direction ; but a compass is not at its best in such a position. Various optical tubes and telescopic periscopes are used to get some sort of view when the ship is not far from the surface, but to what extent successfully it is difficult to discover. At any rate, it is satisfactory to know that in this country the problem has been attacked by so able an optical engineer as Sir Howard Grubb.

One of the most disturbing chapters is that on the antidote to submarines. Information as to what has been done quietly in this country as elsewhere is, of course, difficult to obtain, but even though a charge of high explosion fired in the water may damage or destroy a submarine that is near enough, it is impossible to feel that there is any reasonably sure method of defence against this insidious weapon, always on the supposition, of course, that the mechanical and optical problems referred to are solved in even a fairly satisfactory way.

C. V. B.

WOLLEY'S COLLECTION OF BIRDS' EGGS.

Ootheca Wolleyana. An Illustrated Catalogue of the Collection of Birds' Eggs formed by the late John Wolley, jun., M.A., F.Z.S. Edited from the Original Notes by Alfred Newton. Part ii., Picariæ—Passeres. (London : R. H. Porter, 1902.)

TO European oologists, the name of John Wolley is both well known and held in great esteem, for not only was he one of our soundest and best ornithologists, especially in the field, but also was one of the first egg collectors who fully realised the extreme importance of securing the identification of the parent bird, of carefully, and if possible indelibly, marking each egg when taken, so as to avoid all risk of error, and of procuring and noting down the fullest possible information respecting each clutch, as well as of collecting a series of specimens to show all the variety of colour, size and shape to which eggs of the same species are subject. Collectors will therefore gladly welcome the present part, which completes the first volume of the "Ootheca Wolleyana."

The first part was published so far back as 1864, but the present part, completing the volume, has been retarded from various causes, though this somewhat long delay cannot be regretted when one realises, from a perusal of the work, how carefully the editor has brought the work up to date.

Wolley commenced the study of natural history at a very early age, and after occupying himself with botany, entomology and the habits of animals generally, he gradually began to pay special attention to oology, until after a trip to Spain in 1845 and a visit to Morocco, where he discovered M. Favier, who afterwards became so well known to ornithologists, he devoted himself chiefly to that branch of science. After his return to England, he several times visited Scotland in order to study birds in the field, especially the rarer species at their breeding places. In 1850, he made an excursion to the Faroes, which had never before been visited by any English naturalist, communicating an account of the ornithology to the British Association. In 1853, he began the work with which his name will always be associated, the investigation of the ornithology of Lapland, of which no

connected account had been published for nearly a century. Guided by geographical considerations, he fixed his headquarters on the banks of the great Muonio River, nearly half-way between the head of the Gulf of Bothnia and the Arctic Ocean, at a little Swedish farm opposite to the Finnish village of Muonioniska, and at once began to explore the country in every direction. These explorations he carried on personally for five summers and three winters, extending them to the Norwegian provinces of Nordland and Finmark, as well as to the western portion of Russian Lapland, not omitting the great lake Enara, which he found to be singularly destitute of bird-life. In all this work, he was greatly aided by a young lad, Ludwig Knoblock, with whom he fortunately fell in immediately on his arrival in the country, and finding him to possess a strong taste for observing natural objects, generally intelligent and, above all, truthful, he took him into his service and by training made him the valuable assistant he proved to be. To his perseverance, naturalists owe the solution, in 1856, of the mystery which had hitherto surrounded the nidification of the Waxwing (*Ampelis garrulus*), sought for as it had been by many travellers and in many countries. Wolley himself was never so fortunate as to see this bird, but the success which rewarded his exertions to obtain the eggs of many until then unknown or little known species can best be realised by those who are well acquainted with the last edition of Hewitson's work on the "Eggs of British Birds," in which so many of the rarities were figured. Wolley took copious notes respecting the various eggs obtained by him or his collectors, which have been most carefully reproduced in the present work, and will be of the greatest interest and use to both cabinet and field naturalists.

In 1858, Wolley, who for years had been carefully studying what was known of the history of the Great Auk (*Alca impennis*), undertook a voyage to Iceland, in company with Prof. Newton, for the purpose of making further investigations. It was assumed that this species was extinct, though no one knew that such was the case or how it had become so. Much information respecting its latter years were obtained, and it was ascertained that the last two living examples were procured at Eldey, on the south-west coast of Iceland, in 1844.

The year following this expedition, Wolley's health began to decline, and his death occurred in 1859 at the early age of thirty-six.

His valuable egg collection passed into the possession of Prof. Newton, who retaining in his service some of Wolley's collectors, has added considerably to it, hence many species are included in the present catalogue which were unknown to Wolley.

Amongst the additional notes from the pen of the editor may be especially noticed those on the nidification of the Nutcracker. Four coloured plates of ninety-seven specimens of eggs are given, which, though excellent reproductions of the various eggs and well illustrating the variation in shape, colour and markings, were, as stated in the introduction, executed some time ago. Four lithographic plates of landscapes also accompany the work, two of which are scenes in Lapland, the third being a view of Eldey, the last home of the Great Auk or Garefowl, and the fourth a view of the Alkenhorn in Spitsbergen.

Last, but not least, is an excellent memoir of Wolley, with a very good portrait of him and one of his head assistant, Ludwig Matthias Knoblock, the perusal of which will give infinite pleasure to many an oologist.

THE WANDERINGS OF A NATURALIST IN SOUTH AMERICA.

The Great Mountains and Forests of South America. By Paul Fountain. Pp. 298. (London: Longmans, Green and Co., 1902.) Price 10*s.* 6*d.* net.

IT was only a few months ago that we reviewed a book by the same author on "The Great Deserts and Forests of North America." We learn from the introduction to the present volume that it was originally intended to form a second part of that work, but, on the advice of the publishers, it was "amplified" to make a separate book. Unfortunately, the process of expansion does not appear to have been very happily carried out. In several cases, statements are repeated almost in the same words, and the volume is eked out by a quantity of miscellaneous matter that has little relation to the rest of the book. But the love of nature and the keen observation of animal life that procured so warm a welcome for Mr. Fountain's description of the deserts of the United States are not wanting when the scene is changed to the great forests of the south.

It was in 1884 that the author left behind him the region with which he has made us familiar and set out on his travels in the southern continent. It is a misfortune that he has allowed so long a time to elapse before giving his experiences to the world. It was inevitable that after the passage of nearly twenty years regrettable inaccuracies should find their way into his pages, and these seriously diminish the value of the book.

Taking Obydos on the Amazon as his base, he ascended the Rio Trombetas and subsequently the Rio Purus and several of its tributaries in a boat he had purchased in Pará, transferring himself to a bark canoe of his own manufacture when the water was too shallow for the larger vessel. After his return to Obydos, we lose sight of him for a time and then find him making his way through the forest of the upper Xingu valley to Diamantino in Matto Grosso, where he again passes out of view to reappear sporadically in Guiana, Ecuador, Colombia, Peru, Bolivia and Chili, and finally take leave of us at Rio de Janeiro.

The author is at his best in the description of his excursions up the smaller tributaries of the Purus in the twilight of the overarching trees. It was there, especially, that he was able to make a close acquaintance with the "jungle folk" of the Amazonian plain, of whom those who travel by only the more frequented ways know but little. His long experience as hunter and collector stood him in good stead, and the variety of the forms of life that he met with will seem marvellous to many who have passed over much of the same ground. He does not pretend, however, to scientific accuracy in the determination of species of animals; it is in the

careful watching of the details of their lives in their natural surroundings that the value of his work consists.

Mr. Fountain arrives at times at strange conclusions, especially with regard to the adaptation of form and colour to purposes of concealment.

"All my experience," he says (p. 78), "tends to show that coloration is at best but a partial protection. It is none whatever to the human eye, and most naturalists incline to the opinion that animals are quicker sighted than men. An inexperienced person may be deceived, the practised hunter never, unless as the result of his carelessness." "Nature's idea is to create a pleasing and curious variety to gratify the eye of man, nothing more" (p. 135).

But his own pages rebuke him. We are told (pp. 124–5) that ant-bears and sloths

"look, even when you are close to them, so much like a bundle of the dried herbage that they often escape the eye of the hunter and would be sure to do that of the novice."

In another place (p. 137), we read that the ant-bear has a habit of turning its large, bushy tail

"over its back in such a manner that when the animal is squatting on the ground, it is completely hid under it and looks like a tuft of dead grass."

And again (p. 165),

"both the two-toed and three-toed sloth . . . so much resemble a cluster of dead, dried-up twigs in the trees that they are not easily discovered except by experienced eyes."

About six days' journey north of Pernatingas, near Diamantino in Matto Grosso, some caves were discovered which would seem to deserve careful examination. The author found the "entire carcass" of an animal in a mass of stalagmite. He attempted to get it out, but it broke in pieces. It was, he states, a species of guanaco of much larger size than any now living. This is, we believe, the first time that the remains of an animal of the llama group have been reported from Matto Grosso, or, indeed, from Brazil. There were also bones that seemed "to have belonged to gigantic jaguars and deer, and many small animals and bats." He conjectures that another animal was

"of the rhinoceros kind, but if so it was of a hornless species. The bones of tapirs were here in great mass, but of species half as big again as the living kind."

We can scarcely expect the discovery of a South American rhinoceros to be verified, but the list forms an appetising menu for an osteologist.

The author's geology must not be taken too seriously, as a reference to an "extensive formation" of "fused quartz" is sufficient to demonstrate; but it is interesting to note that in a valley in Ecuador he met with "a mass of pure native iron half embedded in the ground"—apparently a meteorite. It weighed five or six hundredweight and was "in no way oxidised by exposure to the weather." He found a similar mass "on a plain of moderate elevation, as nearly as it is possible to conjecture in the very centre of the southern continent"—a rather vague locality.

Students of the early history of the South American races will be interested in Mr. Fountain's description of a group of huts formed of large slabs of stone on the shore of a lake near the upper Purus. They are not used by the tribes now inhabiting the country, and were, he believes, constructed by a civilised or semi-civilised people since exterminated.

The illustrations appear to have been drawn to the author's descriptions. Though picturesque and creditable to the artist's imagination, they cannot, of course, claim to have any value as accurate representations of natural objects. J. W. E.

OUR BOOK SHELF.

European Fungus-Flora, Agaricaceae. By G. Massee, F.L.S. Pp. vi + 274. (London: Duckworth and Co., 1902.)

THIS is a condensed synopsis of the mushrooms and toadstools of this and other European countries, and will be of considerable use to expert collectors of these interesting but difficult plants.

The author, in his preface, remarks on the false impression as to the significance of the term "species" which is obtained by studying the fungi of one country only, and he points out that "the Continental species can be sandwiched in between British species."

This statement is well borne out by the contents of the book, in which the European species at present unknown as British are thus packed in between our native forms, and distinctly marked off by square brackets. The method is excellent, and the work, as a whole, well done; but, useful as the book must be to the expert in the field, we are doubtful whether these short definitions of all known species do not increase difficulties for everyone but the expert. Granted that such a work was wanted, we are strongly convinced that an even greater need at present exists for a well-written and accurate account of the relatively few common types or illustrative species, arranged so as to give clearly the principal characteristics of the genera and subdivisions, and familiarise the student with the commoner species, the species being so chosen that the student shall not have to attempt the—to him often impossible—task of discriminating between closely allied and critical forms until he has familiarised himself with the common types.

If *Stropharia siccipes*, Karst., is intermediate between *S. semiglobata*, Batsch., and *S. stercoraria*, Fr., the student is driven to wonder why the three forms are kept as separate species as here defined, and many similar puzzles will arise in the minds of those who find the "species" of Agarics resting on such characters as these short and pithy paragraphs convey. These puzzles will increase as the varieties of such species as *Pluteus cervinus*, Schaeff., and *Agaricus campestris*, L., are compared with species of the genera Hypholoma, Lactarius, Cortinarius, &c.

Excellent as the definitions are, moreover, there are points which require improvement—*e.g.* the genus Lepiota is said to have "Ring present, volva absent" on p. 2; but on turning to p. 7, we read under Lepiota, "Ring free, distinct from the volva." Such ambiguities are trivial to experts, but they are serious difficulties to others, and they could be avoided.

Some questions of termination arise on pp. 206 (bottom) and 227—*e.g.* is it *Ag. rubellus*, Gillet, or *Ag. rubella*, &c.?

In conclusion, the book is fully indexed and carefully arranged, and is well printed on paper so light that, in spite of the thickness of the volume, it can be carried into the field, and it is essentially as a field-book that it can be recommended.

An Introduction to Physiology. By William Townsend Porter, M.D. Part iv. Physiological Optics. Pp. vii + 96. (Cambridge, Mass.: The University Press, 1902.)

THE complaint is often made that the laboratory courses in practical physiology can be of little value to the student, in view of the very limited range of the experiments regarded as possible for a class, and the consequent restriction of the student's attention to one or two chapters of the science. The work before us represents a further step of the creditable effort now being made by Prof. Porter to remove this slur on the practical teaching of physiology and to show that it is possible to give the ordinary student a knowledge of physiology based on his own experience rather than on the mere statement of his teacher or text-book. In this book, comprising less than 100 pages, the student is taught in the first part to determine by experiment the main laws of the reflection and refraction of light, and the formation of the image by convex and concave mirrors, as well as the properties of lenses. In the second part, the physical knowledge so acquired is applied to the determination of the optical qualities of the eye, including the mechanism of accommodation. The last three sections deal with the use of the ophthalmoscope, and its application to the estimation of errors of refraction and other defects in the dioptric mechanisms of the eye.

It would be difficult to imagine a course of study better adapted for the purpose, viz. to give the student of medicine a knowledge which shall fit him for the investigation and diagnosis of the various morbid conditions of the eye. Too many men at present begin to learn their physiological optics only when they are brought face to face with actual cases of disease—a state of things for which the physiological teacher is partly responsible. It is probable that a course such as that laid down by Dr. Porter and extending over about twelve lessons would, if introduced into the London schools, be found to meet a want and would receive appreciation and support. We shall look forward with interest to the appearance of the other parts of this practical physiology, which are to include the special senses, the central nervous system and the whole of chemical physiology. E. H. S.

The Potash Salts; their Production, and Application to Agriculture, Industry and Horticulture. By L. A. Groth. Pp. vi + 291. (London: The Lombard Press, 1902.)

THE Triassic strata yielding potash salts occupy a vast area extending through many of the German States. The potash beds are usually at a considerable depth below the surface. The proving of their occurrence is often a matter of considerable expense and uncertainty, and the establishment of mining operations on a commercial scale may occupy several years. Germany has, however, nearly a monopoly in potash production, and both the production and prices are regulated by a syndicate; the general profitableness of the enterprise is thus guaranteed. The working of a commercial trust is well illustrated by the operations of the Potash Syndicate, one object of which is to supply German consumers with a cheap article while much higher prices are charged to foreigners.

The present book contains a great deal of interesting information as to the potash mines, the mode of working them, the composition of the salts found and the steps taken to prepare various salts for the market. There is also a section of about 100 pages devoted to the use of potash salts for manufacturing purposes, and especially to their use as manures for crops and for garden produce.

The agricultural section is disappointing. No information is given as to the large experience gained in Germany on the use of potash manures in various circumstances; the examples of field experiments quoted are all of them from trials in our own country. The examples selected are naturally those in which the application of potash salts has proved a financial success. Potash manures cannot, however, always be used with profit; on many soils they produce no paying result. Every farmer should, therefore, ascertain by actual experiment what is the effect of potash on his own fields and crops before venturing on any considerable purchase of potash manures.

Nothing is said as to the antiseptic effects of potash salts and their hindrance of the decomposition of farmyard manure. Nothing is also said as to the danger of applying them in spring as a top-dressing to a growing crop, due to the injury caused to the leaves on which the salt falls. The differences in the effects of the various potash salts are also not discussed. Notwithstanding, however, the partial character of the book, it is of real value, as it brings together a great deal of information not easily procured. The use of potash manures in agriculture may doubtless be considerably extended, but, as already stated, the deficiency of the soil in potash should in every case be proved by actual experiment before any use of it is attempted on a large scale.

R. W.

Advanced Hygiene. By A. E. Ikin, B.Sc., L.C.P., and R. A. Lyster, M.B., B.Sc., D.P.H. Pp. 300. (London: W. B. Clive, 1902.) Price 3*s.* 6*d.*

THIS work, though styled "Advanced Hygiene," is only written to provide a second year's course of study of hygiene and public health for those who have mastered the contents of a similar small book by one of the authors, entitled "First Stage Hygiene."

Though the matter dealt with is of a very elementary nature, its treatment often leaves much to be desired. It is in some places incorrect and in others misleading. To give an illustration, the wash-down water-closet is said to differ from the short hopper in that "the basin and trap are in one piece," which remark embraces the whole description of a wash-down water-closet.

Many of the illustrations are concerned with sanitary apparatus and arrangements in and about houses, and most of these are badly drawn and otherwise faulty. (Two of them are actually upside-down.) Jennings's plug water-closet is described as a valve water-closet, and Buchan's trap as Buchanan's. The only water filter for domestic use which is illustrated is the Berkefeld, and of this there are no less than six illustrations—all taken from a trade catalogue.

On occasions, different views are expressed in different parts of the same work. It is stated, for instance, on p. 67, that "it seems to be proved that scarlet fever may be directly transmitted from the cow," while on p. 271 it is said that "there is *a possibility* that cows may suffer from a disease akin to scarlet fever." Further, on p. 140, one reads that "the soil *may contain a number of micro-organisms*," while on p. 220 it is (correctly) stated that "the surface soil to the depth of 3 or 4 feet *swarms with bacteria.*"

The analytical notes are of little value, and in many respects they are faulty. In a statement of the particulars to be obtained in a quantitative chemical analysis of water, no mention is made of the estimation of chlorine (p. 243).

Material of Machines. By Albert W. Smith. Pp. v + 103. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1902.) Price 4*s.* 6*d.*

As the life of a machine tool very largely depends upon the nature and quality of the material used in its construction, it is evident that a treatise on this important

subject will be of much use to machine-tool makers. The book under notice is well worth studying; it gives an able description of the metallurgy of iron and steel; it deals with the subject in a concise manner and contains much useful general information. The subject is approached from a scientific point of view, and this is as it should be. Special tool steels are now coming very rapidly to the front; in fact, "Mushet," so long the sheet anchor of the machine shop, is being displaced by these special steels, which only require hardening in a blast of compressed air, thus getting over the risk of cracks due to water hardening and doing infinitely more work. Machine tools have now to be designed to meet the requirements of these new tool steels, more power being required to take the heavier cuts rendered possible by their use. The volume contains much unusually accurate information, but in section 72 we read that the piston rod of a steam engine is of "mild steel"; if a forty-ton steel can be called "mild," then the reviewer is with the author; the same may be said of material for crank pins. Taken as a whole, we can recommend this book. Students of machine design should study it, and those of metallurgy will not waste their time by doing so.

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.*]

Traces of Past Glacial Action in the Orange River Colony, South Africa.

THE subject of glaciation in South Africa is so interesting and important that I venture to take an early opportunity of directing the attention of geologists to the farm of Brit Koppje, situated about three miles west of Vredefort Road Station, fifty miles north of Kroonstad, in the Orange River Colony. Here, on a koppje, the surface of the rock is so very conspicuously smoothed and rounded that its appearance can hardly, I think, be attributed to the action of any agent other than ice. The general resemblance to photographs of the glaciated rocks at Prieska in Cape Colony recently shown me by Mr. A. W. Rogers, of the Cape Colony Geological Commission, is very great (see a paper read before the South African Philosophical Society by Messrs. Rogers and Schwartz on November 29, 1899).

The bedding planes of the rock are perpendicular and the strike is nearly from north to south. So far as I can recollect (although I was unable to take any accurate observations on this point), they are cut across by the slope of the rounded surfaces, which run rather in a north-easterly to south-westerly direction.

The locality can be very easily visited from Vredefort Road Station.

G. E. H. BARRETT-HAMILTON.

Kilmanock House, Arthurstown, Ireland,
December 22, 1902.

Risley's "Tribes of Bengal."

HAVING had occasion to make use of Mr. H. H. Risley's valuable anthropometric data of the tribes and castes of Bengal, some of the "means" for the cephalic breadth, minimum frontal breadth and maximum bizygomatic breadth were incidentally recalculated. This was done whenever the tabulated value for the mean seemed a highly improbable one, and as some serious differences between our means and those given by Mr. Risley were found, it was thought well to point this out for the benefit of those who may be basing their arguments on these data without recalculation. Thus, in vol. i., for the Murmi tribe of the Darjiling Hills, for the mean minimum frontal breadth Mr. Risley gives 113·5, where we find 107·2; for the maximum bizygomatic breadth Mr. Risley's value is 145·9, ours is 138·4.

In vol. ii., Káchi caste of N.W. Provinces and Oudh, for the maximum bizygomatic breadth Mr. Risley's value is 120·8, ours is 130·0. Pathán caste of Panjáb, for the minimum frontal breadth Mr. Risley's value is 117·7, ours is 110·3. These are very serious differences.

As it was important to determine how far these discrepancies reflected on the general accuracy of the work, the means for six tribes taken at random were recalculated. I will merely give a list of the figures for the means:—

Risley.	Recalculation.
132·5	132·57
143·2	143·25
102·6	102·60
132·5	132·59
138·6	138·69
97·7	97·73

There is substantial agreement, except in the decimal figure.

S. M. JACOB.

Biometric Laboratory, University College, London,
December 21, 1902.

Local Floras of India.

THE writer of the notice of "The Trees, Shrubs and Woody Climbers of the Bombay Presidency," by W. A. Talbot (NATURE, December 18, 1902, p. 148), refers to the need of local floras to supplement Sir Joseph Hooker's "Flora of British India," and names several works of this nature, though not always correctly, which have already appeared. Perhaps I may be permitted to add a few facts on this subject.

In the first place, it should be known that Sir Dietrich Brandis's "Forest Flora of the North-West and Central India" is not, in any sense, an outcome of the "Flora of British India," as it was published before the first volume of the latter work. Further, the late Dr. Trimen's "Handbook of the Flora of Ceylon" was not completed by himself, the last two volumes having been prepared by Sir Joseph Hooker. Among the local floras not mentioned by the writer of the notice in question is Dr. T. Cooke's excellent "Flora of the Bombay Presidency" (see NATURE, vol. lxv., 1901, p. 88), of which two parts have been issued, containing the natural orders Ranunculaceæ to Leguminosæ. Two other important works of the same class are nearly completed, namely, "The Flora of Bengal" and "The Flora of the Gangetic Plain." The former is by Major D. Prain, the Superintendent of the Calcutta Botanic Garden and Director of the Botanical Survey of India, and the latter by Mr. J. F. Duthie, Director of the Botanical Department, Northern India. I am not sure that I have given the exact titles these two books will bear. Then there is the modest but useful "Forest Flora of the School Circle, N.W.P.," by Upendranath Kanjilal. More ambitious among the works supplementary to the "Flora of British India" are the "Annals of the Royal Botanic Garden, Calcutta," commenced by Sir George King and continued by Major Prain. Upwards of 1600 quarto plates illustrative of the flora of India have appeared in this publication, including 450 orchids. Finally, there is the second edition of Gamble's "Manual of Indian Timbers," which contains a vast deal more information than the title would imply.

W. BOTTING HEMSLEY.

Herbarium, Kew.

IT was not necessary for our purpose to cite all the works dealing with the Indian flora that were published during the quarter of a century that elapsed between the issue of the first (1872) and of the last volume of Sir Joseph Hooker's "Flora of British India" (1897). In the preface to vol. vii. of that work, the "Forest Flora of the North-West and Central India," by Dr., now Sir, Dietrich Brandis, is mentioned among the works "that have appeared during the publication of the 'Flora of British India,'" and the date assigned is 1874.

The first part of Sir Joseph Hooker's "Flora" was issued in May, 1872, the second in January, 1874, the third in February, 1875; it is in this latter section, at p. 527, that we find the first citations from Dr. Brandis.

Other publications of Mr. C. B. Clarke, the late Mr. Kurz and Colonel Beddome are alluded to in Sir Joseph Hooker's preface, in addition to those cited in Mr. Hemsley's note.

The second edition of Mr. Gamble's "Manual of Indian Timbers" has only reached us quite recently, and, as we believe, since our previous note was written.

THE REVIEWER.

THE SIMILARITY OF THE SHORT-PERIOD BAROMETRIC PRESSURE VARIATIONS OVER LARGE AREAS.

IN an earlier number of this Journal (vol. lxvi. p. 248, July 10, 1902), an account was given of the great similarity of curves representing many solar and meteorological phenomena,[1] and it was suggested that their close accordance indicated, not only the intimate relation between solar and meteorological changes, but the importance of the short-period (three to four years) variations common to them all. The variations of solar activity, as indicated by the greater or less number of spots or prominences or by the changes of latitude of the former, were suggested to have such an action on the atmospheric pressure on the earth's surface that when one place recorded an excess, another, nearly antipodal as regards position, showed a deficiency of pressure. Thus the regions specially referred to were those of India and that about Cordoba, in South America.

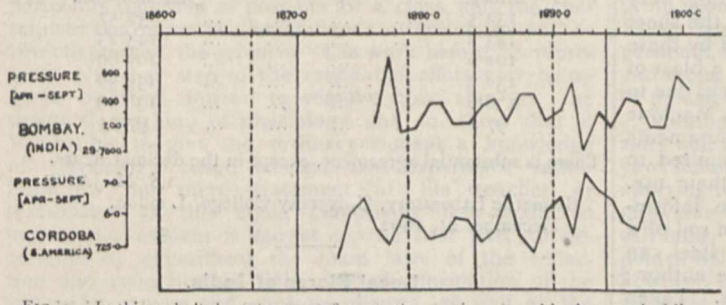

FIG. 1.—In this and all the subsequent figures, the continuous and broken vertical lines represent the epochs of sunspot maxima and minima respectively.

This reversal of conditions, extreme high pressure in one place and low pressure in another at the same moment of time, independent of the yearly or seasonal change, a fact which has since been corroborated by another investigator, as will be seen further on, can be well seen by examining two pressure curves such as those of Bombay and Cordoba (Fig. 1); in each case, the mean pressure for the same months has been used.

In the paper already referred to, it was further pointed out that just as the pressure variations of Bombay were typical of the whole of India, so were those of Oxford (England) or Valencia (Ireland) for western Europe.

With these facts in view, it was important, therefore, to investigate the extent of regions having similar pressure variations, and in the first instance to restrict the inquiry to those areas surrounding India and Cordoba. The results of such a barometric survey were communicated to the Royal Society last October,[2] and it is the purpose of the present article to state the results which have been obtained.

It may, however, first be mentioned that the monthly means of the pressure variations for each station were divided, as in the previous article, into two periods, namely, those months in which the pressures are above and those in which they are below the normal, the normal being the mean pressure for the whole period under investigation in each locality.

Thus, for instance, to take the cases of Bombay and Cordoba, the former has its high-pressure months from April to September and the latter from September to March.

It happens, therefore, in dealing with large areas, that during the same period of time (that is generally, but not invariably, six months) the pressure is above the normal in some places and below the normal in others. In interpreting the curves, therefore, it should be borne in mind that in the one case in which high-pressure months are considered, the crests of the curves denote times of increased pressure, or an excess above the normal conditions, while in the other, where the low-pressure months only are employed, the crests represent the times at which the pressure is not so low as usual.

Dealing first with the region about India, the accompanying curves (Fig. 2) illustrate the variations of pressure which have been analysed. In this set of curves, about the same months are in question, so that the pressure variations refer to the low-pressure (summer) months in the northern hemisphere and to the high-pressure (winter) months in the southern hemisphere.

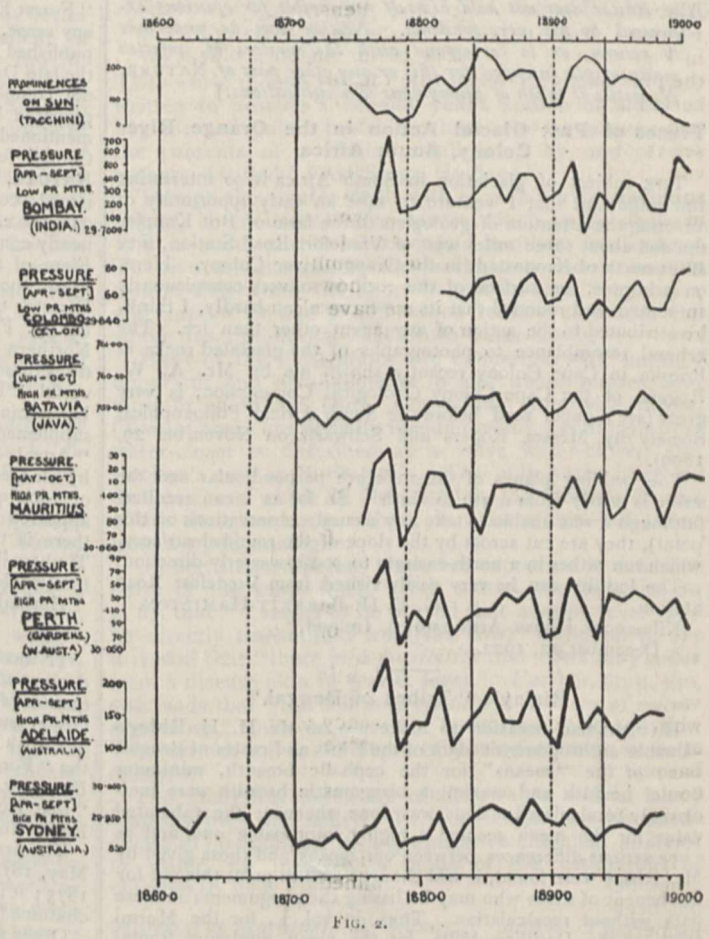

FIG. 2.

Commencing with Indian pressures (as represented by Bombay), the area was gradually extended to Ceylon

[1] "On Some Phenomena which Suggest a Short Period of Solar and Meteorological Changes," by Sir Norman Lockyer, K.C.B., F.R.S., and William J. S. Lockyer, M.A., Ph.D., F.R.A.S. (Roy. Soc. *Proc.*, vol. lxx. p. 500). [Received June 14, read June 19, 1902.]

[2] "On the Similarity of the Short-Period Pressure Variation over Large Areas," by Sir Norman Lockyer, K.C.B., F.R.S., and William J. S. Lockyer, M.A., Ph.D., F.R.A.S. (Roy. Soc. *Proc.*, vol. lxxi.). [Received October 18, read December 4, 1902.]

(Colombo), Java (Batavia), Mauritius, and finally to Australia (Perth, Adelaide and Sydney).

The striking similarity between these curves shows that over the whole of this area, which includes both north and south latitudes, the same kind of variations is in action, and that therefore the whole region is intimately connected meteorologically.

Attention was next paid to extending the region around Cordoba, which station, as has been previously pointed out, exhibits pressure variations similar to, but the inverse of, those of India.

As Cordoba represents an area south of the equator, and the neighbouring stations exhibit similar pressure variations, a portion of the United States of America was taken as typifying an area with north latitude and in about the same longitude, and a commencement was made along the lowest available parallel of latitude.

This was rendered possible by the kindness of Prof. Bigelow, who forwarded proof sheets of a new reduction of United States pressures which he had just completed.

Treating these pressures in the same way as those for the Indian region, several stations which had the best record were chosen. A graphical representation of the variations of four of these stations (Mobile, Alabama; Jacksonville and Pensacola, Florida; San Diego, California) is given in Fig. 3, and for the sake of comparison the pressure of Cordoba, with the *inverted* curves representing the Bombay pressure and solar prominence variation. This series of curves refers in all cases to the variations of the means of the high-pressure (winter) months (October to March in most cases). At Cordoba, which has a southern latitude, the high-pressure months extend from April to September.

The result of the comparison shows that in this region of the world we have also a large area the pressure variations over which are very similar to one another.

Although the general agreement between the two main sets of curves is most striking, there are minor differences which probably will eventually help to determine those cases in which the prominence effects on pressure are masked by some special conditions.

From these collected series of facts it will be seen that, as regards similar short-period pressure variations, the two regions about India and Cordoba have been considerably extended, and extended on both sides of the equator in each case.

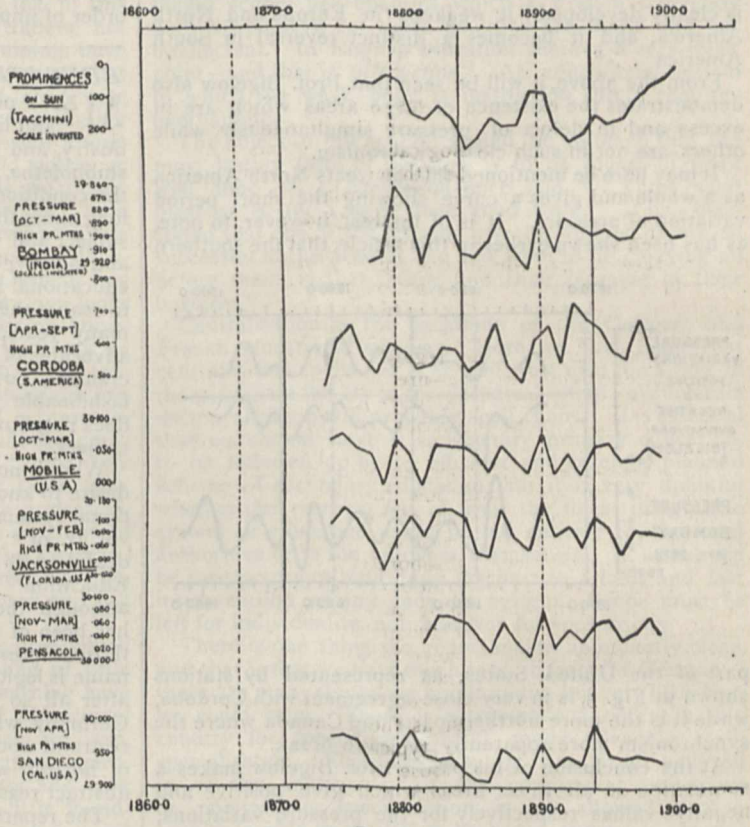

FIG. 3.

With these two large areas indicating similar barometric variations from year to year, but one showing an excess while the other displayed a deficiency, new questions were at once raised. It required, however, a far more general barometric survey over other areas before such questions could be answered, but so suggestive were the facts observed that, as was stated in the paper, such an inquiry was at once undertaken and is still in progress.

It may, however, here be mentioned that already many other localities have been examined. The Indian area has been extended, for instance, to Aden and Egypt, the former of which places is practically a counterpart of India as regards these barometric variations, while the latter approximates to it. If, on the one hand, we denote land areas the barometric variations of which are very like those of India with a positive sign, and those with a positive query sign (+?) which are more like India than Cordoba; and, on the other, pressures similar to those of Cordoba with a negative sign, and those which are more like Cordoba than India with a negative query sign (−?), then it is found that, so far as barometric observations which have as yet been examined are concerned, the earth's surface may be divided approximately into two main regions, one positive the other negative, separated from one another by areas the pressure variations of which may, according to the above notation, be described as positive and negative queries (+?, −?).

It is fortunate that while this reduction and collation of barometric facts has been pursued in this country, another investigator has been working on similar lines in the United States, making it possible to compare results. In fact, Prof. Bigelow's research,[1] which was received some time after the above-mentioned was communicated to the Royal Society, has led him to very nearly the same conclusions as those stated in the present article, if some minor differences be excluded. One of these differences arises from the fact that he has formed the mean of barometric observations made over an area including north-east China, Japan, north India, central India, south India, Batavia and Mauritius, while there seems evidence to show that the whole of India, Batavia and Mauritius behave differently from Siberia, northern China and Japan. This, however, he somewhat concedes later in his article as he points out that "in Siberia and Russia the synchronism begins to break a little . . ." Another difference will be referred to a little further on.

Apart, however, from these, Prof. Bigelow finds that "the same pressure variations, in fact, prevail over very

[1] *Monthly Weather Review*, vol. xxx. No. 7, p. 347, "Studies on the Statics and Kinematics of the Atmosphere in the United States, No. vii., A Contribution to Cosmical Meteorology" by Prof. Frank H. Bigelow (dated August 12, 1902).

large districts of the earth though varying from one region to another."

He says further :—

"If we compare the successive pressure groups with the prominence curve, it will be seen that India and south-eastern Asia are in very close synchronous agreement. This synchronism extends also to New South Wales, the Indian Ocean and even to South Africa. In Siberia and Russia, the synchronism begins to break a little and seems to be transferred somewhat towards the right, although this may be due in part to defective data. In Europe and in the United States, while the same curve is developed as to the number of the maxima and minima, the synchronism becomes more irregular. In South America, on the other hand, the synchronism is resumed very distinctly, but the *entire curve is reversed as referred to India and the Eastern Hemisphere.* Thus we perceive that around the Indian Ocean the synchronism is clearly developed; it weakens in Europe and North America, and it becomes a distinct reversal in South America . . "

From the above, it will be seen that Prof. Bigelow also demonstrates the existence of large areas which are in excess and in defect of pressure simultaneously, while others are not in such close synchronism.

It may here be mentioned that he treats North America as a whole and gives a curve showing the short period variation of pressure. It is of interest, however, to note, as has been shown earlier in this article, that the southern

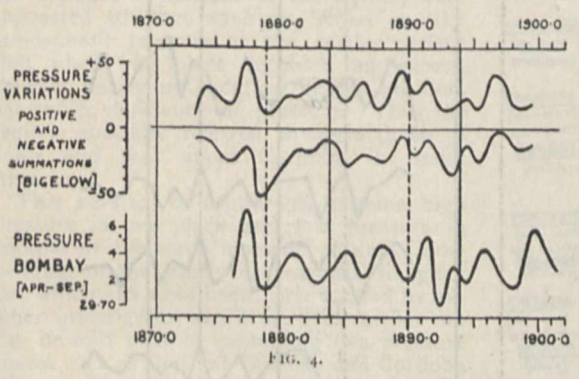

FIG. 4.

part of the United States, as represented by stations shown in Fig. 3, is in very close agreement with Cordoba, while it is the more northern parts and Canada where the synchronism more apparently begins to break.

At the conclusion of his paper, Prof. Bigelow makes a summation of all those areas which give positive and negative values respectively for the pressure variations, and the curves of these are reproduced here (Fig. 4) with a slight change to make the scale homogeneous with others reproduced in this article. The Bombay pressure curve has also been added, and a smooth curve is drawn through the points instead of connecting them with straight lines as in Fig. 2.

The parallelism of the two upper curves indicates, as Prof. Bigelow points out, that "the values do not cancel each other," and that as "the curves match fairly well with the prominence curve, . . . I take it to mean that *some external force is at work to raise and lower the total atmospheric pressure by a small amount from year to year.*"

The two investigations are in agreement as regards the following three main points. First, the close connection between solar activity and barometric pressure; second, the great extent of areas over which very similar pressure variations exist; and, third and last, the presence of two large areas the pressure variations over which are the reciprocal of each other.

It is interesting to remark that, from the comparisons of the pressure variations over the different areas, the authors of both these investigations were led to consider whether these suggestive features were connected with the idea of a periodical see-saw of pressure extending over a few years between these two nearly antipodal areas, or whether we were in presence of a barometric wave travelling round the earth.

There seems little doubt that when more facts are collected these reciprocal pressure variations will in time play an important part in forecasting the general features of seasons and thus supply meteorologists with another means of helping them in their difficult task.

The value that must in future be placed on observations of the sun which inform us of his state of activity or quiescence, since these pressure variations are apparently so closely connected with them, cannot any longer be laid on one side, but must be recognised as of a high order of importance. WILLIAM J. S. LOCKYER.

EDUCATION IN GERMANY AND ENGLAND.

MANY people in this country, eminent men of science and literature, leading men in commerce and industry, and politicians who place efficiency before party shibboleths, have for many years felt apprehensive as to the condition of our national system of education. For a long time, they have been speaking and writing upon the subject and endeavouring—by pointing to advancements and achievements of other nations who have put their educational house in order—to stir up the nation at large to realise the enormous interests which are at stake. For many years, the warnings fell upon deaf ears and the advocates of reform were either looked upon as bores or cranks. To-day all this is changed, and it is almost unfashionable not at least to talk about education; this does not, however, necessarily imply a knowledge of the subject.

Were it not for its terrible prolixity, those who really desire to know the ins and outs of the German educational system could not do better than carefully study vol. ix. of "Special Reports on Educational Subjects," dealing with Germany, which is issued by the Board of Education. A mere glance at this report shows that, although the present system of education in Germany has been of such incalculable value to the Empire, yet those interested in education in that country—and their name is legion—are questioning whether their system is after all so good as it might be. There are many in Germany who think that some of our freedom from restraint would give a breadth of idea and a broadness of horizon which is not obtained by their methods of abstract reasoning and rigid exactness.

The report embraces primary, secondary and technical education. The first 200 pages consist of dissertations by different writers upon different aspects or phases of education. The first of these is by Mr. M. E. Sadler, who has compiled the report, upon "The Unrest in Secondary Education in Germany and Elsewhere." This also includes a comparison between English and German methods. Mr. Sadler admits at once that we have an insufficiency of good secondary day schools and that education at our public schools is not what it should be. Further, our technical training is defective, and, owing to our comparative neglect of national education for many years past, "as a nation we are much less intelligently interested than the Germans in methods of instruction." It is true that German and French methods are now very much advocated in this country, but the great difficulty is that those who desire us indiscriminately to imitate and introduce curricula and methods from other nations seem totally unable to realise that if we wish for an exact copy, we must at the same time reproduce the social and economic conditions of these other countries.

The old idea in England was, teach a boy to be manly, teach him not to be a sneak and a coward, and at the same time give him a smattering of education, then let him be placed in the Army or Navy or business and, come what may, character will carry him through. There is no doubt about it that our public-school life, with its traditions and the *esprit de corps* which it engenders, has had much to do with moulding character, and in past generations, when other nations were settling their internecine troubles and it was simply a question of staking out claims for posterity, this style of education was satisfactory enough. But Germany and other nations, as soon as they had settled their internal struggles, proceeded at once to build up a system of national education which has had far-reaching effects upon many of their most important industries. Not only has German education had such enormous influence upon their own industries, owing to the introduction of scientific methods, but it has likewise been felt in this country, because our manufacturers and traders, not having been taught to believe in scientific training, have stuck to old-time methods, with the disastrous result that in many branches of industry we are unable to compete with the scientific German. In Prussia, all the secondary schools are upon the same lines. The Prussian knows the meaning of a secondary school; it would puzzle an Englishman to define one. The standard is practically the same in all the Prussian secondary schools; here we have no standard at all. English masters as a rule are devoted to their schools, German masters to education. An English boy loves his school; a German boy has not the same feeling of *esprit de corps*, but looks upon his school as an establishment for obtaining knowledge. We lay stress on character, the Germans on knowledge. There are good points in each. The tendency in our schools to make the school standard one of proficiency in sport, and to make fun of earnestness and to chaff those who desire to obtain knowledge, is not good. That objectionable expression "don't talk shop," which is often hurled at the head of those who, through a sincere interest in their business or profession, wish to exchange ideas with others, is the outcome of this characteristic. On the other hand, the Germans would undoubtedly gain if they had more freedom from restraint and were not so bound down by hard and fast rules and regulations.

Other nations have realised that an education which was sufficient fifty years ago is antiquated and of little value in the present day, when science and learning have made such enormous strides. In matters of educational reform, or of accepting new views or theories, we have, as a nation, always shown a conservative spirit. When learning was only advancing slowly and new theories were propounded which had very little foundation of fact to rest upon, doubtless a conservative and cautious policy led in the long run to greater solidarity and was better than being too hasty in taking up new ideas solely because they were new, but which would almost immediately require to be discarded for some newer theory. But now, since the growth of knowledge, resting, as it does, on a broad foundation of experimental fact, is so rapid, it is absolutely essential that we should alter our methods in order to keep abreast of the times.

Fifty years ago, a boy might spend the bulk of his time upon the study of classics and yet be fitted to take his place in business or commerce. To-day, classics alone are of little use. Here it should be pointed out that in Germany the study of classics is not neglected; indeed, considerable stress is laid upon that study. Science is, as a rule, not taught until the boys have at least obtained a thorough general grounding in classics, and there are those in Germany who would make the classical education more thorough than it is at present. The following instance illustrates how thorough, in general, the study of Latin in Germany must be. An Englishman, a friend of the writer's, went to study in Bavaria and had no knowledge of the German language. A nephew of his landlady, a boy of about fifteen, was studying at a public secondary school, and although the Englishman was unable to make his landlady understand his wants, he was able by means of Latin to converse with her nephew and so have his wants attended to.

In a Prussian secondary school, a master has to know a great deal more of the subject which he has to teach than an English master in a similar position. In England, erudition is considered of far less importance than activity of mind and body and success in sport. We often say, "All work and no play makes Jack a dull boy"; we seem to forget the converse, that much play and little or no work unfits the boy for the struggle in after life. On p. 215 of the report, we find the following quotation from the remarks of a Frenchman:—"A boy at an English public school has qualities which a French schoolboy does not possess, but those qualities are moral and not intellectual. In English education there is a very weak point—and that is *instruction*." An educational system in which the weak point is instruction surely requires overhauling.

The object in our schools should be to teach that the most lasting form of pleasure is to be found in work well done. R. L. Stevenson once said, "I know what pleasure is, for I have done good work." It has been stated that one of the reasons why the Americans are so successful in the present day and seem to be carrying all before them is that "they find their pleasure in their business."

Centralisation is the backbone of the German and French educational systems. Here we have found that centralisation spells *red tape*, and now with the swing of the pendulum the cry is for decentralisation. Wholesale decentralisation will probably spell chaos. It is essential that we should have a satisfactory primary education, to be followed up by an efficient and carefully planned scheme of secondary education, but it is very doubtful whether the carrying out of even the finest imaginable system of education could be left entirely to the local authorities or to the teachers themselves. It would not be satisfactory to bind down teachers to a hard and fast interpretation of any code or system. Scope must be left for individuality, not, however, for eccentricity.

There is one thing the report makes abundantly clear, and that is that we have much to learn from the Germans; there are many things we might adapt, but very little that we could copy. There is a tremendous outcry in this country for specialisation, and many advocate early specialisation. Early specialisation is not at all believed in on the continent. In the continental university or polytechnic, specialisation is not allowed until a scholar is able to show that he has a thorough general education. We ought to have some equivalent to the German "Abiturienten," or leaving examination. Unless such an examination has been successfully passed, the student cannot enter a university or polytechnic and take his degree or diploma. Further, in obtaining situations in business houses, preference is invariably given to those who have successfully passed this examination; indeed, many business houses will not take men into their employment who have not passed this satisfactorily.

Sixty-five pages of the report are devoted to the "Measurement of Mental Fatigue." We find that the systematic study of mental fatigue has been taken up in a spirit of earnest, scientific inquiry; and it is worthy of note that post-mortem examinations have shown "that those parts of the brain which serve the purpose of systematic thought, commonly known as the reasoning powers, are the last to mature." The question of what constitutes mental fatigue must always be one of great difficulty. If the laws of hygiene are obeyed

and the subject is sufficiently clothed and fed, he will probably be able to accomplish a very much larger amount of mental work, without being over-strained, than would be the case if these conditions were neglected.

In Germany, the question of dealing with over brain work is probably more pressing than it is in this country, because the brain is often over-exercised, while there is an insufficiency of physical exercise. In England, I am afraid, it is more often a question of physical fatigue than one of mental strain with which we are faced. But of course, when the teaching system is "unintelligent"—that is, one of *cram*—the poor brain must get terribly wearied.

Mr. Sadler has compiled the report with great care, and the portions which he has himself written are marked by a refreshing breadth of view not always to be found in Government reports. It is probable, however, that the object would be better attained if these reports were more condensed. F. MOLLWO PERKIN.

TIDAL CURRENTS IN THE GULF OF ST. LAWRENCE.

FOR many years past, the Canadian Government has been prosecuting an accurate survey of the complicated tides and tidal currents of the Gulf of St. Lawrence. The Tidal Department, under the able directorship of Mr. W. Bell Dawson, has already done much excellent work in this field, although, doubtless, much yet remains to be discovered. In the tidal report for the present year, Mr. Dawson will describe the results of a careful analysis of the remarkable tidal currents which are met with in Northumberland Strait south of Prince Edward's Island. At most places, the times of the changes of tidal currents bear a more or less constant relationship to the times of high and low water, but in this channel the changes are found to be largely governed by the moon's declination. As Mr. Dawson remarks:—"This is very confusing to the mariner, as the turn of the current in relation to the tide is out of accord with the moon's phases, and has thus no fixed relation to the spring and neap tides. The greatest apparent irregularity is when the moon's declination is at its maximum; and this occurs sometimes at the spring tides and sometimes at the neaps. The ordinary navigator takes refuge in the conclusion that the currents are chiefly influenced by the wind."

Diurnal tides are ruled by the declination of the moon, and it would seem that there must be at this place a large diurnal inequality which manifests itself more by current than by variations of height.

Those who are interested in this subject will do well to refer to Mr. Dawson's forthcoming report.

G. H. D.

JOHANNES WISLICENUS.

THE generation that laid the foundation of organic chemistry has almost become a thing of the past, and at the close of last year one of the few remaining links was broken by the death of Wislicenus.

Not long since, the University of Leipzig was mourning the loss, at a venerable age, of a distinguished physicist; to-day the chair which was made famous by that "wahre Bearbeiter" Kolbe is vacant, and a name which will ever be illustrious in the history of spacial chemistry has been added to the classical traditions of this great seat of learning.

The news has come not as a sudden shock, for of late years the health of the venerable Geheimrath has been visibly declining, and waning strength and feeble gait warned his many friends that his working days would soon be over; none the less poignant, however, is the grief felt by all who have had the privilege of sharing his friendship or coming under the influence of his impressive and genial personality.

Johannes Wislicenus was born on June 24, 1835, at Klein-Eichsted, in the Prussian province of Saxony; when he was five years old, his father, a pastor, was transferred to Halle a. Salle, and there the boy received his first impressions of school life. At the "Frankesche Stiftung," a school which has since become celebrated, he remained until the age of eighteen, and at Easter, 1853, having passed his Maturitätsexamen, he entered the University of Halle with the intention of devoting himself to the study of natural science. His project was, however, soon frustrated. The political horizon was still clouded over, and in consequence of certain intrigues, his father, in the autumn of the same year, was compelled to fly the country; he found a home for himself and his family, as did so many refugees of that time, in the United States. In the following year, Johannes was appointed assistant to Prof. Horsford at Harvard University, Mass., and in 1855 became lecturer at the Mechanics' Institute, New York, with a laboratory at his disposal.

It was thus that he acquired that command of English which was such a source of wonder to his foreign students in later years.

In 1856, he was able to return to Europe, and resumed his interrupted studies at the University of Zurich, where he "promovierte" in 1860 and was appointed Privatdocent at the Polytechnic.

In 1861, he became professor of chemistry and mineralogy at the "Kantonale Industrieschule." Four years later, he received the honour of a chair at the University of Zurich, and in 1871 was elected by the "Bundesrath" as director of the Polytechnic in that town. In the following year, he was chosen to succeed Ad. Strecker at Würzburg. There he remained until 1885, and it was during this time that he carried on his classical researches on the constitution of acetoacetic ether and so established his reputation on a firm basis.

The year 1884 witnessed the death of Kolbe and the call of Wislicenus to Leipzig, where he remained until the end. As was pointed out by a writer recently in this Journal, "there is a curious irony in the thought that his first work there should have been directed towards the extension of the theory of Van 't Hoff, whom Kolbe had regarded with such contempt."

Of his scientific work, space will only permit the barest outline. His researches were confined almost exclusively to the domain of organic chemistry, most of them appearing in *Liebig's Annalen der Chemie*. The constitution of lactic acid, on which he worked from 1863 to 1872, establishing the identity of structure for the two different substances fermentation- and para-lactic acids, first brought him into prominence among chemical workers and impelled him to seek an explanation of the metamerism in the spacial relations of the atoms within the molecule. His interest in acetoacetic ether, to which reference has already been made, resulted in a detailed investigation of its reactions and of its value as a synthetic agent; these have gone far to stimulate the study of this most interesting compound, and are of importance, if for no other reason, for the light they throw on the still open question of its constitution.

It was in Leipzig, however, that he achieved his great work. In 1887 appeared his famous memoir, "Über die raümliche Anordnung der Atome in organischen Molekulen," to account for the phenomena of "geometrical isomerism." According to his hypothesis, which was an extension of that formulated independently by Le Bel and Van 't Hoff in 1874, "the centre of gravity of a carbon atom was regarded as situated in the centre of a tetrahedron, and its four affinities at the four corners." When two atoms were linked together, Van 't Hoff, and

after him Wislicenus, assumed that both were capable of rotating in opposite directions about a common axis; this possibility ceased, however, with a double or treble linking of the carbon atoms. Wislicenus further called into play the action of certain "specially directed forces the affinity-energies" which "determine the relative positions of the atoms to one another in the molecule."

The *Annalen* of these years contain a large number of papers worked out in the Leipzig laboratories under his direction, in which the reactions of maleic and fumaric acids, the tolane dichlorides and dibromides, mesaconic and citraconic acids, the crotonic acids, the α-chloropropylenes, &c., were carefully investigated, and the facts shown to be in agreement with those demanded by theory.

The hypothesis naturally evoked much criticism; Wislicenus's controversy with Fittig (*Liebig's Annalen*, 1892, cclxxii. 1–99) is still fresh in the minds of chemists, and it must be admitted that Michael has obtained results which it has not yet been found possible to reconcile with the theory. But when all is said, there can be little doubt that up to the present it remains the simplest and most comprehensive explanation adduced. Even if the theory should ever be disproved, Wislicenus's memoir will always hold a place among the classics of the science as a model of careful reasoning and literary skill, and as an epitome of one of the most laborious researches of that period.

Now, however, is not the time, nor is this the place, to dwell in any detail on his scientific papers; the above indication of the direction which his research took must suffice; it would be presumptuous to attempt to estimate the value of his work; enough that, among the great names in the history of chemical science, Wislicenus will stand with Bunsen and Kekulé and Victor Meyer and such names as made the nineteenth century what it was.

We do not wish to enter into a panegyric of his character; such things belong rather to the columns of a daily paper and to the exaggerated estimates of mediocrities; but a word as to his human aspect—and he *was* a man of wide sympathies—will not be out of place. In politics, he was an ardent admirer of Bismarck, and had little tolerance for the social democrats of latter days; not that charitableness was lacking in his disposition, for many were the kindly acts that he performed. He was fond of children, and when his own family had grown up and he was left alone with his daughter, the cheerful presence of a little niece helped to relieve the gloom that the tragedy of his domestic life had cast over the later years. To music he was almost insensible, and Wagner was to him nothing more than a confusion of sounds. He was present at the first performance of "Siegfried," but left in the middle of the second act with a violent headache. Literature was his one refuge in the intervals of work, and when troubled with insomnia, from which he suffered much, he would pass the hours in his well-stocked library. It is related that at one of his weekly dinner parties, to which all his research students were invited in turn, a youth of an inquiring turn of mind, desirous of probing the extent of the professor's knowledge, read up an almost forgotten author and tackled him on the subject when the cigars were produced; great was the student's chagrin on discovering that it was one of his teacher's favourite authors and at having to sit through an impromptu half-hour's lecture on the author's peculiarities of style. This youth never carried his investigations any further. With his students, Wislicenus was always popular, and though they christened him at one time the "Schmier-Director," from the number of tarry residues that the arbeits were producing, that did not detract from the affection and esteem in which he was held. In his daily round of the research laboratories, he was ever ready with words of sympathy and encouragement that went far to allay the soreness and disappointment of repeated failures; his kindly suggestions have stimulated many to greater efforts.

In 1898, the Royal Society awarded him the Davy medal, and his death makes a vacancy in its list of foreign members.

The loss will be felt not in Germany alone, for his students came from all parts of the world, and while men of science will remember him as one of the founders of stereochemistry, his disciples will look back on him as one of the "influences" of their lives, as a man of broad sympathies and great powers, as an example to emulate and as a memory to inspire.

NOTES.

AMONG the names included in the long list of "Durbar Honours" published on New Year's Day, we notice the following:—Dr. George Watt, C.I.E., officer in charge of the Economic and Art Section of the Indian Museum, Calcutta, has had the honour of knighthood conferred upon him. Dr. W. R. Hooper, C.S.I., President of the Medical Board at the India Office, and Sir Colin Campbell Scott Moncrieff, K.C.M.G., President of the Indian Irrigation Commission, have been made Knight Commanders of the Star of India. Colonel St. George C. Gore, Surveyor-General of India, has been made a Companion of the same order. Dr. B. Franklin, Director-General Indian Medical Service, and Mr. John Eliot, F.R.S., Meteorological Reporter to the Government of India and Director-General of Indian Observatories, have been promoted to the rank of Knight Commanders of the Order of the Indian Empire. Major A. W. Alcock, F.R.S., Superintendent of the Indian Museum, and Prof. J. C. Bose, Presidency College, Calcutta, have been made Companions of the same order. Major David Semple, Director of the Pasteur Institute, Kasauli, has been awarded the Kaisar-I-Hind Medal for Public Service in India.

A GERMAN newspaper records the following exemplary incident, apropos of a recent act of the Kaiser, in appealing to his people for support in a good work. Dr. Dohrn, of Naples, having appealed with little result to the German Minister of Education for financial aid in the extension of his world-famed biological station, sought an interview with the Kaiser. Remarking sympathetically that he could not provide all that Dr. Dohrn desired from his private purse, the Kaiser furnished him with a donation form, headed by himself and a contribution of 1000*l.*, commanding that it should be circulated among the leaders in Berlin society, for return to the Kaiser in person. The result was that within a few days the magnificent sum of 15,000*l.* was subscribed.

MR. HERBERT KYNASTON has been appointed by the Colonial Office director of the Geological Survey of the Transvaal.

M. EDMOND PERRIER has been appointed to the chair of comparative anatomy at the Paris Muséum d'Histoire Naturelle, and M. Pierre Marcellin Boule to the chair of palæontology at the same institution.

A MESSAGE from the *Times* correspondent at Ottawa states that the promoters of the Canadian Marconi Company hope by the end of next summer to have a complete system of wireless telegraphy in operation throughout Canada, extending from the Gulf of St. Lawrence to the Pacific Coast.

MR. MARCONI was entertained at a banquet at Sydney on December 30 by the citizens of Cape Breton Island. Reuter reports that in responding to the toast of his health, Mr. Marconi said that when his system of wireless telegraphy was further developed, it would be possible for ships in distress to signal passing ships. The cable companies, when they began, charged pounds per word; they were now down to shillings,

and his starting at ten cents might soon lead to a charge of one cent per word and thus bind England and her colonies more closely together.

THE *Daily Mail* states that Sir Ernest Cassel has offered to give 40,000*l.* towards the study and investigation of ophthalmia in Egypt.

THE death is announced of M. Pierre Laffitte, who, since 1893, has filled the chair at the College de France for the exposition of the general history of science.

AN anti-tuberculosis union for Austria has been formed, with Count Lützow as president. The Vienna correspondent of the *Times* reports that nearly 5000*l.* has already been received in subscriptions, and the Government has promised the fullest support in combating the disease.

THE death is announced of Prof. Dr. Max Schede, professor of surgery at the University of Bonn, to which post he was appointed in 1895. During the time that Prof. Schede was organiser of the surgical section of Hamburg Hospital, he made it his aim to develop the system of antiseptics introduced into surgery by Lord Lister.

MR. OTTO HILGER, whose death we announced last week, was born at Darmstadt on January 20, 1850, where he passed his apprenticeship under his father, who was the master of the mint. At eighteen years of age, he went with his brother, the late Mr. Adam Hilger, to Paris, where they started a workshop, doing much good work for the observatory. At the outbreak of the Franco-German war in 1870, being Germans they had to leave Paris and came to London. In a few years, they were able to start a small business as scientific instrument makers, and the name of Hilger soon became well known in the scientific world. In 1888, Mr. Otto Hilger was appointed by Lord Blythswood to take charge of his private laboratory, where he was until 1897, when the death of his brother compelled him to return to London to carry on the business, though this necessitated leaving partially completed a dividing engine for ruling diffraction gratings which he had been constructing under Lord Blythswood. During recent years, the demand for a high degree of accuracy in scientific instruments has greatly increased, and many men of science will regret the death of a maker who was able to appreciate the necessity for refinements in workmanship.

ON Tuesday, January 13, Prof. Macfadyen will deliver the first of a course of six lectures at the Royal Institution on "The Physiology of Digestion." On Thursday, January 15, Mr. A. J. Evans will begin a course of three lectures on "Pre-Phœnician Writing in Crete, and its Bearings on the History of the Alphabet." The Friday evening discourse on January 16 will be delivered by Prof. Dewar, on "Low Temperature Investigations." On January 23, Dr. Tempest Anderson will lecture on "Recent Volcanic Eruptions," and on January 30 Prof. W. E. Dalby will lecture on "Vibration Problems in Engineering Science."

ACCORDING to a Reuter message from San Francisco, advices from Corinto (Nicaragua), dated December 15, state that the volcano Santiago, near Granada, was then in active eruption. At night the sky was lit up by the volcano, and great havoc had been wrought. Momotombo, on Lake Managua, was also discharging clouds, and the volcano Izalco, in San Salvador, was in more active eruption, clouds and lava issuing from the crater at short intervals. At night a brilliant spectacle was presented, the lava pouring down the side of the mountain looking like a stream of fire. A telegram from Valparaiso states that it is reported that five volcanoes in the province of Llarquihue are active.

THE Moscow correspondent of the *Standard* states that a well-marked record of the recent earthquake at Andijan was obtained by the seismological instruments at the observatory there. The time recorded was 11 a.m., that is, about 8.30 a.m. Greenwich time. Andijan is the second largest town in the "Territory" of Fergana, and had not less than fifty thousand inhabitants at the time of the earthquake.

DURING the past ten months, the Odessa correspondent of the *Standard* points out, Transcaucasia and Transcaspia have been visited by several severe earthquakes. In February last, Schemakha, on the Caspian side of the Caucasus, was laid in ruins by a series of violent earthquakes and volcanic disturbances, in which upwards of three thousand people perished. In July, a similar calamity desolated several districts in Kashgar, involving the loss of some six thousand lives. Those events have now been followed by the destructive series of earthquakes in the districts of Novi-Marghelan and Andijan. According to the latest reports, the loss of life is equally as appalling as that at Kashgar. A few days previous to the dreadful event in Andijan, a series of slight earthquake shocks was felt at Schemakha, the site of the disaster in February last.

PROF. ROBERT KOCH and two assistants, Surgeon Dr. Kleine, of the Prussian Headquarters Staff, and Dr. Neufeld, of the Prussian Institute for Infectious Diseases, are on their way to investigate cattle plague in Rhodesia. To the Berlin correspondent of the *Daily Mail*, Prof. Koch has remarked:—"I contemplate my mission with more or less misgiving, because the Rhodesian plague is of an absolutely mystifying character. Such symptoms as I have so far examined indicate that the disease is wholly different from any species of rinderpest that has ever come under medical observation. What is peculiarly baffling is that the Rhodesian plague dates only from the late war. The cattle imported from Egypt, Australia and South America, which it was supposed would prove immune, have fallen early victims to its ravages, which threaten to denude the entire colony of live stock. While in South Africa, I shall not neglect the opportunity of continuing my tuberculosis experiments with the view of adducing still more positive evidence of my theory of the non-communicability of bovine tuberculosis to human beings, which I, of course, adhere to resolutely."

CAPTAIN BOYD ALEXANDER has just returned to England, after a short visit to the west coast of Africa, where he has been collecting birds and mammals on the islands of St. Thomas and Fernando Po, in the Bight of Biafra. Captain Alexander has obtained altogether nearly 400 specimens, and is expecting more from a collector that he left in Fernando Po. The results of his work as regards birds will probably be published in the *Ibis*.

MR. J. S. BUDGETT, Balfour student of the University of Cambridge, has returned to England from Lake Albert (where he has been engaged in studying the development of the Polypterine fishes) by the Nile route, and will give an account of his expedition at the scientific meeting of the Zoological Society on January 20. Not having been altogether successful in Uganda, Mr. Budgett will probably make another visit to the Upper Gambia, where he has better prospects of obtaining the required information, in the course of the present year.

MR. W. G. DOGGETT writes from Entebbe (November 5, 1902) that he was then preparing to start for the southern frontier of Uganda, to take up his post as naturalist to the Anglo-German Boundary Commission under Major Delmé Radcliffe. The expedition will start from the shores of Lake Victoria at 1° S.L., and will define the boundary between Uganda and German East Africa as far west as the Semliki

River. In the Semliki Forest, Mr. Doggett hopes to be able to obtain fresh specimens of the new African mammal (*Okapia johnstoni*), which are much required at South Kensington.

THE Institution of Electrical Engineers has issued the preliminary programme of the visit to Italy to be made this spring. It is proposed to leave London on April 2, and the first technical visit will be to the Vatellina Railway and power-house on April 4. At Como also the tomb of Volta can be visited the next day. On April 6, the party will leave for Milan, travelling *viâ* the Milan-Varese Electric Railway and visiting the works of Messrs. Tosi, at Legnano, in passing. On April 7, the Paderno power-house will be inspected. On April 8, visits will be made to various places of technical interest in Milan, including the Technical High School, and on the next day to the power-houses at Vizzola and Tornavento. The party will break up on Thursday, April 9, or on the Friday morning (Good Friday).

AMONG the many papers of interest in the December number of the *Geographical Journal* may be specially mentioned Dr. Stein's account of his explorations in Chinese Turkestan, and the readers of NATURE will not fail to note the importance of his discovery of inscribed wooden tablets on the Niya River site. Here, in a small decayed building, he found more than 200 documents on wood of all shapes and sizes. Besides tablets with the Indian Kharoshthi writing, he unearthed several narrow pieces of wood bearing Chinese characters, and many of the former were still protected by the strings with which they were originally tied and bore clay seals. On the seals, we have figures of Pallas Athene, with shield and ægis, Eros and Athene Promachos, and these prove beyond all doubt the influence which classical Western art has exercised even in distant Khotan. Many of the documents bear dates which are mentioned in connection with the names of rulers, and the texts, which seem to be written in an early form of Indian Prakrit, cannot fail to throw great light on the early, unknown history of the district wherein they have been found. It is important that the materials which Dr. Stein has secured should be worked thoroughly, for they may contain information concerning the frequent communication which must have existed between the East and the West during the early centuries of the Christian era.

THE unfortunate fatal accident which occurred at the Fulham Public Baths on December 23 serves to show how dangerous an electric shock may be when the conditions are such that really good contact is made. In this case, two bathers were killed by standing up in their baths and putting their hands on a metal rail running along the top of the partition between the baths; on top of this rail ran the iron pipes containing the electric-supply leads. It seems that there was leakage, possibly in a faulty lampholder, to these pipes, which were insufficiently "earthed." The bathers therefore completed the earth through their bodies to the bath itself, and thus received a shock which, in spite of the fact that the pressure could only have been something like 170 volts, had fatal results on account of the very good contacts which existed. The circumstances of the case are altogether exceptional, and there is absolutely no need for users of electric light to take any alarm. The moral to be drawn is that in an installation of this kind, where it is possible for people to make direct contact between their damp skin and parts of the installation, more care should be taken in design and supervision to prevent any possibility of contact with any live metal.

THE outbreaks of typhoid fever at Winchester and at Southampton again direct attention to the possibility of the typhoid infection being spread through the agency of shell-fish, in these instances through oysters. Dr. Nash, in a report on an outbreak of typhoid fever at Southend-on-Sea, finds that the incidence of the disease was thirty-six times as great among shell-fish consumers as among those who do not eat shell-fish, and expresses the opinion that if the eating of shell-fish were abandoned in Southend, the incidence of typhoid fever would lessen by fully one-half. In the Southend outbreak, cockles were mainly responsible for the spread of the infection.

A LARGE portion of the contents of the January number of *Climate* is devoted to a consideration of the possibility of stamping out malaria. Major Ronald Ross discusses the prevalence of malaria at Ismailia, and comes to the conclusion that if the mosquitoes in the district were even partially eradicated, as might easily be done, malaria would almost disappear. Sir William MacGregor describes the Italian campaign against malaria, and draws attention to the prophylactic use of quinine, the protection of dwellings with wire gauze, the cultivation of the soil and the drainage of swamps as means of diminishing the prevalence of malaria.

AT an international maritime congress recently held at Copenhagen, M. Willaume-Jantzen, subdirector of the Danish Meteorological Institute, contributed an interesting paper on the climate of the coast of Iceland, based on eighteen to twenty-two years' observations at four representative stations—Vestmannoe (south), Stykkisholm (west), Grimsey (north) and Papey (east). Generally speaking, the lowest mean barometric pressure in the north Atlantic lies to the south-west of Iceland, and to the north-east of the island there is another area of mean low pressure, but a little higher than that on the south-west. These two areas determine the prevalent winds on the east coast, which blow with nearly equal persistency from north-east and from north-west. But from its position with regard to the advance of barometric depressions from west to east in the Atlantic, the pressure in Iceland is subject to sudden and great variations, causing frequent storms, the average annual number of days of storm on the east coast being seventy-five. Generally speaking, the summer climate on the coast is fresh and the winter mild, but the latter may be very severe with northerly winds and the approach of polar ice. In some localities, fog is very prevalent; at Berufiord, near Papey, it occurs on 212 days, but at Stykkisholm on nine days only. Rainfall is heavy on the south and light on the north; at Vestmannoe there are 225 days on which rain falls on a yearly average.

THE volume containing the meteorological observations and results for the United States Naval Observatory, Washington, under the direction of Prof. J. R. Eastman, for the year 1901, has been recently received. As in former years, it contains the details of all the observations which are made every three hours during each day. These include the corrected readings of the barometer, and of the wet and dry bulb thermometers, the symbols indicating the character of the clouds, the estimated amount of cloudiness, wind direction and velocity, together with the daily means. The six tables which follow record the results, such as the maximum and minimum temperatures for each month, daily and monthly means of the corrected barometric readings, &c. The volume contains also the meteorological observations made at the same hours at the new naval observatory with a view to determine the difference of the thermometric conditions at the two localities, in order that future records at the new observatory can be properly compared with the records at the old observatory, which extend from 1845 to 1892 inclusive.

WE have received from the editors of the *Photogram* a new edition of a set of cards which are intended for the pocket-book of the photographer. These cards, 5 × 3 inches in size, contain a great amount of very useful information, some of which the

practical photographer is sure to find serviceable either in his studio or out in the field. Thus we have a brief guide for correct exposure for various kinds of plates and light, tables of enlargement and reduction for telescopic lenses, how to find south without a compass in order to fix the time of best lighting, the metric and British systems of weights and measures and their connection one with the other, photographic temperatures and a comparison of different thermometer scales, &c. These cards, eight in number, can be obtained from the office of the *Photogram* by forwarding one penny stamp, and they are valuable and useful for the money.

THE theory of the dimensions of units in the electrostatic and electromagnetic systems has on various occasions been criticised. A short note dealing critically with dimensions of physical units in general is given by Dr. Ladislaus Gorczyński in the *Physikalische Zeitschrift*, iv. 5. In thermodynamics, the author points out that the dimensions of temperature should not be omitted from the expressions for the dimensions of such quantities as thermal conductivity, specific heat and entropy, and he introduces the dimensions of K and μ into the electrical systems. Herr Gorczyński supports the position assumed by Schreber and disagrees with certain views expressed by Hesehus. In particular, he considers that the assumption of a relation of the form $v = \sqrt{e/d}$ connecting the "v" of electromagnetism with elasticity and density is unjustifiable. The general conclusion is that the conventional treatment of dimensions of units is unsatisfactory, and that it is not at present possible satisfactorily to express the dimensions of all physical units in terms of those of the three fundamental units of length, time and mass alone. It is certainly safer to introduce too many fundamental units the dimensions of which are treated as independent of one another than to cut down the number by regarding the measure of any physical quality as a dimensionless number.

THE first report on a chemical and physical study of the soils of Kent and Surrey has been issued by the South-eastern Agricultural College, at Wye, by Mr. A. D. Hall and Mr. F. J. Plymen (1902). The object is eventually to accumulate such a series of analyses of the soils, chemical and mechanical, as will enable the College, when given the situation of any field, to indicate in a general way the kind of manures wanted for each particular crop. The two counties are not much covered with drift deposits, and these are depicted on the one-inch Geological Survey map, but the pressing need of a geological map on the six-inch scale is pointed out. The present report deals only with the soils resting upon the London Clay, Chalk and Gault. By procuring samples of soils from each geological formation in a number of localities, a good general knowledge of them has been obtained. Particulars of these, with methods of analyses, are given. With regard to the Gault soils, it is remarked that the most profitable use to make of them "is to keep them or lay them down as permanent pasture." On both London Clay and Chalk there is considerable variety of soil, and recommendations are made on the cultivation of different areas.

A SECOND edition of Dr. A. J. Ewart's "First Stage Botany" has been published by Mr. W. B. Clive. Several additions and alterations have been made.

THE second volume of Prof. Wundt's "Grundzüge der physiologischen Psychologie" has been received from Mr. W. Engelmann, Leipzig. The first volume was noticed a short time ago (November 6, 1902, p. 2), and an estimate of the value of this great work can be obtained from that review. After the work has been completed, a notice of the new volumes will appear.

THE three essays which were successful in the recent competition for the erection of a sanatorium for tuberculosis, initiated by His Majesty the King, are reprinted in full in the current number of the *Lancet*, with reproductions of the plans of the buildings. The essays are valuable epitomes of modern knowledge of the cause, prevention and cure of tuberculosis.

WE have received from Messrs. Isenthal and Co. their latest catalogue and price list of apparatus for radiography and general electromedical work. The list is a very complete one and shows that the firm is in a position to supply all the apparatus needed in this class of work from single pieces of the simplest type to full sets made up into suitable cabinets. We note also that the firm arranges for courses of lessons in the use of the apparatus for those who desire it.

THE "Annuaire du Bureau des Longitudes" for 1903 has been published by M. Gauthier-Villars, Paris. This compact little volume contains, as usual, a mass of information indispensable both to the man of science and to the engineer. Among the contents of the volume may be specially mentioned the contribution by M. R. Radau, on shooting stars and comets, and that by M. J. Janssen, on science and poetry. The discourses delivered at the funerals of MM. Cornu and Faye are also included in this year's issue of the annual.

THREE new volumes of the first annual issue of the International Catalogue of Scientific Literature have been received, and are similar in character to those already described. The subjects of the volumes are physics (part i.), meteorology (including terrestrial magnetism) and mechanics. The second part of the catalogue of physical papers will shortly be published and will complete the volume on physics. The two volumes on meteorology and mechanics are each complete in themselves, and the portions of the scientific literature of 1901 not included in them will form a part of the second annual issue of the Catalogue.

MR. W. ENGELMANN, Leipzig, has issued two new volumes in Ostwald's series of scientific classics. As is well known, each volume in this series contains one or more papers which have influenced the progress of science, selected from the works of investigators of various nationalities and translated into German when written in other languages. One of the volumes recently published contains series xiv. and xv. of Faraday's experimental investigations in electricity, translated from the *Philosophical Transactions* of 1838 and edited by Dr. A. J. von Oettingen; the other volume (No. 132) contains a translation of two papers by Andrews, on the continuity of the gaseous and liquid states of matter, from the *Phil. Trans.* of 1869 and 1876, edited by Dr. Arthur von Oettingen and Prof. K. Tsuruta.

WE have before us the forty-second yearly issue of the *British Journal of Photography*, edited by Mr. Thomas Bedding (Henry Greenwood and Co., Strand), and a glance at this bulky volume, which contains nearly 1600 pages, of which about 600 are text matter, is sufficient to indicate its vigorous and healthy condition. The book is arranged on similar lines to those of its predecessors, and will be found a mine of interesting, practical and useful information on photographic topics. Among some of the contents may be mentioned a very complete list of the officers of photographic societies in the United Kingdom, America and on the continent, a large collection of photographic formulæ and recipes in both the English and metric systems, chapters on photomicrography with bibliography by the editor, a summary of the recent novelties in apparatus, &c., since the publication of the last almanac, practical notes and suggestions of the year, and an epitome of the year's progress, in which is given a *résumé* of the more important discoveries and improvements. Scattered

among the text are some excellent reproductions illustrating the behaviour of different lenses and speeds of shutters, and the frontispiece is a contact print on Barnet platino mat bromide paper. The low price of the volume (one shilling) and the useful nature of the contents should render it indispensable to every photographer.

IN the current number of the *Comptes rendus* is a note by Prof. Henri Moissan on a new method of preparing the silicon analogue of ethane, Si_2H_6. This substance was originally obtained by the author, in conjunction with Dr. Smiles, by the partial condensation at −200° C. of an impure silicon hydride prepared by the action of hydrochloric acid upon a silicide of magnesium of undefined composition. Attempts to prepare the same compound from the lithium silicide, Li_2Si_6, by the action of dry hydrogen chloride or a dilute solution of hydrochloric acid were unsuccessful, hydrogen being the only gaseous product. It has now been found that by the gradual addition of lithium silicide to concentrated aqueous hydrochloric acid, the silico-ethane is readily formed in abundance and can be separated by means of cooling to the temperature of liquid air.

THE same number contains an account, by M. F. Bodroux, of another application of the organo-magnesium compounds to organic synthesis. It has been found that if a magnesium alkyl chloride or bromide, prepared in the usual way by the action of magnesium upon an ethereal solution of the alkyl bromide or chloride, is treated with iodine, the alkyl iodide is produced in nearly quantitative yield, together with magnesium iodochloride or bromide. Propyl bromide and isoamyl chloride treated in this way have furnished about 80 per cent. of the theoretical quantities of the corresponding iodides. The reaction is equally applicable to aromatic derivatives, and will simplify greatly the preparation of many monoiodo-derivatives of benzene.

THE much-discussed question of the chemical character of bleaching powder is revived in a recent number of the *Zeitschrift für anorganische Chemie*, which contains a long paper on the subject by Herr Winteler, of Darmstadt. The investigation appears to have arisen from a difficulty which was experienced in making good bleaching powder from electrolytic chlorine, owing to the gas containing considerable quantities of carbon dioxide. The chief conclusions reached by Herr Winteler are as follows. Dry chlorine does not act on dry calcium hydroxide, but in the presence of moisture chlorine water is first formed. This contains hypochlorous and hydrochloric acids, which then act upon the calcium hydroxide. The action involves complicated equilibria, which depend on the temperature, the amount of water present, the rate at which the chorine is passed, &c. Bleaching powder possesses no definite formula, but is a mixture of bodies resulting from the balanced reactions just referred to. It contains basic calcium chloride and basic hypochlorite as normal components, and may contain chloride and hypochlorite as well as hydroxide and the free acids. The decomposition of bleaching powder into chloride and oxygen takes place when there is an excess of hydroxyl ions; on the other hand, an excess of hydrogen ions leads to a decomposition into chlorate and chloride. Working upon this theory of the character of bleaching powder, Herr Winteler shows how it is possible to prepare a good product even when using unpurified chlorine containing 6 per cent. of carbon dioxide.

THE additions to the Zoological Society's Gardens during the past week include a Fennec Fox (*Canis cerdo*) from North Africa, presented by Dixon Bey; two Common Marmosets (*Hapale jacchus*) from South-east Brazil, presented by Mr. J. B. Joel; two Egyptian Jerboas (*Dipus aegyptius*) from North Africa, presented by Miss Chesterman; two Eastern One-wattled Cassowaries (*Casuarius aurantiacus*) from New Guinea; a Blossom-headed Parrakeet (*Palaeornis cyanocephalus*) from India; a Gangetic Trionyx (*Trionyx gangeticus*) from India, deposited.

OUR ASTRONOMICAL COLUMN.

COMET 1902 *d*.—From observations made at Hamburg on December 3 and 11, and at Paris on December 22, Herr Ebell has calculated the following elements and ephemeris for this comet:—

T = 1903 March 23·544 Berlin M.T.

ω = 5° 43′ 32″·6
Ω = 117 29 51·2 } 1903·0
i = 43 54 17·4
log q = 0·443876

Ephemeris 12h. M.T. Berlin.

1903	α (h. m. s.)	δ (° ′)	log Δ	Brightness.
Jan. 0	7 3 10	+3 47·3	0·2925	1·4
4	7 0 19	+4 54·1	0·2880	1·4
8	6 57 23	+6 4·6	0·2847	1·5
12	6 54 27	+7 18·2	0·2825	1·5
16	6 51 34	+8 34·4	0·2816	1·5
20	6 48 47	+9 52·6	0·2818	1·5

Unit brightness at time of discovery.

On December 22d. 10h. 44m.·3 Paris M.T., the comet was observed in the following position by M. Bigourdan at Paris:—α (apparent) = 7h. 9m. 7s.·4, δ (apparent) = + 1° 32′ 55″.

M. Fayet has found that this comet has the greatest perihelion distance recorded for any comet since that of 1729.

OBSERVATIONS OF VARIABLE STARS.—In No. 3837 of the *Astronomische Nachrichten*, M. M. Luizet, of the Lyons Observatory, publishes his observations of five variable stars and gives his results for each star in a tabular form.

The result of 285 observations of Algol, made between November 18, 1897, and March 12, 1902, indicates a possible slight negative correction to the elements published by Mr. Chandler in No. 509 of the *Astronomical Journal*.

One hundred and fifty-seven comparisons of the irregular variable ε Aurigæ indicate great irregularities in the brightness of this star, which on December 10, 1901, was actually one or two degrees fainter than ν Persei.

One hundred and fourteen comparisons of W Orionis were made between October 26, 1898, and March 19, 1902, and these show that both the duration of the period and the magnitudes at maxima and minima vary greatly. The following elements show the closest agreement to the observations:—

Maximum 1899 February 22
Minimum 1899 March 10 } + 32d.·32 E.,

but there are several observations which are not reconcilable to this period.

Observations of T Monocerotis and ζ Geminorum have also been made, and tables of their maxima and minima are given by M. Luizet.

THE SPECTRUM OF ε AURIGÆ.—From the investigation and measurement of spectrograms obtained during 1901 and 1902 by Prof. Hartmann and Dr. Eberhard, Prof. H. C. Vogel has found that ε Aurigæ is a spectroscopic binary which has a very long period.

The spectrograms referred to show that the hydrogen lines in the violet region, beyond H and K, stand out with exceptional prominence in this star, and a close investigation as to the cause has led to the conclusion that the spectra of two stars—one of the α Cygni type, the other lying between the limits of Types I. and II. (α Persei, γ Cygni)—are present, the one being exactly superimposed on the other.

OBSERVATIONS WITH A BINOCULAR TELESCOPE.—In *Popular Astronomy*, No. 100, Mr. D. W. Edgecomb describes the performances of the 6¼-inch binocular telescope, made by Messrs. Alvan Clark and Sons.

In describing the features of the Moon, Jupiter and Saturn as seen with the binocular, the writer states that the objects

present more detail, are brighter, and appear larger than when seen through an ordinary single telescope of the same aperture. In addition to this, the "seeing" is much steadier, and the stereoscopic effect obtained greatly enhances the beauty of the objects observed.

Such objects as Clark's companion to γ Lyræ, the companion to τ Orionis and the Mitchell companion to Rigel have all been steadily observed, and it is generally considered necessary to use an instrument of 7 or 8 inches aperture in order to see the last-named object.

The prisms used in this instrument are $2\frac{7}{8}$ inches long and $1\frac{5}{16}$ inches thick, the rays from the objectives traversing $5\frac{1}{2}$ inches of glass before reaching the eyepieces.

RECENT AMERICAN BOTANY.

MR. M. L. FERNALD[1] has published a very interesting review of the birches belonging to the groups *Betula alba* and *B. nana*. These trees and shrubs inhabit the northern regions of both hemispheres, and Mr. Fernald recognises in America seven species and seven varieties, of which six species and five varieties are common to the Old World. Thus, contrary to the opinion of some recent authors, the American white birches are mostly non-endemic, though exhibiting numerous apparently distinct forms. Not only is this true, but the admitted species intergrade all along the line. "It is quite possible to trace by a series of specimens a direct connection between the dwarf *Betula nana* or *B. glandulosa* and the tall *B. alba*. . . . But since it is obviously impracticable to regard all these forms as one species, it seems wiser to recognise the more marked centres of variation as species which are admitted to pass by exceptional tendencies to other forms ordinarily distinguished by marked characteristics" (p. 189). This, of course, brings up the question of the definition of species. The present writer has been accustomed to use the accompanying diagram in teaching biology. The line *a a* represents a species which is slightly dimorphic, as is indicated by the two prominences. The line *b b* represents a strongly dimorphic species, connected (at *b'*) by very few intermediates. The line *c c* represents a case in which the intermediates have died out, and there is a complete break (at *c'*) resulting in the formation of two species. It is now to be pointed out that this break must be spacial or geographical, and not merely morphological, otherwise the two sexes of the same species would often have to be regarded as distinct species. Such a break need not be geographical in the ordinary sense, but when the two species inhabit what is nominally the same locality, they are found to be differently related to their environment, or related to different closely adjacent environments. Furthermore, they must breed true, and not ordinarily interbreed one with another.

This sounds simple enough, but the application of these principles is not so simple. In the diagram, the case of *b b* is obviously more like that of *c c* than it is like that of *a a*. The difference between a slight break and a slight connection is infinitesimally small, yet after all it is a real difference—something existing in Nature, and not subject to individual opinion. If this criterion is admitted, because of its capability of exact definition, then the whole series of birches discussed by Mr. Fernald must apparently be regarded as one species!

Another sort of case is offered by the plants of the Galapagos Islands, recently reviewed in a most valuable memoir by Dr. B. L. Robinson.[2] *Euphorbia viminea*, J. D. Hooker, has eight distinct forms confined to as many islands (one only being found on two). These plants are readily distinguishable, but their characters are such as would be ordinarily of no value for distinguishing species in the genus. On continental areas, similar species of Euphorbia are polymorphic, with innumerable similar variations connected by every sort of intermediate. Consequently, Dr. Robinson does not treat the Galapagos plants as separate species, or (with one exception) even as varieties, but as "forms." Now, according to the above definition of species, these plants are perfectly good species, for the breaks in continuity, slight as they are, appear to be absolute.

There is, perhaps, one way of escaping from this conclusion. Distinct species should not promiscuously interbreed; there should be some sort of "physiological" barrier. It is known, in the case of the ostensibly distinct species of Lavatera from the islands off the coast of California, that this barrier does not exist. Perhaps, if the different Galapagos Islands' forms of *Euphorbia viminea* were grown together, they would completely fuse and give a single promiscuously varying type like those of the continents. But, after all, the question is what they actually do, not what they might do, under hypothetical conditions. The answer to this question must be that they remain distinct.

It seems to the present writer that the only precise criterion of species must be a spacial one, just as the only reason for species is that of function, or the relation between the nature of the creature and the place it occupies. But, admitting this on philosophical grounds, we are forced to recognise species of every degree of distinctness, just as the geographer recognises islands separated by every sort of distance from the mainland. It is easier, no doubt, to accept instead the morphological criterion, and this is actually what we have to do in taxonomic work,[1] for lack of evidence of the other kind; but this leaves the whole matter to be decided by individual opinions, with results known too well.

It is probable, if not certain, that variable plants on continental areas produce many "temporary species." That is to say, local colonies become more or less differentiated and remain so until swamped by invasions of the parent form or some other variety. Whether we recognise these "temporary species" depends, in practice, upon the degree of difference exhibited. Not rarely, the distinctions are constant and marked over a certain area, but the very same distinctions elsewhere occur as individual variations in the midst of the parent species. I have recorded such cases in the genera Sphæralcea and Cleome.

At the close of his work on the Galapagos flora, Dr. Robinson presents a most lucid and philosophical discussion of the whole subject; it is so full of fact and thought that a brief summary could not do it justice. In particular, attention must be called

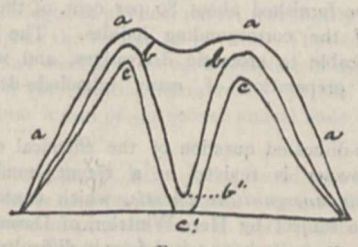

FIG. 1.

to his statement of the reasons why the local insular varieties persist in spite of the occasional infusion of new blood.

Mr. Carl Purdy's revision of the genus Calochortus[2] is another work of great interest. These beautiful "butterfly lilies" are extremely abundant in the Pacific region of North America, and are almost indefinitely variable. The variations are of all sorts, sometimes "constitutional" rather than morphological. Says Mr. Purdy, "In cultivation it has frequently been found that a very slight variability in strains is accompanied by a marked constitutional difference. In two beds of *Calochortus venustus*, planted in the same soil and separated only by a thin board, it would puzzle a botanist to state wherein the plants vary. They come from widely separated localities, and the difference is one more easily detected by the eye than conveyed by words. In one bed, two-thirds of the leaves are already destroyed by mildew (Botrytis), while in the other, not one leaf is injured; and such is the case whenever and wherever the two are planted" (p. 108). Mr. Purdy points out that in some localities the plants are very uniform, while in others they are extremely variable, with hundreds of distinguishable phases. It is probable that the phenomenon of "temporary species" is common in this genus, and the union of such morphologically, but not physiologically, distinct types is the cause of much variability. At the same time, there are species which always remain distinct, never producing fertile hybrids. That Mr. Purdy has tested so many of the forms for such "physiological barriers" gives his work especial value and importance. It does

[1] *Amer. Journ. Science*, xiv., September, 1902.
[2] *Proc.* Amer. Acad., October, 1902 (vol. xxxviii.).

[1] De Vries has assumed that, because botanists so distinguish species (admittedly of necessity), therefore the morphological criterion is the genuine one. Thus species have no better foundation in Nature than genera, which are wholly based on reasons of convenience.
[2] *Proc.* Calif. Acad. Sci., 3rd series, Botany, vol. ii. No. 4 (1901).

not appear that mere isolation suffices to produce even distinct varieties of Calochortus. For instance, *C. catalinae*, Watson, is found on Catalina and other islands, and also on the mainland; but instead of running into numerous insular races, it "is one of the least variable" of all, and no variety has been distinguished by name. On p. 141, Mr. Purdy admits that his *Calochortus venustus*, var. *eldorado*, "var. nov.," is the same as *C. venustus purpurascens*, Watson; while he applies the name *purpurascens* (Purdy, 1895) to a quite different variety of the coast range. This surely cannot be permitted; the former must stand as *purpurascens*, while the latter may be called var. *Caroli*.

T. D. A. COCKERELL.

EARTHQUAKE OBSERVATIONS IN GALICIA.

THE ninth number in the new series of the publications of the Austrian Academy of Sciences relates to earthquakes observed during the year 1901 in Lemberg. The first feature which one observes in this publication, the author of which is Dr. W. Láska, is that he describes each earthquake according to the phases it exhibits, the various phases being distinguished from each other by differences in their periods. Twenty years ago, earthquakes were described as consisting of preliminary tremors, shocks and concluding vibrations, each of which had distinguishing periodic motions. Now we find first preliminary tremors of types p_1' and p_1'', second preliminary tremors of types p_2', p_2'', p_2''' and p_2'''', and on they go, commencing with p_1', with periods between 2·1 and 6·9 seconds, and ending with types where the periods have exceeded one minute. Inasmuch as these groups overlap, so that it is frequently difficult to assign a set of waves to their proper group, for our own part we are for the present content to divide the seismic spectrum into four parts—first and second preliminary tremors, large waves and concluding vibrations. In addition to these entries, Dr. Láska gives tables of tridaily readings of two levels and of a thermometer. The most interesting portion of the work is, however, found in its introduction, where, amongst other matters, reference is made to the natural period of a pendulum as influencing the magnitude of its records and to rules which enable an observer to determine the distance of an origin from the inspection of a seismogram.

One simple rule is to diminish the duration of the first preliminary tremors reckoned in minutes by unity and multiply the same by 1000. The result is an approximation to the distance of the origin expressed in kilometres. For example, if a seismogram shows that the preliminary tremors had a duration of 7·6 minutes, then the earthquake it represents originated at some place about 6600 kilometres distant. The mnemonic is certainly simple, but its application is confined to those records where preliminary tremors are well defined. These are comparatively few in number and the accuracy of the determination is dependent upon the measurement of intervals of time which are small. These objections apply to a second rule suggested by Dr. Láska, the value of which is apparently still further impaired by the introduction of two assumed constants determined by Dr. F. Ōmori. These constants are the velocities of the first and second preliminary tremors as determined from observations of ten earthquakes which originated near Japan and were recorded at Tokio and in Italy.[1] To obtain these velocities, the arcual distance between the Tokio isoseist and Italy is divided by the difference between the times of observation in Tokio and Italy. Had the distance between the origins and Italy been divided by the difference of times between the times of origin (which are easily calculable) and the times of arrival in Italy, then the constants given by Dr. Ōmori would have been reduced. A further reduction would be made on the assumption that the wave paths of the motion considered had approximated to chords. If the speed of the preliminary tremors between their origin to the Tokio isoseist had been the same as it was from that isoseist to Italy, then the above objections might be withdrawn, but this, according to Dr. Ōmori's own showing, appears hardly to be the case.[2]

Although it is interesting to find the relationship between the duration of preliminary tremors and the distance they have travelled again brought to our notice, the well-known method of determining origins by the interval of time between the first motion of an earthquake and the subsequent arrival of the large waves is apparently one of more frequent and certain application.[1]

J. MILNE.

[1] "Publications of the Earthquake Investigation Committee in Foreign Languages," No. 5, pp. 71–80. (Tokio, 1901.)
[2] *Jour.* Sc. Coll., Tokio, vol. xi., p. 158.

PILOT CHARTS OF THE METEOROLOGICAL OFFICE.

IN addition to the usual information, the Meteorological Office pilot chart of the North Atlantic and Mediterranean for the month of January deals with some new features, necessitating the use of the back of the chart as well as the front. There is an account of the destructive cyclone which visited our coasts on October 15–16 last, and also of the slow-moving disturbance and its accompanying gales which wandered about the Tyrrhenian Sea from October 22–29. A summary is given of the characteristics of the surface temperature of the Atlantic for each of the ten months from January to October last, the most striking feature being the evidence of a distinct tendency for the water in the immediate vicinity of western Europe to remain cooler than the normal during the first nine months, a fact which may be associated with the persistent low air temperature over the adjacent land during the spring and summer. On the Newfoundland banks, there was a marked excess of warmth through the first six months, little or no ice being found in the locality. In October, an excess was shown on the eastern side of the ocean for the first time, and simultaneously the air temperature over the British Isles passed above the average in all districts. With the object of discovering what connection, if any, there is between the movements of weather systems and the distribution of the temperature of the surface water, observations are being collected for obtaining the mean barometric pressure month by month over the region from 30° to 60° N., 0° to 70° W., and the tracks of the centres of storm areas. For October, the mean isobars are superimposed on the sea temperature results, while the storm tracks are given on a separate chart.

To arrive at any definite conclusion as to cause and effect, it will require a long series of such charts—probably, too, for shorter periods than a calendar month, periods determined by the prevailing type of conditions, depending mainly on the positions and stability of the controlling anticyclones. Summaries are given of the ice reports from the whaling steamer *Balaena*, up Davis Strait, and the barque *Lady Head*, in Hudson Bay, last summer. Neither vessel passed any ice in the lower part of Davis Strait when heading for home in October. On July 1 last, the New Zealand Shipping Company's s.s. *Waikato* was disabled in 33° S., 6° E., and for twenty-six days she drifted helplessly about the south Atlantic, being finally taken in tow on July 27 in 28° S., 13° E., having in the interval travelled 812 miles, or at an average rate of more than thirty-one miles per day. The track of her wanderings day by day, together with the direction and force of the wind, supplied by Captain Kiddle, is reproduced, with the addition of the normal current circulation of the region, which shows that the *Waikato* followed closely the drift indicated by the Admiralty chart.

STARVING A PARASITE.

IN a recent paper read before the Royal Society,[2] Prof. Marshall Ward described the results of three series of experimental cultures of Brome-seedlings in sand, to which had been added various nutritive salts, or manurial mixtures, which were then infected with the parasite to see how the latter behaved on starved seedlings. Some of the seedlings received all the salts necessary for successful development, others none of such salts other than the root-hairs could extract from the sand itself and from the reserves in the endosperm, and others all necessary minerals except phosphorus, or potassium, or magnesium, or calcium, or nitrogen respectively.

So far as the seedlings themselves are concerned, the effects of the mineral starvation were most evident in the small stature,

[1] "Brit. Assoc. Reports," 1900, p. 79; and "Seismological Investigation Report," 1902.
[2] "Experiments on the Effect of Mineral Starvation on the Parasitism of the Uredine Fungus, *Puccinia dispersa*, on Species of Bromus." By Prof. H. Marshall Ward, F.R.S. Read before the Royal Society on November 27.

reduced root-system, narrow leaves, pale colour, &c., the nitrogen-starved and phosphorus-starved specimens, and in those lacking all salts.

In no case, however treated were the starved or manured seedlings rendered immune. All were successfully infected by normal uredospores adapted to the normal species, though in the phosphorus-free and in the nitrogen-free seedlings, and in those deprived of all salts, there were signs of retardation of the infection, and the resulting patches and pustules of fungus spores (uredospores) were fewer and smaller.

As regards the fungus, apart from the reduced size of the mycelium, as expressed in the small pustules and retardation of development above referred to, even the reduced number of spores borne on the smallest pustules—*e.g.* on phosphorus-starved plants—showed no signs of morphological degeneration, or of diminished germinating capacity or virulence—*i.e.* capacity for infection.

The positive results, therefore, are purely *quantitative*. A starved plant develops smaller pustules and fewer spores, simply because it can offer smaller quantities of food materials to the mycelium in its tissues; these food-materials, however, are as good in *quality* as they are in the case of a normal or highly manured plant. Not only so: the experiments also show that spores developed on starved seedlings can also infect seedlings which have been *similarly starved*—for instance, the few spores obtained from the very minute pustules of a phosphorus-starved seedling *can infect another phosphorus-starved seedling* just as readily as they can a normal plant, and so on through the series.

Consequently, we must infer that predisposition and immunity on the part of the Brome, and impotence and virulence on the part of the Fungus, are alike independent of mere nutrition; and since the author has shown in previous papers[1] that these properties are also independent of the anatomical structure of the host-plant, it must be concluded that the phenomena of adaptive parasitism depend on deep-seated peculiarities of the living protoplasm of the cells—possibly their capacity for forming enzymes, toxins and antitoxins, chemotactic bodies and the like, although such bodies have as yet resisted all efforts at extraction.

The full paper is illustrated with photographs and tables.

THE NORTH OF ENGLAND SCIENCE CONFERENCE.

THE first annual conference of persons in the north of England concerned in primary, secondary, technical and other forms of higher education, was held at Manchester on January 2 and 3, and proved highly successful. The conference may be regarded as a natural outcome of similar meetings which have for some years past been held annually in London under the auspices of the London Technical Education Board. Many teachers and other educationists from the north of England have, year by year, attended the conferences in London and have become familiar with the benefits to be derived from a discussion of educational methods. Believing that many teachers and others in the northern counties, anxious to reap the advantages springing from such meetings, were debarred from attendance by the expense of travelling, a number of prominent educationists in Lancashire and Yorkshire arranged this series of meetings in Manchester, and the phenomenally large attendance at all the discussions has fully justified their enterprise. More than three thousand persons accepted invitations to be present, and every meeting was characterised by the greatest enthusiasm. It had been intended to hold all the meetings at the Manchester Municipal School of Technology, but the number of visitors to be accommodated necessitated the duplication of meetings, and a few days before the commencement of the conference arrangements were made for additional papers to be read in other places at the same time as those originally provided.

In addition to the papers and discussions, the executive committee provided exhibitions to illustrate methods of nature-study, the teaching of experimental science, school furniture and other forms of school equipment. Demonstrations on the teaching of light and magnetism were respectively given by Messrs. Adamson and Moore, of the Manchester Technical School; and, in addition, the numerous excellent educational institutions in different parts of the city were thrown open for the inspection of visitors. A conversazione, held at the School of Technology on the evening of the first day of the conference, provided a good opportunity for teachers in different districts to become acquainted.

The method of conducting the meetings deserves to be more widely imitated in educational conferences. Immediately after the reading of a paper, the discussion of the subject was opened by one or two speakers of wide experience, who had been previously selected for the purpose and had prepared their remarks, with the result that the discussion was much more helpful to teachers than is usually the case on similar occasions. Moreover, as printed copies of the papers for discussion could be obtained immediately before the commencement of the meetings, subsequent speakers were able to contribute something of value to the debate, and general remarks having little relation to the subject in hand were reduced to a minimum. Messrs. J. H. Reynolds and H. Lloyd Snape, the honorary secretaries, are to be congratulated upon the complete success of the conference.

Half an hour before the commencement of the serious business of the conference, the visitors were welcomed by the Lord Mayor of Manchester, and his remarks were warmly endorsed by Dr. Maclure, Dean of Manchester, by Prof. Hopkinson, principal of Owens College, and by other prominent educational authorities of the district.

School Curricula.

Mr. M. E. Sadler presided at the first meeting of the conference, and in his introductory speech dealt with the aims of education. The purpose of all practical inquiry and experiment was, he said, to find the kind of training which would best equip the rising generation for their life as home-makers or wealth-makers, under the actual conditions of the modern world. The reform of the curricula of our schools would, he thought, involve certain practical changes in the conditions under which many English teachers at present worked. Little boys ought not to be prematurely specialised in classical erudition in order to win scholarships at the public schools. In no school should any pupil fail to gain insight into the meaning of scientific method and into the operation of physical laws. In any type of curriculum, drawing and other forms of expression by means of the hand should be given a permanent place and should be worked in, as far as possible, in connection with the other subjects of study. There was a need that scientific and experimental study of education should be actively carried on at the universities, with encouragement of similar investigation among teachers already at work in the schools.

Miss Burstall, head mistress of the Manchester High School for Girls, then read a paper on the curriculum in different types of schools, in which she endeavoured to find general principles by which school curricula may be tested and, if necessary, amended. Three principles were deduced; first, the gradual adjustment of the child to the spiritual possessions of the race; second, that of training; and third, the theorem that the order of subjects in school life is conditioned by the laws of development of the child. These principles, Miss Burstall contended, lead to a broad rather than a narrow curriculum. The compulsory subjects of the curriculum for all children could be divided into three groups—English, including literature, history and geography, the humanities; science, *i.e.* arithmetic and nature-study for young children, mathematics and science later; physical and manual training. Technical education should be reserved for the last year of school life, when the specialised study of mathematics and science required for engineering, or housewifery and the domestic arts for girls, might be taken up. The subsequent discussion was very animated, and many teachers took part in it. Mr. King, high master of the Manchester Grammar School, contended that the subjects of education did not so much matter as the method in which they were taught. Prof. Armstrong, F.R.S., deprecated a statement of Miss Burstall's that a child's reasoning powers developed late.

A paper by Mr. W. E. Hoyle, of the Manchester Museum, on the value of natural history collections for teaching purposes, was also read at Owens College during the first morning of the conference.

[1] *Proc.* Cambridge Philos. Soc., vol. xi. 1902, pp. 307–328; and *Annals of Botany*, vol. xvi. 1902, pp. 233–315.

Coordination of Science Teaching.

Prof. Armstrong, F.R.S., took the chair at the afternoon meeting, when Dr. Kimmins read a paper on the coordination and delimitation of science teaching in various grades of schools. He maintained that the aim of rational methods of teaching science was not the acquisition of knowledge, but rather the training of the intelligence of the child and the development of certain mental qualities of the highest value. Useful knowledge had been and was still the curse of science teaching. He urged that the adoption of rational methods in science teaching simplified to a remarkable degree the relation and delimitations of such teaching, and instanced the coordination in workshop and laboratory instruction which has been so effectually secured in London schools. In the discussion which followed, Dr. Forsyth emphasised the need of a sound general education for all students who intended later to enter technical colleges.

During the afternoon, Canon Rawnsley read a paper at the Central Higher Grade School on the national import of co-education.

Elementary Experimental Science.

Prof. Smithells occupied the chair at the third meeting, when papers were read by Mr. French, on the teaching of experimental physics in its early stages, and by Mr. R. L. Taylor, on the similar teaching of experimental chemistry. Mr. French described and approved the methods of teaching elementary physics advocated by the British Association committee and now very generally adopted in secondary schools. Mr. Taylor attacked, in a friendly way, the heuristic method of teaching chemistry as advocated by Prof. Armstrong, an admirable method which, he said, had become an undesirable system. A lively debate ensued, in which many speakers, following Mr. Taylor's lead, appeared to strive to accentuate the abuses of the "research" method of teaching chemistry rather than to recognise its many advantages.

Prof. Armstrong, in replying to Mr. Taylor's criticisms, said the question at issue was not merely a difference of opinion. There was a great principle at stake, and that principle was—Were they or were they not to train boys and girls at school to think for themselves, to reason for themselves, to do for themselves, to be thoughtful, observant human beings throughout the time they were at school, whenever they left school, and ever afterwards? The majority of the subjects that were taught and had been taught up to the present day had been taught in an academic, didactic and unpractical way. Britain was what it was because of the individuality of Britishers. Our modern school system was sapping our individuality. It was with the object of avoiding that loss of character that he and others were bringing practical methods into vogue.

Prof. Smithells, in a very able speech, summarised the discussion, and traced many of the improvements in the teaching of science in England during the last ten years to the advocacy by Prof. Armstrong of rational methods of teaching, but at the same time pointed out there were extravagances in some of Prof. Armstrong's utterances which were, perhaps, inseparable from the work of a pioneer.

At the Central Higher Grade School during the discussion on the heuristic method, Mr. Lomas read a paper on fitting up school laboratories.

The Teaching of Nature-Study.

The concluding meeting of the conference was presided over by Prof. Miall, F.R.S. A paper was read by Mr. H. Wager on the methods of nature-study, in which he urged that nature-study in its widest aspects should be regarded as the study of elementary natural science, and should include, in addition to the simple facts of botany, zoology and geology, so much of elementary physics and chemistry as was concerned with the study of air and water, the condensation of moisture, frost, snow, and other simple natural phenomena. The formal study of any branch of science was not implied in it, nor was it desirable, in the earlier stages, at any rate, that they should be restricted to one branch of science only. The main objects in advocating the inclusion of nature-study in schools were (1) to arouse an interest in natural objects and phenomena, and (2) to develop to some extent the scientific method of dealing with simple problems, by the careful observation and comparison of facts and drawing inferences from them.

Prof. Weiss afterwards suggested that some portion of public parks should be made available for nature-study. He disagreed with Mr. Wager, who had deprecated the employment of diagrams and museums, and said he could not but think that there were many objects from which lessons could usefully be learnt without having the living animal before them. They should first go to the living objects, but useful illustrations could be drawn from other countries, and where they had opportunities they should use them.

During the concluding afternoon, Mr. W. C. Fletcher, of Liverpool Institute, read a paper on the teaching of geometry, in which he generally supported the recommendations of the British Association committee.

The next conference will be held at Leeds.

A. T. S.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE annual meeting of the Association of Science Masters in Public Schools will be held at the University of London on January 17.

WE learn from the *Times* that the Treasury has given its assent to the scheme by which Reading Corporation acquires the site and buildings of the University College at a cost of 50,000*l*. The college, in exchange, obtains a much larger site on the London Road, whereon it is intended to erect a handsome pile of college buildings.

FROM a letter which Sir Michael Foster has addressed to Sir John Rotton, it appears that an election of a new member for the University of London may not be necessary. This news will be received with great satisfaction by most of the electors, for the University has in Sir Michael Foster a representative of the high intellectual standard demanded of an academic constituency. Since expressing the wish to resign his seat, the circumstances which suggested that course have, most fortunately, changed, and he now desires to know whether the graduates wish him to remain their member or not.

CANDIDATES for the Andrew Carnegie research scholarships to be awarded by the Iron and Steel Institute must send in their applications, on a special form, before the end of February to the Secretary of the Institute, 28 Victoria Street, S.W. The object of this scheme of scholarships is not to facilitate ordinary collegiate studies, but to enable students, who have passed through a college curriculum or have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel and allied subjects, with the view of aiding its advance or its application to industry. There is no restriction as to the place of research which may be selected, whether university, technical school or works, provided it be properly equipped for the prosecution of metallurgical investigations. Last year the Andrew Carnegie gold medal was awarded to Dr. J. A. Mathews, New York, and scholarships, each of the value of 100*l*., were awarded to O. Boudouard, Paris; W. Campbell, New York; A. Campion, Coopers Hill; P. Longmuir, Manchester; E. Schott, Berlin; and F. H. Wigham, Wakefield.

PROF. ROBERTSON, the Canadian Commissioner of Agriculture and Dairying, recently made a visit of investigation and observation to a portion of the State of Ohio, where remarkable progress has been made in the improvement of rural schools by the plan known as that of consolidation. Instead of having a great number of small school districts, each with its own little school, these districts are united in one, and a large central school meets the needs of the whole area. The children are conveyed to and from the central school by means of vans at the expense of the rates. Prof. Robertson sums up some of the advantages afforded by the consolidation of rural schools and the free transportation of pupils. It results in the attendance of a larger number of the children in the locality, it brings about a more regular attendance of pupils of all grades of advancement, it ensures teachers of higher qualifications and longer experience in rural schools, it creates conditions for a proper classification of pupils and provides the beneficial influences of fairly large classes of pupils of about equal advancement. It makes it convenient for boys and girls in rural districts to obtain a high school education without leaving home, and leads to the erection of better school buildings and more satisfactory equipment. It makes it practicable for rural schools to teach nature-

study, manual training and household science, and for advanced pupils to obtain instruction in agriculture, horticulture and allied subjects. It stimulates public interest in the schools and brings to the pupils of a township an institution in which all can have an equal interest and a worthy pride.

THE address given by Sir J. Wolfe Barry on Tuesday, as president of the Association of Technical Institutions, contained several instructive comparisons as to the position of technical education at home and abroad. For instance, he pointed out that while the matriculated students in German technical high schools number 15,442, the number in the whole of similar institutions and universities of Great Britain is only 3873. But it is not so much the number of students as the spirit in which scientific knowledge is regarded that is of importance to national progress. What is wanted, Sir J. Wolfe Barry remarked, is, first, that the highest intellects among us for research as applied to the arts should be rendered available, and secondly, the best possible directing minds should be discovered and utilised in our manufactures. In other words, the man of science should be encouraged to help in the development of industries. Efforts should be made to ensure that industrial leaders are well equipped with scientific knowledge and the principles of technology, and in our schools less time should be given to dead languages and more to the efficient study of science, applied mathematics and other subjects demanded by modern life. Finally, everyone should endeavour, each in his own sphere of influence, to direct, without any exaggeration, but with profound conviction, the attention of our commercial classes to the fact that technical education of the best and most thorough kind is an urgent and crying necessity if we are to maintain a leading position among the nations of the world.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 11, 1902.—"An Error in the Estimation of the Specific Gravity of the Blood by Hammerschlag's Method, when employed in connection with Hydrometers." By A. G. **Levy**, M.D. (London). Communicated by Sir Victor Horsley, F.R.S.

Hammerschlag's method may be briefly described as the adjustment of the specific gravity of a mixture of chloroform and benzol by small successive additions of either constituent until it corresponds to the specific gravity of the blood, the test of the attainment of this condition being that a small drop of the blood, when immersed in the mixture, shall remain suspended without any very obvious tendency to rise or sink. The specific gravity of the mixture is then estimated by means of a hydrometer.

This method is known to be liable to an error of varying magnitude. The investigation into the source of this error resolved itself into a series of observations upon the effect of the low value of the surface tension of the above mixture upon the readings of hydrometers immersed therein. The surface tension of the mixture may be taken as 2·75 mg. per mm., and that of clean tap water as 7·3 mg.

The readings of four different hydrometers when immersed in a mixture of the specific gravity 1·000 are appended :—

No. of hydrometer.	No. 1.	No. 2.	No. 3.	No. 4.
Reading of scale in a chloroform benzol mixture of specific gravity = 1·000	1·002	1·003	1·0095	1·010

The author found, however, that the *calculatea* errors exceeded in each instance those *observed*, and the results are contrasted in the following table :—

Hydrometer.	Observed error.	Calculated error.
1	0·002	0·0035
2	0·003	0·0056
3	0·095	0·0123
4	0·010	0·0146

The difference was accounted for satisfactorily by an innate error demonstrated to exist in each hydrometer, evidently due to the standardisation of the instrument in unclean (*i.e.* greasy) water, which possesses a lower surface tension than 7·3 mg. This appears to be a common fault in hydrometers.

Chemical Society, December 17, 1902.—Prof. Emerson Reynolds, F.R.S., president, in the chair.—The following papers were read :—A reagent for the identification of carbamide and of certain other nitrogen compounds, by Mr. H. J. H **Fenton**. Among the derivatives of methyl-furfural previously described by the author is one which may be either methyl-furil or the isomeric ketone-aldehyde ; this in presence of a trace of acetyl chloride gives with carbamide and monoalkyl carbamides a brilliant blue colour.—The rate of decomposition of diazo-compounds, part ii., diazo-compounds of the naphthalene series, by Messrs. **Cain** and **Nicoll**. The reaction is monomolecular, but after a time is not strictly so owing to the formation of azo-colours.—State of carbon dioxide in aqueous solution, by Prof. J. **Walker**. It is shown that obedience to Ostwald's dilution law in the case of solutions of carbonic acid gas and similar substances affords no evidence as to the amount of real carbonic acid present in solution.—Qualitative separation of arsenic, antimony and tin, by Prof. J. **Walker**. The mixed sulphides are dissolved in soda solution and oxidised with sodium peroxide ; from the solution, stannic oxide is precipitated by boiling with ammonium chloride, whilst arsenic and antimony can be separated in the usual manner.—The hydrates and solubility of barium acetate, by Prof. **Walker** and Mr. W. A. **Fyffe**. The solubility curve consists of three portions, all convex to the axes and representing the solubilities of a trihydrate, monohydrate and anhydrous salt respectively.—*cis*- and *trans*-3β Dimethylglutaric acid, and the separation of the *cis* and *trans* forms of substituted glutaric acids, by Messrs. J. F. **Thorpe** and W. J. **Young**.—Constitution of metallic cyanides, by J. E. **Marsh**. Metallic cyanides, with the exception of those of silver and mercury, are oxidised by permanganate to cyanates, whence the author concludes that in general these cyanides have the isonitrile structure, the exceptions being nitriles.—Auto-reduction of mercury and silver cyanides, by Messrs. **Marsh** and **Struthers**.—Note on the action of acids on cellulose, by Miss M. **Gostling**. The black residue formed when cellulose is heated with strong haloid acids closely resembles the artificial humus obtained by the action of dilute acids on sugars.—Nitrotartaric acid and some of its esters, by Prof. P. F. **Frankland**, Mr. H. L. **Heathcote** and Miss **Hartle**.—The nitration of diethylmonobenzoyl and mono-*p*-toluyl tartrates, by Prof. P. F. **Frankland** and Messrs. **Heathcote** and **Green**. A preliminary description of these derivatives of tartaric acid.—Interchange of halogen for hydroxyl in chloro- and bromo-naphthalenediazonium hydroxides, by Dr. **Orton**.—Purpurogallin, by Messrs. A. G. **Perkin** and A. B. **Steven**. A description of acyl and alkyl derivatives is given and the products of decomposition by potassium hydroxide are found to be two ketonic substances of the formula $C_{11}H_6O_5$.—Note on the destructive distillation of ethyl gallate, by Mr. A. G. **Perkin**. In addition to pyrogallol and ethyl alcohol, there is formed 7 per cent. of rufigallic acid ; the latter is also produced by the distillation of gallic acid itself.—A series of double chromates, by Mr. S. H. C. **Briggs**. A double salt of the composition $(NH_4)_2Ni(CrO_4)_2,6H_2O$ and a second of the composition $(NH_4)_2Ni(CrO_4)_2,2NH_3$ have been obtained, as well as the corresponding salts of copper, zinc and cadmium, by the action of ammonia on the appropriate dichromates.

Linnean Society, December 18, 1902.—Prof. Sydney H. Vines, F.R.S., president, in the chair.—Notes on some Copepoda from the Faröe Channel, by Mr. Thomas **Scott**. Waterlogged and partly decayed pieces of wood are frequently brought up in the dredge, and these fragments harbour Entomostraca. In this manner, some of the rare forms, commented on in this paper, were obtained. Three new species and a new variety of another previously characterised species were described.—The Amphipoda of the *Southern Cross* Antarctic expedition, with remarks on bipolarity, by Mr. A. O. **Walker**. The collection was made between Cape Adare in April, 1899, and Franklin Island in February, 1900, the larger part after the death of the zoologist of the expedition (Mr. N. Hanson) by Mr. Anton Fougner, partly by dredging. The species obtained have a striking resemblance to forms found in Arctic seas, though only one species has been deemed identical, *Ampelisca macrocephala*, Lilljeb. The author does not put forward any theory of his own to account for the similarity of forms in the Arctic and Antarctic regions, with their absence from the intervening tropical seas, but he adduces many instances of it, especially the distribution of the genus Orchomenopsis, Sars, which is widely spread in waters of low temperature. One new genus, Oradarea, is described with a single species, from Cape Adare.

—The deep-sea isopod, *Anuropus branchiatus*, Bedd., and some remarks on *Bathynomus giganteus*, A. M.-Edw., by Dr. H. J. **Hansen.** The aberrant genus Anuropus was described by Beddard in the report of the *Challenger*, vol. xvii., from a single specimen brought up from 1070 fathoms off the coast of New Guinea. The author has recently examined this specimen during a visit to the British Museum, and supplements the original description in several important particulars.

Royal Microscopical Society, December 17, 1902.—Dr. Hy. Woodward, F.R.S., president, in the chair.—Mr. **Rousselet** exhibited an apparatus designed by Mr. H. Bausch for drawing objects natural size. It was described in the Society's *Journal* in 1900, but had not been previously exhibited.—The Rev. R. **Freeman** read a paper by Mr. F. R. **Dixon-Nuttall** and himself on the genus Diaschiza which was illustrated by drawings shown on the screen by means of the epidiascope. The authors alluded to the confusion in which this genus of rotifers had remained to the present time and pointed out the errors into which Gosse had fallen. They described the characters of those species which they considered should be included in the genus and also described a new species.—Mr. E. R. **Turner** gave a description of Lumiére's process of taking photomicrographs in colours.

EDINBURGH.

Royal Society, December 1, 1902.—Lord Kelvin, president, in the chair.—Prof. Cossar **Ewart** read a paper on the callosities of the horse, in which from a study of their occurrence in the fœtus he concluded that the wrist callosity corresponded to the supplementary pad in the foreleg of the dog, and that the hock callosity corresponded to a pad which occurred in the banded ant-eater. There was no evidence of the callosities being remnants of glandular organs. The evidence was rather in favour of Beddard's recent suggestion that they were remnants of tactile organs such as occur in marsupials, lemurs, and the ungulate hyrax.—Prof. **Ewart** also read a paper on a new horse from the Western Islands, *Equus Caballus Celticus*. This newly recognised variety was a pony which took in the west the same place which the Arab took in the east. It agreed with asses and zebras in having no callosities on the hind legs, and it resembled the Przevalsky horse of Central Asia in having short hairs on the upper part of the tail just as in mules. It was yellow dun in colour, had black fetlocks, small head, small ears, prominent eyes, and had stripes and dorsal band, and fragments of stripes on legs, shoulder and face. In many characteristics, it differed decidedly from the Przevalsky horse, and nothing like it was to be found in the east, the recognised home of the Arab. It was found in Iceland, Faeroe, Barra and other small islands of the outer Hebrides, also in Connemara. From the drawings of Palæolithic man and from the bones found in caves, we are able to distinguish two kinds of horses, a large and a small size, and it was suggested that the Celtic pony represented the small-sized horse known to Palæolithic man. The evidence disproved the once prevalent view that all the various breeds of European horses were descended from the one domesticated stock which originated in the east. Dr. Munro thought that Prof. Ewart's paper was of great anthropological importance as furnishing additional evidence as to the continuity of man and his domesticated animals from Palæolithic times, and so giving the *coup de grace* to a fetish which had existed for many years in this country, that Palæolithic man had died out and all his civilisation become extinct before the appearance of Neolithic man.

PARIS.

Academy of Sciences, December 29, 1902.—M. Bouquet de la Grye in the chair.—M. Mascart was elected a vice-president for the year 1903.—On the presence of argon in the gases from the Bordeu spring at Luchon, and on the presence of free sulphur in the sulphurous water from the cave and its vapours, by M. Henri **Moissan.** An analysis of the gases from this spring, carefully collected in the absence of air, showed the presence of 2·56 per cent. of argon, 1·22 per cent. of methane, the remainder of the gas consisting of nitrogen. The water and the vapour from it contained free sulphur.—On a new preparation of the silicon hydride, Si_2H_6, by M. Henri **Moissan** (see p. 233).—Experimental cultures in the Mediterranean region: modifications in the anatomical structure, by M. Gaston **Bonnier.** Experimental cultures of the same species of plant were made in the same soil at Fontainebleau and at La Garde, near Toulon, and a minute account of the anatomical differences observed is given.—On the conditions necessary that a fluid should be in stable equilibrium, by M. P. **Duhem.**—On the velocity with which the different varieties of X-rays are propagated in air and in different media, by M. R. **Blondlot.** X-rays of varying penetrative power were examined, and the velocities determined in air, paraffin wax, beechwood, vaseline oil and essence of turpentine, and it was found that within the limits of experimental error the velocity of the different varieties of X-rays was the same in all the media, being equal to that of light in air.—On the germinating power of seeds exposed to sunlight, by M. Emile **Laurent.** Sunlight exerts an injurious influence upon the seeds or dried fruits of the higher plants, the first effect being a delay in the germination and then the death of the embryos. In general, moderately bulky seeds are less sensitive to the effects of sunlight than smaller ones, especially if the latter have dark coatings.—Notice on M. Millardet, by M. **Bornet.**—Anomalies of the earth's magnetic field on the Puy de Dome, by MM. B. **Brunhes** and **David.** Report by M. Bouquet de la Grye.—New observations on the volcanic eruptions at Martinique, extracts from letters addressed by M. **Lacroix** to MM. Darboux and Michel Levy.—Observations of the comet *d* (1902) made at the Observatory of Algiers with the 31·8 cm. equatorial, by MM. **Rambaud** and **Sy.** Observations of magnitude, apparent positions of the comet and of comparison stars.—Observations of the Perseids, Leonids and Bielids made at Athens in 1902, by M. D. **Eginitis.** The Perseids were observed under favourable conditions between August 8 and 13; they were less numerous than in the five preceding years. The conditions for the observation of the Leonids and Bielids were not so favourable.—On entire functions, by M. **Hadamard.**—Remark relating to my note on the approximate representation of functions, by M. W. **Stekloff.** A correction of an error in a previous note.—On the fundamental formula of Dirichlet relating to the determination of the number of classes of definite binary quadratic forms, by M. Mathias **Lerch.**—An application of the theory of residues to the analytical prolongation of Taylor's series, by M. Ernst **Lindelof.**—On a plane representation of space and its application to graphical statics, by M. B. **Mayor.**—Study of the magnetofriction of the anode bundle, by M. H. **Pellat.** In previous papers, the author has described a series of phenomena which are produced when a kathode or anode flux is submitted to the action of an intense magnetic field and which are inexplicable by the laws of electromagnetism. The assumption of the existence of an anisotropic friction affecting the particles in motion, very great in the sense perpendicular to the lines of force of the magnetic field and much less in the direction of the lines of force, serves to explain the observed phenomena perfectly, and the name magnetofriction is proposed as a general name for this phenomenon. Experiments are described in which the effect of varying the pressure and nature of the gas is shown.—On the emanation from phosphorus, by M. Eugène **Bloch.** It has been known for some time that air placed in the neighbourhood of a stick of phosphorus becomes a conductor of electricity. The study of this phenomenon having led to contradictory explanations in the hands of Barus, G. C. Schmidt and Harms, further experiments have been carried out by the author, who concludes that the conductivity of dry air which has passed over phosphorus is due to ions of very feeble mobility which serve as nuclei of condensation for water vapour, even non-saturated. The question of the exact chemical mechanism by which these ions are produced, whether their formation is due to the production of a definite chemical compound such as ozone or an oxide of phosphorus, or to a simple modification of the oxygen, requires further study.—On the Hall effect and the mobility of the ions of a saline vapour, by M. Georges **Moureau.**—On a new electric accumulator, by M. D. **Tommasi.** A description of the method of constructing the lead plates of an accumulator. The capacity obtained is 17·7 ampere-hours per kilogram of plates.—On the spectra of flames, by M. C. de **Watteville.** The method of M. Gouy is applied to the study of flame spectra in the ultra-violet. The results given tend to show that temperature is the only factor which influences the constitution of spectra.—On the proportion of hydrogen in atmospheric air, by M. Anatole **Leduc.** A reply to the criticisms of M. A. Gautier, the author maintaining the accuracy of his original conclusions.—The thermal study of metaphosphoric acid, by M. H. **Giran.**—On some sources of mineral gases, by

M. Ch. **Moureu.** An analysis of the gas arising from mineral springs in the region of the Pyrenees. All the gases examined contained argon in amounts varying from 0·9 to 1·8 per cent. Only one of the five samples examined could be shown to contain helium.—On cryolites, by M. E. **Baud.** A thermochemical paper.—On a new method for the volumetric estimation of hydroxylamine, by M. M. L. J. **Simon.** Hydroxylamine oxalate can be titrated with potassium permanganate in neutral solution in a perfectly definite manner, and an exact method for the titration of any salt of hydroxylamine can be based upon this fact.—On the method of manufacture of arms of the bronze period, by M. F. **Osmond.** By the application of the methods of micrographic analysis to specimens of ancient bronze implements, it has been found possible to trace differences in the mode of manufacture, and it is regarded as possible that a methodical study on these lines may lead to the classification of bronze implements with regard to time.—On the composition and constitution of the hydrates of sulphuretted hydrogen, by M. de **Forcrand.** The method of study is based upon the measurement of the dissociation pressures.—On the dibromide of metho-ethenylbenzene, by M. M. **Tiffeneau.**—On the synthesis of an aromatic hydrocarbon derived from camphor, by M. C. **Chabrié.** A study of the interaction of benzene and monochlorocamphor in the presence of aluminium chloride.—On a method for transforming monochloro- and monobromo-derivatives of hydrocarbons into monoiodo-derivatives, by M. F. **Bodroux** (see p. 233).—On the decomposition of some di- and tri-basic organic acids, by MM. Oechsner de **Coninck** and **Raynaud.** Malonic, succinic, tartaric, malic and citric acids were heated with glycol, glycerol and with sulphuric acid, and the decomposition products noted.—On the nature of the nitrogen compounds which exist in the soil at different heights, by M. C. **Andre.**—Normal hermaphrodism in fishes, by M. Louis **Roule.**—Organic variations in carnivorous fowls of the second generation, by M. Frédéric **Houssay.**—On the origin of the *Nebenkirn* and the nuclear movements in the spermatid of *Notonecta glauca*, by MM. J. **Pantel** and R. de **Sinéty.**—On the otocysts of polychætal annelids, by M. Pierre **Fauvel.**—On the nuclear emissions observed in the Protozoa, by MM. A. **Conte** and C. **Vaney.** The conclusion is drawn that the nucleus takes part directly in the formation of zymogen grains, and consequently it is of high importance in the phenomena of digestion, both intracellular and extracellular.—The organisation of *Trepomonas agilis*, by M. P. A. **Dangeard.**—On intermediary wood, by M. Paul **Vuillemin.**—The influence of formaldehyde upon the vegetation of some fresh-water Algæ, by M. Raoul **Bouilhac.** In presence of light, certain moulds can grow in solutions containing small quantities of formaldehyde, and can utilise the latter as food.—On the vegetation of Lake Pavin, by M. C. **Bruyant.**—On a conidian form of the fungus of black rot, by M. C. **Delacroix.**—On some connections between the genesis of metalliferous layers and general geology, by M. L. de **Launay.**—On the age of the old volcanic formations of Martinique, by M. L. **Giraud.**—On the discovery of a new granitic *massif* in the valley of the Arve, between Servoz and Les Houches, by MM. E. **Haug** and P. **Corbin.** Cryogenin in fevers, by M. **Carrière.** Cryogenin (metabenzaminosemicarbazide) has a marked effect in lowering the body temperature, especially in the case of fevers, and appears to be free from toxic properties. Its antithermic action is variable, but is especially strong in tuberculous subjects.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 8.

MATHEMATICAL SOCIETY, at 5.30.—A Method of representing Imaginary Points by Real Points in a Plane: Prof. A. Lodge.—On the Mathematical Expression of the Principle of Huygens: Dr. J. Larmor.—Generational Relations for the Abstract Group simply Isomorphic with the Linear Fractional Group in the Galois Field $[2^m]$: Prof. L. E. Dickson.—Series connected with the Enumeration of Partitions (second paper): Rev. F. H. Jackson.—On the Jacobian of Two Binary Quantics considered Geometrically: Prof. W. S. Burnside.—On the Resolution of some Skew Invariants of Binary Quantics into their Factors in Terms of their Roots: Prof. W. S. Burnside.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Notes of Recent Electrical Design: W. B. Esson.—Notes on the Manufacture of Large Dynamos and Alternators: E. K. Scott.

FRIDAY, JANUARY 9.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Preliminary Note on the Possible Existence of two Independent Stellar Systems: F. A. Bellamy and H. H. Turner.—New Double Stars detected with the 17¼-inch Reflector in the Year 1902: Rev. T. E. Espin.—The Sun's Stellar Magnitude, and the Parallax of Binary Stars: J. E. Gore.

GEOGRAPHICAL ASSOCIATION, at 3.30.—The Australian Commonwealth: Sir John A. Cockburn.

MONDAY, JANUARY 12.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Recent Volcanic Eruptions in the West Indies: Dr. Tempest Anderson.

TUESDAY, JANUARY 13.

ROYAL INSTITUTION, at 5.—Physiology of Digestion: Prof. A. Macfadyen.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Electric Automobiles: H. F. Joel.

WEDNESDAY, JANUARY 14.

SOCIETY OF ARTS, at 8.—Industrial Trusts: Prof. W. Smart.

THURSDAY, JANUARY 15.

ROYAL INSTITUTION, at 5.—Pre-Phœnician Writing in Crete and its Bearings on the History of the Alphabet: Dr. A. J. Evans, F.R.S.

FRIDAY, JANUARY 16.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Measurement of Water: Prof. W. C. Unwin, F.R.S.

ROYAL INSTITUTION, at 9.—Low Temperature Investigations: Prof. Dewar, F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Cutting Angles of Tools for Metal Work, as Affecting Speed and Feed: H. F. Donaldson.

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