THURSDAY, MAY 20, 1886

THE YEAR-BOOK OF PHARMACY

Year-Book of Pharmacy, 1884. (London: J. and A. Churchill, 1884.)

THIS volume contains the transactions of the British Pharmaceutical Conference at Hastings in August 1884, in addition to abstracts of papers relating to pharmacy, materia medica, and chemistry, from July 1, 1883, to June 30, 1884. The work is of course especially intended for chemists and druggists, but it also contains some information to general readers, and as this might be apt to be overlooked from the special nature of the work, we shall extract from it somewhat more largely than we might otherwise do. Amongst the most striking facts it contains is an observation of Sachs regarding the effect of light on plants, mentioned by Mr. Williams, President of the Conference, in his address. This observation is not only interesting in itself but it appears to give a reason for the rules which the herbalists, centuries ago, laid down for the collection of medicinal plants, and which in modern times have been regarded as simple nonsense, and have consequently been abandoned. The herbalists were particular about collecting their herbs at certain hours of the day or night, and even at special phases of the moon. We have not yet got any exact information regarding the effect of the moon upon the chemical composition of plants, but Sachs's observations show that the amount of starch present in the leaf of any given plant varies considerably under different circumstances. In direct sunshine and under otherwise favourable circumstances, starch is formed very rapidly; but it generally disappears entirely during the night, so that a leaf collected in the evening will prove full of starch, while another leaf of the same plant collected before sunrise will not show a trace. But even in direct sunshine, with all the necessary warmth and moisture, the plant will not form starch if the air in which it is growing be deprived of carbonic acid by means of caustic soda. The method of ascertaining the presence of starch in a leaf is very simple. "The leaf to be examined is first plunged into boiling water for about ten minutes, then taken out and digested in alcohol for about the same time (methylated spirit answers perfectly well). This treatment extracts the whole of the colouring-matter (chlorophyll), and leaves the leaf perfectly white. The leaf is now placed in an alcoholic solution of iodine, and the presence or absence of starch is demonstrated in a few minutes. The absorption of iodine commences at the edges, and soon colours the leaf blue-black if much starch be present, or brown if the quantity of starch be but small. The venation of the leaf appears as a pale network on a dark ground, rendering it a very beautiful object, but all my efforts to preserve a specimen beyond a few hours have hitherto failed." The variations in the amount of starch in the leaves at different periods of the twenty-four hours are peculiarly interesting as rendering it probable that the amount of alkaloidal or other active principles may also vary in a similar way. Since the publication of this book other researches have been made which render such a variation all the more probable inasmuch as they show that some of the poisonous alkaloids formed by the putrefaction of albuminous substances are identical with those occurring in some plants.

In the chemical section of this Year-Book there are several articles on putrefaction-alkaloids or ptomaines. These alkaloids were shortly after their discovery supposed to differ in certain respects from the alkaloids produced by plants, but the points of difference on which reliance was at first placed in order to distinguish between alkaloids which might be formed in a dead body and poisons of vegetable origin which might have been administered for the purpose of producing death have now been shown to be untrustworthy for this purpose. Amongst the most important of the researches on this subject are those of Brieger, some of which are abstracted in this Year-Book, and others of which have been since published in his works ("Ueber Ptomaine" and "Weitere Untersuchungen über Ptomaine," Berlin, Hirschwald). The abstract of another paper by Poehl in this Year-Book contains interesting information regarding alkaloids formed by the decomposition of rye-meal. His results are that ergot and mould have a peptonising action on the albuminous matters of the meal. The degree of putrefaction of albumens is directly proportional to their peptonisation. In the first stages of putrefaction the decomposition of albumens is greater in ergot meal than in mouldy or pure meal. But in the more advanced stages these differences are not so marked. Various alkaloidal products were obtained both from pure and tainted meal after they had been allowed to putrefy. This fact may be of considerable importance in regard to the action of alcoholic drinks. Guareschi and Mosso in a paper abstracted in this Year-Book describe the methods by which they obtained from putrefying fibrine an alkaloid having an action similar to curare. In another work, which is not abstracted here ("Les Ptomaïnes," Première Partie, Rome, Turin, Florence, H. Loescher), they mention that one of the difficulties they had to contend with was the presence of organic alkaloids in different kinds of alcohol. If we consider that a great deal of the spirits used for ordinary consumption are made of so-called silent spirit flavoured with various substances, and that silent spirit is also used in fortifying wines, it is evident that the purity of this spirit is of very considerable importance; but we believe that silent spirit is sometimes obtained by the fermentation of grain which has become mouldy or decomposed to such an extent as to be useless for food, and volatile alkaloids formed during its decomposition will pass over in the process of distillation, and being thus present in the spirit so produced may injuriously modify its action.

The most interesting of the other facts contained in this Year-Book are those which refer to the synthesis of organic alkaloids. Hofmann has shown that piperine, the alkaloid of pepper, can be built up from pyridine, a coal-tar base, and that piperidine, one of the intermediate compounds, which is also obtained with piperic acid when natural piperine is split up by potash, is probably a stepping-stone to the formation of conine and atropine. It was mentioned in a former Year-Book that caffeine, the alkaloid of tea and coffee, can be prepared from theobromine, the alkaloid of cocoa, which in its turn can be obtained from xanthine, a substance which is present in

beef-tea or Liebig's extract, and lastly, xanthine can be obtained from guanine, so that it seems not improbable that the manufacture of caffeine for medicinal purposes from Peruvian guano may be looked for as a consequence of the researches already made on the chemistry of these substances.

EUCLID REVISED

Euclid Revised, containing the Essentials of the Elements of Plane Geometry as given by Euclid in his First Six Books, with numerous Additional Propositions and Exercises. Edited by R. C. J. Nixon, M.A., formerly Scholar of St. Peter's College, Cambridge. (Oxford: Clarendon Press, 1886.)

THE movement for greater freedom in the teaching of elementary geometry than is consistent with a rigid adherence to Euclid's Elements, which may be regarded as having taken definite shape with the formation of the Association for the Improvement of Geometrical Teaching in the year 1871, gains strength surely, if not rapidly. Of this Mr. Nixon's book is one of many indications, notwithstanding his decision in favour of retaining Euclid's Elements as the basis of geometry. For this decision he assigns "*two* substantial reasons of expediency and convenience:—

"(1) That an established *order* of geometric proof is convenient for examination purposes;

"(2) A recognised *numbering* of fundamental results is convenient for reference."

He adds, "as co-operative reasons—the fact that there is no consensus of opinion among experts as to the superiority of any other scheme yet proposed; and the sentiment of repugnance at the thought of sweeping away an institution rendered venerable by the usage of more than 2000 years."

It may be questioned whether Mr. Nixon's first reason "of expediency and convenience" leads as a consequence to the retention of Euclid as a class-book. The experience of the examinations of the University of London is held by many examiners as well as teachers to prove the contrary. But apart from this we would enter our protest against the subordination here, as so often elsewhere, assumed of teaching to examination, of teachers to examiners. Examiners are doubtless strong, but teachers, if they will only combine and assert their convictions in practice, are stronger. We believe too that those who have most carefully considered the question of a rival order of sequence of geometrical propositions would agree that the best order in a logical arrangement does not seriously *conflict* with Euclid's order, except by simplifying it. Rather, by bringing the proofs of each proposition nearer to the fundamental axioms and definitions than Euclid does, it renders less assumption of previous propositions necessary for the proof of any given proposition. It stretches the chain of argument straight instead of carrying it round one or many unnecessary pegs.

Many instances of this may be found in Mr. Nixon's own book. To mention one only—the proof which he judiciously gives of the fundamental proposition that "similar triangles are to one another in the duplicate ratio of their homologous sides" depends directly on the 1st Proposition only of the Sixth Book, instead of the chain being carried round the unnecessary peg of the 15th Proposition, as it is by Euclid himself.

Waiving, however, farther discussion of these general considerations, and granting Mr. Nixon his postulates of expediency and sentiment without farther cavil, we have no hesitation in thanking him for having produced a good and useful book. The conditions under which he has worked are such as to make it unsatisfactory to one who seeks for a natural and symmetrical sequence and grouping of propositions forming a well compacted whole, but all the materials are there for enabling the student, if he has sufficient patience, to make it for himself. The book is well furnished with important propositions not contained in the ordinary editions of Euclid, but various excrescences in the shape of addenda and lemmas have been necessary to accommodate them, and in these addenda those which are of real importance for after use are rather hidden amid a crowd of other consequences, interesting as results, but not necessary parts of the geometrical edifice.

Mr. Nixon has, wisely as we think, distributed his axioms and definitions among the propositions, introducing each one exactly when it is required, instead of commencing with the full series, but it seems to us a serious defect that they are neither numbered nor anywhere collected together for reference. We are rather surprised that he has not taken the opportunity of revising Euclid's editors, and reverting to Euclid's division, into common notions and postulates, of what modern editions call the axioms and postulates; the common notions embracing those general axioms which are true for all magnitudes, while the postulates relate to geometrical magnitudes only and are the really essential basis of geometry.

While retaining the order of Euclid's propositions, Mr. Nixon has very freely revised his demonstrations both in substance and in form. Where he has introduced new demonstrations, they are in all cases, we believe, improvements. The famous *pons* disappears in favour of a proof founded on turning the triangle about one of its equal sides till it falls again into its original plane. Philo's proof of i. 8 is adopted, and consequently i. 7 omitted as useless. In Book II. the diagonals of the rectangles disappear. Euclid's propositions about the correspondence of equal chords, arcs, and angles at the centre of a circle are proved directly by superposition, as recommended in the Syllabus of the Geometrical Association, to which here as elsewhere Mr. Nixon acknowledges his indebtedness, but he still retains the propositions about similar segments which we should have expected him to omit (as in the case of i. 7), as thereby rendered useless. Book V. contains the essentials of the theory of proportion, deduced from Euclid's definition, in the form first suggested by De Morgan. In Book VI. superposition is often employed, where Euclid makes a separate construction, but not invariably, as, we think, might have been done with advantage.

We are less satisfied with the form of Mr. Nixon's demonstrations than with their substance. He objects strongly to Euclid's "prolixity," of which he goes so far as to say, after twenty years' experience as a teacher, that "NOTHING is so great a hindrance to the learner." We doubt this, speaking also not without experience. In

some respects Euclid's prolixity, recalling over and over again propositions which have gone before, does much to fix them in the memory of the learner and prevent looseness in reasoning, and though we think Euclid's style admits with advantage of some pruning, we feel that Mr. Nixon, with overstrained regard to the examination hall, has used the knife too freely, and has run the risk by his style and free use of abbreviations and signs of letting the young pupil believe, as he is only too glad and ready to do, that mathematical work should be written after the fashion of a telegram, grammar disregarded, articles and little words omitted, and what should be sentences written without verb or copula.

Mr. Nixon has deliberately omitted the usual marginal references, on the ground that "learners (1) very generally ignore them; and (2) will gain greater benefit by having to hunt up the references themselves." We believe he has thereby seriously injured the value of his book. Because many boys, in the hands of a careless teacher and left to themselves, ignore the references, is hardly a good reason why they should not be supplied for those who would use them, or who would be required by their teacher to use them; and they would be exceptional pupils under exceptional teachers who could be depended on, or find it easy, "to hunt up the references themselves." Doubtless the exercise of doing this is excellent, but the beginner needs some help in doing it.

We have thought it would be most useful to dwell at some length on Mr. Nixon's revision of Euclid's text, and can only notice generally the exercises and addenda, which occupy more than half the book. The collection of exercises appears to be very well chosen and complete, though we should have been glad to see more of them interspersed among the propositions from which they naturally flow.

The addenda include all the more important developments of the elementary geometry, as well as an introduction to many of the methods of the higher geometry. As a collection of results in the geometry of the straight line and circle this part of the book appears to us from a cursory perusal to be excellent, giving a full account of the important relations of the triangle and its associated circles, centres of similitude, coaxial circles, &c.; while for methods the elementary notions and use of cross ratios, harmonic ranges, inversion, poles and polars are explained and applied to such an extent as to prepare the student naturally for their application to geometry beyond that of the straight line and circle. We fail, however, to find such prominence given to the great principles of duality and reciprocity as their importance, scarcely less in elementary than in the higher geometry, appears to us to demand.

The typography, and the accuracy and clearness of the figures, are to be commended as worthy of the Clarendon Press. R. B. H.

OUR BOOK SHELF

Practical Histology and Pathology. By Heneage Gibbes, M.D. Third Edition. (London: H. K. Lewis, 1885.)

THE text in this edition does not, on the whole, differ much from that of the previous editions, some new useful formulæ of staining and a more comprehensive arrangement of the subject-matter being the chief differences.

The tables given at the end of the book as to the conversion of degrees of Centigrade into Fahrenheit and *vice versâ*, as to the conversion of English weights and measures into French, are in some points incorrect, and might have been easily correctly copied from any standard work. E. KLEIN

Farm Live-Stock of Great Britain. By Robert Wallace, F.C.S. F.H.A.S., &c., Professor of Agriculture and Rural Economy in the University of Edinburgh. (London: Simpkin, Marshall, and Co.; Edinburgh: Oliver and Boyd, 1885.)

WITHIN 200 pages octavo, of rather large type, does Prof. Wallace condense much useful information upon farm live-stock. It must, however, be evident that to treat of cattle, sheep, swine, and horses, from a biological, an agricultural, and an economical point of view would at least require double the number of pages, containing twice the number of words, and folded quarto. Brevity has been said to be the soul of wit; but in a work such as this we cannot but feel that it must be intended by its author either for those who know nothing or for those who know something of the subject. It appears to us to fall short of the requirements of each of these classes of readers. Four and a half lines—forty words, in fact—upon the Devon breed of cattle cannot be considered adequate, however terse and compressed they may be (and to the point they undoubtedly are), to giving a good word-picture of this race. Besides, Prof. Wallace must excuse us for differing from him as to his statements even in this very short description. He is wrong in saying "colour blood-red, no white." There is white upon the fore-udder in almost all Devon cattle, and it is unfortunate that there should be a manifest error in this very short description of an important breed.

The book aims at too much, and is too vague in its general plan. The writer is successful in being concise, but he is not free from errors, and a greater amplitude in his observations would have both conferred a greater general interest upon his pages, and been more satisfactory to an earnest student of agriculture. Let us hope shortly to see an enlarged edition.

Common-Sense Euclid. Books I. and II. Part I. By the Rev. A. D. Capel, M.A., St. John's College, Cambridge. (London: Joseph Hughes, 1886.)

THE object of this book, as the author tell us, is to point out, especially to teachers and those teaching themselves, the portions of the treatise which either present difficulties to the beginner or escape their notice altogether.

The propositions are explained in a very clear and concise way, some of them being even worked backwards and their analysis being made in every case; explanations are given, here and there, where they are most required, and are put in the easiest possible way. Problems, at the end of each proposition and also at the end of the book, are given, making a total of 300, followed by hints for their solution.

The figures are not placed opposite each proposition, as they are in most editions, but all together at the end. The plan adopted is a very good one, it being understood that the student must construct the figures for himself.

J.

Arithmetic for Schools. By the Rev. J. B. Lock, M.A. (London: Macmillan and Co., 1886.)

THIS is a carefully prepared school-book, forming, as to scope, a sort of arithmetic mean between Hamblin Smith's and Brook Smith's or Muir's. It contains the usual rivulets of text ending in seas of examples. In the purely arithmetical part of the book logical accuracy is attempted with considerable success. Want of grasp is much more evident in the part which deals with the applications. There the division into subjects is strangely illogical, and

slight inaccuracies of thought and language occur. Is it really the case, for example, that rate of interest (p. 181) is totally independent of *time*?

LETTERS TO THE EDITOR

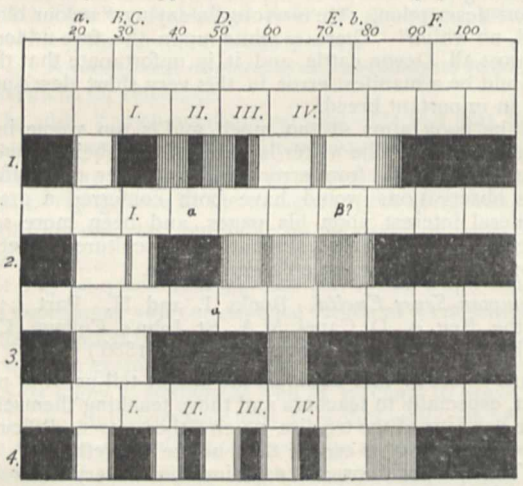
[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

Chlorophyll

In a short note in NATURE (vol. xxxii. p. 342) I mentioned the discovery of a colourless substance produced by the action of reducing agents on chlorophyll and regenerating, on being exposed to the air, the original green solution. I may be allowed to add to my previous statement that if this reaction is not pushed too far and the resulting substance is duly concentrated, it is not colourless, but of a reddish-brown by daylight, of a splendid ruby red (very different from the well-known port-wine red colour of chlorophyll) by limelight. Its spectrum is chiefly characterised by the total absence of band I., and the presence of a broad band corresponding exactly to band II., and the two intervals between I. and II., and between II. and III. Band IV. seems also to be present, though somewhat altered in its position and intensity.

The presence of a slightest trace of oxygen is immediately announced by the appearance of the I. chlorophyll band, so



that the reaction may be considered as a most sensitive test for oxygen. On further exposure to the air, as already mentioned, chlorophyll is regenerated. This new substance being evidently a product of reduction of *chlorophylline*, the green-colouring matter of chlorophyll isolated and described by me in 1869, it may be called *protochlorophylline*, or simply *protophylline*.

Its solutions can be kept in sealed glass tubes containing H_2 or CO_2: *in this latter case in a dark place, for on being exposed to light they turn green.* Can it be inferred from these facts that the oxidation takes place at the expense of CO_2—that carbonic acid is actually reduced under the joint action of light and of a chlorophyll solution? The question, if answered in the affirmative, is of so great importance, that I am now taking all the pains to arrive at a definite conclusion.

The optical properties of *protophylline* seem to indicate its presence in freshly-prepared chlorophyll solutions. Indeed the difference presented by the spectrum of a freshly-prepared green solution and that of Mr. Stokes's *modified chlorophyll* may be easily accounted for by the presence in the former of the broad *protophylline* band intercepting the rays of light in the two intervals between the bands I. II. and III., as just mentioned. To the presence of different quantities of *protophylline* may be likewise attributed the varying relative intensity of the bands II. III. IV.,—a fact that has attracted the attention of many observers.

At all events, it cannot be doubted that the study of this curious substance, though attended with considerable difficulties, all the operations taking place in a total absence of oxygen, and under the continual control of the spectroscope, will throw a new light on that most important of physiological problems—the part played by chlorophyll in the decomposition of carbonic acid by the living plant.

C. TIMIRIAZEFF

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The Stone Age in the Malay Peninsula

In NATURE, vol. xxxiii. p. 377, there is a notice of a paper by M. de Morgan, published in *Cosmos*, on the Stone Age in the Malay Peninsula. Will you permit me to offer a few remarks with reference to this matter. In the first place, it is said that M. de Morgan came into contact with three native races, which he respectively names Sakayes [Sakai], Seumangs [Sĕmang], and Rayats [Ryot]. I have put in brackets the commonly-accepted spelling in the Straits. It is funny what peculiar mistakes travellers make when passing through a country the language of which they do not understand, ryot being the word used in the Straits to express those followers or retainers of a native chief who are not actually his debt slaves, but who owe him more or less of feudal allegiance; Malays here invariably use the word when speaking of the following of a Sakai chief. The word ryot is, I believe, also used in the same sense in India. With reference to the tribes of whom M. de Morgan speaks as living in the recesses of the mountains, and whom the Sakaies called "fire apes," I cannot help remarking that I have never heard the Sakaies speak of them myself, nor can I find that any other Government servant here has heard of them either; still we are in pretty constant communication with certain of the Sakaies of these hills, and for my part I have at different times stayed for longer and shorter periods at the clearings of some of the chiefs whom M. de Morgan visited, and moreover I have employed most of the same Malays who followed M. de Morgan. By the bye, these were Sumatran Malays, and they told me some very extraordinary tales about the wild tribes before I started up country with them; these foreign Malays are especially addicted to telling marvellous tales of the wild tribes of the mountains, but so far I have not been able to verify their information in the least degree either from the Sakaies themselves or from native Malay sources. It would be interesting to know what equivalent was used for the expression "fire apes." Was it a Malay word or a Sakai word? With reference to the Stone Age I quite agree with M. de Morgan in believing that at a not very late period—probably just before the Malay invasion—there were tribes living in the interior who were not acquainted with the use of iron; up to the present moment I have been able to collect twenty-two stone implements. I have sent drawings and notices of these to the Anthropological Institute. I may, however, here mention that of these twenty-two specimens one is the half of a stone bracelet; the rest are all chopping-tools of different descriptions, used, I think we may fairly conclude, by a race of boat-builders, who most likely constructed dug-outs, much like the Malays of the present day. I adduce this supposition from the fact that of my twenty-one specimens two are perfect gouges, and six others are of the description which Dr. Evans has classed under adzes. The cutting-edges of nearly all my specimens have been considerably damaged by use. The high polish which M. de Morgan's specimens—and mine also—exhibit is, I think, accounted for in a great measure by the fact that they are used and very highly prized by the Malays as whetstones; the women preserve them, especially to sharpen their razors on, with which they shave the heads of their children during the periods ordered by custom or religious law; and the men were, until lately, very anxious to procure them to sharpen the iron spurs used in cock-fighting. As almost all of the specimens procured by me have been purchased of Malays who have inherited them from their ancestors, and prized them as heir-looms, it is, I think, reasonable to suppose that in their original condition some of them, at least, were considerably rougher than when they came into our hands; this supposition is further confirmed by a remark made to me the other day by a Malay chief. He said that he once had a thunderstone given to him which was so rough that he had to wear it down on his emery-wheel before he could use it as a whetstone. I have one specimen which has no cutting-edge, but is squared off at each end and is almost spindle-shaped. I have

also seen another specimen of the same description. Can it be that these two specimens have been manufactured by Malays for whetstones out of the so-called thunder-stones? I cannot account for them in any other way; they are too slight for hammers.

For my part, I have always found the Sakaies especially wanting in every respect as to traditions beyond the memory of their own generation, and they have invariably answered my inquiries as to the origin of the stone axes by saying, like the Malays, that they are thunder-stones. To such an extent is this belief held by Malays, that the other day a Malay of considerable social standing assured me that once a cocoa-nut palm was struck by lightning close to his house, and that about a month afterwards he searched about the roots of the tree and found the thunder-stone which was the cause of the damage: it was this man's father who for several years kept a fire alight in his house, which fire was generated from the same tree after it had been struck by the electric current.

I have already drawn attention to the Malay belief as to these so-called thunder-stones (NATURE, vol. xxxii. p. 626). My specimens are all in the Perak Museum at Thaiping.

Kinta Perak, April 5 A. HALE

On a Thermo-electrical Phenomenon in Connection with Prof. Balfour Stewart's Paper on Terrestrial Magnetism

IN the *Philosophical Magazine* for May Prof. Balfour Stewart, in his paper "On the Causes of the Solar-Diurnal Variation of Terrestrial Magnetism," takes in one place (p. 443), for an example, the case of "an ordinary electric circuit, say of a circular shape, and horizontal, and heat it by causing some source of heat, such as a lamp, to travel slowly around it with a definite rate of progress." He goes on to say that no current due to the heating will take place. So it would generally be thought. If, however, the experiment be even roughly tried, at all events with an iron or nickel wire, the contrary takes place. An account of the experiments, &c., which I have made on this subject, was read before the Royal Dublin Society on March 24, and will, in the course of time, be printed in the Society's *Proceedings*. Though there is a current in a wire on causing a heated portion to travel along it, it seems unlikely from the nature of the phenomenon that it could in any way be inferred that the higher air would similarly affect a current under the sun's heating. FRED. S. TROUTON

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Do Migratory Birds Return to their Old Haunts?

MUCH evidence has been given by naturalists to prove that birds of passage return to their old haunts. The following, I think, may be of interest to some of the readers of your valuable paper. For the past two springs a cuckoo gifted with a decidedly peculiar note has visited this neighbourhood. Within the last fortnight it has again arrived. Its song consists of three clear distinct notes, cuck—coo—coo, the second note being a semitone above the last. This it never varies. We all know that towards the end of its sojourn the cuckoo suffers from hoarseness, or, as the country people say, "changes its tune." Although this bird suffers in a similar way, yet it still maintains its peculiar song—three notes. As far as I can ascertain, it does not wander beyond the same limits—from the park here to a little hill about half a mile distant. I think these facts not only conclusively prove that the cuckoo returns to its old quarters year after year, but that it also restricts itself during its stay in this country to the same locality. F. C. TAYLOR

Summerleaze, East Harptree, May 13

The Poison of the Stinging-Nettle

IN the interesting article in your issue for May 6 (p. 5), on "Plants and their Defences," there is one sentence on which I should like to be allowed to offer a few remarks. It runs thus:—"This fluid [of the stinging-gland of the stinging-nettle] is generally conjectured to be formic acid—a view based on the fact that this acid can be obtained from the nettle-plant by suitable means." Does this "conjecture" rest on any other basis than the similarity of the effect produced by the sting of the nettle and the bite of the ant? I am inclined to think not. Certainly the fact that formic acid can be obtained from the nettle-plant is not in itself a cogent argument, seeing that it has been shown that this acid is a widely-spread constituent of the cell-sap of living plants. The formic acid theory is also out of harmony with the fact that the fluid contained in the stinging-glands of the nettle has frequently, if not always, an alkaline reaction. It seems strange that we have at present no trustworthy observations on so interesting a question. Can none of our physiological chemists come forward and remove it from the region of conjecture? ALFRED W. BENNETT

St. Thomas's Hospital, May 13

What is Histioderma?

CAN any of the readers of NATURE inform me to what class of fossil organisms belongs the genus Histioderma? Mention of the name—but of the name only—is made by Sterry Hunt in this journal, vol. vi. (1872), p. 54, and by Hicks in the *Quarterly Journal* of the Geological Society of London, vol. xxix. part 1, 1873, table facing p. 42. It does not occur in Broun's "Index Palæontologica," in Pfeiffer's "Nomenclator Botanicus," nor in Scudder's "Zoological Nomenclator." The name is not to be confounded with that of Carter's genus, Histoderma, established 1874, for recent sponges. S.

Leyden, May 15

ON THE INFLUENCE OF FORESTS ON THE CLIMATE OF SWEDEN[1]

A VALUABLE Report on this subject has been prepared by Dr. H. E. Hamberg, and printed as an appendix to the Report of the Forest Commissioners of Sweden for the year 1885. The observations were commenced in 1876, on the principles established by Dr. Ebermayer in Bavaria, but Dr. Hamberg soon found that the mere comparison of the results obtained at the forest station with those yielded by its sister station in the open country was insufficient to bring out all the peculiarities of forest influence, and accordingly he added a third class of station, situated in a clearing in the forest itself (*öppen plats i skogen*). The various results of these observations are discussed in a very exhaustive manner, and we must refer those interested in the subject to the Report itself. The author's conclusions, however, are very interesting, and are reproduced here in full.

"Our researches do not allow us to determine whether the presence of the forests on the whole contributes to increase or diminish the quantity of heat in the atmosphere, that is to say, to raise or lower its temperature. In fact, we have been entirely unable to take into account either solar radiation or the radiation from the needles[2] and the points of the trees. Until we are able to ascertain the quantity of heat which escapes from these surfaces, and its relation to that escaping from other surfaces, it is quite impossible to determine with certainty the influence of the forest on such an important subject as the mean temperature, and must confine ourselves to approximate estimations. Among the various surfaces which are met with in Sweden the most important are assuredly water, bare ground or rock, soil covered by herbage, and finally forest. Neither the surface of the lakes and sea nor the bare soil of town streets have any resemblance to the forest: the climate of the latter bears no similarity to a maritime climate or a town climate. A forest may best be considered as an instance of vegetation on a gigantic scale, as is evident from the low temperature of the ground under the trees, and the freshness of the air in summer, especially in the evening and at night-time, thus affording evidence of active radiation. In this case the forest would be a source of cold rather than of heat. But here we are simply dealing with suppositions.

"From this point of view a forest is distinguished from all the other surfaces we have mentioned, in that it extends into a stratum of air lying far above that in which man lives and carries on all of his occupations which depend on

[1] "Om skogarnes inflytande på Sveriges klimat." From *Quart. Journal Roy. Met. Soc.* for April 1886, communicated by Mr. R. H. Scott, F.R.S.

[2] The forests dealt with were entirely of pines and firs.

climate, such as agriculture, &c. It should follow from this that whether the annual result of the presence of a forest be an excess or a defect of heat, the one or the other should, thanks to the winds, be communicated to a greater mass of air, and be less sensible in the stratum close to the ground. The thermic properties of other surfaces are more immediately available in the lower stratum, and consequently, from the practical point of view, exert a greater influence on the temperature of the earth and of its immediate vicinity.

"If, then, we confine our consideration to that which from the practical point of view is perhaps the most important, the influence of forests on the state of temperature in the stratum in which man generally lives, in so far as this can be determined in the ordinary way by thermometers, I think that our reply for this country (Sweden) will be less uncertain, and it is as follows:—

"In the districts of our country which are open and are cultivated, during the annual interval of cultivation, a forest lowers the temperature of air and soil during evenings and clear nights, restricting the period of daily insolation, and thereby checks vegetation.

"The other influences of forests on temperature are either so slight that they possess no practical importance, as, *e.g.*, the moderation of cold in winter, or else are of such a character that they elude the ordinary mode of observation by thermometers. Among the effects of this nature we may mention the well-known fact that forests afford shelter against cold and violent winds to vegetation which would suffer from these winds, or to objects whose temperature is higher than that of the environment, as for instance the human body. It is in this last respect that the Swedish saying is true, namely, that 'the forest is the poor man's cloak.' In certain cases it may also yield protection against the cold air or fog which on cold nights comes from districts in the vicinity which are visited by frost. The advantages on the score of temperature derivable from the forest may therefore be considered to resemble that obtainable from a wall, a palisade, a hedge, or any object of that nature.

"On the one hand a forest, where it is close at hand, offers mechanical protection against cold and violent winds. On the other hand, it does injury either by retaining the solar heat required by crops, or by lowering the temperature of the soil during clear nights, and thus favouring the development of hoar-frosts. At a distance forests have no sensible influence on the climate of Sweden.

"If we wish to put these results to a practical application, it is impossible to say in general whether one should, or even could, clear the forest without injuring agriculture. But it appears that as regards the temperature, if we disregard the utility of forests in other directions, we might make extensive clearances without any prejudice to agriculture. It is certainly not a mistake to say that our best cultivated districts are the freest from wood, nor is it a mere chance that the harvests are, on the whole, more sure in the open country than in the forest. In the event of a bad harvest it is, as I well know, the wooded districts which have suffered most. At the same time I must at once admit that these provinces are also influenced by other powerful physical factors, possibly even more active than forests, such as an elevated situation, a bad soil, the presence of swamps, &c. But nevertheless it appears to me, after all that has been said in the preceding pages, that the forest has some bearing on the subject.

"At the present day, the words spoken 130 years ago by Pastor P. Högström, and at that time member of the Swedish Academy, are very generally applicable, inasmuch as it has been found that cultivation can to a great extent remove from a district its tendency to hoar-frost; this same result has frequently been obtained by draining or by clearing the forests, particularly those of deciduous timber, where the fogs, especially those which bring on frosts, appear to have their origin and their aliment. On the contrary, a pine forest is an excellent shelter against cold, especially when it can stand between the country and marshes or surrounding districts where the cold has its rise. If, however, the forest interferes with sunshine and with wind, it should be cleared. It results, therefore, that while in some districts the clearing of a forest has been beneficial in averting hoar-frost, in others the result has been directly the opposite."

RESULTS DEDUCED FROM THE MEASURES OF TERRESTRIAL MAGNETIC FORCE IN THE HORIZONTAL PLANE, AT THE ROYAL OBSERVATORY, GREENWICH, FROM 1841 *TO* 1876

SIR GEORGE AIRY has recently published a valuable and extensive series of diagrams representing the diurnal changes in the magnetic forces in the horizontal plane at Greenwich between 1841 and 1876. In an introduction, the ex-Astronomer-Royal gives a short statement of the circumstances under which the magnetic work was undertaken at Greenwich, and the various changes which have taken place. With regard to the curves here brought together he writes as follows:—

The form of the curves, and the position of the points on them corresponding to hours of solar time, leave no doubt that the diurnal inequality is due mainly—and, as far as I can judge, entirely—to the radiant heat of the sun; and, it would seem, not to its heat on the earth generally, but to its heat on points of the earth not very distant from the magnets. In the hot months of the year the curve, though far from circular, surrounds the central point in a form which, as viewed from that central point, never crosses itself, and is, generally speaking, usually symmetrical with regard to E. and W. But in the cold months the space included in the curve is much smaller, in many cases probably not one-fifth of what it is in the summer months; and the curve often crosses itself in the most bizarre fashion, with irregular loops at these crossings. In the summer months there is a certain degree of symmetry; but here is, constantly, a preponderance on the west side, which leads me to imagine that the magnetic effect of the sun's heat upon the sea is considerably greater than the effect on the land.

To obtain some numerical basis for a report which, though undoubtedly imperfect, may convey some ideas on this wonderful subject, I have adopted the following course. I have confined myself to the months of June and July as probably the two hottest, and the months of December and January as probably the two coldest. In each of the curves applying to these months I have laid down a system of rectangular co-ordinates corresponding to the Greenwich astronomical meridian, and the line at right angles to the meridian (the geographical E. and W.). The extreme north ordinate and the extreme south ordinate were measured, and their sum taken, and interpreted by a scale of measure formed in accordance with the theory of the instruments, and this interpretation forms the "range of meridian force in terms of the mean horizontal force." In the same manner, the "range of transversal force" is measured. As the time of each two-hourly or hourly result is marked on the curve, there is no difficulty in fixing approximately on the solar times corresponding to the extreme N. and S. values and the extreme E. and W. values mentioned above. These are all the elements of the magnetic record which are included in the table.

MOVEMENTS ON THE SUN'S SURFACE

M. A. BELOPOLSKY, of the Moscow Observatory, states in *Astronomische Nachrichten*, No. 2722, some considerations of much interest regarding the solar

rotation. They are based upon a hydrodynamical investigation by Dr. Jukowsky, showing that in a liquid globe of which the angular rate of rotation increases from centre to surface according to a certain law, superficial currents set from the poles towards the equator, but take the opposite direction if the rotation be accelerated from surface to centre. These theoretical deductions have been experimentally verified by M. Belopolsky. A new criterion is thereby furnished as to the fashion of the sun's internal rotation. For both Spörer and Carrington have recognised that the motion of spots in latitude tends, on the whole, poleward ; while the closing in towards the equator, with the progress of each epoch of disturbance, of the zone in which spots, faculæ, and prominences chiefly manifest themselves, is a well-recognised feature of periodical solar activity. This zonal movement is held to depend upon currents at considerable depths, but the drift of individual spots upon surface-flow ; hence the sun's system of circulation is such as to indicate, according to Jukowsky's theory, rotation accelerated towards the centre.

The cause of this inequality is found by M. Belopolsky in the non-homogeneous character of the solar globe. Assuming that the variations of its density conform to the law adopted by M. Roche for the terrestrial spheroid ($\rho = \rho_0 (1 - \beta r^2)$), it follows that gravity must attain a maximum at a certain depth below the surface (this depth, in the case of the earth, is 1/6th of the radius). Under these circumstances the rate of rotation and amount of polar compression of successive solar strata must vary with gravity, and in the same sense. It is, moreover, highly probable that gravity and angular velocity will attain a maximum simultaneously. The ensuing frictional acceleration of the superimposed slower-moving layers is so conditioned as to lead directly to a law of surface-rotation identical with the empirical formula arrived at by Spörer from observation solely ($\xi = \omega + a \cos \phi$).

The minimum period of rotation for an interior solar shell, computed according to the foregoing hypothesis, is 21·3 days ; the longest observed period for any part of the superficial globe is 27·5 days The mean of the two (24·4 days) differs very little from the period of 24·5 days deduced by Hornstein from magnetic observations. It is pointed out that Faye's *rationale* of the peculiar character of the sun's rotation implies for an inner nucleus the improbably short period of 2·2 to 3 days.

EDUCATION IN THE UNITED STATES[1]

THE work of education in the United States of America, as delineated in the Commissioner's report, is making steady progress and keeping pace with the great increase of population in that country, where are 266 cities with an average of 40,000 inhabitants, and a lowest limit of 7500. Various States are able to perceive that a more efficient course of education provided in them for the next generation is one of the greatest attractions to those earnest striving settlers who are the backbone of a growing country ; and money and energy in increasing amounts are devoted to the purpose. The successful guidance of these powers to desired results depends largely upon the selection of capable district superintendents who will provide for the more careful selection and improvement also of teachers, and introduce the best methods and the best facilities of instruction ; thus making common to the many what would have been confined to the extra intelligent few. The first use, therefore, to be made of liberal money votes is the provision of high-class inspectors, who can be secured only by higher salaries. One important duty of these officers arises from the system of establishing schools in every district being so perfect in all of the United States, that in Connecticut, for example, there are 158 school districts which have less than eight scholars in attendance during the year, and one case is quoted, not as being by any means unparalleled, of a school having only four scholars during the year, and for three months having one only, whose education consequently cost the district 60 dollars. In such circumstances the State inspectors can recommend the consolidation of several of these school districts into one. Where this cannot be done, it is not likely that an efficient, qualified teacher can be secured for each. Yet rather than this scattered population should grow up half taught, the New York superintendent of popular instruction recommends that a sufficient salary shall be made good out of State or general Government funds. It is the more necessary to meet this difficulty as population is not everywhere increasing. In Maine, for example, population has decreased, and the number of school districts has been reduced already.

In Massachusetts a greater number of scholars than the whole number of the school population (from 5 years of age to 15) were enrolled ; but, on the other hand, Maryland and Virginia showed only 28 and 29½ per cent. attending, and what reports could be gained from Louisiana showed only 19 per cent. enrolled, and not above 13 per cent. attending. Of course, in such a State, there is the double difficulty of getting the coloured population to school and of raising the money to pay for it ; poverty standing in the way of fair remuneration of teachers as much as the lazy ignorance of the blacks in that of regular attendance. Naturally half-day sessions have suggested themselves as being economical in every way, requiring only half the staff of teachers, and half the schools and school-furniture. But a danger in this system is lest the teacher should be overworked ; and, where he is able to do so greatly increased work, it is fairly recommended that his salary should be increased accordingly. A great variety of work therefore presents itself to the inspectors, and much discretion and knowledge will be required to meet all emergencies.

It is easy to see that no New World organisations or ambitions are any match for the evils of population bred down to the point of a hard struggle for existence. These evils are developing in America as fast as they did in ancient cities. Truancy is increasing, and many children never attend school even in such a city as Providence, R.I. New York experience acquits employers of labour of any mischievous influence in the matter. It is curious to note that while in England charitable funds have been diverted gradually to the education of the more promising children, and School Boards have had intrusted to them the unpromising residuum, in American great cities the public schools take in all the former, while the benevolent are urged to take up the work of teaching the latter, for whom the regular course is too advanced. Free education, approved by certain States, can be more easily adopted in such a state of things, where the large ratepayers get large advantages, than in a country like ours, where payment made and advantage to be gained would be in exactly inverse ratio.

A very large proportion of the pupils in the primary schools are of the ages of 8 and 9, and the number who pass on to the secondary schools is about 40 per cent. ; but not 1 in 12 of these reaches the higher standards of the secondary schools. Since also 60 per cent. never get beyond the elementary schools, the report urges how needful it is that the education given in these schools should be as complete in itself as possible, and not merely a preparatory step towards the "grammar" or secondary studies. The different proportions of arithmetic required in the different cases will force this upon the mind at once. Elsewhere in the report it is taken as an accepted rule that more cultivated fitness is required to teach a primary than a model school.

[1] "Report of the Commissioner of Education for the Year 1883-84." (Washington, Government Printing Office, 1885.)

The number of females attending the second-grade schools is equal to the number of males, and three-fifths of the teachers also in these schools are women. So many important institutions having for their main object the higher education of the sex have been opened in the United States that it is considered that the special examinations of females conducted for some time past under the auspices of the Harvard University may now be dropped. The number of them competing for scholastic honours on the same basis as the men is steadily increasing; "but," the report suggestively adds, "not rapidly enough to threaten any disturbance of existing social, domestic, or business relations."

One association for promoting the higher education of women reports that while the physique of lady students is higher than among women at large, yet that even that of the former is painfully low, and requires that measures should be taken against so dangerous a deterioration.

With regard to the co-education of men with women, a committee, appointed by a Western College to inquire into the subject, conclude by saying:—

"Joint education of men with women in the higher studies has now been tried in a sufficient number and variety of colleges, and for a sufficient length of time to prove that no special difficulties and evils grow out of it, and that it does away with the greatest difficulties and evils of the old monastic system. It makes college life and society more nearly human instead of only 'half-human.' The half-human ever verges first and last towards the bestial, whether in armies, on shipboard, in miners' camps, or in colleges, monasteries, or nunneries. It would be wise to humanise the colleges still more, rather than to begin the process of dehumanising them."

It is then urged that all lectures and studies should be conducted in as public a manner as possible, and attended by friends and relations of both sexes.

Kindergarten teaching is being carried out more largely, but is making its way more as a charitable institution than as a branch of education. Very appropriately it is becoming the ladies' charity; its work is found specially beneficial as the early beginning of a reformatory education for the purpose of overcoming inherited vicious propensities and physical infirmities. Most energetic efforts for this purpose are being made at San Francisco in particular.

Attention is specially called in this report to the desirability of teaching history so as to make the reading of it an intelligent study, attractive to its learners, who will fill up leisure time with its pursuit instead of, as of old, insisting on the laying to heart long tables of dates and dry facts, "killing the life out of the subject, disgusting the pupils, and giving them a dislike for historical reading."

Colleges of the highest class keep increasing in number, yet, nevertheless, the totals of teachers and pupils are small for the proud name each claims of "University." Some have resigned that title and devoted themselves to school work; but more fresh ones have sprung up which constitute a splendid force for future generations when their work, their wealth, and the population supporting them, have been multiplied. The fact of a superabundance of such institutions proves how highly learning even of the least utilitarian character is esteemed.

Perhaps traceably to temporary reasons, classics seem to be gaining rather than losing ground upon physical science at Harvard, a higher standard of instruction and attainment having been required in the latter. Technical schools, however, make steady, though not rapid, progress. Agriculture, mining, and building form so large a proportion of American employment that full attention can be given to these subjects with little hesitation. The bulk of their pupils are at once absorbed in further teaching, instead of putting into practice what they know, with their own hands.

The United States Commissioner of Education takes an annual survey of the whole educational world, and presents it to all who study his report, and when the subjects to be taught a different people like the 200,000,000 of British India are in it placed side by side with those which seem important in our own schools, a question suggests itself whether scientific teachings have not a better claim than the old knowledge to the title of "literæ humaniores." We see how local and confined are classical and historical studies, and of what common value to the whole human race are the elements of natural and physical science.

The free education which Texas and others of the United States are in favour of is not recommended by our Commissioners even in a country where it would interfere with so few vested interests as in India.

We are glad to know that a work on public libraries is progressing, which is intended to supplement the special report published in 1876.

There are 11,663 institutions in regular correspondence with the Bureau, and no one reading this report can fail to see the importance of a common centre of communication to so many and so various efforts to carry on the great work that will have such an influence over the next generation. A central nucleus, again, to this organisation must be a library, by reference to which inquiries from so many quarters on so many subjects may be answered. It is hard, therefore, to believe it a wise economy of a great nation to cut down the allowance for so permanent a part of the office as this from 1000 dollars to 500 dollars, which, nevertheless, has been done.

W. ODELL

COLLECTION OF HAIRS AFTER EARTHQUAKES IN CHINA

IN Dr. Macgowan's "Note on Earthquakes in China," republished in NATURE for May 6 (p. 17), I find the following passage:—

"The tremors that are experienced in Chehkiang, Kiangsu, and coterminous regions to the west, are sometimes followed by the appearance on the ground of substances that in Chinese books are styled 'white hairs.' When I first called attention to records of that kind that are found in local gazetteers, I suggested that they might be crystals precipitated by gaseous emissions, such as were once reported as occurring after an earthquake in south-west of the United States; from later descriptions of these 'horsetail-like' substances I incline to the opinion that they are organic, perhaps mycelium."

I think there can be little doubt that Dr. Macgowan's conclusion is well founded, and that the "white hairs" have no real connection with the earthquake.

In 1852, during one of the late Mr. Fortune's visits to China, he experienced the shock of an earthquake at Shanghai. He gives the following curious account in "A Residence among the Chinese" (pp. 4, 5), of the subsequent search for the hairs:—

"Groups of Chinese were seen in the gardens, roadsides, and fields engaged in gathering hairs which are said to make their appearance on the surface of the ground after an earthquake takes place. This proceeding attracted a great deal of attention from some of the foreign residents in Shanghai, and the Chinese were closely examined upon the subject. Most of them fully believed that these hairs made their appearance only after an earthquake had occurred, but could give no satisfactory explanation of the phenomenon, while some, more wise than their neighbours, did not hesitate to affirm that they belonged to some huge subterraneous animal whose slightest shake was sufficient to move the world.

"I must confess, at the risk of being laughed at, that I was one of those who took an interest in this curious subject, and that I joined several groups who were

searching for these hairs. In the course of my travels I have ever found it unwise to laugh at what I conceived to be the prejudices of a people simply because I could not understand them. In this instance, however, I must confess the results were not worth the trouble I took. The hairs, such as I picked up, and such as were shown me by the Chinese, had certainly been produced above the earth and not below it. In some instances they might readily be traced to horses, dogs, and cats, while in others they were evidently of vegetable origin. The north-eastern part of China produces a very valuable tree known by the name of the hemp-palm [*Chamærops Fortunei*, see Kew Report, 1880, p. 31], from the quantity of fibrous bracts it produces just under its blossoms. Many of these fibres were shown to me by the Chinese as a portion of the hairs in question; and when I pointed out the source from which such had come, and which it was impossible to dispute, my friends laughed, and, with true Chinese politeness, acknowledged I was right, and yet I have no doubt they still held their former opinions concerning the origin of such hairs. The whole matter simply resolves itself into this: if the hairs pointed out to me were the *true* ones, then such things may be gathered not only after earthquakes, but at any other time. But if, after all, these were not the real things, and if some vegetable (I shall not say animal) production was formed, owing to the peculiar condition of the atmosphere and from other causes, I can only say that such production did not come under my observation."[1]

W. T. THISELTON DYER

THE U.S. GEOLOGICAL SURVEY

THE American papers contain an announcement which will be received with some astonishment in Europe. A member of Congress, Mr. Herbert, of Alabama, has introduced a Bill into the House prohibiting the Geological Survey of the United States from expending any money for palæontological work, except for the collection, classification, and proper care of fossils and other material; and from composing, compiling, or preparing for publication monographs, bulletins, or other books except an annual report containing merely the transactions of the bureau and other routine official matter. It is further proposed to sell off the laboratories and other property of the Survey which after the passing of the Act would be no longer needed. Of course there may be official or departmental reasons for reorganisation or retrenchment of which the outside world is ignorant. But these reasons must be very serious indeed to justify such action as is proposed. If there is one scientific undertaking of which the United States have pre-eminently just reason to boast as a model to all civilised countries, it is their Geological Survey. For completeness of equipment it has no rival in the world, and already though it has only been seven years in existence its work both for excellence and amount has placed it in the very front of the scientific organisations of the time. Whether we look to its purely scientific achievements or to the importance of its practical work in mining and other economical departments, the crippling of the resources of the Geological Survey of the United States would be a calamity against which not only all lovers of science but all who are interested in the continued development of the natural productions of the great republic would energetically protest. We can hardly suppose that Mr. Herbert will have many supporters, and it is difficult to conceive from what possible motive he is acting. He calculates that if his Bill passes he will effect a saving of 250,000 dollars. He should try to find some branch of the public service where economy and retrenchment could be practised without seriously injuring the scientific credit and industrial progress of his country. And no doubt he could succeed in this search.

[1] "During a recent visit to the North-West Provinces of India, where earthquakes are not unfrequent, I could find no traditions such as that I have alluded to."

THE ROYAL SOCIETY SOIRÉE

THE President and Council of the Royal Society are to be entirely congratulated on the success of the reunion at Burlington House on the 12th inst. It was generally felt that the display of objects of interest was finer than any brought together for some years, and the general satisfaction expressed must have amply rewarded those upon whom the burden of the arrangements had fallen.

It is a little hazardous to say which was the most interesting object; but as an *actualité* the unpaired parietal eye of Sphenodon exhibited by Mr. Baldwin Spencer, fully described in last week's NATURE, perhaps bore the palm.

Next in biological interest came an exhibit by Mr. W. H. Caldwell including a complete series of the Ceratodus from the unsegmented egg to hatching. The complete exhibit illustrated early stages in development of the Monotremata—Ornithorhynchus and Echidna, the Dipnoid Ceratodus and some marsupial genera. The series were as follows:—

(1) Series of early stages of Ornithorhynchus, from a few hours after fertilisation to the newly-laid egg, of about the stage of a 36-hour chick; (2) series of early stages of Echidna, from just before laying to the newly-hatched fœtus; (3) various stages of young Echidna, from hatching up to 5 inches long; (4) complete series of Ceratodus, from the unsegmented egg to hatching; (5) stages of young Ceratodus after hatching; (6) series of about thirty stages, from segmenting egg up to birth of *Phascolarctos cinereus*; (7) ditto of *Halmaturus rufus*; (8) Specimens showing the arrangement of the embryonic membranes in *Macropus major*.

There were two exhibits of micro-organisms—one of micro-photographs of Bacteria, and another of certain micro-organisms themselves—by Mr. Cheshire. The former included enlargements, from negatives obtained with an oil immersion $\frac{1}{25}$ inch, of the following:—

Anthrax-bacillus, in tissue-sections and cultivations; hay-bacillus; bacillus of malignant œdema; micrococcus of pneumonia; tubercle-bacillus; bacillus of foul brood; *Bacillus megatherium*; *Clostridium polymyxa*; microbe of chicken cholera; comma-bacilli of Koch, Lewis, and Tinkler; Bacteria of putrefaction.

Mr. Cheshire exhibited (1) *Bacillus alvei* in sporulation; (2) *Bacillus alvei* spores in chain; and (3) spermatozoa of Apis forming in flocculent masses for packing in spermatophore.

Preparations illustrating the histological structure of the secretory tissues of certain plants, in which the substances secreted are of economic importance, were exhibited by Mr. W. Gardiner. Among these were hairs of leaf of *Flemingia Grahamiana*—wurras dye; laticiferous vessels of the stem of *Manihot Glaziovii*—ceara rubber; glands of the leaf of *Cinnamomum Camphora*—camphor.

In connection with biological inquiry may be specially mentioned Mr. Frank Crisp's demonstration of a new microscopic object-glass, by Prof. Abbe of Jena, an exhibit rich in hope not only for the future of microscopy, but also for astronomy. Eight of the ten lenses of this objective are made of a new kind of optical glass, composed of phosphates and borates without silex. The glass hitherto used contains as essential components only six chemical elements, while the new objective contains not less than fourteen. The secondary spectrum is by this means entirely removed, and only a small tertiary spectrum remains. The improvement in definition is especially marked

in the case of Bacteria and other minute micro-organisms.

As representing this last-named science we may specially mention a magnificent collection of the photographs of sun, stars, and planets which have recently astonished and delighted astronomers. The collection included specimens of the results recently obtained by Dr. Janssen, the Brothers Henry, Mr. Common, and Dr. Gill. Among these the star-photographs by the Brothers Henry, a photograph of a sunspot by Dr. Janssen, in which the minute structure of the penumbra and bridges of a large sunspot were exquisitely shown on a scale of something like 10 feet to the solar diameter, and two exquisite photographs of Saturn, enlarged eleven times by the Brothers Henry, excited the greatest wonder.

The Solar Physics Committee sent a collection of the daily solar photographs which they are now obtaining from India and the Mauritius to supplement the Greenwich series. These photographs are on scales of 12 inches or 8 inches to the solar diameter.

Mr. Norman Lockyer exhibited some photographs of spot spectra showing the widening of the lines and the reversal of H and K; and also some photographs illustrating the first results of a new branch of work recently undertaken at South Kensington, in which it is hoped eventually to obtain photographs of the spectrum of the chromosphere and prominences without an eclipse. The photographs showed that the bright lines H and K have already been caught. Mr. Lockyer also exhibited the new split-grating spectroscope recently described at the Royal Society; the green line of thallium or the red line of lithium being shown between the D lines.

Nor must we forget to mention a selection of drawings of the sun on a large scale from those now daily made at Stonyhurst College Observatory; these were exhibited by the Rev. S. J. Perry. Special care has been devoted to the faculæ, which are drawn with a red pencil, and their position is as accurately determined as that of the spots.

Mr. Howard Grubb exhibited a model of an equatorial and observatory which he has proposed for the 3-feet refractor for the Lick Observatory. All the required motions of the telescope, dome, and rising floor are effected by water-power (represented here by clockwork) governed by an electrical arrangement, the commutator being portable and carried by observer. By this arrangement the necessity of assistants, even in case of the largest sized instrument, is obviated, and the observer himself can, from any part of the Observatory, control all the motions of instrument and dome without using any physical exertion.

Even observatory clocks were not neglected. Dr. Leonard Waldo, of Yale College, U.S., exhibited a gravity escapement adapted for use in a precision clock, in which the escapement lifts the gravity arms with a gradually-increasing velocity, and with more certainty than in the ordinary forms; and a new astronomical clock.

Finally the Eclipse Committee of the Royal Society were represented by charts of the West Indies and of the Island of Grenada, showing the path of the total eclipse of August next, arrangements to observe which are now being made.

In pure physics the *pièce de résistance* was the colour photometer, for comparing the luminosity of colours and for testing the perception of colour, exhibited by Capt. W. de W. Abney, and Major-General Festing. The form exhibited was an improvement upon the original one, which was fully described in NATURE a little time ago.

Two exhibits by Mr. A. Stroh, also optical, may next be referred to. The first was an apparatus for showing stereoscopic effects on a screen; the next was an instrument for enlarging the angular division by means of reflectors, and thereby causing an object to be seen in exaggerated relief.

Electrical science was represented by the following new electrical apparatus, exhibited by the Electrical Power Storage Company: (1) various types of cells; (2) ring contact switches; (3) automatic switch, for closing the circuit when the dynamo is running at the required speed, and for breaking it in case of accident; (4) hydrometers, specially for use with the Company's cells; (5) pocket voltmeter for cell-testing; (6) automatic switch to cut out two or more cells when dynamo is started to keep constant electromotive force on lamps.

In addition to these there were the following, contributed by Messrs. Woodhouse and Rawson:—

(1) Assortment of incandescent lamps, showing the latest developments in connection with the manufacture of incandescent lamps. (2) Small arc lamp, giving 200 to 300 c.p. or more if required: specially designed for being connected upon the same circuit with incandescent lamps of ordinary c.p., and being run by the same dynamo. These lamps can be also wound for running in series. (3) Switch-boards, illustrating the universal system introduced by Messrs. Woodhouse and Rawson. (4) Electric-lighting switches and safety-junctions, for manipulating currents of from 200 to 500 amperes and upwards.

Mr. Pitkin exhibited some very interesting portable electric lamps intended for use in coal-mines and powder-magazines. A small teak box contains three or more accumulator-cells, which, when charged, give a continuous light for ten hours. In a modified form of the invention the lamp is detached from the box containing the accumulators, and is electrically connected to it by means of a flexible cord; by this arrangement a very convenient railway reading lamp is formed, as the box can be placed under the seat or on the rack, and the lamp itself either held in the hand, or hooked to the back cushions or to the button-hole of the coat of the reader in a convenient manner.

A new electrical influence-machine, having eight disks working within a glass case, was exhibited by Mr. Wimshurst.

Electricity applied to meteorology was represented by an electrical wind-vane and indicator exhibited by Mr. F. M. Rogers. This instrument enables the direction of the wind to be ascertained at any moment, and at any reasonable distance from the vane, within a house, observatory, or office. One vane will actuate several receivers, which are quite independent of each other. Should the vane remain for many hours upon any one point no waste of current takes place; the expenditure of such being limited to the momentary impulse required to effect change of direction upon the dial of receiver.

Messrs. de la Rue and Hugo Müller showed how the chloride of silver battery could be applied to electric lighting by a quantity arrangement. Instead of using a solution of chloride of ammonium simply, the solution, containing 2½ per cent. salt, is converted into a vegetable jelly, by dissolving in it Ceylon moss (Agar-Agar) to make a stiff jelly; this supports the zinc plate. The chloride of silver in *powder* is spread evenly on the bottom of the dish on which a piece of silver foil is placed.

One of the most interesting exhibits was by Mr. Conrad Cooke, C.E., who showed Dr. Auer von Weisegg's incandescence system of burning gas. A small Bunsen flame burning about 2½ feet of gas per hour gave a dazzling light of about twenty candles by suspending in it a gauze cylinder which had been impregnated with the salt of a rare earth (probably zirconium). Tested by the spectroscope, the light showed a large excess of blue rays as compared with an ordinary gas-flame.

Voltaic cells with solid electrolytes were exhibited by Mr. Shelford Bidwell.

Great excitement was caused among the chemists by the specimens of the new element germanium and some

of its compounds, from Prof. Winkler, of Freiberg, brought by Dr. Hugo Müller. These were :—

(1) Metallic germanium ; (2) germanium monosulphide, GeS ; (3) germanium disulphide, GeS_2 ; (4) crystallised germanium, obtained by the action of hydrogen on germanium sulphide.

Germanium is claimed to be the ekasilicium predicted by Mendeléeff in his periodic law.

	Mendeléeff's ekasilicium		Germanium
Sp. Gr.	5·5	...	5·469
Atom. weight ...	72	...	72·75
Atom. val.	13	...	13·3

Mr. G. J. Symons exhibited a small pocket thermometer as constructed by Immisch. This thermometer is actuated by a minute Bourdon tube. It is shaped like a watch, is water-tight, and nearly unbreakable.

A terrestrial globe showing magnetic meridians for the epoch 1880, and general distribution of the secular change of the declination, made for the Hydrographic Department of the Admiralty, was exhibited by Staff-Commander Creak, R.N. The approximate positions of the foci of greatest secular change of the declination and vertical force—except for the Arctic and Antarctic zones—are also shown. A consideration of these foci shows the general angular motion of the north or marked end of a freely suspended needle as regards secular change.

The fact that our space is nearly exhausted, although we have only referred to about one-half of the exhibits, well indicates the care taken to make the *soirée* a success. In conclusion we refer as briefly as possible to some of the remainder :—

Jordan's photographic sunshine-recorder, with specimens of observations, exhibited by Mr. J. B. Jordan, of the Mineral Statistics Branch, Home Office.

Original geological map of the Orange Free State, and section of part of Cape Colony, by the late G. W. Stow (unpublished), exhibited by Prof. Rupert Jones, F.R.S.

Specimens of daily synchronous charts of the North Atlantic for the period of thirteen months, from August 1882 to August 1883 inclusive, now in the course of preparation by the Meteorological Office, exhibited by the Meteorological Council. The specimens show the meteorology of the North Atlantic on three summer and on three winter days.

New and interesting plants, exhibited by the Director of the Royal Gardens, Kew.

Nolls' apparatus for demonstrating secondary growth in thickness of stems ; Hopfe's Collectiones Phytomicrotomicæ, exhibited by Prof. Bayley Balfour, F.R.S.

Collection of stone-headed arms, implements, &c., from New Guinea, exhibited by Mr. H. B. Brady, F.R.S.

Diagrammatic sections showing the geological structure and physical features of parts of Arabia Petræa, and Palestine, exhibited by Prof. Edward Hull, F.R.S., Director of the Geological Survey of Ireland : (1) from the sea-coast at Askalan by Jerusalem to the Jordan Valley at Jericho ; (2) from the table-land of Southern Judæa—across the Dead Sea to the Plains of Moab ; (3) from the Gulf of Suez, near Tor, by the Mountains of Sinai, to the Plateau of Badiet et Tih

Apparatus for measuring the luminosity of leaves, invented and exhibited by Dr. Gorham, to show that the white light reflected from leaves can be measured in *cents.* of a circle by the novel use of a *gray ring*, and that by putting this luminosity in the form of an equation its equivalents in colour are discovered, which, when placed in sectors on a circular disk and rapidly rotated on a wheel, are seen to match the colour of the leaf from which the luminosity has been originally reflected.

Specimens of miners' electric lamp, invented and exhibited by Mr. Swan.

Dr. Sohlberg's celestial globe of glass ; Dr. Schmidt's tellurium ; cosmographic clocks for showing universal time ; contoured map of the English Lake District, constructed by Mr. Jordan ; enlarged original photographs taken by Mr. Joseph Thomson in his recent journey up the Niger ; replica of Frankfort globe, of date 1520 ; two large diagrams—(1) Roraima, British Guiana, by Mr. Im Thurn, (2) a similar formation in the north of Brazil, by Mr. Wells ; collection of minerals from summit of Mount Roraima, exhibited by the Royal Geographical Society.

NOTES

It is with much regret that we announce the death of Surgeon-Major T. Lewis, Medical Staff, Assistant Professor of Pathology in the Army Medical School at Netley. Within the last few weeks the Council of the Royal Society decided to recommend Dr. Lewis for their Fellowship, in recognition of the importance of his various contributions to science. Dr. Lewis had only just reached the forty-fifth year of his age at the time of his death.

The death is announced of Dr. E. Linnemann, Professor of Chemistry at Prague, which occurred on April 27. Among his papers a letter was found addressed to the Vienna Academy of Sciences containing a communication on a new chemical metallic element called austrium (Aus). This new element was prepared by the late Prof. Linnemann from orthite of arendal. The spectrum of austrium shows two violet lines ; the wave-lengths were found to be, for Aus α, $\lambda = 416{\cdot}5$, and for Aus β, $\lambda = 403{\cdot}0$. According to a note made by Prof. F. Lippich, of Prague, who communicated Prof. Linnemann's letter last week to the Vienna Academy, three not yet identified lines—$\lambda = 415{\cdot}56$, $\lambda = 416{\cdot}08$, and $\lambda = 416{\cdot}47$—are shown in Ångström's atlas of the normal spectrum of the sun in the neighbourhood of the Aus α line ; the last of them might be supposed coincident with the Aus α line ($\lambda = 416{\cdot}5$).

M. Chevreul, who on August 31 will be a centenarian, was on Monday afternoon presented by his colleagues of the Academy of Sciences with a bronze bust of himself, executed by Paul Dubois. Admiral Jurien de la Gravière, one of the senior members—his age being 73—made the presentation, and warmly complimented M. Chevreul on his long and distinguished career, which made France proud of him and of herself. M. Chevreul, who was much affected, made a brief acknowledgment of the honour done him.

The Swedish Academy of Sciences celebrated its centenary on April 5 last, having been founded by Gustavus III. on the eve of the French revolution.

The paper to be read at the ordinary meeting of the Society of Arts on May 26 will be "The Purification of Water by Agitation with Iron, and Sand Filtration," by William Anderson, M.Inst.C.E. On Tuesday, May 25, a paper on "Cyprus since the British Occupation," will be read by G. Gordon Hake, before the Foreign and Colonial Section. In the Indian Section, Capt. Richard Carnac Temple's paper on "Every-day Life of Indian Women, as Revealed in their own Sayings," will be read on May 21.

William Landsborough, whose name is known in connection with Australian exploration, died at Caloundra, near Brisbane, on March 15. His father was a Scottish naturalist of note. Having gone to Australia, Landsborough in 1860 discovered the head of the Thompson River, and in the following year traced the Gregory and Herbert Rivers to their sources. He then undertook to lead the expedition in search of Burke and Wills, and traversed the continent from the Gulf of Carpentaria to Melbourne. Subsequently he was appointed to a post in the public service of Queensland, and was voted 2000*l.* for his explorations in that colony.

A telegram from Catania of May 18 states that Mount Etna had been in eruption since 11 o'clock that morning. A very active discharge of vapour and cinders was proceeding from the western side of the central crater.

We are glad to learn of the formation of a Natural History Society at Yokohama. The marvel is that so long a time has been allowed to elapse before such a society was founded there or in Tokio, for probably there are no communities in the world in which the proportion of men of science is so high as here. But no doubt the local Asiatic Societies and the Seismological

Society absorbed much of the scientific work of the residents. The first meeting of the new Society was held at the beginning of last month, when Prof. Milne delivered a lecture on the geology of Japan, which is reported in full in the *Japan Weekly Mail* of April 3, and which is too comprehensive and detailed to lend itself to adequate treatment in a short note. We observe, however, that in speaking of the difference between the fauna of Yezo and of the other islands of the Japanese archipelago he suggests that the line between the two should be called Blakiston's line (from Capt. Blakiston, who first pointed it out), on the model of Wallace's line between the Javan and Australian fauna. Prof. Milne proposed this nomenclature a few years ago, and it is now adopted by some German publications. The difference, indeed, is not so great as that marked by Wallace's line, still it is of considerable importance. Thus in Japan we have the monkey, the sheep-faced antelope, the bear, and the pheasant; but on the other side of the straits the bear is a totally different one, the monkey, the pheasant, or the antelope is not found, and a totally different fauna exists. The suggestion of marking the dividing line with Capt. Blakiston's name is an appropriate one.

Dr. Trimen's Report for 1885 on the various botanic gardens in Ceylon, of which he is Director, is a very satisfactory document, as such reports from our colonial gardens generally are. It contains a considerable number of meteorological observations, and describes the arrangements made to carry out the scheme of a garden at Badulla, in the new province of Ceylon, for which funds have been voted. The usual report on the distribution of plants and seeds is given, and then comes a long list of additions to the collections of plants at the various gardens, which is followed by some interesting notes on economic plants and products. Under this head he makes various recommendations and suggestions which will no doubt be of the utmost value to perplexed planters who are assailed on all sides by dangers which are only too apparent, but which it requires scientific training and investigation to combat. Thus he advises that tea and cinchona should not be grown together, as it is only in such cases that the planter's scourge, *helopeltis*, does any appreciable damage to tea. On the other hand, he thinks that the diminution in the cultivation of cacao, through dread of *helopeltis*, is unreasonable, for the insect only attacks cacao grown in the open, and not that grown under the shade of trees, for example. The Ceylon Herbarium has been arranged during the year in accordance with Dr. Trimen's "Systematic Catalogue of Ceylon Plants," and in the work of rearranging he was able to put together a series of notes describing about 280 additions to the flora of Ceylon, and 40 new species or varieties. That much yet remains to be done is obvious from the fact that during 1885 fifteen additional have been discovered in the island, many of which are striking plants. The Government has approved the formation of an exhibition containing specimens of the plants, grains, &c., of the island. Like many other colonial officials, Dr. Trimen has been busy during the past year preparing for the Colonial and Indian Exhibition, where the series of woods in the Ceylon section was prepared by him.

According to a letter received from Baron Schwerin, the well-known Swedish geographer, who is at present on a scientific mission to the Congo for his Government, he observed the great November meteor-stream on the 27th of that month, at 8 p.m., off Cape Palmas, on the Guinea coast (lat. 4° 29′ 9″ N., and long. 7° 44′ 16″ W.). He describes it as the most magnificent spectacle he ever beheld, "the whole sky being furrowed from nearly north to south by falling stars, looking like gigantic fireworks, in which thousands of 'star-rockets' were burnt off."

On the evening of April 27 a bolide was observed in several parts of the north-western provinces of Russia. A large ball of bluish colour was moving from south to north; in about two seconds it changed its colour into a bright electric-white, and suddenly broke in many pieces and disappeared.

In consequence of the ice breaking on the Volga, a considerable number of naphtha-barges were wrecked this spring, and about 2,000,000 poods, or 33,000 tons, of naphtha are now floating along the river. According to the observation of past years the presence of such a large amount of hydrocarbon in the water will produce a very disastrous effect upon Russian fisheries, not only along the Volga, but even on the northern coast of the Caspian Sea.

The tendency amongst modern Oriental scholars is to trace the origin of Chinese arts, sciences, and civilisation to Babylonia. The theory, however, is not accepted by many of the most eminent Chinese scholars. In the last number of the *China Review*, Dr. Edkins of Pekin gives his reasons for assigning a Babylonian origin to Chinese astronomy and astrology. Amongst these are the following:—Both peoples divided our day and night into twelve hours; the sun-dial is a Babylonian invention, and reached China at a very early date; the intercalary month belonged to the Accadians, and is found in the first sections of the Chinese Book of History. Geminus states that it was the dwellers on the Euphrates who discovered that, after 223 lunations or eighteen years, eclipses of the moon recur in the same order. The early use of the intercalary month by the Chinese implies that either they, or those from whom they derived it, knew this fact about lunations. Early Chinese astronomy, Dr. Edkins thinks, is too good to come from the Chinese of those days, and, on various learned grounds which he states, he concludes that the double hour, the astrolabe, the dial, the intercalary month, and the knowledge of the length of the year were all communicated from Babylon to China at different periods by land or by sea between about B.C. 2200 and B.C. 820.

The invitation to Norwegian sea-captains to make barometrical observations during the eclipse next August was not issued by the Norwegian Meteorological Society but by our Norwegian contemporary *Naturen*, to which the returns are also to be sent.

Messrs. Whittaker and Co., and Messrs. Bell announce in their new "Series of Hand-Books for Practical Engineers" Dr. Jul. Maier's book on "Arc and Glow Lamps." It will be a complete hand-book on the subject, especially relating to its practical applications, giving the latest results and improvements. The next volume in the same series will be Mr. Gisbert Kapp's "Electric Transmission of Energy," which is promised early next week. Mr. William Anderson has revised and added some new matter to his "Lectures on the Conversion of Heat into Work," which excited much attention when delivered last year at the Society of Arts. They will be published in book form by Messrs. Whittaker and Co.

The additions to the Zoological Society's Gardens during the past week include two Shaw's Gerbilles (*Gerbillus shawi*) from North Africa, presented by Mr. W. R. Ogilvie Grant; two Black-backed Jackals (*Canis mesomelas*) from South Africa, presented by Mr. F. Mosenthal; a Ring-tailed Coati (*Nasua rufa*) from South America, presented by Mr. T. P. Lymn; a Brown Condor (*Sarcorhamphus æquatorialis*) from Chili, presented by Mr. R. J. James; two Red Kangaroos (*Macropus rufus*) from Australia, two Grey Parrots (*Psittacus erithacus*) from West Africa, an Indian Rat Snake (*Ptyas mucosa*) from India, a Green Lizard (*Lacerta viridis*), European, deposited; an Indian Coucal (*Centropus rufipennis*) from India, an African Tantalus (*Pseudotantalus ibis*) from West Africa, four Black-tailed Godwits (*Limosa ægocephala*), European, a Spotted Eagle Owl (*Bubo maculosus*) from South Africa, purchased; an Eland (*Oreas canna*), four Chilian Pintails (*Dafila spinicauda*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN

THE BINARY STAR α CENTAURI.—Mr. E. B. Powell, to whose observations and calculations we are largely indebted for our present knowledge of the orbit of this celebrated binary, has recently published new elements giving the period as 87·438 years, the time of periastron passage at 1875·447, and eccentricity = 0·544. These elements appear to satisfy fairly the recorded equatorial measures made from 1834 to 1885 (as well as most of the ancient observations), with which Mr. Powell has compared them; but all the available observations have not been used—for instance, the Sydney measures subsequent to 1877 have been omitted, as some influence appears to have operated to throw out these measures from accord with those taken at other observatories. Mr. Powell considers that the evidence is tolerably strong against the period of α Centauri being only some seventy-six years (as given by the Downing-Elkin orbit), but thinks that in six or eight years, if careful measures be taken, the point will be settled as to whether the period is about seventy-six years or exceeds eighty-six years.

A NEW BELGIAN OBSERVATORY.—The Cointe Observatory, attached to the University of Liége, has been founded at the instigation of M. Folie for the purpose of affording instruction to the students in astronomy and geodesy, as well as of furnishing original observations. M. Folie is Director of this Observatory, as well as of the Royal Observatory at Brussels. The Cointe Observatory is furnished with a meridian circle by Cooke, the object-glass of the telescope of which is of 6 inches aperture, and the circle 0·8 metre in diameter. The Observatory also possesses a 10-inch refractor by Cooke, of the optical qualities of which M. Folie speaks in the highest terms. The astronomers attached to this institution are MM. L. de Ball and P. Ubaghs, the former of whom observes with the 10-inch equatorial, and the latter with the meridian circle. The Observatory is destined, we hope, to do good work in both these departments of astronomy.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1886 MAY 23–29

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on May 23

Sun rises, 3h. 59m.; souths, 11h. 56m. 29·6s.; sets, 19h. 54m.; decl. on meridian, 20° 37′ N.: Sidereal Time at Sunset, 11h. 59m.

Moon (at Last Quarter on May 25) rises, 23h. 33m.*; souths, 4h. 8m.; sets, 8h. 48m.; decl. on meridian, 16° 38′ S.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian ° ′
Mercury ...	3 25	10 37	17 49	13 12 N.
Venus	2 35	9 4	15 33	5 4 N.
Mars	12 10	18 54	1 38*	7 54 N.
Jupiter... ...	13 24	19 42	2 0*	2 53 N.
Saturn... ...	6 13	14 25	22 37	22 48 N.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

May	h.	
23 ...	20 ...	Jupiter stationary.
29 ...	13 ...	Venus at greatest distance from the Sun.

Variable Stars

Star	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei	0 52·2	81 16 N.	May 25,	3 18	*m*
U Monocerotis ...	7 25·4	9 32 S.	,, 28,		*M*
U Ophiuchi... ...	17 10·8	1 20 N.	,, 26,	2 16	*m*
			,, 26,	22 24	*m*
X Sagittarii... ...	17 40·6	27 47 S.	,, 26,	2 25	*m*
			,, 29,	0 0	*M*
U Sagittarii... ..	18 25·2	19 12 S.	,, 26,	2 25	*M*
			,, 29,	21 40	*m*
β Lyræ...	18 45·9	33 14 N.	,, 28,	21 30	*m*
R Lyræ	18 51·9	43 48 N.	,, 28,		*m*

M signifies maximum; *m* minimum.

Meteor Showers

The *Draconids*, radiant R.A. 280°, Decl. 54° N., and the *Cygnids*, R.A. 301°, Decl. 37° N., are due this week. Meteors from radiants near α Ursæ Majoris, R.A. 175°, Decl. 64° N.; in Lyra, R.A. 273°, Decl. 34° N.; and in Lacerta, R.A. 329°, Decl. 48° N., have also been observed at this season.

GEOGRAPHICAL NOTES

THE Kermadec Islands, which have during the past week been occupied by the orders of the Home Government by Admiral Tryon, Commander-in-Chief on the Australian station, are a group of rocky islets about 600 miles to the north-north-east from the North Island of New Zealand, and lying on the steamer route from Christchurch or Wellington to Fiji. They are due east of Norfolk Island. The principal islands of the group are Raoul or Sunday Island, the position of which is put at 29° 12′ S. and 178° 15′ W. It is described as about 12 miles in circumference, rugged and very steep, without an anchorage. It is said to be covered with wood, and to be uninhabited except for a few white men, waifs and strays from the ocean, shipwrecked sailors, deserters, &c. The other islands of the group are Macauley, the Curtis Islands, Havre, and Espérance.

AT the last meeting of the Geographical Society of Paris a letter was read from M. Borelli, who is at present travelling in that part of Eastern Africa where M. Barral has been murdered. M. Brettes, referring to his explorations of the Grand Chaco between the Argentine Republic, Bolivia, Brazil, and Paraguay, said he had discovered a great salt lake which he proposed to call Lake Crevaux, and three rivers, hitherto unknown, the most important of which would be called Rio Lesseps. M. de la Grye stated the propositions adopted by the committee appointed to study the reforms necessary for the adoption of a common international orthography for maps. These were—(1) any change for European countries is recognised as impossible; (2) in Asia, Africa, and America it is proposed that the French *u* should be replaced by the diphthong *ou*, the value of the French vowels *a*, *e*, *i*, *o* remaining unaltered; (3) in the geography of the Far East the sound of the *u* with a diæresis is represented by *oe*, *g* and *l* are always hard, *ch* is reproduced by *sh*, amongst the gutturals the soft ones are represented by *gh*, the hard by *kh*; (4) as far as possible, by the aid of this common alphabet, the most generally used pronunciation of places, towns, rivers, mountains, &c., shall be reproduced. Prof. Ersler of Copenhagen described the results of his investigations into the cartography of Denmark from the time of Ptolemy.

THE French staff officers are busy with the continuation of the Paris meridian to Laghouat, about 4° south of Algiers. When this work is finished this line will be measured with precision from the Orkneys to this locality. The length determined will not be far from 30°, or about three times its original extension, which was 10°, from Dunkirk to Formentera.

TWO Finnish *savants*, Drs. Hammarström and Ehnberg, have just returned to Helsingfors from a scientific journey in Eastern Siberia and China, whence they bring valuable scientific collections.

NEWS received from Baron Schwerin, the Swedish scientific explorer on the Congo, informs us that he landed from the Liverpool steamer in December last at the mouth of the River Chiloango, whence he proceeded on foot through the districts of Cacongo and Cabinda to Banana. During the journey along the coast the Baron succeeded in making many valuable observations of the shore-lines or terraces on the gradually-rising coast, and of the effects of the tide on the plastic formation of the sandy fore-shore. He also paid special attention to the study of the great influence which ocean currents exercise on the direction of the flow of rivers in their lowest course.

COUNT SAMUEL TELEKY is organising, at Pesth, an Expedition for the exploration of Central Africa; the fitting out will be completed by the end of May, and 100 well-armed men will reach Zanzibar in the course of June. Capt. Hähnel, of the Austrian Navy, will take part in the Expedition, and two boats will be taken out in pieces. It is believed here that the Expedition will not confine itself to scientific explorations only.

THE three numbers of the *Journal* of the Geographical Society of Tokio for last year which have been recently published do not contain much of special interest to English students of geography, although the papers could hardly fail to instruct a Japanese audience, which can hardly be expected to be as familiar with the colony of Victoria, or with the progress of Russia to the southward, as Western readers. The report of the Japanese delegate to the Prime Meridian Conference at Washington is also printed. Of special papers there are two: one on the Bonin Islands, called Ogasawarajima by the Japanese; another on the area within which Mount Fuji is visible.

THE IRON AND STEEL INSTITUTE

THE Iron and Steel Institute held its meeting on the 12th, 13th, and 14th inst., under the presidency of Dr. J. Percy, F.R.S., in the Theatre of the Institution of Civil Engineers.

The President made some introductory remarks having reference to the papers about to be read. He had strong hopes that, from a scientific point of view, great results were likely to flow from investigation of the microscopic structure of iron and steel, as it was only by physico-chemical investigation that our present ignorance of the causes of many phenomena relating to metal would be lessened or dispelled. He was peculiarly glad to read Mr. Turner's paper, as he had had the honour, when first addressing the Institute, of suggesting the solution of specific problems relating to iron and steel which had been ably attempted by the author; he should be glad to see medals or rewards conferred on those who solved problems emanating from the Institute. He made special reference to Mr. C. P. Clarke's paper, which we hope to print *in extenso*. He had great pleasure in drawing attention to Sir Henry Bessemer's gift to the Institute of a series of specimens illustrative of the process universally known by his name, which he exhibited at South Kensington some time ago. The President very shortly referred to what Sir Henry had done for metallurgy, and called upon the members to join in cordially thanking him for his gift to the Institute, which was done with acclamation.

With regard to the prevailing depression in trade, he thought over-production was the main cause of the evil in question. Considering the enormous power the iron and steel trades, for instance, possessed for production, it was not surprising that over-production should take place. Besides, what had taken place in our own country had also occurred to a greater or less extent in Germany, Belgium, France, Austria, Russia, and especially the United States of America.

British workmen had a special enemy to contend against in the fierce competition from abroad, where men labour for less wages and work longer hours. He hoped that the problem would be solved, not by our countrymen having to be paid less for their labour, but by the labourers in foreign countries rising to our level, when our trades would have less to fear from foreign competition.

Passing from the over-production of iron and steel, the President referred to the fact that the surface of the earth was limited, whilst the human race was constantly increasing, and as the world could only sustain a certain population, so portions of it could do no more; he was of opinion that what was really at the bottom of the troubles of Ireland was the sentiment of Irishmen trying to live where they could not gain their livelihoods, when there were millions of acres in our colonies which they could cultivate and be happy upon. Shortly referring to the Colonial and Indian Exhibition, the speaker concluded, a vote of thanks for his address being moved by Sir Isaac Lowthian Bell and seconded by Sir Bernhard Samuelson.

The Bessemer Medal for the year was awarded to Mr. Edward Williams, who was unfortunately prevented by ill-health from coming to the meeting to receive it.

There was a very large number of papers on the agenda, some of which had to be deferred. Amongst the papers read and discussed some were important not only technically but scientifically. Mr. P. W. Flower's paper on the origin and progress of the manufacture of tin plates is hardly of this character, but it is interesting both from an archæological and industrial point of view. Aristotle, Pliny, the Phœnicians, Herodotus, and Diodorus Siculus have all made reference to this manufacture. In more modern days we find it flourishing in Bohemia in 1620, from which country Yarranton introduced it into England about 1665, thus fortunately succeeding in benefiting the iron trade of Wales and the tin trade of Cornwall, which were both much depressed. Later on, the use of coal instead of charcoal, of vitriol for pickling-purposes in place of barley-meal, of Siemens's soft steel for charcoal iron, of Bessemer steel in place of puddled bar, have all had their influence on this industry. Ninety-six works, with 320 mills in all, work up about half a million tons of British steel and iron annually into tin plates. The production last year was over 7,000,000 boxes, of which probably 3,000,000 were used in the manufacture of 875,000,000 of 1 lb. canisters. "By means of these canisters Europe receives largely of beef from the Western prairies, salmon (in shiploads) from Oregon, mutton from the plains of Australia, fruits of all sorts from California, lobsters from Boston and Nova Scotia, oysters and peaches from Baltimore, sardines and green peas from France, pine-apples from Mauritius, apricots from Lisbon, milk from Switzerland, jams from Tasmania, and many other products of foreign soil, which complete the list of what the French have called *conserves alimentaires*."

Mr. Hamilton Smith, jun., in his paper on wrought-iron conduit pipes, refers to the method of hydraulic mining introduced in California in 1852. It may roughly be defined as the discharge of jets of water, actuated by gravity with a considerable head, against a bank of auriferous gravel, the water acting first as an excavator, and afterwards as a carrier of the washed material. The supply of water for these jets was at first conducted through hose made of heavy cotton duck cloth, which was strengthened by outer nettings of cordage when the pressure was large. In 1853 an ingenious miner laid in his main a line of pipe consisting of joints of ordinary stove-pipe, made of very thin sheet-iron lightly fastened together with cold rivets; the joints being united stove-pipe fashion. This pipe answered admirably, and in a short time all the hydraulic gravel mines in California obtained the pressure for their water-jets by means of thin sheet-iron pipes. As a protection against rust, each joint is immersed for several minutes in a bath of boiling asphalte and coal-tar; a little rosin is added when a glassy surface is desired, and sometimes a little fish-oil. After successful practice in the mines had demonstrated the advantages and capabilities of wrought-iron pipes, they were used for permanent conduits both for conducting water to mining districts across deep mountain gorges, and also for the supply of cities. San Francisco, a place of some 300,000 inhabitants, receives its water through two lines of such pipes, and a third pipe, many miles in length, and of large diameter, is now being laid for an additional supply.

"On a Neutral Lining for Metallurgical Purposes" was the title of a paper in which M. Ferd. Gautier, after describing various linings of an acid, basic, reducing, and oxidising character, refers to one in which chrome iron is the main constituent. From a physical point of view chrome ore is essentially refractory; heated in lumps it does not crumble to pieces, however high the temperature. In general metallurgy, where no alkalies in notable quantities are present, chrome iron is a refractory material of a specially neutral character, since neither acids nor bases act upon it. The chrome iron is employed shaped in pieces, and also as a mortar in combination with lime. The use of this material in the basic open-hearth process has been kept secret for some time; it was exhibited last year at the International Inventions Exhibition.

The President's paper on steel wire of high tenacity referred to experiments on the tensile strength and chemical composition of wires of various thickness. The mechanical tests were made at the request of the author by Col. Maitland, R.A., and the analyses by Sir Frederick Abel. The wire was of a very pure character, there being a percentage of total carbon 0·828, manganese 0·587, silicon 0·143, sulphur 0·009, copper 0·030, without a trace of phosphorus. The tensile strengths of the wires increased as their thickness diminished, as shown by the following table:—

Diameter in fractions of an inch	Tensile strength in tons per sq. inch
0·093	154
0·132	115
0·159	100
0·191	90

The difficulty in accounting for the increase of strength with diminution of diameter in wire-drawing is the circumstance that the density of the material diminishes during this process.

Mr. T. Blair's paper on certain necessary products of blast-furnaces, and Mr. Bauerman's note on a rare blast-furnace slag of the composition of gehlenite, were discussed together.

The paper by Mr. John Head on blow-holes in open-hearth steel brought about a very animated discussion. The blow-holes in steel, the author explained, are due to the contraction of the metal on cooling, or to the presence of imprisoned gases in its mass. Those of the first kind are removed by welding, when the steel is subjected to pressure. Those of the second kind the author maintains to be similar to what is technically known as "seedy boil" in glass, and may be removed in the manufacture of steel by not allowing the flame to touch the fused metal, just in the same way as they have been

got rid of in the manufacture of glass by the use of the radiating furnace. It was suggested, in explanation of certain mysterious failures which had occurred in steel, the possibility that in these cases the gaseous blow-holes in an ingot may have sorted or arranged themselves in a series, thus forming a line of weakness in the plate or bar, which has failed along that line when subjected to a strain much below that which test-pieces from the same plate or bar would withstand. In conclusion the author had no doubt "that, by manufacturing open-hearth steel free from gaseous blow-holes, the metal produced would be much stronger and more reliable than that made by contact of flame, and the result would be a greater confidence in its use." In the discussion of this paper a unanimous verdict was given in favour of steel alike by representatives of the Admiralty, the Board of Trade, and Lloyd's Registry, who are the official judges of the metal, and by shipbuilders and boiler-makers who have found the material more trustworthy than the best iron. As regards the manufacturers, one acknowledged to the fact of there being a large difference in the total carbon, according as a sample was taken from one end or another of a large ingot, whilst another speaker had found the metal to be more regular if made in a radiation than a contact of flame furnace. As the author stated in his reply, the users were evidently even better satisfied with the material supplied them than the makers, which is certainly a favourable sign.

Mr. F. W. Webb's paper on the endurance of steel rails added further testimony to what had already been said in favour of steel. In 1876 the London and North-Western Railway put down 31,391 tons of iron and steel rails together, twelve months after which iron rails entirely disappeared, whilst the estimated requirements for this year are only 11,600 tons. The small quantity of rails required for renewals account in some measure for the depression in the steel-making trade. On the other hand, if steel sleepers are found to answer, and the author sees no reason why they should not, 45,000 steel sleepers having been put down on the London and North-Western line, and giving every satisfaction, orders for steel sleepers should in great measure make up for want of orders for rails.

Dr. H. C. Sorby drew attention to the application of very high powers to the study of the microscopical structure of steel, having employed a power of 650 linear which, being about ten times that used in his previous researches, opened out a new field for research. The chief facts were best seen in the case of an ingot of steel of medium temper. On fracture, comparatively large crystals were visible, radiating from the surface to the interior. When a properly-prepared microscopical section was viewed with a moderate power, it was easy to see that, after having crystallised out from fusion at a high temperature, these large crystals broke up on further cooling into much smaller ones. What was now seen with very high powers was that these smaller crystals finally split up into alternating very thin plates. Taking all the facts into consideration, it appeared as though a stable compound of iron with a small amount of carbon existed at a high temperature, which at a lower broke up into iron combined with a larger amount of carbon, and into iron free from it. If these two products had not differed so much in hardness, or if the alternating plates had been considerably thinner, or if definite plates had not been formed, such a compound structure would never have been suspected. It has probably never been specially looked for in other substances, and might exist without being visible, even with the highest and best magnifying powers. To give a good idea of the size of the plates, he would refer to what was seen in a longitudinal section of medium steel forged from an ingot 3 inches in diameter down to a bar 1 inch square. When broken, it showed a very fine grain, and when a prepared section was examined with a moderate power, this grain was seen to be due to crystals often about 1/1000 inch in diameter, which were not drawn out or distorted, as they would have been if they had existed previously to final cooling after hammering, and as they were distorted if the steel were hammered at a lower temperature. Examined with a power of 650 linear, these crystals only 1/1000 inch diameter were seen to contain something like 60 of the alternating plates, and even this extremely delicate structure showed little or no trace of distortion. Of course it was impossible to separate and analyse such thin plates, and reliance must be had on induction to furnish a knowledge of their nature. His reason for concluding that the hard plates contained combined carbon was that they were not seen in iron free from carbon; they increased in amount with increase of carbon, and were seen to the greatest perfection when there was a considerable amount in a combined state.

Mr. Thomas Turner's paper on the constituents of cast-iron is an attempt now made for the first time to systematise in some measure our knowledge of the constituents generally present in cast-iron, to estimate the mechanical value of any given specimen of which the chemical analysis is known, and conversely, when any given mechanical properties are desired, to predict the most suitable composition for the material. In connection with this subject two opposite opinions have been advanced by different authorities, both of which found expression at the Glasgow meeting of the Institute. On the one hand, it was suggested that probably the best mechanical properties would be obtained in a cast-iron which contained if possible nothing but carbon and iron, all other elements being regarded as impurities. On the other hand, it was said that possibly very considerable quantities of other elements might be added, even upwards of 10 per cent., without rendering the metal unfitted for the founder's use. It might be, if chemically pure iron could be obtained, that the first suggestion would be correct, and possibly if the various constituents could be added in just such proportions as to neutralise each other's ill-effects, as under such circumstances they are capable of doing, then the second suggestion might likewise prove true. As a matter of fact, pure iron cannot be manufactured, and the ill-effects of large proportions of foreign substances cannot be neutralised. A cast-iron of tolerable purity can, however, be produced, from which, by variations in the proportions of the constant constituents, a metal of desired character may be prepared. The author treats in detail of the influence of carbon, manganese, phosphorus, silicon, and sulphur, all of which are invariably present in greater or less proportion. Of these, carbon is the most important constituent, and remarkable differences are produced by variations in the proportions of combined carbon and graphite. For the more ordinary cast-iron the amount of total carbon varies from about 3 to 3·8 per cent., a lower proportion being generally due to some irregularity in the working of the blast-furnace. The relative proportion of graphitic to combined carbon can only be affected in two ways—by difference in the methods of fusion after cooling, and by variations in the proportions of other elements present. Maximum general strength, that is, considerable crushing strength combined with high tensile strength, is obtained with not less than 0·4 per cent. of combined carbon, the metal being sufficiently soft to work with the tool; with more combined carbon the metal becomes harder, its crushing strength increases while the tensile diminishes. The amount of graphitic carbon depends upon the total and combined, but, in the majority of cases, 2·6 per cent. for crushing strength, 2·8 per cent. for general strength, and 3 per cent. for strength and softness, will be found best. It is to be remembered that any required proportion of combined carbon may be obtained by altering the amount of silicon on the one hand, or of manganese and sulphur on the other, the former diminishing and the latter increasing it. As regards silicon, the experiments show that, if high crushing strength is required, it can be obtained by a low percentage of silicon; if a high tensile strength is required the silicon should be somewhat higher, while for softness, smoothness of surface, and fluidity a still higher proportion is necessary. The author is of opinion that, although phosphorus is objectionable in wrought-iron and steel, it is not so in cast-iron, the specimens which possessed the highest average quality being all moderately phosphoric irons, averaging from 0·19 to 0·72 per cent., 0·3 per cent. being a very suitable average proportion for strong iron; the amount must be proportioned according to the object the founder has in view. A small quantity of sulphur is known to produce hard white iron, owing to an increase in the amount of combined carbon, acting therefore, when in small quantity, in a manner almost exactly opposite to that of silicon. Sulphur and silicon are to a considerable extent mutually exclusive of each other in cast-iron. Thus the addition of sulphur to siliceous iron causes the separation of graphitic matter containing silicon, while the addition of silicon to an iron rich in sulphur causes the separation of graphitic matter rich in sulphur, one part of sulphur neutralising the effect of from five to ten parts of silicon. From 0·2 to 0·75 per cent. of manganese appears to exercise no injurious effect in the majority of cases, and may even be beneficial. The author considers the following to be proved, that pure cast-iron, *i.e.* iron and carbon only, and cast-iron containing excessive amounts of other constituents, would not be suitable

for foundry work; that the ill-effects of one constituent can at best be only imperfectly neutralised by the addition of another constituent; that there is a suitable proportion for each constituent present in cast-iron, depending upon the character of the product desired, and upon the proportion of other elements present; and that variations in the proportion of silicon afford a reliable and inexpensive means of producing a cast-iron of any required mechanical character which is possible with the material employed.

Krupp's hot-blast pyrometer, which was shortly described, consists of an arrangement by which the hot blast is drawn with a fixed proportion of cold air into a chamber, the temperature of which, being measured with an ordinary thermometer, gives that of the hot blast by calculation.

ON DISSOCIATION TEMPERATURES, WITH SPECIAL REFERENCE TO PYROTECHNICAL QUESTIONS[1]

IN bringing the subject of dissociation before the Royal Institution of Great Britain, the author proposed to confine himself to its influence on combustion and heating, that is to say, to its effects on combustible gases and the products of combustion, and on furnace work generally. His researches had been made for the most part in connection with large gas furnaces constructed according to his new system of working with radiated heat, or what may be otherwise called free development of flame. In the first or active stage of combustion the flame passed through a large combustion chamber (all contact with its surfaces being avoided), and parted with its heat by radiation only; while in its second stage the products of combustion were brought into direct contact with the surfaces and materials to be heated, by which means the remainder of its heat was abstracted. This, in a few words, was a description of the method of heating with free development of flame. In perfecting this system of furnace, the principle of which was in many respects the reverse of that generally accepted, both as regards construction and working, he had to examine into the accuracy of certain scientific theories which could not be brought into harmony with the actual results he obtained.

Adopting the generally-accepted theory of combustion, according to which a flame consists of a chemically-excited mixture of gases, whose particles are in violent motion, either oscillating to and from each other, or rotating around one another, it followed that any solid substance brought into contact with gases, thus agitated, must necessarily have an impeding effect on their motion. Motion being the primary condition of combustion, the latter would be more or less interfered with, according to the greater or less extent of the surfaces which impede the action of the particles forming the flame; in the immediate neighbourhood of such surfaces the combustion of the gases would cease altogether, because the attractive influence of the surfaces would entirely prevent their motion; farther off, their combustion would be partial, and only at a comparatively great distance the particles of gas would be free to continue unimpeded the motion required to maintain combustion. On the other hand, the surfaces themselves must suffer from the motion of the particles of gas producing the flame, for, however small these particles might be, they produce, while in such violent motion, an amount of energy which acting constantly would in time destroy the surfaces opposed to them, just as "continual dropping wears away stone." This circumstance fully accounted for the fact that the inner sides of furnaces, and the materials they contained were soon destroyed, not by heat, but by the mechanical, and perhaps also by the chemical, action of the flame. It would seem strange that the heating power of a large volume of flame should be so much interfered with by the contact of its outer parts only with the inner sides of a large furnace chamber, if there was not another cause besides imperfect combustion to reduce the heating effect of a flame which touched the surfaces to be heated. A flame when in a state of combustion radiated heat not only from its outer surface, but also from its interior by allowing the heat to radiate through its mass. In this manner every particle of flame sent its rays in all directions, but if the flame itself touched anywhere combustion ceased there, free carbon was liberated and produced smoke which enveloped that part and prevented the rays of heat of the other portions of the flame from reaching it.

[1] Lecture by Mr. Frederick Siemens at the Royal Institution, Friday, May 7.

The author had avoided for various reasons referring to the subject of dissociation until recently, although it had been brought forward by several writers, and used as an argument against his new system of furnace; as according to these writers it would appear to be impossible to produce such exceedingly high temperatures as he claimed to reach. He had long held the opinion that appearances of dissociation not being observable in furnaces heated by radiation, but occurring in furnaces in which the flame was allowed to come into contact with surfaces, must be due to the action on the flame of those surfaces at high temperature. He was led to this conclusion partly from his own observations, and partly from descriptions of dissociation observed by others, amongst whom was his brother, the late Sir William Siemens, who described a case of dissociation (see lecture delivered March 3, 1879, at the Royal United Service Institution, entitled "On the Production of Steel, and its Application to Military Purposes") which occurred in a regenerative gas furnace constructed according to their old views of combustion and heating. *The conclusion at which he had arrived was, that solid surfaces, besides obstructing active combustion, must also at high temperatures have a dissociating influence on the products of combustion.*

In order to obtain information on this subject he examined the laws and theory of dissociation, and endeavoured to bring the various results obtained by scientific authorities into agreement with one another, and with his own experience, but failed entirely in doing so. The temperatures of dissociation of carbonic acid and steam, the two principal gases forming the products of combustion when ordinary fuel was used, vary very much according to these observers, and the results he had obtained in practice were different from most of them. He hoped to prove that the temperature at which dissociation sets in is, in most cases, much higher than generally admitted; and that the authorities he was about to refer to had omitted in almost all the experiments they had made to take into proper consideration one element which was liable to alter materially the results obtained by them. *This element was the apparatus used for those experiments as regards its surface, form, and material.*

In considering the question of dissociation, he proposed to commence with Deville, who first discovered and called attention to the dissociation of gases at high temperatures. He made numerous experiments with various gases, and fixed certain temperatures at which he found that either complete or partial dissociation took place. Without going into details, he might mention that Deville required to use vessels and tubes of definite dimensions, material, and structure, in order to obtain the results stated. One experiment had to be made with a porous tube, another required the use of a vessel with rough interior surfaces, or containing some rough or smooth material. In this way Deville arrived at a great variety of results, and although he did not state that the rough surfaces, or porous tubes, or the solid material placed inside the vessels which he employed, had any particular influence on the temperature at which dissociation took place, yet it would appear that he could not obtain his results without having recourse to those means. Deville's results depended very much upon the various kinds of surfaces he used in his experiments, if they were not entirely brought about by them; these experiments, moreover, were of a very complicated nature, so he proposed to pass on to more modern authorities, whose experiments were of simpler character, and less open to objection.

The most important experiments which modified those of Deville were due to Bunsen. Bunsen observed the dissociation of steam and carbonic acid by employing small tubes filled with an explosive mixture of these gases, to which suitable pressure-gauges were attached. On igniting the gaseous mixture, explosion took place, and a high momentary pressure was produced within the tube; from the pressure developed, Bunsen calculated the temperature at which the explosion took place, and found that it varied with the mixtures employed. He records the circumstance that only about one-third of the combustible gases took part in the explosion, from which circumstance he concluded that the temperature attained was the limit at which combustion occurred. To prove this, Bunsen allowed the gases sufficient time to cool, after which a second explosion was produced, and even a third explosion when time was allowed for the gases to cool down again. Bunsen obtained much higher temperatures for his limits of dissociation than other physicists; these were for steam about 2400° C., and for carbonic acid about 3000° C. These temperatures were probably higher than

are reached in the arts, as materials used in furnace-building would not withstand such temperatures for any length of time; but still he must call attention to the circumstance that if the influence of the inner surfaces of the tubes on the combustion of the gases therein could be removed, the dissociation temperatures arrived at would be found still higher. He could not admit that Bunsen's explanation of the cause of the second and third explosions was quite satisfactory, as it was not the cooling of the gases alone which rendered the subsequent explosions possible, but also the thorough re-mixture of the gases by diffusion after each explosion. This he illustrated by means of diagrams which represented—

(1) A tube filled with an explosive gas mixture which was shown white.

(2) The same tube immediately after an explosion had taken place, with a white margin to indicate the unexploded mixture close to the sides, and deep red, towards the middle of the tube, the exploded gases. The white was shown as merging into deep red by degrees, because close up to the sides the surfaces prevented explosion or combustion altogether; nearer the middle partial combustion took place, whilst only in the middle of the tube the gases found sufficient space for complete combination.

(3) The same tube after the burnt and unburnt gases had mixed by means of diffusion, which was coloured light red.

(4) The same tube immediately after the second explosion, coloured light red at the sides, turning into deep red by degrees towards the middle.

(5) The same tube after diffusion has done its work a second time, coloured a deeper shade of red.

(6) The same tube after the third explosion, coloured nearly deep red throughout, but still a lighter shade on the sides.

In Bunsen's mode of determining dissociation at high temperatures we had only to deal with the obstruction which surfaces offer to combustion, leaving out their dissociating influence at high temperatures, which affected most of Deville's results. For that reason Bunsen arrived at much higher dissociation temperatures than Deville, and his mode of experimenting possessed the advantage that it might lead to a proper settlement of the question of temperatures at which dissociation would set in when taking place in a space unencumbered by surfaces.

By taking a narrow tube of about the same size as Bunsen used for his experiments, and a hollow sphere of the same capacity, in both of which Bunsen's experiment should be repeated, the real dissociation temperature, if no surfaces were present to influence the result, might be approximately calculated.

Bunsen's method of experimenting, according to his view of the matter, should form the foundation of further research to determine the dissociation temperatures of products of combustion. Even if means were found for eliminating the influence of surfaces, no known material at our disposal could withstand the very high temperature to which the vessels or tubes would be subjected if experiments were carried out according to Deville's method.

That the surfaces of highly heated vessels or tubes either produce, or tend to produce, dissociation, had been corroborated lately by two Russian experimentalists, Menschutkin and Kronowalow. These gentlemen found that dissociation of carbonic acid and other gases was much facilitated when the vessels used for the experiments were filled with material offering rough surfaces, such as asbestos or broken glass.

The lecturer's view of the theory of dissociation caused or influenced by surfaces might be given as follows. Increase of temperature producing expansion of gases would reduce the attractive tendency of the atoms towards one another, or, in other words, diminish their chemical affinity. In the same ratio as the temperature was increased the repelling tendency of the atoms must increase also, until at last decomposition, or what is called dissociation, took place. This being admitted, it would follow that the adhesive or condensing influence of surfaces on the atoms of the gas, which action would increase at high temperatures, would assist this decomposition by increasing the repelling tendency of the atoms.

Victor Meyer, who at first disputed the accuracy of the results obtained by the two Russian physicists, ultimately accepted them, thus confirming the results he had arrived at in practical work with furnaces. Thus the question might be considered nearly settled, the more so as Meyer was himself a great authority in questions of dissociation, having carried out many interesting experiments. Meyer, for instance, proved dissociation by dropping melted platinum into water, and found that oxygen and hydrogen were evolved from the steam produced. There could be no doubt on this point, but the question arose whether heat was the sole agent that brought about the dissociation of steam in this case. In the first place the dissociating influence of the highly heated surfaces of platinum on steam had to be taken into consideration, and, secondly, the chemical affinity which platinum had for oxygen, and still more for hydrogen. The same remarks applied to Meyer's experiment of passing steam or carbonic acid through heated platinum tubes, in which case he obtained only traces of dissociation, the temperature being much lower. Other experiments might be mentioned, but none led to a different conception of the question.

There is one other circumstance connected with dissociation, proved by experiment, which, however, required explanation. It was considered as a sure sign that dissociation was going on when a flame whose temperature was raised became longer; this it was said could only be accounted for by dissociation having commenced. He agreed with this conclusion, but the experiments by which it had been proved had been made, like others referred to, in narrow tubes or passages in which the dissociating action of the heated surfaces must come into play. It was not alone the heat to which the gases were raised that in these cases caused dissociation and increased the length of the flame, but also the influence of the heated surfaces in contact with the combustible gases, more especially if these gases contained hydrocarbons. The extension of the flame was also partly due to the obstruction which the surfaces offered to the recombustion of the dissociated gases through want of space. If the same flame were allowed free development in a space unencumbered by surfaces, as in the lecturer's radiation furnace, no such extension of its length would be observed; but, on the contrary, it would get shorter with increase of temperature. This action could be best observed in the regenerative gas-burner exhibited, whose flame became shorter the greater the intensity of the temperature, and therefore of the light, produced. On the other hand, flame might be extended almost to any length if conducted through narrow passages; this might be seen in regenerative furnaces, which would send the flame to the top of the chimney if the reversing valves were so arranged that the flame, instead of passing through the furnace chamber, was made to burn directly down into the regenerators. No proper combustion could then take place in the brick checkerwork of the regenerative chambers, and the flame would consequently continue to extend until cooled down below a red heat, being ultimately converted into dark smoke; thus in this case the extensive surfaces offered by regenerators would act both ways, by preventing combustion, and by assisting dissociation.

It would be understood that regenerative furnaces themselves offered special opportunities for making experiments, most questions, indeed, being best settled by the results obtained in actual work. If dissociation set in the consequences were seen in want of heat, reduced output, and in destruction of furnace and material. If the causes of dissociation were removed, a rise in temperature, increased output, longer furnace life, and saving of material ensued. Similar results might be obtained with other furnaces, but the beneficial action would not be so great as in the case of the regenerative furnace, because the intensity of heat obtainable in them was much lower.

After describing a new regenerative gas stove he had lately introduced, the lecturer referred to the better distribution of the radiated heat by its use; he found that a room warmed by means of a stove or open fire, such as described, was of a more uniform temperature than when warmed by an ordinary fire or by a gas and coke fire, such as his brother was engaged in introducing into this country shortly before his death.

This, in his opinion, was mainly due to the fact that a source of radiant heat of low intensity but of large surface, sending out its rays at various angles, heated an object in its vicinity very much more than was the case with a smaller source of radiant heat of greater intensity, whose rays struck the object from one direction only, notwithstanding that both sources radiated the same quantity of heat. This action was illustrated by means of two diagrams exhibited, which represented two rooms, the one heated by a small flame of high intensity, and the other by a large flame of low intensity, both radiating the same quantity of heat. In each room two objects, globes or spheres, were repre-

sented, the one close to, and the other at a distance from the source of heat. The object in the one room near to the source having the large heating surface was almost enveloped in rays, while that in the second received rays only in one direction, the former therefore being much more heated than the latter. This difference did not occur when the two globes at a distance from the two sources of heat were compared. The law that the rays of heat diminished in the inverse ratio of the square of the distance was only correct as regards small but intense sources of heat, whilst the decrease of radiant heat took place in a much higher proportion in the case of large sources of heat of low intensity. This clearly proved that for the purpose of warming rooms by means of radiation, it was important that the heat should be concentrated in an intensely hot focus, as was the case in nature, our earth being warmed in this way by the radiant action of the sun.

ON THE EFFECT OF HEAT IN CHANGING THE STRUCTURE OF CRYSTALS OF POTASSIUM CHLORATE

IT was observed some time ago by M. Mallard (*Bulletin de la Société Minéralogique*, 1882, p. 214) that certain crystals, such as boracite and potassium sulphate, have their crystallographic character profoundly modified by exposure to a high temperature, and that in the case of potassium sulphate a number of hemitrope plates are thus formed.

Now, potassium chlorate, while it does not belong to the same crystal-family as potassium sulphate, shows a still more inveterate tendency to produce twins (such as would assuredly drive a Malthus to despair). It was therefore an obvious inference that heat might produce a similar physical change in this substance, although I have not been able to find any account of the experiment having been tried. The decrepitation of crystals of potassium chlorate, when heated, has of course been noted; but the wreck of the crystal has been always rather inadequately explained as due to the vaporisation of included films of water.

A clear transparent crystal of potassium chlorate, from which the inevitable twin plate had been ground away so as to reduce it to a single crystal-film about 1 mm. in thickness, was placed between pieces of mica and laid on a thick iron plate. About 3 cm. from it was laid a small bit of potassium chlorate, and the heat of a Bunsen burner was applied below this latter, so as to obtain an indication when the temperature of the plate was approaching the fusing-point of the substance (359° C., according to Prof. Carnelley). The crystal-plate was carefully watched during the heating, but no decrepitation took place, and no visible alteration was observed, up to the point at which the small sentinel crystal immediately over the burner began to fuse. The lamp was now withdrawn, and when the temperature had sunk a few degrees a remarkable change spread quickly and quietly over the crystal-plate, causing it to reflect light almost as brilliantly as if a film of silver had been deposited on it. No further alteration occurred during the cooling; and the plate, after being ground and polished on both sides, was mounted with Canada balsam between glass plates for examination. Many crystals have been similarly treated with precisely similar results; and the temperature at which the change takes place has been determined to lie between 245° and 248°, by heating the plates upon a bath of melted tin in which a thermometer was immersed. With single crystal-plates no decrepitation has ever been observed, while with the ordinary twinned plates it always occurs more or less violently, each fragment showing the brilliant reflective power above noticed. Doubtless the decrepitation is due to the wrenching asunder of the hemitrope plates, caused by their unequal expansion by heat in different directions.

The following brief account will show the nature of the changes which the crystal has undergone:—

(1) Examined in common white light, the ordinary crystals of potassium chlorate reflect no more light, either superficially or internally, than a plate of glass, in whatever position they are viewed.

The altered crystals, when similarly examined, reflect little light at small angles of incidence, but at all angles greater than about 10° they reflect light with a brilliancy which shows that the reflection must be almost total. This reflective power does not seem to be materially greater at high angles of incidence. When the plate is turned round in its own plane, two positions are found, differing in azimuth by 180°, in which the crystal reflects no more light than an ordinary crystal under the same conditions. In these cases the plane of incidence coincides with the plane of crystallographic symmetry.

The reflected beam is slightly iridescent; and when the plate is held obliquely and examined with a magnifier, a striated faintly-coloured structure is observable, resembling that of watered silk or mother-of-pearl. The coloured bands always lie parallel to the plane of symmetry. When the reflected light is examined with a spectroscope, it is found to give a rather complicated spectrum containing numerous narrow absorption-bands. In some specimens these bands are fairly straight and regular, but in most cases they are rather wavy, and vary in thickness in different parts of their length, appearing somewhat like the interlacing twigs in a bundle of sticks. As the angle of incidence is increased, these bands move towards the more refrangible end of the spectrum, while others appear and join in the procession.

The spectrum of the transmitted light is, of course, strictly complementary to that of the reflected beam; and both of them strongly resemble the spectra given by some of the iridescent crystals described by Prof. Stokes (see NATURE, vol. xxxi. p. 565), and also by many sections of opal and mother-of-pearl, and by films of decomposed glass.

(2) When examined in a parallel beam of plane-polarised light, the ordinary crystals show little or no colour, unless held so that the light passes nearly in the direction of the optic axes, when the usual broad, rather faintly-coloured bands are seen. The altered crystals, on the contrary, give in all positions (except when the light passes through nearly normally, or when the plane of polarisation is either parallel or perpendicular to the plane of symmetry) a most complicated and brightly-coloured pattern, resembling that which is shown by many of the complicated macled crystals of amethystine quartz, which vary, like patterns on watered silk, with slight changes in the direction of incidence of the light.

(3) When examined in a micro-polariscope, in plane-polarised, highly convergent white light, the ordinary crystals show the usual isochromatic lemniscates surrounding the optic axes, which latter are themselves just visible at the edge of the field. In the altered crystals nothing of the kind is visible, only patches of colour distributed rather irregularly over the field, somewhat like those of certain of Nörremberg's mica-selenite combinations.

(4) When homogeneous (sodium) light was substituted for white light in the micro-polariscope (an expedient which is of great use in simplifying and giving definiteness to the phenomena shown by crystals), the remarkable nature of the structural change which heat had caused was much more clearly apparent. The ordinary crystals simply showed the usual multitude of curved isochromatic bands symmetrically arranged round the optic axes and filling the whole field. The altered crystals showed nothing of the kind; but a set of hyperbolas appeared—the form of the isochromatic curves of extremely high order which are given by biaxial crystals when the directions of the optic axes make a very large angle with the normal to the surface of the plate (see Verdet, *Œuvres*, vol. vi. pp. 172-175). These hyperbolas are not rectangular, thus proving that the optic axes do not lie in the plane of the plate (as in the case of cleavage plates of selenite); but they so nearly do this that I could not, even by immersing the plate in oil, satisfactorily determine their precise position. The bands are rather irregular and shifty, as is usual in composite macles; in some parts of a crystal they may appear as the central portions of a lemniscate-system.

(5) It seemed desirable to examine the effect of heat upon the crystal during its progress, so as to determine whether the change of structure takes place at the period of the formation of the reflective layer. For this purpose a polished plate of potassium chlorate was clasped in a copper holder (like that used for plates of selenite in Mitscherlich's well-known experiment), so that it could be placed in the field of the polariscope and examined while its temperature was gradually raised by the application of a lamp-flame to the outer extremity of the holder.

The ordinary set of isochromatic curves lasted nearly unchanged for some time as the temperature rose, but at a certain point they faded away like a dissolving view; and then out of the confusion there emerged the set of hyperbolas above mentioned, which grew in definiteness and regularity, but did not

otherwise alter until the field quickly became dark owing to the fusion of the crystal. This seems to indicate that the change in structure begins quite independently of the formation of the reflective layers, the latter being only an incident occurring at a particular stage of the cooling.

(6) It would seem that something of the following kind happens to the crystal. It is, of course, anisotropic in structure, and the effect of heat is to set up a molecular strain which at a certain point of temperature causes so strong a shearing action between nearly contiguous layers of the substance that whole rows of crystal elements lying between these layers are rolled over, as it were, by the "couple" applied to them, until they take up their "second positions of equilibrium," as M. Mallard would say (see his paper "Sur la Théorie des Macles," *Bull. Soc. Min.*, December 1885, p. 467). If these latter positions were such as to bring the *obtuse* bisectrices (supplementary lines) into parallelism with a normal to the main plate, the occurrence of the hyperbolas above described would be fully accounted for. Such an action would be of the same general character as that which takes place in calc-spar when macles are being developed in it by Reusch's method; viz. by carefully compressing a crystal of it in a definite direction (*Pogg. Ann.*, vol. cxxxii. p. 445), I have succeeded by properly regulating the direction and amount of the pressure in making spar-macles containing numerous "planes of sliding" (*Gleitflächen*, as Prof. Reusch calls them), which reflect light with a pearly lustre, and almost as brightly as the potassium chlorate macles described above.

It has yet to be explained, however, why the intense reflective power does not show itself during the process of heating, when the tilting over of the crystals would certainly take place, and not until a particular stage of the cooling is reached. I am inclined to believe that this may be due to the substance acquiring a certain amount of plasticity at high temperatures, such as has been observed by M. Mallard in crystals of nitre under similar circumstances. This may prevent any loss of optical continuity until a certain critical point in the cooling has been reached; and at this point the displaced crystal elements suddenly part company with their unaltered neighbours, leaving a numerous series of parallel tubular cavities, precisely like those which are undoubtedly present in calc-spar macles formed by Reusch's method. The opposite sides of these parallelogrammatic cavities may be so near each other that the rays reflected from them may interfere, and give the colours of thin plates corresponding to a rather high order in Newton's scale. Although a large amount of light must escape reflection at any single cavity, yet if the transmitted rays encountered a large number of precisely similar and similarly situated cavities at slightly lower levels in the crystal, the sum of the partial reflections would produce an effect almost equivalent to a total reflection of the original incident ray, and a corresponding deficiency in the amount of light transmitted through the whole plate. The brilliancy of the colours in the light reflected from the well-known films of decomposed glass is accounted for in precisely the same way, and the successive separate films of glass can be easily seen under a microscope at the edges of the compound film, where they only partially overlap.

The fact that no brilliant reflection is observed in and near the plane of symmetry of the crystal may be due to the sides of the cavities in a given horizontal row not lying strictly in the same plane, but being slightly inclined alternately in opposite directions, so as to form a series of anticlinals and synclinals, or ridges and furrows like those of a roof. Thus a beam of light incident in the plane of symmetry would be reflected in directions lying a little to the right and left of this plane, and not in the plane itself. The satin-like appearance of the reflecting layers, already alluded to, would be fully accounted for by such a structure.

The changes above described seem of interest as bearing upon the cause of the strong iridescence of some crystals of potassium chlorate, about which I may have something to say in a future communication.

H. G. MADAN

Eton College, May 10

SCIENCE IN RUSSIA

THE last volume of the *Memoirs* of the Kharkoff Society of Naturalists (vol. xviii.) contains several papers of interest. All who have had to deal with Acarides, and are acquainted with the difficulties of their classification, will welcome the elaborate memoir, by M. Krendowsky, on the Hydrachnids of Southern Russia. It is not a mere description of forms, with a more or less happy classification, but an elaborate contribution towards the systematic arrangement of this imperfectly-known subdivision. The embryogeny of the Hydrachnids, and especially their larval phase, have received special attention, no satisfactory classification being possible without that preliminary study. It appears also from M. Krendowsky's researches that many Hydrachnids of Southern Russia are really temporary parasites on several insects, mollusks, and sponges, especially when young and in the state of six-footed larvæ. The Hydrachnids of South-Western Russia belong to thirty-five species (nine species each of *Nesæa* and *Arrenurus*, five of *Atax*, and four of *Limnesia*); the author has been led to revise the whole of the classification of the freshwater Acarides, and gives it complete, with analyses of each family, as well as of the very numerous genera.

Another paper of great interest is devoted by the same author to the estuaries of the Bug, Dnieper, and the smaller ones in the neighbourhoods of Kherson and Odessa. This paper is full of the most useful information as to the characters and geological history both of these estuaries and the *limans*, which are now shut off from the sea by their sand-bars, and have become mere elongated salt lakes.

Prof. Lewakowsky contributes to the same volume a paper on the Jurassic limestones of the Crimea, based especially on their micro-structure. It appears that they mostly contain very small debris of corals and rhizopods; they are not coral structures, as was supposed, but have much likeness to what Dana describes as beachsand-rock. Like the clay-slates of the same formation in the Crimea, they have been deposited in a wide basin which extended into Kherson and Ekaterinoslav, and they were composed of materials brought from the south, from a continent which occupied part of what is now submerged by the Black Sea. M. Genjouriste's researches into the microscopical structure of the coal of the Donez Basin are interesting inasmuch as they show that the prevailing materials for the formation of this coal were the higher vascular Cryptogams, and not Algæ, as was sometimes supposed by Russian geologists. Dr. M. Dybowsky's additional note on the Spongilla *Dorvilia stepanovii*, one of the most interesting discovered in Europe, contains a description of the structure of its gemmulæ, with the porous and "cirrous appendages." The note, as also the preceding papers, are accompanied by several plates.

SCIENTIFIC SERIALS

The Quarterly Journal of Microscopical Science, vol. xxvi. part 3, April 1886, contains a memoir on the leeches of Japan, by Dr. C. O. Whitman (plates 17 to 21). A short abstract of this important memoir has been given in our Biological Notes. —Contributions to the embryology of the Nemertea, by Prof. A. A. W. Hubrecht (plate 22). No. 1 is an account of the development of *Lineus obscurus*, Barr. These investigations, already published in the Dutch language, are fully detailed in this paper, and the plate gives the details of the principal results, combined into fifteen diagrammatic tracings. In one section the earliest developmental stages and the derivatives of the primary epiblast; in a second the hypoblast before the shedding of the primary larval integuments; and in a third the mesoblast, are treated of.—On the early development of *Julus terrestris*, by F. G. Heathcote, M.A. (plates 23 and 24). This is the first part of an essay on a subject not treated of by British naturalists since the days of Newport. It treats of the segmentation of the ovum, which shows a remarkable resemblance to that found in Amphipods by Uljanin. The formation of the blastoderm is such as is generally found in tracheate development. The cells, which at the conclusion of the blastoderm formation remain within the yolk, represent the endoderm. The mode of formation of the mesoderm almost exactly resembles that described by Balfour for spiders. In a future paper the author intends describing the further developmental stages of the embryo.—William A. Haswell, M.A., on the structure of the so-called glandular ventricle (*Drüsenmagen*) of Syllis (plate 25). This organ is in reality a well-developed muscular gizzard, and contains no glands in its walls. The muscular elements of the organ present an embryonic character containing as they do a polynucleated core.—Arthur B. Lee, on Carnoy's cell researches (plate 26). While Carnoy's conceptions of the cell body do not materially differ from received views, the author of this paper thinks that sufficient attention has not been given to his labours on the

question.—Prof. E. Ray Lankester, the Pleomorphism of the Schizophyta. A reminder of the simple fact that ten years ago Prof. Lankester called attention to the pleomorphism of the Schizophyta in a paper in this *Journal*, which attracted the deep attention of all those botanists who had taken any interest in the subject.

Journal of Anatomy and Physiology, April 1886, vol. xx., part 3, contains :—Dr. J. W. Frazer, on the action of infused beverages on peptic digestion. This paper is a continuation of one in the eighteenth volume of this *Journal*, and is based on the results of the same experiments, the difference being that the amount of peptones dialysed, instead of being estimated as the total organic matter, as was done in that paper, are here estimated by the amount of organic nitrogen.—W. A. Lane, some variations in the human skeleton ; asymmetry of skull, spinal column, &c., bifid ribs.—Dr. R. L. MacDonnell, case of bicipital rib.—Dr. R. W. Shufeldt, osteology of *Conurus carolinensis* (plates 10 and 11). The extermination of this parrot appears imminent. To this memoir there is appended a synopsis of the skeletal characters of this bird which exhibit many points of interest.—On a Navajo skull (plate 12), with a note by Sir Wm. Turner.—J. Bland Sutton, on the origin of certain cysts (plate 13).—Dr. J. Lockhart Gibson, the blood-forming organs and blood-formation : an experimental research (plate 14) (continued). Among the chief conclusions are the following : throughout life, nucleated red cells, derived from white corpuscles and colourless marrow-cells, are the only predecessors of the non-nucleated red blood-corpuscles. The transformation takes place in the bone marrow, spleen, and lymphatic glands ; the red bone marrow in extra-uterine life plays the more important part in the work, the spleen a subordinate one ; the lymphatics, while chiefly producing white, do also produce red corpuscles. Both colourless cells and nucleated red cells multiply by division in the blood-forming organs, and in these latter there are also to be found cells whose function appears to be to break down red blood-corpuscles.—Dr. E. E. Maddox, on the relation between convergence and accommodation of the eyes.—Dr. R. Robertson, a contribution to splenic pathology (plate 15).—Dr. F. Tuckerman, supernumerary leg in a male frog (*Rana palustris*) (plate 16).—Dr. D. Noël-Paton, the nature of the relationship between urea formation and bile secretion. Both these phenomena would seem to depend in large measure on the destruction of blood-corpuscles, and through this they necessarily bear a direct relationship to one another.—Prof. D'Arcy W. Thompson, on the hind limb in *Ichthyosaurus platyodon*, and on the morphology of vertebrate limbs.—Sir Wm. Turner, on the lumbar curve of the spinal column in several races of men (see also abstract of a memoir on this subject by Prof. D. J. Cuningham, NATURE, vol. xxxiii. p. 378).—Anatomical notes.

American Journal of Science, April.—On Lower Silurian fossils from a limestone of the original Taconic of Prof. Emmons, by James D. Dana. These fossils were recently found in the "sparry" or western limestone of the Taconic system, that is, the oldest limestone stratum of the system according to Emmons. They come from Canaan, New York, near the Massachusetts border, and several species have been determined by Prof. Dwight, notwithstanding the metamorphism of the rock. They include remains of Murchisonias, Pleurotomarias, Crinoids, Fenestellæ, a Trilobite, and probably some Brachiopods, showing that this limestone is not pre-Cambrian or Cambrian, but belongs probably to the Trenton or Lower Silurian age of the Eastern or Stockbridge limestone.—Preliminary report of S. W. Ford and W. B. Dwight upon the fossils obtained in 1885 from metamorphic limestones of the Taconic series of Prof. Emmons at Canaan, New York : A. Explanatory statement with reference to the palæontological investigations at Canaan, by W. B. Dwight. The authors are strongly inclined to the opinion that the limestones of Canaan, which have yielded these fossils, are of Trenton age.—On surface transmission of electrical discharges, by H. S. Carhart. A practical bearing of the experiments here described and illustrated is that there is no sufficient scientific basis for making lightning conductors of large surface, and that large sectional area is essential to ample conductivity.—The minerals of Litchfield, Maine, by F. W. Clarke. The paper contains a careful study and analysis of the elæolite, cancrinite, sodalite, hydronephelite (new species), albite, and lepidomelane from the numerous boulders of an elæolite rock scattered over the district between Litchfield and West Gardiner, in Kennebec County, Maine.—On the chemical behaviour of iron in the magnetic field, by Edward L. Nichols. A set of experiments with aqua-regia, nitric acid, hydrochloric acid, and sulphuric acid is here described in illustration of the phenomenon that, when finely-divided iron is placed in a magnetic field of considerable intensity and exposed to the action of an acid, the chemical reaction differs in many respects from that which occurs under ordinary circumstances. The experiments are preliminary to a more complete investigation of the novel series of effects developed by them.—The inculcation of scientific method by example, with an illustration drawn from the Quaternary geology of Utah, by G. K. Gilbert. This paper is a reprint of the Presidential Address read before the American Society of Naturalists at Boston, December 27, 1885. It discusses, not the results nor the subject-matter of the several sciences with which naturalists are concerned, but their methods of investigation and their methods of teaching generally.—Nova Andromedæ, by Asaph Hall. The history of the discovery of the new star in Andromeda by Dr. Hartwig, of Dorpat, last August, its observation and gradual fading away, forms the subject of this paper.—On some new forms of the Dinocerata, by W. B. Scott. What appears to be a missing link between the two sub-orders of Amblypoda (the Coryphodons of the Wahsatch Eocene and the Dinocerata of the Bridger) is here described under the name of Elachoceras. It was discovered by the Princeton Expedition of 1885 in the Bridger beds of Henry's Fork, Wyoming, and represents a genus allied to Uintatherium, without upper incisors, and having six molars of the Uintatherium type and large upper canine tusks, but without nasal protuberances, and having only rudiments of the maxillary and parietal protuberances. The supra-occipital is pierced by two large venous foramina placed one on each side of the median line. In the same locality, but at a somewhat higher level, was found a large Uintatherium skull, undoubtedly representing a new species (*U. alticeps*) of that genus.

The American Naturalist for April 1886 contains :—On the ancestry of Nasua, by Saml. Lockwood.—On the mechanism of soaring (illustrated), by J. Lancaster.—The Stone Age in Vermont (illustrated), by Geo. H. Perkins.—On Grosse's classification and structure of the Mallophaga (illustrated), by Geo. Macloskie.—On traces of a cyclone which passed over Western Indiana more than 300 years ago, by Jno. T. Campbell.—On the mounting of fossils (illustrated), by F. C. Hill.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, April 1.—"On a New Form of Stereoscope." By A. Stroh.

Two optical lanterns are placed side by side, as for dissolving views. Two transparencies, photographed in the same manner as if intended for an ordinary stereoscope, are placed one in each lantern, and projected on a screen in such a position that they overlap each other as nearly as possible. The picture which is intended to be seen by the right eye may be placed in the right-hand lantern, and the other in the left.

Supported by suitable framework, and in front of the two lenses of the lanterns, is a revolving disk, portions of which are cut away, so that during its revolutions it obscures the light of each lantern alternately, or, in other words, so that only one picture at a time is thrown on the screen. A continuous change from one picture to the other is thus obtained.

In the same framework, and in convenient positions for the observers, two pairs of eye-holes are provided, one pair on either side of the apparatus. Behind each pair is also a rotating disk, and these disks are connected by suitable wheel-work or driving-bands with the one previously mentioned, in such a way that the three disks rotate together, and at the same rate. The two last-named disks are also so cut that they will obstruct the view through the right and left eye-holes alternately.

Finally, the connection between the three disks has to be so arranged that the time of obscuring the view through the right eye-holes, or the left eye-holes, shall coincide with the time when the light is shut off from the right or left lens of the lanterns respectively.

It is obvious that by this arrangement an observer can only see the picture projected from the left lantern with the left eye, and the one from the right-hand lantern with the right eye.

The rotation of the disks must be of such a rate that the alternate flashes of the right and left pictures on the corresponding

eyes follow in such rapid succession that the impression made by one flash does not diminish sensibly before the next flash on the same eye is received. The number of flashes for each eye which is required to produce an apparently continuous view, without any flickering effect, is from thirty to forty per second. As the disks are so cut as to produce two flashes for the right eyes and two for the left in one revolution, they must consequently be kept rotating at a rate of from fifteen to twenty revolutions per second.

The rotation of the disks is effected by a driving-wheel and band worked by a crank handle at the back of the apparatus.

The perspective effect obtained by the above arrangement is very perfect, the image of each object standing out in solid relief.

Considering that by this arrangement the two eyes never see at the same time, and that each eye views its picture after the other, it is interesting to find that the persistence of vision so completely bridges over the alternate interruptions to which it is subjected as to produce the effect of a continuous view.

The advantages claimed for this form of stereoscope are: that the pictures can be enlarged to such an extent as to appear equal to or even larger than the original objects from which they were taken; and that the eyes in looking at the pictures are not in any way subjected to strain by lenses, prisms, or reflectors, or by the difficulty which some persons experience in getting the two pictures to superpose. For each eye views its corresponding picture in exactly the same position it would see it in if it were looking at the original, since the two pictures are practically in the same place, which is not the case in any other form of stereoscope.

Although with the apparatus as here described only two persons can see the pictures at the same time, it would not be very difficult to construct it so as to be available for a greater number. The side disks above described only serve to control one pair of eye-holes each, but by making them larger they would serve for two pairs each, thus accommodating four observers. By increasing the number of disks, the number of observers might be increased proportionately.

May 6.—"The Influence of Stress and Strain on the Physical Properties of Matter. Part I. Elasticity (continued). The Effect of Change of Temperature on the Internal Friction and Torsional Elasticity of Metals." By Herbert Tomlinson, B.A. Communicated by Prof. W. Grylls Adams, M.A., F.R.S.

The author has recently had the honour of presenting to the Society a memoir relating to the internal friction of metals when vibrating torsionally at temperatures ranging from 0° C. to 25° C. He now brings forward results which have been obtained in experiments on the effect of change of temperature on the torsional elasticity and internal friction of metals. The apparatus used and the mode of experimenting are fully described in the paper, so that it will be sufficient, perhaps, to state here that the vibration-period and the logarithmic decrement were very carefully determined at four different temperatures between 0° C. and 100° C., and that the formulæ were worked out by the method of least squares. These formulæ were given in tables.

From a consideration of the tables it may be gathered that:—

(*d*) The torsional elasticity of all metals is temporarily decreased by rise of temperature between the limits of 0° C. and 100° C., the amount of decrease per degree rise of temperature increasing with the temperature. To this may be added that the percentage decrease of torsional elasticity produced by a given rise of temperature is for most metals about twenty times the corresponding percentage increase of length.

(*e*) If we start with a sufficiently low temperature the internal friction of all annealed metals is first temporarily decreased by rise of temperature and afterwards increased. The temperature of minimum internal friction is for most annealed metals between 0° C. and 100° C.; for most hard drawn wire, however, the temperature of minimum internal friction is below 0° C.

(*f*) The temporary change, whether of the nature of increase or decrease, wrought by alteration of temperature in the internal friction of metals, is in most cases enormously greater than the corresponding change in the torsional elasticity.

Linnean Society, May 6.—Sir John Lubbock, Bart., President, in the chair.—Prof. H. Marshall Ward was elected a Fellow of the Society.—Mr. D. Morris exhibited a number of living beetles (*Pyrophorus noctilucus*) from the island of Dominica. These had been fed on sugar-cane during the voyage to England. On the meeting-room being darkened, the phosphorescent show of light emitted by the insects was very brilliant.—Dr. Chas. Cogswell drew attention to framed water-colour drawings of *Lettsomia aggregata* and *Fothergilla gardeni*, botanical mementos of the two distinguished physicians Lettsom and Fothergill.—Sir J. Lubbock's paper on forms of seedlings was, by request, adjourned, so as to give opportunity for discussion of Mr. Romanes's communication.—Mr. G. J. Romanes then read his paper on physiological selection: an additional suggestion on the origin of species. A full account of this paper will appear in a future number.—Thereafter the two following papers were read in abstract:—Descriptions of new species of Galerucidæ, by Joseph S. Baly.—On some new species of the genus *Metzgeria*, by Wm. Mitten.

Geological Society, April 21.—Prof. J. W. Judd, F.R.S., President, in the chair.—Henry Fisher, Frederick Edwin Harman, Henry Johnson, Edward Alloway Pankhurst, and Henry Woolcock were elected Fellows of the Society.—The following communications were read:—On a certain fossiliferous pebble-band in the "Olive group" of the eastern Salt Range, Punjab, by A. B. Wynne, F.G.S. The principal object of this paper was to oppose the views recently published by Dr. Waagen as to the age of certain Boulder-beds in the Salt Range of the Punjab. By that author these beds had been considered contemporaneous with each other, and assigned to the epoch of the Coal-measures, in consequence of the discovery by Dr. H. Warth of Carboniferous fossils, especially Australian forms of Conularia, in nodules restricted to a particular layer in the upper part of a Boulder-bed in the eastern Salt Range. Mr. Wynne adduced evidence to show that the fossils in question occur, not in concretions, as supposed by Dr. Waagen, but in pebbles evidently derived from an older series; and consequently there was no proof that the Boulder-bed in question was older than the Cretaceous Olive-beds with which it had hitherto been associated. The principal Boulder-beds in the Salt Range were then briefly noticed; those beneath the Carboniferous Limestone west of the Indus, those near Amb and Sakesir peak, associated with the "purple sandstone," "Obolus-beds," and "speckled sandstone," and those in the eastern portion of the Salt Range, amongst the beds of the "Salt pseudomorph zone" and "Olive group" being successively passed in review, and their relations to overlying and underlying strata explained. It was shown that Boulder-beds and conglomerates containing pebbles and boulders of the same crystalline rocks are not confined to one horizon. In conclusion, the resemblance of the rock, of which the pebbles containing Conulariæ, &c., were formed, to that forming some of the "magnesian sandstone" and "Obolus-beds" was pointed out, and it was suggested that the pebbles in question may have been derived from representatives of those beds formerly existing to the southward.—On the phosphatic beds in the neighbourhood of Mons, by M. F. L. Cornet, For.Corr.G.S. These beds are situate in the province of Hainaut, near the town of Mons (Belgium); the workings have increased of late years, and in 1884 yielded 85,000 tons of phosphate. They occur in the Upper Cretaceous, which is exceptionally well developed in the district, filling a trough in the Carboniferous rocks, and itself denuded for the reception of Tertiary and Quaternary beds. Omitting all Cretaceous groups below the middle of the fifth stage, the following is the sequence of the Cretaceous beds which contain the phosphatic series:—C. Tufaceous chalk of Ciply, with the Poudingue de la Malogne at its base. D. *Brown phosphatic chalk of Ciply*. E. Coarse chalk of Spiennes. F. White chalk of Nouvelles. F is a pure white chalk with some flints, and contains *Belemnitella mucronata, Rhynchonella octoplicata, Terebratula carnea, Ananchytes ovatus*, &c.,—an horizon well known throughout North-Western Europe. Series E and D represent one geological horizon characterised by Ostreæ, Brachiopoda, &c., in great numbers, but also containing *Belemnitella mucronata*, and lying between two distinct planes of erosion. The brown phosphatic chalk (D), which forms the upper division of the series, is about 70 feet thick, and may be described as consisting of three parts; the upper is tolerably pure carbonate of lime, but in its lower portion becomes charged with brown granules mainly consisting of phosphate of lime; these continue to increase towards the central or main phosphatic mass, which is also highly fossiliferous in places. This central portion constitutes the main phosphatic beds, but the amount of phosphoric acid (dry) is not more than 12 per cent. Hence, it is necessary to increase the richness in phosphate of the deposit in order that it may be available for

conversion into a superphosphate. This may be done by mechanical means. But nature has already partially anticipated this process, and the result has been a deposit known as "rich phosphate," containing about 25 per cent. of phosphoric acid. This occurs in wide cracks and holes in the ordinary phosphatic chalk. It usually occurs as a fine sand-like powder, and is evidently the result of the action of carbonated waters upon the phosphatic chalk, whereby the amount of carbonate of lime is reduced. This is especially the case where the phosphatic chalk is not protected by the tufaceous chalk of Ciply, but is only covered by Tertiary or Quaternary beds. The author calculates that each square foot of the phosphatic basin, which he estimates approximately at 5 miles by 3, contains 355 lbs. of tribasic phosphate of lime. Finally, he intimates how the phosphatisation of the chalk may have been brought about.

Physical Society, May 8.—Prof. H. McLeod, F.R.S., Vice-President, in the chair.—Mr. W. A. Price was elected a member of the Society.—The following communications were read:—On a modified form of Wheatstone's rheostat, by Mr. Shelford Bidwell. A wire is coiled upon a non-conducting cylinder as in the ordinary forms of rheostat, one end of the wire being in contact with the brass axle of the cylinder. A screw is cut upon the axle, the pitch being equal to the distance between the consecutive turns of the wire, and this, working in a fixed nut, causes the whole cylinder to travel in the direction of its axis. A fixed spring bears upon the wire at a convenient point, and by the travelling motion of the cylinder this point of contact remains fixed in space, and the effect of turning the cylinder is to introduce more or less resistance between the spring and the brass axle. Binding screws on the base of the instrument are in contact with the nut and the bearing spring. Though this arrangement has several obvious advantages over the usual forms, Mr. Bidwell does not recommend it in cases where it is required to introduce a known resistance, but where it is important to adjust a resistance to a nicety, or to cause a continuous variation, it is of great use.—Prof. Perry, remarking upon the importance of being able to vary a resistance gradually, described an instrument he had used with advantage. A number of plates of gas-carbon are placed between two parallel copper plates, one of which is fixed and the other adjustable by a screw; by applying pressure by means of the screw the resistance between the plates can be varied uniformly and regularly from 2 to 10 ohms, beyond which point the increase is very rapid.—On a theorem relating to curved diffraction-gratings, by Mr. Walter Baily. In a paper read before the Society in January 1883 the author showed that if a plane be taken perpendicular to the lines of a curved diffraction-grating, and a normal to the grating be taken as the initial line, the equation—

$$\frac{\cos^2\theta}{r} = \frac{\cos\theta}{c} + \frac{1}{d}$$

(in which c is the radius of curvature of the grating, and d is an arbitrary constant), gives a curve having the property that if a point of light be placed anywhere upon it the curve is the locus of the foci of all diffracted rays whether reflected or transmitted. In the present investigation d is supposed to be greater than c, which allows of the source of light being at infinity. The points where the curve given by the above equation cuts the normal are called the normal foci. There are two of these, one relating to the reflected and the other to the transmitted light, the grating being supposed to consist of a number of opaque lines in space. It is then shown that if the grating be supposed to turn about the line in it intersecting the initial line, the normal foci will trace out two parabolas whose common focus is the origin, and common latus rectum is equal to the diameter of curvature of the grating, the parabola for reflected light being convex to the source of light, and that for transmitted light concave.—On some thermodynamical relations, part iv., by Prof. W. Ramsay and Dr. Sydney Young. The first part of this communication deals with Profs. Ayrton and Perry's criticisms upon the previous papers by the authors upon this subject. In the second part a brief review is given of the various attempts that have been made to represent the pressure of a saturated vapour as a function of the temperature.

Anthropological Institute, May 11.—Mr. Francis Galton, F.R.S., President, in the chair.—Mr. Galton read some notes on permanent colour-types in mosaic, in which he advocated the adoption of certain specimens of mosaic material as permanent specimens of standard colours for the description of tints of skin. The original paintings by Broca, as well as the lithographs from them, have already changed colour, and some more permanent standard is greatly needed. There can be no question as to the persistence of the colours of mosaic: some specimens in St. Peter's at Rome, that are more than a century old, have the appearance of being brand-new. The material is inexpensive, and as the variety of tints in the Vatican manufactory is very large, the flesh-tints appropriate to European nations alone being about 500 in number, there would be no difficulty in selecting such a series as anthropologists desire.—Prof. Flower exhibited a Nicobarese skull, sent over by Mr. E. H. Man, together with some photographs of the natives.—Prof. Thane read a paper by Prof. A. Macalister on some African skulls and on a New Ireland skull in the Anatomical Museum of the University of Cambridge.—Dr. Garson reported that the correspondence as to an international agreement on the cephalic index had been brought to a satisfactory conclusion, and that the scheme advocated by him in his paper read before the Institute in February last had been accepted by sixty of the leading anthropologists on the Continent.—Dr. Garson read a paper on the skeleton and cephalic index of Japanese.

Entomological Society, May 5.—Prof. J. O. Westwood, M.A., in the chair.—The following were elected Fellows:—The Rev. E. N. Bloomfield, M.A., Mr. F. Fitch, Mr. A. J. Rose, and Mr. W. E. Nicholson.—Mr. J. Jenner-Weir exhibited a large spiny Lepidopterous larva from Western Africa.—Mr. Stevens exhibited *Apion sorbi* and other Coleoptera recently obtained in the Isle of Wight.—Mr. Crowley exhibited four specimens of *Leto venus*, a large moth belonging to the family *Hepialidæ*, from Natal.—Mr. Howard Vaughan exhibited a long series of *Cidaria immanata* from Kent, Surrey, Perthshire, Isle of Man, Isle of Arran, the Orkneys and Shetlands. He also exhibited *C. russata* from various localities in the south of England, and from Perthshire, Argyllshire, and the Islands of Arran, Lewis, and Hoy. Mr. Vaughan further exhibited varieties of *C. suffumata* from Dover and Darlington. Prof. Westwood commented on the interesting nature of the exhibition of *C. immanata*, and stated that he had never before seen such a wonderful collection of varieties of a single species.—The Rev. W. W. Fowler exhibited *Staphylinus latebricola* and *Quedius truncicola*, both from the New Forest.—The Secretary exhibited, for M. H. de la Cuisine, of Dijon, coloured drawings, life-size, of a variety of *Urania crœsus* and a variety of *Papilio memnon*.—Mr. G. Elisha exhibited specimens of *Antispila pfeifferella*, together with the cases, and the leaves mined by the larvæ.—Mr. J. W. Slater read a paper "On the Origin of Colours in Insects," in which he showed that the assertions of Mr. Grant Allen, that all brightly-coloured insects were flower-haunting species were incorrect, and that many brilliantly-coloured insects were carnivorous. Mr. McLachlan said that the physiological question in connection with colour had not been paid attention to; he thought that colour in insects was, to a great extent, dependent upon the circulation of fluids in their wings. The discussion was continued by Prof. Westwood, Mr. H. Goss, the Rev. W. W. Fowler, Mr. Jacoby, and Mr. Weir.

Victoria (Philosophical) Institute, May 3.—A paper by M. Maspero, describing his discovery of many Syrian geographical names in the lists of Thothmes III., was read. It was illustrated by a map, specially prepared by the author, as an aid to the inquirer in following his description of the Egyptian account of the events connected with each name. M. Maspero concluded his statements in the following words:—"Such are the observations which a long study of the lists has suggested to me. I have elsewhere given the justification of my transcriptions. I have endeavoured to bring to my identifications the same prudence that I have exercised in my transcriptions. The The names enumerated arrange themselves almost wholly in the districts that surround Megiddo; Qodshu, Damascus, and two or three other towns at most belong to countries comparatively remote. This result, to which the independent study of the lists has led me, arises clearly from the history of the campaign as the inscription at Karnak makes it known to us. In the year 23 (of his reign) Thothmes III. set out from Gaza, cleared Carmel, beat the confederates, including the prince of Qodshu, under the walls of Megiddo, besieged and took the town, then returned to Egypt without pushing farther on towards the north. The fall of Megiddo was decisive, for, as Thothmes III. has himself observed, 'every chief of the whole country [was shut up] in it, so that the capture of Megiddo was as good as the

taking of a thousand towns.' When the war was finished he 'reinstalled the chiefs in their dignity' on condition that they should pay tribute. The stress of the campaign fell thus on the plain of Esdraëlon: the Egyptian troops had long remained there, and had pillaged all the district round, not without pushing on to some distant points. On his return, when Thothmes III. built the pylon of Karnak with the booty of this campaign, he inscribed on the wall the names of the towns that he had sacked and which had unwillingly contributed to the completion of the edifice. The wall was large, and must be entirely covered. They took indiscriminately all the names of Galilee and Southern Syria that they knew, without troubling about the importance of the town itself: one name did as well as another for that matter." Sir C. Wilson, K.C.M.G., Mr. Boscawen, and others took part in the discussion.

EDINBURGH

Royal Society, April 19.—Sir W. Thomson, Hon. Vice-President, in the chair.—Sir W. Thomson exhibited and described a new form of portable spring balance for the measurement of terrestrial gravity. In this instrument a metallic spring is used. The curvature of the spring when unweighted is such that, when one end is firmly clamped and a suitable weight attached to the other end, the spring becomes straight. When so arranged, the equilibrium of the spring and weight can be made as nearly unstable as is wished by simply tilting the instrument. Hence the apparatus can be made as delicate as necessary.—Mr. A. P. Laurie read a paper on the measurements of the E.M.F. of a constant voltaic cell with moving plates. Mr. Laurie determined the E.M.F. of a cadmium-iodine cell by drawing a large current from it, while the plates were kept moving. The value so got agreed with that given on open circuit as determined by the electrometer, thus showing that the fall of the current when the plates were not moving was due to alteration of the composition of the layers of liquid next the plate.—Mr. W. E. Hoyle read a note on the formation of Hectocotylus in Rossia.—Prof. Tait submitted a paper on some definite integrals.—Messrs. H. Rainy and R. D. Clarkson described the alterations in the electric conducting power of alloys at their melting-point.—The Rev. T. P. Kirkman submitted a communication on the reading of the circle, or circles, of a knot.

May 3.—Robert Gray, Vice-President, in the chair.—Dr. R. W. Felkin read notes on the Waganda, a Central African tribe.—J. Murray discussed the drainage-areas of continents, and their relation to oceanic deposits.—Dr. A. B. Griffiths read a paper on the vitality of the spores of parasitic fungi, and the antiseptic properties of ferrous sulphate.—Dr. R. Stockman discussed the action of benzoyl-ecgonin.

PARIS

Academy of Sciences, May 10.—M. Jurien de la Gravière, President, in the chair.—On the formation of oxalic acid in plants (continued): *Amaranthus caudatus*, *Chenopodium Quinoa*, *Mesembryanthemum crystallinum*, by MM. Berthelot and André. Tables are given of the varying quantity of oxalic acid in the roots, stems, leaves, and flowers of these plants at different seasons of the year. The results throw great light on the essentially different physiological conditions of life and organisation in these various types of vegetation.—Observations of the comet 1886 *b* (Brooks II.), and of the new planet 258 (Luther), made at the Paris Observatory (equatorial of the West Tower), by M. G. Bigourdan. The new planet 258 was discovered by Dr. R. Luther at Düsseldorf on May 4 at 10 o'clock mean Düsseldorf time, when it occupied the position: 14h. 20m. R.A.; 9° 31′ Decl. When observed in Paris on May 7 it had the appearance of a planet of the twelfth magnitude.—Observations of the Brooks comets (1886) made at the Lyons Observatory, 6-inch Brunner equatorial, by M. Gonnessiat. Brooks I. appears like a diffused nebulosity with diameter of about 2′, and but slight central condensation. On May 4 the head of No. II. was bright, narrow, and elongated in the angle of position 258°; tail visible for a space of about 12′, faint, and at its extremity spreading out towards the south.—Transformation of the horary angles and declinations to azimuths and heights, by M. Vinot. To supplement Warnstorff's tables, giving this transformation for the latitude of the Altona Observatory, the author has prepared others calculated for the latitude of Paris. They are presented to the Academy in the hope that, if preserved, they may enable other observers to dispense with long and tedious calculations.—On the employment of crusher manometers for the measurement of the pressures developed by explosive substances, by MM. Sarrau and Vieille. Two cases are recorded, in which the maximum pressure is accurately determined by the measured value of the crushing force.—Remarks on M. Ledieu's communication regarding marine engines, by M. Aug. Taurines. Attention is drawn to some errors in this communication presented on March 23, 1885, where M. Ledieu describes the dynamometric experiments made on board the corvette *Le Primauguet*, which he mistook for a simple aviso.—Note on certain sounds produced in vibrating metal plates by the discharges of static electricity, by M. E. Semmola. The conditions are described under which these sounds occur, but no theory is offered in explanation of the phenomenon.—Secondary electrolysis, by M. E. Semmola.—The island of Ferdinandea. the blue sun, and red after-glows of 1831, by M. A. Riccò, With a view to the elucidation of the crepuscular lights of 1883–84, the author gives a detailed account of the analogous phenomena which accompanied the appearance of the island of Ferdinandea in the Sicilian waters in the year 1831. It is pointed out that the atmospheric effects attending the eruption of Ferdinandea closely resembled those following that of Krakatão. But the ashes took no part in the production of the blue sun and red after-glows of 1831; consequently, the ashes of Krakatão would also seem to have had nothing to do with the similar light effects of 1883–84.—Note on the extraordinary halos seen at the Observatory of Parc Saint-Maur on March 29, 1884, and, with still more interesting light effects, on May 3, 1886, by M. E. Renou.—On products of decomposition of hypophosphoric acid: secondary hydrate, by M. A. Joly.—On the definite compounds of hydrochloric acid with the chloride of zinc, by M. R. Engel. The experiments here described have confirmed the theoretical view already advanced by the author, regarding the probable existence of one or more hydrochlorates of the chloride of zinc stable at the ordinary temperature.—On the combinations of quinone with the benzenic phenols, by MM. Ph. de Clermond and P. Chautard.—Action of the perchloride of phosphorus on the hydrocarburets, by MM. Alb. Colson and H. Gautier. It is shown that by means of the perchloride of phosphorus it is possible to substitute chlorine for hydrogen in the aromatic carburets. It thus becomes possible to prepare the symmetrical chloruretted compounds in the fatty and aromatic series to the exclusion of the isomerous substances, which always accompany them in all other methods of preparation.—On the rancid element in butter, by M. E. Duclaux.—Note on sozolic acid (orthoxyphenylsulphurous acid), by M. Serrant. This acid, whose formula is $C_6H_4OH_{(1)}SO_2OH_{(2)}$, is described as even a more powerful antiseptic than salicylic and phenic acid. Being perfectly soluble, it may be taken inwardly without any inconvenience, and is rapidly and completely eliminated from the system.—On the position in the crab of the parasite *Sacculina carcini*, by M. A. Giard.

BERLIN

Physiological Society, April 9.—Dr. Goldscheider spoke on the effect of menthol on the nerves of temperature. It was known that menthol (which for headaches has been extensively applied) generated a keen feeling of cold on being spread over the forehead. It was assumed that this feeling of cold resulted from the cooling of the skin consequent on evaporation. On the other hand, it was explained that the feeling of cold in the mouth produced by mouth washes containing mentha was due to an astringent effect of the mentha. The speaker had come to the conclusion that the two explanations referred to in the respective cases were neither of them correct. He made his experiments with a solution of menthol in lanoline, which was rubbed into circumscribed places of the skin. Measured with the thermometer, the places of the skin in question showed after the rubbing an increase of temperature of about 20° C., and yet for all that there was a quite decided feeling of cold. This feeling of cold was also observed when the place where the solution was rubbed in was protected against evaporation by a watch-glass. The feeling in question could proceed therefore only from a direct stimulation of the nerves of cold sensation. If of two places on the forehead exactly corresponding to one another, the one were rubbed with menthol salve and the other not, then bodies which before had produced no impression, as being indifferent, would now be felt as cold by the part of the skin where the rubbing was made, whereas there would be no perceptible impression at the other part. From these and several other experiments the speaker

concluded that the menthol exercised a specific influence on the nerves of cold, which were distributed with especial copiousness on the forehead. Menthol produced an effect on the nerves of warmth and the nerves of feeling of less amount than on the nerves of cold. A sensation of warmth after the rubbing in of menthol was obtained only at spots which were very rich in nerves of warmth. This was most easily obtained on the volar side of the lower part of the arm in the neighbourhood of the elbow joint. As analogous to his menthol experiments, the speaker called to mind how Prof. Herzen had quite recently communicated the observation that moderate pressure on the nerve-trunk produced a different effect on the cold feeling nerve-ends than on the warm feeling nerve-ends.—Prof. Albrecht, from Brussels, developed his views on the morphological significance of the auditory ossicles of the middle ear, of the external ear, and of the Eustachian tube. Respecting the auditory ossicles there had hitherto prevailed two views. There was, first, the German view, represented by Prof. Gegenbaur, according to which the joint between malleus and incus corresponded to the quadrato-mandibular joint of the lower vertebrates, incus answering to the os lenticulare, stapes to the os quadratum, and malleus to the os articulare. The second view was the English one, set up by Prof. Huxley, according to which all four auditory ossicles of the mammalia were homologous with the os quadratum. The speaker considered both views to be incorrect. As to the latter, the four auditory ossicles of the mammalia, seeing they lay between the fenestra tympanica and the fenestra ovalis, must in his opinion be the homologue of the columella of the reptiles, amphibia, and birds, which likewise extended from the fenestra tympanica to the fenestra ovalis. The columella itself was the homologue of the symplecticohyomandibulare of the fishes. The auditory ossicles had nothing whatever to do with the quadrato-mandibular joint. The os quadratum of the lower vertebrates must, on the contrary, be sought for at an entirely different place, in the lower part, namely, of the pars squamosa of the temporal bone. At this place Prof. Albrecht had in point of fact observed in different cases fissures by which the superior part was separated from the zygomatic part, the proper os quadratum. The middle ear was, in the opinion of the speaker, divided by the columella into two sections, of which the anterior, the precolumellare, was, through the Eustachian tube, brought into connection with the larynx, and, through the anterior part of the tympanum, with the external organ of hearing. This whole section of the ear was, according to the view of Prof. Albrecht, the remains of a special pharyngeal gill-segmentation.—Prof. Flesch, as guest, communicated some results of his investigations into the peripherical nervous cells. The question of the histological diversity of the nerve-cells, which, by the labours of Stieda, had been solved in a negative sense, had again been taken up by Prof. Flesch. In order to a settlement of the question, he had applied himself to the peripherical nerve-cells and to different methods of staining. It was the colouring method with Weigert's hæmatoxylene and treatment with osmic acid which especially yielded beautiful results. The osmic acid had been used on quite fresh preparations, at most five to ten minutes after the death of the animal. The fact at once established itself that the nerve-cells, under precisely the treatment and under perfectly the same conditions of experiment, showed variations which were not artificial products. It was, first, possible to distinguish between stained and colourless cells. The former were mostly small, the latter large. The relation of the large pale cells to the small dark cells was a perfectly constant one, and that even in the case of different animals. In the peripherical ganglia the pale cells constantly amounted to 20 per cent., the dark to 80 per cent. In the spinal marrow, on the other hand, the number of the pale cells invariably amounted to about 40 per cent. On further investigation it came out that little colourless cells also occurred in small number. The occurrence of these differences among the nerve-cells under use of the most varied staining means and in various animals, especially, however, the determinate numerical relation of the various groups of nerve-cells in the peripherical ganglia and in the spinal marrow, were deemed by the speaker to be proofs that there was here a question of physiological variations. This difference might be of manifold significance. In the first place there might here be a question of various stages of development on the part of the nerve-cells—young, adult, and senile forms. In the second place the various forms might be the expression of a different nature on the part of the nerve-cells: one set being, possibly, motory, another sensory, and so on. In the third place and lastly, these various forms might, in a manner similar to what had been observed in the glandular cells, be the expression of different states of activity or of rest on the part of the nerve-cells. By way of arriving at a decision among these different possibilities, Prof. Flesch had had a series of experimental investigations undertaken which had not yet come to a conclusion. The probability, however, was that the experiments in question pointed to functional variations on the part of the nerve-cells which were the subject of investigation.

BOOKS AND PAMPHLETS RECEIVED

"The Journal of the Anthropological Institute of Great Britain and Ireland," May (Trübner).—"Bulletin of the Buffalo Society of Natural Sciences," vol. v., No. 1 (Buffalo).—"Bulletin of the U.S. Geological Survey," Nos. 15-23 (Washington).—"Bulletin of the U.S. National Museum," No. 23, by N. P. Scudder (Washington).—"Chemistry of the Gold-Fields," by J. G. Black (Horsburgh, Dunedin).—"The Monthly Weather Report of the Meteorological Office," December 1885 and January 1886.—"The Quarterly Journal of the Geological Society," May (Longmans).—"Report of the New York Meteorological Observatory, 1885."—"Manual of Operative Surgery," by W. A. Lane (Geo. Bell and Sons).—"Meteorological Record for Quarter ending December 31, 1885," by W. Marriott (Stanford).—"Quarterly Journal of the Royal Meteorological Society," April (Stanford).—"The Colloquial Faculty for Languages," second edition, by Dr. W. H. Walshe (Churchill).—"Proceedings of the Society of Natural History, St. Petersburg," vol. xvi.—"Annual Report and Proceedings of the Belfast Naturalists' Field Club, 1884-85" (Mayne and Boyd, Belfast).—"The Rotifera or Wheel-Animalcules," part iv., by C. T. Hudson and P. H. Gosse (Longmans).—"Engineering Education at Home and Abroad," by E. Mitchell (London).

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