THURSDAY, OCTOBER 12, 1893.

THE CORRESPONDENCE OF BERZELIUS AND LIEBIG.

Berzelius und Liebig. Ihre Briefe von 1831–1845. Mit erläuternden Einschaltungen aus gleichzeitigen Briefen von Liebig und Wöhler. Herausgegeben mit Unterstützung der kgl. bayer. Akademie der Wissenschaften von Justus Carrière. (München und Leipzig: J. F. Lehmann, 1893)

THIS most interesting, and, for the historian of chemistry, most valuable little book owes its origin to a sentiment akin to that which prompted the publication of the no less interesting and valuable collection of the letters of Liebig and Wöhler. How important the correspondence of Berzelius and Liebig is to him who essays to write the history of the chemistry of the nineteenth century will be obvious from the fact that this exchange of letters occurred during one of the most eventful decades of the century. It began at the period of the epoch-making work of Liebig and Wöhler on the radicle of benzoic acid, and extended over the time when Liebig was devoting himself, with characteristic ardour and enthusiasm, to the study of animal chemistry and to the applications of chemistry to agriculture. Frequent reference, as might have been expected, is made to these and the many other matters which during that time engaged the energies and occupied the thoughts of Liebig at what was the most active and the most fruitful period of his career. Nor was Berzelius less communicative concerning his own work. Nothing, however, is more characteristic of the difference in temperament of the two men than the manner in which each speaks of what he has done, is doing, or means to do. With Berzelius it is nearly always concerning what he has accomplished, seldom of what he is doing, and still more rarely of what he is going to do. The sanguine, ardent character of Liebig is reflected in almost every letter. He is terribly in earnest on the matters of the moment, and full of enthusiasm and confidence concerning the plans of the future. The philosophic calm which pervades every letter of the great Swedish chemist is a source of wonder and envy to his correspondent.

"I envy you," writes Liebig, "the priceless tranquillity of mind with which you do your work. Pray tell me is it always so with you. Has not the keen desire for discovery not even once made your heart beat quicker? With you there is an ever present intellectual calm."

Liebig wrote as he thought and spoke. "I cannot, like others of cooler blood," he wrote to Wöhler, "keep myself apart from and unidentified with my work: what I do I do with all my faults and shortcomings, but also with all the energy that actuates me."

The letters, therefore, are valuable not only as sidelights on matters which are now regarded as classical in the history of chemistry, but also as evidence of the character and temperament of the two men; and from this point alone they will have a special interest for the historian of science.

The correspondence begins with a new year's letter from Liebig in the January of 1831. The two chemists had made one another's personal acquaintance at Hamburg during the summer of the preceding year, and Berzelius had already expressed to his friend and former pupil Wöhler, the pleasure it had afforded him to meet Liebig. Liebig had perfected his method of organic analysis, and the Giessen laboratory was busily engaged in determining the elementary composition of whole series of organic substances, and he gives in his first letter a brief account of the main results to which he and his pupils had arrived. Berzelius in his acknowledgment congratulates him on his work:—

"It is quite incomprehensible to me how you can have accomplished so much in so short a time."

He tells Liebig of the discovery of a new metal by Sefström, which the discoverer had named Vanadium:

"It is an interesting thing. It will take its place between chromium and molybdenum. Wöhler had well-nigh lighted upon this body. He undertook to analyse lead chromate from Zimapan. He discovered that the substance hitherto regarded as chromic acid was not so in reality, but gave himself no further trouble to determine what it actually was."

Wöhler has himself told us the story, and let the world see the characteristically humorous letter in which Berzelius "chaffed" him for being too lazy to open the door when the goddess knocked.

There is the customary Teutonic contempt for most things Gallic:

"It gives me a real pleasure to read your writings by reason of the love for truth which pervades them—in striking contrast with Dumas, who seems to do everything for show."

In the second letter Berzelius writes:—"Die Unzuverlässigkeit der französischen Analysen. . . . ist eine verdammt curiose Sache," and again Dumas and his pupils are somewhat severely handled. Berzelius is "so satt" with Vanadium that he is constrained to tell Liebig all he knows about this "sehr interessanter Körper." He has just finished his memoir for Poggendorff "in welcher die viele Salzbeschreibungen gewiss manchen Leser einschlafen machen werden." The letter was written with the so-called "vanadium ink," made by adding extract of gall-nuts to a solution of ammonium vanadate. "It flows," says Berzelius, "so extraordinarily well that it is preferable to all iron inks, and fades less easily." Unfortunately Berzelius's expectations respecting the new ink have not been fulfilled: the writing of this particular letter, the editor points out, has become quite yellow, and is difficult to decipher. Liebig does not altogether share Berzelius's opinion respecting Dumas:

"Small as is the confidence I have in Dumas' work, the calculations of this rope-dancer seldom fail in their object: I have assured myself by a direct determination of the vapour density of the non-inflammable gas [phosphuretted hydrogen] that he is right. I am continually annoyed that the fellow, in spite of his wretched and slovenly style of work, should shake masterpieces, so to say, out of his sleeve."

In 1831 Liebig's position at Giessen, in spite of his growing fame, was pecuniarily very poor. He writes to Berzelius:—

"I have latterly taken upon my back a big burden in yoking myself with Geiger as co-editor of his magazine,

and all for the sake of filthy lucre. At the small university where I am, where the dullest pedantry sits enthroned, and where natural science is learnt from the Greek authors or from Wilbrand's writings, I should otherwise die of hunger."

However much Liebig may share Berzelius's opinion of French chemical work in general during the thirties, he will hear of no word of disparagement of his old master Gay Lussac, for whom he had the most genuine respect and esteem. A captious remark by Berzelius respecting Gay Lussac at once rouses Liebig, and his impetuous pen dashes off a panegyric which is almost eloquent in the warmth and intensity of its feeling. The only thing to his discredit that Liebig will allow is that, in common with his countrymen, Gay Lussac is not sufficiently attentive to what is done outside France:

"A certain mental indolence prevents the French, to their shame be it said, from making themselves acquainted with foreign work. Gay Lussac shares this failing, and feels that it will gradually effect the ruin and extinction of all scientific growth in France: all his letters to me are filled with complaints on this score, and principally as regards himself. However that is no fault in his character, and can well be forgiven him when one takes his other good qualities into account."

A letter from Liebig, dated December 28, 1831, announces the discovery, and describes the properties of chloral, a "Substanz welche ich, da ich keinen besseren Namen weiss, Chloralkohol nennen will." Berzelius, in his reply, gives an account of his work on tellurium. In May, 1832, Liebig writes that he has begun to work on amygdalin.

"I am on the point of becoming Wöhler's enemy: I see that Fate will not allow either of us to do anything that the other has not already done or is on the point of doing: all originality goes to the devil. He suggests that we should do a joint investigation on bitter almond oil—and just before I got his letter I had written to all the apothecaries I knew of to procure me bitter almond oil, because I too had the matter in view."

What came out of that memorable investigation on oil of bitter almonds no chemist needs to be reminded of. On July 2, Liebig writes that he has been engaged in determining the composition of an "ether-like substance," sent to him by Döbereiner, who had named it "Sauerstoffether."

"Oxygen-ether is no name for this substance. I am, however, very stupid at naming things. What think you of acetal (acetum and alcohol)?"

In more than one of his letters Liebig held out the hope to himself that he might be enabled to visit Berzelius in Stockholm, and do some research in common with him, and he sends to Wöhler for a Swedish grammar. The terrible pressure of his work at Giessen at this time is beginning to tell upon him. He writes to Berzelius:

"I am always ill, and fear my life's thread will not spin out much longer. Each work I undertake makes me worse, and the slightest effort excites me as if I were in a fever. Wöhler and my family tell me daily what a fool I am; however, we shall see. If the journey to Stockholm does not mend me, then I shall never be cured."

Berzelius answers:—

"The pleasure which your news of matters scientific gave me, great though it was, is as nothing compared with that of your promise to spend some months with me and to do a piece of work with me. I have seldom had such a pleasant surprise, but now comes the question: When is this good fortune to befall me? You do not need to speak a word of Swedish to come here. If you wish to learn it, may it be my privilege to be your teacher. Come soon and spend the winter months with me. A Swedish winter is healthier than a German one. Your depressed nervous system will right itself here. We will work, joke, and skate, and not over-fatigue ourselves, and yet labour to good purpose. You will find my laboratory far below your expectation. It is small and badly furnished. But it is just in such a place that one learns to do with little."

The visit, unfortunately, was never made. Wöhler lost his wife in the summer of that year, and in his dejection sought the society of his friend at Giessen. Moreover, the outbreak of cholera at various ports in North Germany made travelling irksome and dangerous. As it was, the two never met again. The correspondence was maintained, with intermissions, down to 1845—that is, until about three years before the death of Berzelius. Little by little misunderstandings arose which eventually ended in coolness, despite the most persistent efforts by Wöhler to preserve friendly relations. The conservatism of Berzelius, who clung, with the obstinacy of age, to views which the rest of the world regarded as obsolete, reacted painfully on the strong-willed, impulsive nature of Liebig, who could as little brook contradiction. There was more than one sharp passage of arms, and at length open rupture. Berzelius made his *Jahresbericht* the vehicle of many bitter attacks on the work of the Giessen school, to which Liebig, restrained by Wöhler, and to some extent swayed by mixed feelings of reverence and pity, seldom replied.

His sentiments towards the great master will be evident from the following excerpt from a letter to Wöhler, with which this most interesting volume closes:

"The opinions and theories of Berzelius were a clear and formal expression of the ideas of his time, and therefore of great value; but they went no further. I will not say that this was a fault, but it would have been a virtue had he possessed a larger measure of that creative thought which I may term the poetry of natural philosophy."

T. E. T.

BACTERIOLOGY FOR THE STUDENT.

Manual of Bacteriology for Practitioners and Students, with especial reference to Practical Methods. By Dr. S. L. Schenk, Professor Extraordinary in the University of Vienna; translated from the German, with an Appendix by W. R. Dawson, B.A., M.D. (Univ. Dublin). 8vo. 310 pp. (London: Longmans, Green and Co., 1893.)

THE bacteriological library has recently been enriched by yet another text-book which, although only published in German a few months ago, has already appeared in an English translation. In this work we have the responsibility divided between the author and translator, for the latter has not merely acted as interpreter, but has added numerous foot-notes, besides an appendix intended to bring the book as far as possible up to date, all of which additions are signed by the translator. It does not

appear to us that there is much advantage in thus dividing the responsibility in a small text-book which does not contain any original or speculative matter of importance; and in our opinion the reader would have gained had the German original been freely edited by the translator, who should have borne the entire responsibility for the English edition.

The arrangement of the material is much the same as in most previous works on this subject, but the description of a larger number of micro-organisms, considering the size of the book, is attempted. In this matter the time has now come for a new departure, for with the continual additions to the number of known bacterial forms, it is both impossible and undesirable that the descriptions of all of them should find place in the body of a text-book. For the purpose of illustrating the principles of bacteriology, comparatively few forms need be described in detail, whilst for an account of those forms which are of secondary importance, special works should be consulted. A work of this kind, which endeavours to describe in the tabular form, every micro-organism hitherto discovered, fortunately already exists in the shape of Eisenberg's "Bakteriologische Diagnostik" (Hamburg and Leipzig, 1891), so that the necessarily brief and imperfect descriptions of bacteria which are to be found in small text-books, like the one under review, become worse than valueless, inasmuch as they take up space which should be devoted to the discussion of general principles. Now, in this latter particular the work before us is specially weak; not only is the preliminary chapter on the "general morphology and biology of micro-organisms" very scanty, but the introductory matter at the commencement of the several chapters is generally also quite inadequate. Thus, for instance, in the chapter on the micro-organisms of soil we find no less than two pages devoted to the description of such obscure and unimportant forms as *bacterium mycoides roseum*, *b. radiatus*, *spinosus*, *liquefaciens magnus*, *scissus*, and *clostridium fœtidum*, whilst there is absolutely no mention of the bacteria producing nitrification, nor of the organisms occasioning the tubercles in leguminous plants, which are of such enormous importance, both from a practical and theoretical point of view.

In that portion of the book devoted to the practical methods, we find very ample descriptions of the mechanical details for staining bacteria, but the account given of the principles upon which these methods rest is very meagre, and often betrays much ignorance of chemical principles in general. Thus, what are we to think of the statement that "*aniline oil* and *phenol* are the mordants (*sic*) most used in bacteriological research"? Surely a few words from a competent chemist would be calculated to put some order and arrangement into the wilderness of empirical staining recipes with which the student is confronted, and would prevent such inaccuracy in the use of old-established technical terms. A mistake of more practical importance, which a little chemical knowledge again would have rendered impossible, is the statement on page 20, that plates intended for culture may be sterilised "after being cleansed with alcohol and corrosive sublimate"; in this case, however, we are inclined to believe that the "alcohol" being placed *before* instead of *after* the "corrosive" sublimate must be a *lapsus plumæ* which has failed to receive correction in the proof.

Of the same order, again, is the statement that some bacteria "cause a splitting-up of urea into ammonium carbonate"; surely if the reaction in question, and which consists in the adding on of two molecules of water,

$$\underset{\text{Urea}}{CN_2H_4O} + 2\underset{\text{Water}}{H_2O} = \underset{\substack{\text{Ammonium}\\\text{Carbonate,}}}{CN_2H_8O_3}$$

can be described as "a splitting up," the addition of two chimneys to a house might as logically be called a disruption of the building!

The author in his preface states that "conformably to the scope of a hand-book like the present, all references to the literature have been omitted," but the names of investigators have been freely introduced in the text, and in some cases they have been selected apparently without a due knowledge of the literature. Thus, from the text (p. 124 and p. 156) it would appear that it is to Rubner and Kirchner that we are indebted for the discovery of the great bacteriological efficiency of the soil as a natural filtering medium, whilst we were certainly under the impression that Pasteur, not to mention others, showed the bacteriological purity of spring and deep well waters before the names of the above gentlemen were known to the scientific world. In the same way the discovery of the increase in the efficacy of chemical disinfectants by moderately raising the temperature is ascribed to Heider, whilst it was really first made by Dr. Wynter Blyth, some eight years ago, but his paper, which was published in the Proceedings of the Royal Society, was doubtless unknown to both Heider and the author of this book; but the translator might, in the interests of British science, have seen that the papers in that and other English media of publication had received their due. In the chapter on Morphology we find no mention of the researches of Ray Lankester and others on the polymorphism of beggiatoa, which are of such interest in connection with those phenomena of variation in both the form and function of bacteria which are now beginning to receive the serious attention of investigators; nor is there, indeed, any special reference to this subject of variation, which at the present time is certainly one of the most important in the whole domain of bacteriology.

A considerable part of the translator's appendix is devoted to the bactericidal action of light; here again we think that the work of the original discoverers, Downes and Blunt, has been inadequately appreciated, for these investigators practically explored the whole subject in outline, and the more recent researches have principally consisted in a confirmation of their results, and in filling in details; thus they showed that the bactericidal action of sunlight is independent of rise in temperature, that the most refrangible rays of the spectrum are the most active, that their effect, moreover, is highly favoured if not entirely dependent on the simultaneous presence of oxygen, and, further, that the bacteria may be destroyed by light in the absence of any culture-medium, but that they are more resistant to light when immersed in water or very dilute culture material. Again, we find no reference to one of the most interesting recent additions to our knowledge of this subject, viz. the discovery by Laurent that exposure to sunlight causes some chromogenic

bacteria to lose their power of producing pigment, either temporarily, as in the case of the *bacillus prodigiosus*, or even permanently, in the case of the *bacillus ruber* of Kiel. We are, therefore, surprised at being categorically informed, both in the introduction and in the appendix of this work, that pigment is formed especially under the influence of light, a statement which is entirely out of harmony with the observations of Laurent, and for which the experimental foundation should have been carefully set forth.

These and other points of a similar character will doubtless be rectified by the translator in preparing a second edition, which it would be well to amplify with references to literature, with which even an elementary student in a new science must at once be made familiar. The illustrations are in the majority of cases very good, and contrast most favourably with those we have seen in some recent works of the kind in which photographic representations have been attempted. The coloured prints of cholera and typhoid bacilli are especially excellent.

OUR BOOK SHELF.

Exploration of Mount Kina Balu, North Borneo. By John Whitehead. (London: Gurney and Jackson, 1893.)

MR. JOHN WHITEHEAD belongs to the much-maligned class of field-naturalists. For the purpose of obtaining a knowledge of the ornithology of Mount Kina Balu, he spent nearly four years collecting in the region, and accumulated a large number of new species. In addition to visiting North Borneo, he stayed some time at Java and Palawan, and made an expedition into the State of Malacca. The rather cumbersome volume before us recounts the story of these explorations. It consists of 192 pages of general description and 115 pages of matter reprinted from the proceedings of various Societies. Thirty-two excellent plates illustrate specimens from the extensive zoological collections made by Mr. Whitehead, and the places and peoples seen by him. It need hardly be said that these add considerably to the value of the book. Several woodcuts are also included. It would be ungracious to find fault with Mr. Whitehead for looseness of expression, since he craves indulgence for his "literary shortcomings." He found it far easier to explore an unknown tract of country than to write an account of his travels. Like some other travellers who have given to the world accounts of their wanderings, Mr. Whitehead dwells too much on trivialities. But for all that, there is much that is new and interesting in the book, and one cannot but admire the indomitable spirit which carried the author through numerous difficulties, and enabled him at last to reach an altitude of 13,525 feet on the mountain of Kina Balu.

Pillow Problems. Curiosa Mathematica, Part II. By Charles L. Dodgson, M.A. (London: Macmillan and Co., 1893.)

IN these pages we have a series of problems worked out, or, as the author says, "nearly all thought out during sleepless nights." In the preface he informs us the exact method of procedure, and the way in which he obtained his results. The problems are about seventy in number, and deal with many branches of mathematics, but chiefly with algebra, plane geometry, and trigonometry. The order of the three and only chapters is as follows: questions, answers, and solutions; and he explains the reason for this peculiarity in the preface. Considering the problems themselves, one is apt to think that some of them at least are not so very hard, but the publication of them will be found very interesting and perhaps useful to those of ordinary mathematical powers, who may like to follow the same routine way of thinking as that adopted by the author.

The A B C Five-Figure Logarithms. By C. J. Woodward, B.Sc. (London: E. and F. N. Spon, 1893.)

THIS small book of logarithms may be said to be a second edition of the tables previously published by the author. In addition to the tables of mantissæ of numbers, the same A B C system has been applied to logarithms of arc functions, with only a slight difference in the method. Besides these the square roots of numbers (from 1 to 100) to three places of decimals are given, and a table of "numbers often wanted," and of the densities of gases, weights and measures, &c. To facilitate the finding of the logarithms, &c., a lateral index is adopted. Besides being a compact and convenient set of tables, the worker will find them easy to use, and accurate enough for such calculations as are generally met with in the physical laboratory, the class-room, &c.

Enunciations in Arithmetic, Algebra, Euclid and Trigonometry. By P. A. Thomas, B.A. (London: Macmillan and Co., 1893.)

IN these pages one is treated to a selection of some of the chief questions that relate to Arithmetic, Algebra, Euclid, and Trigonometry. Stress is laid on the more elementary parts of each subject, and several typical problems are inserted. The latter relate chiefly to the arithmetical and algebraical sections, while the Euclid section is accompanied by important riders. The book should prove acceptable to those revising these subjects, whether for examination or not, and will be, both for teachers and taught, a useful companion to the text-books in use.

LETTERS TO THE EDITOR.

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

Thoughts on the Bifurcation of the Sciences suggested by the Nottingham Meeting of the British Association.

THE opening paragraph of the President's address contains this sentence: "We have come to learn what progress has been made in departments of knowledge which lie outside of our own special scientific interests and occupations, to widen our views, and to correct whatever misconceptions may have arisen from the necessity which limits each of us to his own field of study."

A most worthy and attractive ideal. Something of this kind of intersectional information does go on at these meetings; but to how small an extent! It may be said, indeed, that except for the presidential address and the two evening lectures, everyone sticks to his own section, and discusses matters lying in his own groove.

This state of things is perhaps inevitable, but it is none the less to be regretted. It is extremely difficult for anyone actively engaged in the work of any one section to attempt to attend any other. I myself used to make the attempt, but concluded that the results were too precarious and uncertain to be worth the dissipation of energy involved, and have now abandoned it. Yet there can be little doubt that if the state of things postulated by the President were feasible in practice it would be a distinct gain.

But it would seem as if the modern tendency were all in the other direction. Papers in the two great scientific departments are read as far as possible on different days at the Royal Society, and are published in separate volumes. Such an arrangement is decidedly convenient: I am not repining at it. The

Royal Society type of paper is almost necessarily unintelligible to any but specialists, perhaps sometimes even to them.

But the arrangement should not be regarded as anything but a lamentable necessity. If a more conjoint character could by any device be given to the meetings of the B.A. it would be an excellent thing: so it seems to me.

Whether the British Association can or cannot act as a connecting link between the sciences, there is no doubt but that the pages of NATURE do so act; and long may it be before NATURE (I mean the publication) finds herself also bifurcated or otherwise subdivided, and we on either side cease to hear even an echo of what the other side is talking about.

Perhaps few are able to say that they read NATURE all through as Mr. Darwin did, but we all have the chance of doing so; and I hope it is the practice of the biological side to communicate to its pages at least an epitome or a popular account of all the researches which have a wide embracing interest.

Much that the chemist does—still more that the biologist does—we of the physical camp do not care to hear; partly because we might not understand it, chiefly because the research lies so far from the field we are at present occupied in cultivating, that we can perceive none of the connecting links.

But some of the problems on which the biologist—especially perhaps the physiologist—is engaged are, or might easily become, of supreme interest to physicists; notably everything connected with sense organs and the "mechanism" of sensation.

The fear is lest we drift apart so far that we cease to understand each other's language.

The current language of physics consists mainly of adaptations of simple English phrases. It is full of common words, redefined and made definite in connotation. We do indeed use the word "coefficient" occasionally, but we are getting ashamed of its length and high-falutin' character. We got it from the Mathematicians. We have also a few other long words, as Electricity and its derivatives, which we sometimes try to abbreviate without much success. We got them in the Middle Ages. But the words we coin now are as nearly monosyllabic as possible, and as near akin to the ordinary usage of language as may be.

The current language of biology is quite different. Its sentences, as exemplified in parts of the presidential address, are highly dignified and elaborate structures, not wholly different from a once more prevalent German model. Its words, especially its new words, are hendecasyllabic or, at any rate, polysyllabic. They are extremely classical, and as unlike the language of daily life as can be contrived. This is done of good set purpose, viz. to keep free from the misunderstandings arising out of the attempt to give to popular words a scientific, *i.e.* an accurate, meaning.

I suppose it is inevitable, and no doubt biologists know what is best for their own science; I only lament it because it seems likely to retard that free intercommunication between the sciences which many of us would like to see made more possible than at present it is. I shall have the President with me here; but may I put a question to him without profanity? May I ask him if he can imagine a biologist asking about a process, "What is the go of it?" I conjecture, but perhaps I am wrong, that if a young biologist wanted to know more about a most important and interesting process occurring in the blood, he would ask, "What mechanism do you consider it was which supplied the chemiotactic stimulus impelling these leucocytes towards the morbific microbes which they are devitalising?"

I do not complain of this language—very likely it is well suited for home consumption—but it does seem to render intercommunion difficult.

Now, for instance, I am anxious to learn the most recent view of biologists on the subject of life, or vitality, or vitalism, or whatever word conveys the hypothesis that the life of an organism is something different from the chemical and mechanical activities of its tissues. I see that the President touches on this very subject, but somehow I cannot seize concerning it any distinct idea, though I rejoice to see his warning against the misuse of the terms "mechanism" and "mechanical." The term "mechanical" is regarded by physicists as the *ne plus ultra* of explanation, and it is unlikely that any explanation of physiological processes will skip the intervening chemical and physical stages, and land itself straight in simple mechanics.

But I wonder if I am right in supposing that the definition of life, given apparently by Treviranus, satisfies the modern biologist, viz. (I put it only in paraphrase, for more exact wording see NATURE, September 14, p. 464), "that property of an organism which enables it to respond similarly to a variety of different stimuli"; because a steam engine or any other prime mover can do as much as that. It matters nothing by what means the throttle valve is opened, whether by the proper driver, or by a larky boy, or by a piece of string, or a falling weight, or an electric current; the result is the same—wheels go round.

This property of responding to stimuli, and responding always in the same way if at all, may be characteristic of a clock-work mouse, but surely it is not a special peculiarity of *life*. If a muscle can only twitch, then, however you tickle it, it must either twitch or do nothing.

But life surely is something other than a power of response to a stimulus; it is more like a something which directs the stimulus, more like the driver who decides whether the throttle valve shall be opened or not. But it is absurd for me to attempt to answer such questions. I only want to ask them: all I clearly perceive from the physical standpoint is that live creatures have the power of directing energy into otherwise unoccupied channels, and that life in itself, whatever it is, is *not* a form of energy.

But this leads me to a subject which though apparently trivial may, if not attended to, have serious or at any rate inconvenient consequences, I mean the occasional misuse by one science of the language of another science.

The term "energy" is a physical one given us by Thos. Young, and it has been fought for by us through a great part of this century. It will be wanted seriously by Physiologists before long, in its proper sense, and it will be a thousand pities if they misuse it.

If it be urged, "but Helmholtz used the term *specific energies*," I reply yes, a long time ago, and so also he used the phrase, *Erhaltung der Kraft*. But precision in the use of the term energy is of comparatively modern growth, and every one now translates *Erhaltung der Kraft* as "conservation of energy." So, also, I venture to think, they should usually translate the phrase "specific energy" by the words *normal activity* or *normal reaction*. Of course if normal activity of an organ or tissue does not represent the thing meant, that is another matter—so far as I can judge, it usually does; but whether it does or not, I am clear that specific energy is usually wrong. There is one definite theory or hypothesis, to express which the words energy in some form would be correct—viz. when it is meant to assert that, for instance when light falls upon the retina, all it does is to pull a trigger, and the explosion or nerve stimulus which results is due to energy in or near the nerve ending itself. If that is a true statement of the case, and there must be a great deal to be said for such a view, the latent energy of the organ can no doubt be measured. But inasmuch as energy is all one thing in many forms, the adjective *specific* is better omitted; moreover the phrase is not usually limited to this particular hypothesis; and by "the specific energy of an organ," is usually meant, not anything quantitative, but simply the mode in which it normally reacts.

Another case of terminology occurs to me. For specification of small lengths microscopists have introduced the term *micron* for a thousandth of a millimetre, or a millionth of a metre; and very handy is both the magnitude and the name, and I hope physicists will adopt it. But everyone should consent to use it in the same sense. There was a discussion about it in the pages of NATURE a few years ago, but I am not sure that the usage even now is quite distinct. Many biologists call it a micro-millimetre, which it is not; and though they may mean the same thing, it can only be by an erroneous, because unconventional, use of the prefix micro. All these things are conventions, and once made the convention should be rigorously adhered to. Sometimes the word is written *micro* instead of micron; a very small divergence, but better avoided. Either term will do perfectly well, but not both.

May we understand then that a micron is a micro-metre, or a milli-milli-metre, or 10^{-4} centimetre; and that a millimicron is a micro-millimetre, or 10^{-7} centim.?

And may I incidentally protest against too much public use of the meaningless and wasteful symbols μ and $\mu\mu$ for these two lengths. If these symbols are found too handy in technical microscopy to be abandoned, they must be used there; but they should never be allowed to obtrude into anything intended for the general reader, nor for workers in other departments of science.

I trust that physicists will agree with me in this. I know that some Electricians try to sin in a similar way, by writing 6ω when they mean 6 ohms. But with all deference to any individuals who may have allowed themselves carelessly to drift into this practice, it is a thoroughly bad precedent. We shall soon be having $12a$ and $5v$ and $3h$ for current and voltage and inductance respectively; a simple specification will look like algebra, and algebra will look like gibberish.

Similarly the custom of writing M for a millionth of an atmosphere, or 1 barad, is a worrying custom. Let us always have names for units with which we have much to do, but never single letters. Single letters have to serve a far more important purpose, that of denoting the quantities themselves—the whole of a quantity, numerical part, unit, and all.

This last is an old hobby of mine. Ever since my brother showed me the advantage of consciously interpreting algebraical symbols as standing for concrete quantities, and not merely for abstract numbers, the advantage of doing so has presented itself to me with cumulative force. Most physicists are, I think, now of a similar opinion, if they have thought at all about the matter, and Prof. Greenhill is being left almost alone in his state of grievous error; I would say heresy, but that I fear he has some of the pure mathematicians with him for company.

I have dragged Prof. Greenhill in because I want to deny the extraordinary assertion which he makes in an article on page 457 of your issue for September 14, viz. that I would like to "banish the word *hundredweight* from our language." On the contrary, for the specification of loads I have always found it a very convenient word; and if architects use it thus, for pressure on foundations, so much the better. I know what he is referring to—a part of my book on mechanics where I am instructing youth in the meaning of the term *mass*, and the difference between mass and weight. Till they are clear on this point I say that "hundredweight" is a term better avoided for the present. I should, for instance, recommend its avoidance for the present by Prof. Greenhill.

But to return to Dr. Burdon Sanderson's address, which it is perhaps evident from a former part of this article that I have been trying to read, there are two small points on which I would ask a question. First, with regard to totally colour-blind vision. If a person sees all the world in shades of gray he may properly be called colour-blind, in one, and that the most important, sense; but it does not seem to me to follow that he necessarily appreciates white, still less that he proves a specific white sense in normal eyes. On the orthodox theory, as held by physicists, such an eye would strictly be called monochromatic; one only of the three colours would be seen, and which it was would matter nothing to the seer, though it might be ascertained by studying his spectrum vision which the one colour was in any given case. I believe that Abney and Festing found it usually blue. But as regards the psychological impression produced by mono-chromatic vision on the seer, its indiscriminating monotony would obviously result in total absence of colour perception. One colour sensation is psychologically the same as none.

The other question is whether it is useful to distinguish between "physical light" and "physiological or subjective light." The term *light* applies to the stimulus as far as the retina, but after that is it not better called either *sight* or some other and more impressive-looking word, beginning with *photo* or *neuro* and perhaps ending with *taxis*, signifying the specific disturbance of the optic nerve and brain centres. These terms light, heat, sound, &c., have always been ambiguous; but, if needful to discriminate, they had better perhaps now be handed over entirely to physics, to signify monosyllabically the external physical stimulus; while fresh words are coined for the physiological, and again, where not already existing, for the psychological, result.

I trust that this letter has not the appearance of undue presumption; the whole of it is written in the key of interrogation.

OLIVER J. LODGE.

British Association: Sectional Procedure.

MEMBERS of the British Association often entertain schemes for the improvement of sectional procedure, which rarely, so far as I have seen, commend themselves to the good opinion of the organising committees. I beg leave to produce one scheme more. Whether the remedy is practicable or not, I am quite sure that the grievance I have to point out is a real one.

Every member of the Association has suffered from the great uncertainty as to the hour at which a particular paper will come on. At the recent Nottingham meeting I was unlucky enough to spend one morning to no purpose. I had a direct interest in two communications; one was not reached that day, the other was taken as read. There is no care taken to prevent such accidents, and yet it would have been easy to provide against the second one at least by marking the communication as "Title only." The other case is of greater, but not, I think, of insuperable difficulty. The remedy which occurs to me is this: a fixed time should be assigned to communications which in the opinion of the Sectional Committee are of special interest and importance. There might be at least two absolute fixtures in each day's proceedings, when members would know that nothing would be allowed to interfere with the punctual production of certain papers or addresses. I should be inclined to mark these by some distinctive title, such as "Address by request of the Section." It seems to me very desirable to send out special invitations before the meeting to persons who could communicate interesting results, and I have little doubt that a fixed time would often lead to acceptance by persons whom the Sections would be glad to hear, but who rarely or never appear in the programme under the existing system. What is bad for the audience is bad for authors too, and after an author finds that his communication is addressed only to people who come to hear something else, and to people who in their despair are working through the entire list, he ceases to offer himself.

If the facilities granted to pre-arranged addresses should lead to a stricter treatment of trivial papers and business matter of no direct scientific interest, the Sections would not suffer.

L. C. M.

Orientation of Temples by the Pleiades.

EIGHTEEN months ago, while at the Mena House, Cairo, I came across a back number of NATURE, which contained an article on "The Origin of the Year," in which reference is made to the orientation of some Egyptian temples, and I suggested that inquiries should be made as to whether they were not in some cases oriented by the Pleiades. I had not then seen the numbers that referred to stellar orientation.

A pamphlet of 105 pp. was privately printed by myself *thirty years ago* (!) for my own use in the prosecution of "A Comparison of the Calendars and Festivals of Nations," with special reference to the Pleiades.

Since that pamphlet, and a second, of about 20 pp. on cycles regulated by the Pleiades, were printed, I have collected a great deal of further data confirming the conclusions arrived at in 1863. Müller says, in his Religion, &c., of the Dorians, I. 337, that the famous eighth-year cycle, which was in general use in Greece, was luni-sidereal, and regulated by the Pleiades, and that the great feasts of Apollo at Delphi, Crete, and Thebes, were arranged by it. He also states (p. 338) that there are vestiges of a sacred calendar in general use in Greece in early ages based on this cycle, but that it fell into disuse, and, in consequence, the Attic festivals and months were thrown into confusion. He had previously stated that the Olympiads were based on the eight-year cycle. Apollo, generally assumed to have been essentially a solar deity, though he evidently was originally a type of Karlikeya, was a god of the Pleiades, and hence the seventh day was sacred to him at Athens. As those stars were the daughters of Atlas, the forty days during which they deserted the nightly sky were spent by Apollo in dancing and singing among the Hyperboreans of Marlas. When the rising of the Pleiades at early morning took place, he returned. In 1882, at the American Association, I showed that he is still remembered south of the Atlas as "Apŏlo, a good god, who comes and plays upon the harp." But in the lapse of centuries the Pleiades seemed to go astray, and were forgotten, and, strange to say, Athenæus was forced to treat the history of the Pleiades as a bit of obsolete folk-lore. In discussing the subject of the two groups of *Peleiades* on the handles of the divining cup of Nestor, he says that it is a mistake to suppose that Homer by *Peleiades* meant "doves" (a mistake which Mr. Gladstone has also made in his Homeric Studies), and he explains that the cup had two clusters of seven stars represented on it. Many persons, he says, are puzzled at the prominence thus given to those stars, but in early times they were regarded as very important, and left their impress on early mythology, and he also shows that they once regulated the time

of sowing, and the season for navigation. He goes at great length into the question in his *Deipnosophists;* and I invite the attention of those who wish to know something as to the early history and influence of the Pleiades to the work in question.

As Plutarch says that the great feast of Isis was always held at the time "when the Pleiades are most conspicuous," and I found that the month of Athyr, in which it was held, was described as "the shining season of the Pleiades," I sent, in 1865, a copy of my pamphlet to Prof. C. P. Smyth, before he went to Egypt, and invited his attention to the probability that those stars were in some way indicated by the Great Pyramid.

The recent discovery by Mr. Penrose that the Hecatompedon site of the Parthenon, and other archaic Greek temples were oriented by the Pleiades, lends a new interest to this subject.

This diversity of orientation has had a far wider range than has been supposed, for nearly forty years ago it was noticed in the Mississippi mounds by Squier and Davis; and was long ago detected in several early churches of the south of England, a very remarkable fact, which I think was referred to at the Anthropological Institute. As it greatly surprised and interested me, I made a careful note of it when it was published, which I regret that I cannot now hunt up, as I am preparing to leave England for the winter; but as the point cannot have escaped the attention of others, some one among your readers will perhaps be able to give you further information as to it.

NATURE of August 31 contains an interesting letter on the importance of the study of the date of the birth of Rama by competent astronomers. For several years I have been trying to find out what was the precise time of the year when Kartikeya was born—"*The Birth of the War God*" does not refer to it. There is a most interesting subject which is new to science, the connection of the Pleiades with the nativity of divine heroes. I think I can at last supply a clue to the *Star of Bethlehem* (which Kepler imagined to have been a conjunction of planets!) in "*the Christmas Stars*," of the negroes, and other African races.

September 7. R. G. HALIBURTON.

Early Chinese Observations on Colour Adaptations.

IT seems of interest to record that the Chinese, neglectful of the sciences as they are nowadays, nevertheless suggested the Darwinian interpretation of animal colours as early as the ninth century A.D.

Twang Ching-Shih, in his Yú-yáng-táh-tsú (Maútsin's edition, book xvii. p. 7 Kyōto, 1697), describes a trap-door spider as follows:—"Whenever rain has fallen, the ground facing my book-room has plenty of the 'tien-táng' (that is, the 'tumbling-defender'). Its nest, commonly so-called, is as deep as an earthworm's hole, and the network is finished in it. The earthy lid of the nest is quite even with the ground, and of the size of elm-samara. The animal turning upside down, guards the lid, and thus watching for the appearance of flies and caterpillars, it readily turns up the lid and catches them. As soon as it retreats the lid is closed again. The lid is coloured like the ground."

Apparently from this and other facts the observer has attained a revelation of the truth, which he expresses thus:—"In general, birds and mammals necessarily conceal forms and shadows by their assimilation with various objects. Consequently, a snake's colour is similar to that of the ground; the hare in the Imperata-grass is unavoidably overlooked, and the hawk's hue agrees with that of the trees."

Twang Ching-Shih was a man of great erudition, and versed in poetry; he died in the period of Hwi-Chang (841–846 A.D.), leaving us the work cited above, consisting of thirty books. It is highly commended by Sie Tsái-Kang, a distinguished encyclopædist of the seventeenth century A.D., as one of the two "Crowns of all Miscellanies."

KUMAGUSU MINAKATA.

15, Blithfield-street, Kensington, September 26.

A Remarkable Meteor.

A METEOR of surpassing brilliancy and great size was seen here on the 1st inst., just before 10 p.m. The course seemed to be from westwards towards the north-east. The meteor was of a vivid blue colour, and it lighted with its splendour the whole visible horizon. In a clear blue sky the harvest moon, on the wane, was at the time shining brightly.

On disappearance the blue fiery ball left behind it for some seconds a long luminous trail, like that which follows the flight of a rocket. Travelling apparently at a considerable height, the ball was observed at much about the same time at Llanefydd, amongst the hills in North Wales. A correspondent writes thence: "Last night (the 1st inst.) I witnessed a remarkable meteor. I always, these moonlight nights, go up the Frith just before 10 p.m. I went up last night; it was just like day (the effect of the moon shining in the clear air of the hills). Just when I was on the top, turning to come down, and looking up the valley, the place suddenly became lit up with a blaze of intense blue light. I thought it was a tremendous lightning flash; but as it lasted too long for that, I looked, and then saw what it was. There was a meteor falling just behind Tan-y-Gurt Mountain, as bright apparently as the sun. It was a globe of flame as large as an ordinary foot-ball, and of a light blue colour. I saw the ball for about as long as a rocket takes when falling. The ball was very much like an enormous rocket, and afterwards there was an appearance just like a stick falling from the flame. The meteor came from the west, travelled towards the north-east, and fell perpendicularly." My correspondent adds: "The meteor did not shoot from any radiant known to me."

Worcester, October 4. J. LLOYD BOZWARD.

THIS meteor was distinctly seen at Driffield, East Yorkshire. It proceeded from a point about 45° altitude in the west, and passed towards south-south-west at an angle of about 40°, disappearing at an altitude of about 20° in the south-west. Duration two seconds; slow motion. A trail of yellowish-red sparks appeared on both sides (top and bottom) as it travelled forward. Several letters appear in the *Yorkshire Post* of the 5th inst. from persons who saw it in Yorkshire.

J. LOVEL.

TERTIARY AND TRIASSIC GASTROPODA OF THE TYROL.[1]

THOUGH much has already been done for continental palæontology, a great deal still remains to be accomplished. The earlier workers in the field laboured under the disadvantage of having to deal with comparatively scanty material, mostly scattered in private collections over large areas at a time when intercommunication was far from easy. Nowadays these old collections with their type-specimens have for the most part found their way into the museums of the principal cities. Moreover, not only may they freely be examined on the spot, but sometimes, we are glad to know, are allowed, under proper precautions, to be removed for the purpose of comparison with types preserved elsewhere. These altered circumstances and the acquisition of new specimens have not merely aided, but even provoked the revision, rectification, and completion of the labours of bygone times.

The two articles before us are examples—the one of supplementary, the other of both supplementary and revisionary work.

To take them in their order:—

Dr. Dreger's paper is the first of a projected series in which it is intended to treat of the fauna of the tertiary beds at Häring in so far only as it has not already been dealt with. Any conclusions Dr. Dreger may have come to concerning the exact age of these deposits, which Gümbel considered to be the equivalents of our Bembridge and Headon beds, are reserved till the whole of the material has been disposed of.

The fossils are in a very bad state of preservation, being much crushed, distorted, and broken: the more

[1] "Die Gastropoden von Häring bei Kirchbichl in Tirol." Von Dr. Julius Dreger. (*Annalen des K.K. Naturhistorischen Hofmuseums*, Bd. vii. 1892, pp. 11–34; Pls. i.–iv.). "Die Gastropoden der Schichten von St. Cassian der südalpinen Trias." Von E. Kittl. II. Theil. (*Ibid.* pp. 35–97, Pls. 5. (Wien: A. Hölder.)

delicate parts, such as the outer lips, long anterior canals, where such existed, and any spiny projections, are usually missing. With such unsatisfactory material to work upon it is little wonder the author has in many cases been unable to come to any definite determination as to the species; indeed in several instances, most wisely, no specific identification is attempted.

The list given at the end shows 114 forms, including 15 which are described as new; but of these some had better have been left unnamed till more perfect examples were forthcoming, whilst in certain instances, such as *Voluta stromboides*, one feels sceptical, if any reliance may be placed on the figure, as to the very determination of the genus. Nor is the description of these new species always adequate: that of *Trochus demersus* being especially insufficient. One of the figures is that of an interesting example of *Xenophora*, considered by Dr. Dreger to be very near to, if not identical with, *X. subextensa*, d'Orb. This individual must have possessed a somewhat fastidious taste, for in lieu of the ordinary fragments of shell and other oddments that its kindred usually love to attach to their tenements, it selected for the decoration of its house the fusiform shells of *Cerithium* and *Pleurotoma*, which it disposed radially, attaching them by their apices. This unwonted arrangement is paralleled in a recent example of *X. pallidula*, Reeve, dredged off the Philippines during the *Challenger* expedition, the decorative shells being those of *Terebra* and *Pleurotoma*.

The nomenclature employed by Dr. Dreger is not in all instances up to that standard of exactitude which the present-day devotees of the law of priority demand, and undoubtedly will bear revision, and so, too, we regret to see will his synonymy. Dr. Dreger's principle of giving in synonymic references the name of the authority cited for the species by the author who is quoted is decidedly the fairest and best system and one which for our part we would gladly see universally adopted. By way of instance a portion of the synonymy of *Cassidaria ambigua*, Brander is here given, omitting however for sake of brevity the references to the several papers:—

1776. *Buccinum ambiguum*, Brander, &c.
1812. *Cassis striata*, Sow., &c.
1843. *Cassidaria ambigua*, Brander, Nyst, &c.
1851. *Cassis affinis*, Philippi, &c.
1854. ,, ,, ,, E. Beyrich, &c.
1851. ,, ,, Beyr., Gümbel, &c.
1864. ,, ,, Phil., Giebel, &c.
1865. ,, *ambigua*, Sol., v. Koenen, &c.

Unfortunately our author has not been as careful in following out his own system as he should. Moreover the reference to the first description of a species is frequently omitted altogether; the descriptions from Brander's "Fossilia Hantoniensia" are sometimes attributed, and correctly, to Solander, and sometimes, as in the example quoted, to Brander: the synonymy is frequently unduly swollen by references to mere lists such as that in Gümbel's "Geognostische Beschreibung."

The paper concludes with a table showing the distribution of the 19 species which are also known to occur in other localities. This is supplementary to the similar table given by Gümbel (*op. cit.* Abth. i. pp. 608-9).

Turning to the second article, it is needless to remark that the St. Cassian beds must ever remain a source of interest to the geologist, not only on account of the remarkable mixture they offer of palæozoic with mesozoic forms of life, as evinced by the occurrence of *Orthoceras* on the one hand and *Ammonites* on the other, but also from the fact that so large a number of fossil species are peculiar to them.

The St. Cassian fauna has been treated monographically by Münster in his "Beiträge zur Petrefacten-Kunde" (Hft. iv., 1841), by Klipstein in his "Beiträge zur Geologischen Kenntniss der östlichen Alpen" (1843), and by Laube in a series of papers published in the "Denkschriften der k. k. Akademie der Wissenschaften, Wien," between 1865 and 1870. Although the last-named palæontologist added very largely to the number of species known, the subject was far from being exhausted, and the accumulation of fresh material has enabled Dr. E. Kittl to still further augment the list of Gastropoda by the addition of many new forms, mostly of small size and many of very great beauty.

The first part of this paper, published last year in the preceding volume of the same serial, contained descriptions of all the species of Scaphopoda and of Gastropoda Prosobranchiata from *Patella* to *Clanculus*; the second portion now before us embraces the families represented in these beds between and including the Neritidæ and the Littorinidæ, and introduces two new genera—*Palæonarica*, in Neritidæ, and *Pseudoscalites* in Trichotropidæ.

The classification and nomenclature followed, it should be stated, is that adopted by Zittel in his well-known "Handbuch der Palæontologie," and of course shares the merits and demerits of that system. Only in two instances does our author depart from his model. The genus *Chilocyclus*, Bronn, is restored on the ground that it is distinct from the *Cochlearia*, Braun, to which Münster had referred the St. Cassian species. In the same way *Delphinulopsis*, Laube, which has been set aside as embracing forms referable to two genera—*Neritopsis* and *Fossariopsis*—is re-established by Kittl for reasons which are too technical to be dwelt on here, but which we confess do not seem entirely satisfactory.

To criticise so elaborate and careful a work as this in detail is, indeed, not possible without seeing the actual specimens, however good the figures and lucid the descriptions may be, and we fear it would sound ungracious when so much is vouchsafed us to wish that some of the new types had been less fragmentary, or to express an opinion, however guardedly, that some of the specimens figured, besides that so acknowledged, convey the impression of being immature and possibly the fry of other species.

The difficulties that have to be contended with in the production of a work of this sort are far from small, and the conscientious palæontologist must frequently be at his wits' ends to decide whether he shall refer a given example, especially if imperfectly preserved, to a known genus from the typical forms of which it differs considerably, or shall incur the odium of adding another name to an already overburdened nomenclature.

Take such an instance as that here afforded by the genus *Scalaria* (or should we write *Scala?*). Amongst the species are forms which the synonymy shows were referred by so able a palæontologist as Laube to the very distinct genera *Turbo*, *Trochus*, and *Turritella!* A glance at the figures shows how far these forms depart from those we have been accustomed to associate with the old familiar Wentle-traps, and it is little wonder that Dr. Kittl suggests the desirability of establishing a new subgeneric name for some of the St. Cassian species: we think he would be justified in even founding a new genus to receive them.

The plates that accompany this paper are admirable bits of drawing, but the figures would in most instances have been more satisfactory for working purposes had more of them been enlarged, and those that are enlarged yet further magnified. The double numeration of these plates is, moreover, both clumsy and unnecessary.

It is very interesting to observe in how many of the species of *Naticopsis* the colour markings seem to have been preserved, nor is this the less remarkable because instances of a similar description from yet older formations are on record. (BV).

NOTES.

SIR HENRY GILBERT sailed for America at the end of last week, to deliver the biennial Rothamsted Agricultural Lectures. There is an appropriateness in Sir Henry being the lecturer for 1893, the jubilee year of the Rothamsted wheat experiments. He is, of course, bound in the first place for Chicago, where Sir John Lawes and himself have a considerable exhibit.

WE are glad to learn that the fund which is being raised to pay the expenses incurred by Dr. Budge, of the British Museum, in the action recently decided against him, now amounts to about £900, so that there is every prospect of the whole amount being shortly obtained.

LORD KELVIN will open the new science buildings erected at the Leys School, Cambridge, on Saturday, October 28. The buildings include an extensive museum, three lecture theatres, and laboratories for elementary and advanced chemistry, biology, and physics.

THE Paris correspondent of the *Times* says that a collection of Egyptian papyri, recently purchased by subscription for the Geneva Public Library, is being examined by M. Jules Nicole. Among the discoveries already made are included a didactic elegy on the stars, and several scientific compositions.

THE Adelaide meeting of the Australasian Association for the Advancement of Science commenced on September 25, when Dr. Stirling, C.M.G., F.R.S., delivered a lecture on "Prehistoric Man." Prof. Ralph Tate, the president-elect, delivered the presidential address on the following day. The following are the sections and the names of their presidents:—Astronomy, mathematics, and physics, Mr. H. C. Russell, C.M.G., F.R.S.; chemistry, Mr. C. N. Blake; geology and mineralogy, Sir James Hector, K.C.M.G., F.R.S.; biology, Mr. C. W. de Vis; geography, Mr. A. C. Macdonald; anthropology, Rev. S. Ella; economic science and agriculture, Mr. H. C. L. Anderson; engineering and architecture, Mr. J. R. Scott; hygienic and sanitary science, Mr. A. Mault; mental science and education, Prof. Henry Larvire.

AN International Exposition will be inaugurated in San Francisco on January 1, and will remain open until June 3, 1894.

THERE is to be a "castle in the air" at the International Exhibition to be held at Antwerp next year. An immense balloon, built in six separate parts, on the principle of the water-tight compartments in steamers, will be held captive by means of ropes, and from it a castle-shaped structure, 33 yards long by 8 yards wide, will be suspended instead of a car. Entrance to the castle will be obtained by means of two lifts, and the supply of gas will be kept up by connecting a generator on the ground with the balloon by means of a silk tube.

THE Congress of the Photographic Society of Great Britain and Affiliated Societies was opened on Tuesday. In his presidential address, Captain Abney reviewed the advances recently made in photography, dwelling particularly upon the Lippmann processes for obtaining photographs in natural colours. A special lantern display will be held this evening at the Gallery of the Society in Pall Mall.

A TERRIBLE storm passed over the Gulf of Mexico on Monday, October 2, and, in conjunction with a tidal wave, did serious damage. Immense destruction was caused to the plantations, crops, and villages near the shore, and a report from New Orleans states that 1200 lives were lost in the portion of Louisiana visited by the cyclone. Hundreds of small vessels along the Gulf Coast were wrecked, and at Chandileur Island the wind is reported to have had a velocity of 100 miles an hour. All the buildings on the island, including the lighthouse, were destroyed, several miles of the island being completely washed away. As the railway and telegraph service in the region visited by the storm have been destroyed, details of the path traversed and the damage done have not yet been obtained.

THE *Société d'Encouragement pour l'Industrie Nationale* has made the following awards. The grand medal for agriculture to Prof. E. Lecoutteux; the prize of 3000 francs for perfecting the ventilation of mines, to M. Murgues; the prize of 2000 francs for a study of the coefficients required in a calculation of the mechanical possibilities of an aerial machine has not been awarded, but a sum of 500 francs has been assigned to Prof. Le Dantec. The prize of 2000 francs for the inventor of new methods of utilising petroleum, advantageously and without danger, for industrial and domestic purposes, has also not been awarded, but an encouragement in the shape of 1000 francs has been given to Dr. Paquelin. M. Kayser has obtained the prize (3000 francs) for a study of alcoholic ferments, and M. Girard that of 2000 francs for the best experiments on cattle feeding. M. Decaux has received the prize of 1000 francs for a new photographic shutter. Gold medals have been awarded to MM. L. Figuier, J. Fournier, M. Mustel, E. Petrousson, and G. Tissandier (the Editor of *La Nature*).

THE Patent Laws of this country make no provision for an official search as regards the novelty of inventions, hence the necessity for a perfect system of indexing of specifications of patents can readily be understood. In order to facilitate reference and enable intending patentees to satisfy themselves whether their brain-creations are really novel or not, a new series of illustrated Abridgment Classes is being published at the Patent Office. These abridgments have been classified according to subject, and they refer to all the specifications of patents applied for in the period 1877–83. Everything depends, of course, upon the manner in which a classification of this character is made, and we are glad to be able to say that the Comptroller-General has grouped the specifications in an excellent manner. He certainly deserves the thanks of men of science for arranging philosophical instruments in a class by themselves. The volume devoted to this class includes over five hundred short illustrated descriptions of inventions relating to optical, nautical, surveying, mathematical, and meteorological instruments. It is interesting reading, and should be useful to devisers of apparatus for any branch of science. During the period covered by the summary, inventors appear to have directed their attention principally to perfecting and devising new forms of those instruments which were already in existence. At any rate, very few new discoveries are indicated by the inventions set forth, which may perhaps be taken as evidence that the fundamental laws of nature have now been fairly well recognised. Among the most ingenious apparatus we may note the telemeters, or range-finders, by means of which the distances of objects can be ascertained directly from a single station, the importance of which from a military or naval stand-point cannot be over-estimated. Other surveying instruments, such as theodolites, levels, telescopes, &c., are fully represented, as also are magnetic compasses, ships' logs and sounding apparatus, sextants, and other nautical instruments. In the field of meteorology we find barometers, thermometers, hygrometers, anemometers, wind vanes, sunshine recorders, &c., while among optical instruments occur improvements in telescopes and microscopes, stereoscopes, magic-lanterns, and spectacles, reading-glasses, lenses, and reflectors. The volume also comprises mathematical drawing instruments and tripod-stands for various kinds of apparatus.

A LARGE number of papers on various branches of anthropology were discussed at the International Congress of Anthropology, which met at Chicago from August 28 to September 2. Dr. D. G. Brinton opened the session with an address on "The Nation as an Element in Anthropology." The second day's meeting was devoted to Archæology, principally American. On the third day, devoted to Ethnology, Dr. Brinton read a paper "On the Alleged Evidences of Ancient Contact between America and other Continents," in which he categorically denied that "any language, art, religion, myth, institution, symbol, or physical peculiarity of the American aborigines could be traced to a foreign source." Folk-lore was the subject assigned to the fourth day's proceedings, Religions to the fifth, and Linguistics to the sixth. The meetings were well attended, and the presence of foreign delegates showed that the Congress was truly an international one.

AT the Meteorological Congress held at Chicago in August last, as many as 130 papers were read "outlining the progress and summarising the present state of our knowledge of the subjects treated." In Section A, presided over by Prof. C. A. Scholt and Mr. H. H. Clayton, the papers were devoted to instruments and methods of observation, especially methods of observing in the upper air. Prof. Cleveland Abbe was chairman of Section B, which mostly dealt with questions of meteorological dynamics, much attention being also given to the study of thunderstorm phenomena in various countries. Section C, of which Prof. F. E. Nipher was chairman, comprised a series of sketches of the climate of different portions of the globe. Section D, in charge of Major H. H. C. Dunwoody, was devoted to the discussion of the relation of the various climatic elements to plant and animal life. Section E, under Lieut. W. H. Beehler, dealt with questions relating to marine meteorology, particularly to ocean storms and their prediction, methods of observation at sea, and international co-operation. Prof. Charles Carpmael and Mr. A. Lawrence Rotch presided over Section F, which comprised papers relating to the improvement of weather services, and especially to the progress of weather forecasting. Prof. F. H. Bigelow guided Section G, which dealt with problems of atmospheric electricity and terrestrial magnetism and their cosmical relations. Section H (Prof. Thomas Russell) had to do with rivers and the prediction of floods. Section I, under Oliver L. Fassig, was devoted to historical papers and to bibliography, with special reference to the history of meteorology in the United States. Preparations have been made for printing all the papers, and it is hoped that the work will be completed at an early date.

THE weather over our islands has recently been much disturbed by the passage of atmospheric depressions across the country; rainfall has been general in all parts, while thunder and lightning have frequently occurred, especially over the western and southern parts of the kingdom. On Sunday, the 8th inst., three-quarters of an inch of rain fell in the north of Scotland, and on the following day a depression in the south caused a heavy downpour in that part of the country; the fall measured in the neighbourhood of London on Tuesday morning amounted to an inch and a quarter. The excess above the average in all the western and southern parts of England during the week ended the 7th inst. was very large, amounting to an inch in the south-western district. The greatest deficiency in the aggregate amount since the beginning of the year was then 8·7 inches in the west of Scotland, while in the south of Ireland, and the midland counties of England, the deficiency exceeded 6 inches.

WE have received a copy of the *Osservazioni meteorologiche* made in the year 1892 at the Turin Observatory, containing observations taken three times daily, with daily and monthly means, and the differences from the normal values, calculated by Dr. G. B. Rizzo, assistant at the Observatory. We are indebted to the Italians for some of the earliest and best series of observations; those for Bologna began as early as 1723, and M. Toaldo, the first director of the Padua Observatory, early established a system of more than sixty stations, the results of which were published by M. Schouw, in Copenhagen, in 1839. At the Turin Observatory observations were begun in 1753 (see NATURE, June 1, 1893, p. 108), and for many years past the results have been regularly published each year. The cost of the establishment is now borne partly by the University, and partly by the town of Turin.

FOREST-INSPECTOR R. SCHÜTTE reprints, from the *Agricultural Journal* for West Prussia, an elaborate account of the district known as the Tucheler Haide, the largest continuous forest district of Western Prussia, extending over an area of thirty-five square miles. It is characterised by great and sudden changes of temperature. The winter minimum generally falls below −20° R. Snow has fallen on May 19, followed by a temperature of 21° R. on the 26th, and this again by night frosts on the first and third of June. Prehistoric remains are found belonging to the later stone and to the bronze ages. The inhabitants are occupied almost entirely with forestry and agriculture. Polish is still the prevalent language, though German is now generally understood.

ALTHOUGH one of the most recent organisations of its kind, the Geological Survey of Russia has already taken high rank amongst the surveys of Europe; the director is A. Karpinsky. The survey was commenced in 1882, and has published thirteen 4to volumes of Memoirs and eleven 8vo volumes of Bulletins. The maps, on the scale of 1 : 420,000, are issued with the Memoirs. An additional annual publication is the Bibliography of Russian Geology from 1885 onwards, which is edited by S. Nikitin. This gives abstracts in Russian and French of all publications relating to the geology of Russia. Although the detailed survey of this vast country is not yet sufficiently advanced for the publication of all the large scale maps, the surveyors have now accumulated enough material to warrant the issue of a general map on the scale of 1 : 2,520,000. This has recently appeared in six sheets, with brief explanatory text in two editions—Russian and French. (On the title-page of the French edition the scale of the map is erroneously given as 1 : 520,000.) Fuller explanations of various districts and formations will be issued subsequently. Some of the information here published was supplied by S. Nikitin for the geological map of Europe issued by Prof. Prestwich in vol. ii. of his "Geology." The map now issued is a beautiful example of cartography; it is not overloaded with detail, but the streams, railways, and main roads are clearly indicated. The names of places, rivers, &c., are printed in Russian, but to the descriptions of geological formations in the index a translation in French is added. The following statement of subdivisions indicated on the map will give some idea of the amount of geological information supplied:—5 Quaternary, 5 Tertiary, 2 Cretaceous, 1 Volgian, 3 Jurassic, 4 Triassic, 1 Permian, 1 Permo-Carboniferous, 2 Carboniferous, 5 Devonian, 2 Silurian, 1 Cambrian, 1 Crystalline Schists, 1 Gneiss, Granite, &c., 5 Volcanic Rocks, Tuffs and Serpentine. In addition to these well-recognised rock-groups extra tablets and colours are given for beds between the Permian and Trias occurring in some districts and not yet understood; the Devonian and Carboniferous, not separated, of the Transcaucasus; the Palæozoic rock, of the Caucasus; and for the ancient sandstones, &c., of Volhynie. The interesting group of Volgian beds, linking together the Cretaceous and Jurassic, are developed around Moscow, in Simbirsk and Kalouga; they have recently been discovered in

Poland. The system of colouring adopted is, as far as possible, that of the International Geological Map of Europe. The quaternary deposits are omitted where they would much obscure the solid geology, but elsewhere they are shown. In some parts, especially in Northern Russia, these superficial deposits are thick and widely spread, so that the solid geology is not known; here it was necessary to show only these deposits. The southern limit of erratic blocks is shown by a strong red line.

MESSRS. FLETCHER, RUSSELL, AND CO., the well-known makers of gas appliances, have just introduced a new process to supersede the use of Berlin black and black-lead for protecting the cast-iron portions of their manufacture. The casting is coated with a film of enamel, which is so thin that even the finest details on the metal are preserved. This enamel is said to be absolutely proof against rust, and preserves its qualities at any temperature up to a bright red heat. All colours are obtainable, including gold and silver, bright or dull, and as many as are wished can be produced on one casting. The process therefore offers great facilities for decorative work of all kinds, and its protective qualities should ensure it a wide field of usefulness.

IN a previous number of NATURE (No. 1247) we published the opening address by Mr. Jeremiah Head, President of Section G, Mechanical Science. In this, among many of the mechanical forces used by man, he referred at some length to the prospect of man ever being capable of flying. Some very interesting experiments, to which no allusion was made, although not bearing directly on actual flight, may yet be found of sufficient importance to be here related. For a very detailed account the reader may be referred to No. 205 of the weekly journal, *Prometheus*. The experimenter in question is Herr Otto Lilienthal, and his success in his so-called "flight" is the result of much thought and considerable practice. The apparatus may be described as a pair of large wings, similar in principle and construction to those of a bird, with two tails at the back, one placed vertically, and the other horizontally. The wings are rigid and fixed, and no motive power at all is used; the whole apparatus weighs twenty kilograms. At the place where the experiments have been carried on, a long sloping hill has been used, with a platform raised about ten metres above the general surface at the top, for the starting point. From this platform the experimenter grips the apparatus between the wings or sails with his hands, and springs off the edge. In the flight he descends at an angle of about 10° to 15°, and the distance covered is sometimes very considerable. In the experiments carried on between Rathenow and Neustadt he covered 80 metres, while from another point he made a flight of 250 metres. The wind of course plays an important part in these flights, but Herr Lilienthal says that with practice one can steer the apparatus well. With the wind blowing stronger on one wing than on the other the equilibrium of the apparatus was found to be greatly disturbed, but this was checked by the movement of the legs, which changed the position of the centre of gravity. In these experiments there is a great opportunity for gaining experience in steering, and it seems very likely that we may learn much thereby.

THE assumption, current some years ago, that the properties of liquids change in proportion to the amount of matter held in solution, has already been invalidated for the case of electrolytic conductivity. Messrs. F. Kohlrausch and W. Hallwachs, in *Wiedemann's Annalen*, publish some results showing that the assumption is also erroneous in the case of density of dilute aqueous solutions. The method adopted was the Archimedian one of immersing a solid in the solution and noting its decrease in weight. Errors due to capillarity were eliminated by attaching the solid, a glass ball, to the suspending wire by means of a clean cocoon fibre. During mixing and stirring, the glass was held in position by glass rings. The stirrer was one of mica or platinum. Densities were observed up to 1·03, and the weighings were reliable to within 0·2 mgr. provided that no dust or fibres were attached to the cocoon thread. This gave a limit of error equal to 1 in 10,000. Large variations of temperature were corrected by a flame or ice, smaller ones by calculation according to known formulæ. All the bodies investigated show a decrease of the ratio of condensation to concentration between 0·005 and 0·5 gramme-equivalents per litre. This decrease amounts to 1 per cent. for sugar, 2 for hydrochloric acid, 2·5 for common salt, 13 for phosphoric acid, and 20 or sulphuric acid. The correspondence between this change of density and the change of electrolytic conductivity is very apparent. Sugar, a non-electrolyte, shows the greatest constancy of molecular density in solution. The authors intend shortly to publish analogous results obtained in their investigation of optical refraction.

M. VAN AUBEL has continued his experiments on the resistance of bismuth, and gives an account of the results he has obtained in the *Journal de Physique* for September. The results obtained are of special interest, as the use of spirals of bismuth seems to be the most convenient way of measuring powerful magnetic fields, at any rate with a sufficient degree of accuracy for most industrial purposes. According to Righi, the electrical resistance of commercial bismuth at 0° varies considerably, and bismuth which has been compressed has its resistance less affected by magnetism than that which has been melted. The author in his experiments has made use of pure bismuth, prepared by electrolysis according to the method he gave in his former paper in the *Annales de Chimie et de Physique*, and his observations show that neither sudden cooling nor compression has much effect on the electrical properties of pure bismuth. The resistance at 0° C. and the rate of change of the resistance with temperature, and the strength of the magnetic field in which it is placed, are almost the same, for rods that have been annealed quickly cooled, or compressed. The resistance always increases with rise of temperature, and between 0° and 100° the change is very nearly regular. A mere trace of impurity, however, completely changes the properties of the metal. The action of a magnetic field being the same, whatever the mode of preparation of the bismuth, it is better to use the spirals of compressed bismuth rather than the more difficultly obtained films of electrolytically deposited metal used by M. Leduc.

IN the current number of the *Philosophical Magazine*, Mr. John Trowbridge has a paper on the oscillations of lightning discharges and of the aurora borealis. By means of a rotating mirror the author has photographed the oscillating spark passing between two knobs, using both great electromotive force and great quantity of electricity. He finds that the subsequent sparks, at any rate for three hundred-thousandths of a second, exactly follow every sinuosity in the path taken by the pilot spark. Thus the comparatively small resistance to the passage of a second spark in air is probably due to this permanence of path.

THE University Correspondence College Press has issued the London University Guide for the year 1893-94.

Bulletins 96–99 have been received from the Michigan Agricultural Experiment Station.

MR. G. GAMMIE has prepared a report on his botanical tour made on the Sikkim-Tibet frontier during 1892. The report is issued by the Superintendent of the Royal Botanical Gardens, Calcutta.

WE have received the second part of "A Dictionary of Birds," by Prof. A. Newton and Dr. Gadow, extending from "Ga" to "Moa." Messrs. A. and C. Black are the publishers.

MR. W. F. PETTERD has issued, through Mr. Wm. Grahame, Jun., Hobart, a catalogue of the minerals known to occur in Tasmania, with notes on their distribution.

WE have received reports containing the results of physical and meteorological observations made on the coast of Germany during the first half of 1892. The reports are published by Herr Paul Parey, Berlin.

THE last ordinary meeting of the session of the North of England Institute of Technical Brewing will take place in Manchester on October 20, when Prof. Percy Frankland, F.R.S., will read a paper on "The Polariscope in relation to Chemical Constitution."

THE Upper Norwood Literary and Scientific Society has prepared a varied programme of lectures for the coming session, in which science and literature are given equal prominence, and are treated by well-known lecturers.

A MEMOIR, by Dr. Carlos Berg, the Director of the National Museum at Buenos Ayres, on *Geotria macrostoma* (Burm.), Berg, and *Thalassophyrne Montevidensis*, Berg, has been reprinted from the *Anales del Museo de la Plata.*

THE second part of "Dissections Illustrated," by Mr. C. Gordon Brodie, has been published by Messrs. Whittaker and Co. It refers to the lower limb, and includes twenty finely-drawn coloured plates and six diagrams, by Mr. Percy Highley.

MESSRS. O. NEWMANN AND CO. are publishing a series of 120 new wall diagrams for instruction in botany and zoology in schools and colleges. The diagrams are well printed in colours on a black ground, and are highly commended by German educationalists.

THE thirteenth edition of Gray's "Anatomy, Descriptive and Surgical," edited by Mr. T. Pickering Pick, has been published by Messrs. Longmans, Green and Co. The work has been thoroughly revised, and in some parts rearranged, and much new matter referring to surgical anatomy has been added.

THE first number of a bright little quarterly magazine, *The Nature Lover*, edited by Mr. H. Durrant, has just been published by Mr. Elliot Stock. In style it is like the Selborne Society's magazine, *Nature Notes*, though in rather lighter vein. We trust that the lovers of nature are numerous enough to make the venture a success.

DR. V. STERKI has made an exhaustive study of those minute and interesting molluscs which are generally regarded as constituting the genus *Vallonia*. His paper appears in the Proceedings of the Academy of National Sciences of Philadelphia, 1893 (pp. 234-279), and though not a monograph of the genus, it will serve as a useful guide to further investigations.

THE Proceedings of the Liverpool Geological Society (part 1, vol. vii.) contains several interesting papers communicated during the thirty-fourth session (1892-93). Among these may be mentioned the address of the president, Mr. W. Hewitt, on "The Physical Conditions of the Aralo-Caspian Region, as bearing on the conditions under which the Triassic rocks were formed," and a paper on "The Formation of Clay," by P. Holland and G. Dickson.

A LECTURE on "Bulbous Irises," delivered before the Royal Horticultural Society in May, 1892, by Prof. Michael Foster, has been expanded, and is now published separately at the society's offices. A detailed description of the various species mentioned in the lectures has also been added. Growers of irises will find the book of great use to them, it being intended more for the gardener than the botanist.

A MONOGRAPH of the "Coraciidæ, or Family of the Rollers," by Mr. Henry E. Dresser, will shortly be published by subscription. This work will contain illustrations, accompanied by letter-press, giving as complete an account as possible of all the known species of these richly-coloured birds. All the species have been drawn, life-size, on stone, by Mr. J. G. Keulemans.

THE Rev. W. Colenso, F.R.S., read several interesting botanical papers before the Hawke's Bay Philosophical Institute during 1892, and they are published in the Transactions of the New Zealand Institute, vol. xxv. A paper of much interest, entitled "Bush Jottings," is a brightly-written account of many botanical sights to be seen in the high inland wooded district known as "the bush." More technical in their character are the descriptions of a few newly-discovered rare indigenous ferns, some phanerorgamic plants, and a list of fungi. All these contributions help to make known the botany of New Zealand.

WE have received from Mr. Stanford an "Illustrated Official Handbook of the Cape and South Africa," which reflects the greatest credit upon all who have had anything to do with its production. The volume is edited by John Noble, who evidently recognises the importance of science, for we find chapters devoted to the following subjects:—"Geology, Fossils and Minerals of South Africa," "Vertebrate Fauna of South Africa," "Flora of South Africa," "Woods and Forests," and "Viticulture," all of which are contributed by specialists, who, as far as we can see, have performed their several tasks with great care. The work is enriched with a map and over a hundred "process" illustrations.

SILICIDE of carbon, CSi, has been obtained by M. Moissan in beautiful large crystals very similar in appearance to sapphires and considerably harder than rubies, by four different processes involving the use of his recently described electric furnace. The existence of this curious compound of two closely allied elements was first pointed out by M. Colson, who obtained it in the amorphous form by heating crystals of silicon in a current of hydrogen charged with vapour of benzene. Some years ago M. Moissan obtained it, in the condition of crystals several millimetres in length, by dissolving carbon in silicon, the latter being maintained in a state of fusion by means of a small but powerful blast furnace. The crystals were isolated from the excess of silicon by treating the product with a boiling mixture of nitric and hydrofluoric acid. M. Moissan now shows, however, that crystallised silicide of carbon may be much more readily prepared by heating a mixture of carbon and silicon, in the proportions of their atomic weights, in the electric furnace. The mass of crystals produced during the passage of the current may be purified by boiling first in the acid mixture above mentioned, and subsequently in an oxidising mixture of nitric acid and potassium chlorate. The crystals produced by this simple method are most frequently yellow, but are quite transparent if the operation is performed rapidly in a closed crucible of carbon, and provided the silicon employed is free from iron. Sometimes, however, the crystals are coloured blue, and closely resemble sapphires. The second process for the preparation of the compound consists in heating in the electric furnace a mixture of iron silicon and carbon, or more simply of iron silica and carbon; a regulus of metallic iron containing large crystals of silicide of carbon is produced. The third process consists in reducing silica by means of carbon in the crucible of the electric furnace, and this mode of preparation possesses the advantage of furnishing crystals which are more nearly colourless than those produced by the first two methods, inasmuch as the silica and carbon can be employed in a fairly pure state. Perhaps the most interesting of all the methods of pre-

paration is the fourth, in which the compound is formed by direct synthesis by the union of vapour of carbon with vapour of silicon. For, as has been previously described in these columns, M. Moissan is able to actually distil carbon at the high temperature of the arc which he is able to produce in his furnace. The experiment is conducted in a small crucible of pure carbon of elongated form, and enclosing a little block of silicon. The base of the crucible is arranged so as to occupy the position where the highest temperature of the arc is attained, and after the conclusion of the experiment the interior of the crucible is found to be covered with almost colourless prismatic needles of carbon silicide.

CRYSTALLISED carbon silicide is an extremely stable substance which resists the action of the most energetic reagents, even those which are capable of readily attacking its elementary constituents. The pure crystals are colourless and perfectly transparent, and present the appearance of regular hexagons. Their density is 3·12, and they are so hard that the ruby is readily scratched, and may be ground by means of the powdered compound. They are unalterable in air or sulphur vapour at 1000°. Chlorine attacks them very slowly at 600°, but more rapidly at 1200°. Fused nitre and potassium chlorate are entirely without action upon them, as are likewise boiling sulphuric, hydrochloric, and nitric acids, and even aqua regia and the silicon-dissolving mixture of nitric and hydrofluoric acids are incapable of attacking them. Fused caustic potash, however, after heating to redness for an hour in contact with them, reacts with formation of carbonate and silicate of potassium, and thus affords a means of estimating the content of silicon. The carbon may also be estimated by repeated combustion with chromate of lead, which gradually effects oxidation of the carbon. The analyses thus carried out agree in all cases with the simple formula CSi.

NOTES from the Marine Biological Station, Plymouth.—Last week's captures include various types of *Foraminifera*, colonies of the Hydroid *Coryne pusilla* (without gonophores), a colony of the *Scyphistoma* stage of *Aurelia*, and the Nudibranchs *Platydoris planata*, *Candiella plebeia* and *Polycera quadrilineata*. In the floating fauna the Hydroid medusæ *Cytæandra areolata* and *Eutima insignis* have been observed in addition to the forms mentioned last week.

THE additions to the Zoological Society's Gardens during the past week include a Sooty Mangabey (*Cercocebus fuliginosus*) from West Africa, presented by Mr. Swaniston Cyril Hopkins; a Serval (*Felis serval*), a Nilotic Crocodile (*Crocodilus vulgaris*) from Africa, presented by Mr. T. E. C. Remington; a Lesser White-nosed Monkey (*Cercopithecus petaurista*) from West Africa, presented by Mrs. Noakes; a Yellow-collared Parrakeet (*Platycercus semitorquatus*) from Australia, presented by Miss A. Fenwick; a Common Sheldrake (*Tadorna vulpanser*) European, presented by the Rev. H. G. Morse; an Oyster-catcher (*Hæmatopus ostralegus*) European, presented by Mr. Edmund Elliot; a Goliath Beetle, from West Africa, presented by Mr. F. W. Marshall; two Great Eagle Owls (*Bubo maximus*) European, deposited; a Flocky Lemur (*Avahis laniger*) from Madagascar, a Raccoon-like Dog (*Canis procynides*) from North-east Asia, a Sanderling (*Calidris arenaria*), a Puffin (*Fratercula arctica*) European, purchased.

OUR ASTRONOMICAL COLUMN.

ASTRONOMY AT THE WORLD'S FAIR.—The astronomical exhibits at Chicago seem to be fairly representative of the state of astronomical science at the present day, but they are too much scattered about in the different buildings for a proper study of them to be made. Among many of the more interesting exhibits we may mention the following: Fine collection of astronomical photographs, made by the Harvard College Observatory, which included those of stellar spectra nebulæ and clusters, and of a portion of the lunar surface enlarged over one thousand diameters. Dr. Chandler's four-inch almacantar, the collections of Draper and Langley, and the diffraction gratings and photographs of spectra by Prof. Rowland, the last of which formed the Johns Hopkins University exhibit. Specimens of the famous Jena optical glass, Kirchhoff's original spectroscope, Brill's mathematical models, and the magnetic apparatus of Gauss and Weber form part of the German Educational exhibit. In the English exhibit are found many astronomical photographs by Roberts, Gill, and others; others from the Royal Observatory, Greenwich, Boeddicker's Milky Way drawings, and the fine five-foot glass speculum by Dr. Common. Among some of the exhibits of the American astronomical instrument makers, we are glad to note the mounting of the great forty-inch Yerkes telescope by Warner and Swasey, who exhibit also some minor instruments. J. A. Brashear exhibits the stellar spectroscope for the Yerkes telescope, eighteen-inch and fifteen-inch objectives, gratings, &c. Among G. N. Saegmuller's (of Washington) exhibits is a four-inch steel meridian circle. Two twenty-three-inch discs of the celebrated Jena glass are shown by Schott and Genossen, of Jena, in addition to other specimens of optical glass. In the Cape Colony exhibit Dr. Gill's interesting stellar photographs are prominent, while the Lick Observatory display is housed in the educational department of the California State building, and, as *Science* says, is "strangely enough mixed up with the Kindergarten exhibit there." The U.S. Government building contains interesting apparatus as used in the Coast Survey, while the Naval Observatory shows a small observatory with several instruments.

THE AURORA OF JULY 15, 1893.—The system of observation of the aurora as lately instituted, seems to be already at work, and the observations of the aurora of July 15, most of which have been made on this system, show that the results are of the highest interest. A brief account of this aurora, by M. A. Veeder, will be found in the *Bulletin of the New England Weather Service* for the month of August (No. 18), from which we gather the following few notes:—With regard to the places of visibility and invisibility, it may be mentioned that its absence was verified up to midnight in Nova Scotia. In New England it was observed at a few stations, of short duration, and not at all conspicuous. Towards New York it was a fine display, and lasted all night, and was seen as far south as Washington at this longitude, while it was defined as a fine red aurora at Salt Lake city, and was seen as far south as the Lick Observatory, at both of which places this phenomenon is very rare. A special feature of this aurora was the "formation of a narrow band having an east and west direction, and passing just south of the zenith." This was seen in New England, the neighbourhood of Lake Ontario, and occasionally in Michigan, Wisconsin, and Iowa. An unusual formation recorded was that of an auroral curtain with a clearly defined lower margin. The twenty-seventh day interval coinciding thus with a synodic revolution of the sun, shows, as M. Veeder says, that whatever it is in the sun that originates an aurora can have this effect only when it has reached a certain position relative to the earth, and, further, that "the effect must proceed from the eastern limb." That in certain cases of large sunspots auroral effects might proceed from the central meridian of the sun as seen from the earth, M. Veeder freely admits; but he adds that, until further study has been made, this question cannot as yet be said to be satisfactorily answered.

NEW VARIABLE STARS IN CYGNUS.—A communication to the *Astronomischen Nachrichten*, No. 3191, by Herr Fr. Deichmüller, informs us of two new variable stars in the constellation of Cygnus. Their positions are respectively.

h.	m.	s.	°	′	
19	8	27	+ 49	24·2	1855
20	6	24	+ 47	23·0	

The first of these stars has a range of one and a half magnitudes, while the second varies from 7½ to the ninth magnitude.

ASTRONOMICAL WORKS (ANTIQ.).—We have received the catalogue of Herr Oswald Weigel's Antiquarium in Leipsig, which is devoted simply to works on astronomy (astronomical geography and geodecy). Included also is the library of Prof. C. Fearnley, of Christiania; so that our readers may be sure that there are now some important works for sale.

GEOGRAPHICAL NOTES.

NORWEGIAN enterprise has led to the fitting-out of a steamer, renamed the *Antarctic*, for a whaling voyage to the Antarctic Sea south of New Zealand, where Ross attained his highest south latitude in 1842. The *Antarctic* has already sailed, but will touch at an Australian port to complete preparations. It is understood that those on board will endeavour to make as complete meteorological observations as possible throughout the voyage.

A TELEGRAM from San Francisco, dated October 3, states that the American steam-whaler *Newport*, one of the fleet working north of the Arctic coast of America, which passed last winter at Herschell Island (long. 139° W. near the mouth of the Mackenzie), succeeded this summer in steaming through an almost open sea to 84° N. No details are given, and until the observations for latitude have been critically examined it is necessary to reserve an opinion as to the latitude really attained. The farthest north points, reached through Smith Sound, are 83° 20′ by Markham, and 83° 24′ by Lockwood. If the report is correct, the *Newport* got nearly fifty miles farther north than any previous expedition.

MR. F. G. JACKSON, who is travelling in the Yalmal peninsula, reports that Dr. Nansen did not finally leave Yugor Strait until August 20, the ice in the Kara Sea turning out to be much worse than was expected. The conditions must have improved shortly afterwards, however, as a telegram from St. Petersburg announces the safe arrival in the Yenesei of the Russian vessels which left Dumbarton with railway material on July 29. The date of arrival is not mentioned, but the fact proves that the *Fram* would have no difficulty in getting east as far as the Yenesei, at any rate, and as she is not reported by the Russian vessels, she was probably far beyond that river before they arrived.

PROF. KOTO publishes in the *Journal of the College of Science*, Imperial University, Japan, a detailed description of the surface changes accompanying the great earthquake of 1891, illustrated by sketch maps and photographic views of the great fault, forty miles long, which was formed in the valley of Neo. On one side of this fault the ground has subsided in places for nearly twenty feet, and has also been displaced horizontally. The result, apart from the destruction of towns and buildings, has been to considerably modify the physical geography of an extensive area, changing the course of streams and their rate of flow, forming swamps, and in many ways accelerating the gentler processes of surface change by erosion.

MR. CLEMENTS R. MARKHAM, President of the Royal Geographical Society, has this year been invited to deliver the opening lecture at the three provincial Geographical Societies. He opened the session of the Tyneside Geographical Society at Newcastle, by a lecture on Peru, on the 6th; that of the Liverpool Geographical Society, by an address on the Polar Regions, on the 10th; and that of the Manchester Geographical Society on the 11th, when his subject was Central Asia with special reference to trade routes. The interest taken in the younger societies by the Royal Geographical Society is sure to increase their popularity and usefulness in their own localties.

BIOLOGY AT THE BRITISH ASSOCIATION.

ON Thursday the address of the President was for several reasons postponed till 12.30, and the work of the section was opened by the Chairman (Sir William Flower) with a sympathetic reference to the recent sudden death of Mr. George Brook, who was to have been one of the secretaries at this meeting. A paper was then read by Dr. David Sharp, on the zoology of the Sandwich Islands. This was followed by the report of Prof. Newton's committee on the present state of our knowledge of the zoology of the Sandwich Islands. The committee have obtained valuable results in several departments of zoology, and more especially in entomology. The consignments received during the year from their collector may be roughly estimated at nearly 150 birds'-skins, 3000 insects, 1000 shells, a collection of spiders in spirit, together with some crustaceans, worms and myriapods. The importance and urgency of the work carried on was testified to by Sir William Flower, Prof. Newton, Dr. Hickson, and others. The report of the committee dealing with observations on the migrations of birds at lighthouses was then read by Prof. Newton. This committee have made progress with the systematic tabulation of their statistics, and are now commencing to fill up the schedules for their final report. The sixth report of the committee investigating the zoology and botany of the West India Islands shows that the Committee have been chiefly engaged during the past year in working out the great series of specimens secured from the West Indian region by means of the collectors. Papers on the birds, on the myriapods, scorpions, pedipalpi, peripatus, and the parasitic hymenoptera, have been published, and investigations on other groups of insects are now proceeding. Collections of various groups of cryptogams have also been made, are now being worked out, and are proving to comprise many new species. The committee propose to examine next the island of Margarita, the natural history of which is wholly unexplored. An important note on the discovery of *Diprotodon* remains in Australia, by Prof. Stirling, was read by Prof. Newton. The new material now found has added to our knowledge of the structure of this remarkable gigantic marsupial, especially in regard to its limbs and feet.

The presidential address (*see* NATURE, p. 490), in the absence of Canon Tristram from illness, was read in the afternoon by Sir William Flower; and the vote of thanks was proposed by Prof. Newton and Prof. Burdon Sanderson.

The section opened on Friday with a physiological discussion on the physico-chemical and vitalistic theories of life. The discussion was opened by Dr. J. S. Haldane, of Oxford, who, starting from the fact that about the middle of the century physical and chemical theories to explain the peculiar properties of living organisms were completely substituted for the traditional vitalistic theories, proceeded to inquire how far this substitution has been justified by the results of subsequent investigation. He argued that as evidence has accumulated the failure has become more and more manifest of the attempts to specify physical and chemical factors from which vital properties may be deduced. This argument he based on the facts relating to cell-formation, nutrition, heat-production, the secretion and absorption of solids, liquids, and gases, and to other physiological processes. He then endeavoured to show that the old vitalistic theories were not mere expressions of the negative fact that physiologists are face to face with a large residuum of unexplained facts, but constituted real working hypotheses, which summarised the peculiarities of living organisms, and indicated fruitful lines of inquiry. In conclusion he maintained that the former crude beliefs as to the existence of a material or immaterial "vital principle," formed no essential part of a vitalistic theory of life.

The Chairman (Mr. Langley), in inviting discussion, said that the problems of life had been thought to be physical and chemical questions, and the mistake had been that they had been thought to be easy questions. Possibly the fact was that the unexplained residue appertained to more complex chemistry and physics than we know at present.

Prof. Cleland said that the old vitalism was dead, but that there was a new vitalism which must be supported. To him there appeared to be something in life in addition to the mere laws of dead matter.

Prof. Burdon Sanderson said that the real change that took place about 1840 was not a change of doctrine but a change of method. It was then seen that the only way to investigate the phenomena of life was by processes which they understood, such as those of chemistry and physics. A great number of easy questions had since been settled, and the difficult ones appeared now all the greater because we had come nearer to them. Profs. Schäfer, Allen, Heger, Hartog, Bohr, and Dr. Waller also took part in the discussion. In his reply Dr. Haldane maintained that physiologists had always employed methods of observation based on physics and chemistry. The change at the middle of the century seemed to him to be a change in working hypotheses rather than in methods.

The Chairman, in closing the discussion, said that during the first half of the century there had been a lamentable absence of results, mainly owing to the fact that the whole process of research was governed by the vitalistic theory.

A paper by Dr. A. R. Wallace, on malformation from prenata influence on the mother, was illustrated by photographs of a remarkable case of a child born with an imperfect arm some months after the mother had been engaged in dressing the wound of a gamekeeper who had had his arm amputated.

In the afternoon the section divided into the two departments of Physiology and Zoology. In the former, the following papers were read:—(1) On the digestive ferments of a large Protozoon, by Prof. Marcus Hartog and Augustus E. Dixon. The authors experimented with about 2000 large individuals of *Pelomyxa palustris*, and found that the watery extract hydrolyses starch paste in a neutral solution, and converts the starch rapidly into erythro-dextrin, has no action on thymolised milk in two days, liquefies fibrin rapidly in presence of dilute acids, only attacks fibrin very slowly and partially in neutral solution, and indol and skatol are not formed. (2) On the effect of the stimulation of the vagus on disengagement of gases in the swim-bladder of fishes, by Dr. Christian Bohr (Copenhagen). This showed that the air secreted in the bladder is largely composed of oxygen. The paper was illustrated by tables showing the increase in the proportion of oxygen at stated times during the refilling of the bladder after puncture. (3) On a method of recording the heart sounds, by Prof. W. Einthoven. (4) On nerve stimulation, by Prof. F. Gotch. The author finds that with the induction current he obtained excitation of the nerve of a frog at a low temperature which disappeared at a higher temperature, while with the discharge of a condenser the result was the reverse of that. He also found a similar difference in action in regard to the passage of the impulse down the nerve in the two cases. Therefore he comes to the conclusion that the impulse started in the nerve is somewhat different in the two cases. (5) On fatigue of nerves, by Prof. Schäfer. (6) On Calorimetry, by Dr. A. Waller. This applied more particularly to the temperature difference of the body under varying conditions of the surrounding medium. (7) The report of the committee on the physiological action of the inhalation of oxygen in asphyxia. The results are as follows:—(1) In the case of asphyxiated rabbits, oxygen is of no greater service than air; (2) pure oxygen when inhaled by a healthy man for five minutes produces no effect on the respiration or pulse; (3) oxygen produces no effect upon a patient suffering from cardiac dyspnœa, either on respiration or on pulse; (4) an animal can be kept for a long time in a chamber containing 50 per cent. of carbonic acid without muscular collapse, provided a gentle stream of air or oxygen be allowed to play upon the nostrils.

In the Zoological Department the following papers were read:—(1) Report of the committee appointed to explore the region of the Irish Sea lying around the Isle of Man. The committee have conducted eight dredging expeditions, most of them lasting for several days; about 1,000 species of marine animals have been collected and identified, of these thirty-eight are new records to the British fauna, 224 are new to the district, and seventeen are new to science. Prof. Herdman gave a general account of the expeditions and the results attained, while Mr. A. O. Walker, Mr. I. C. Thompson, Mr. Stebbing, and Prof. Brady gave more detailed accounts of special groups of Crustacea. (2) Report of the committee on a deep-sea tow-net. (3) On luminous organs in Cephalopoda, by W. E. Hoyle. These minute light-producing organs are scattered over the general integument in certain species. (4) On the origin of organic colour, by F. T. Mott. This was to show that the colours in going from stem to blossom indicate a decrease in the amount of light absorbed, and the author contends that the amount of reflected light increases as the plant attains maturity. (5) On the roots of *Lemna*, and the reversing of the fronds in *Lemna minor*, by Miss Nina F. Layard, who showed that in dry seasons, when the fronds dried up, the root-cap would act as a protector for the tender cells of the root. Miss Layard accounted for the observed reversal of the fronds as cases where a growth had covered the upper surface, and the fronds had revolved in order to expose a better surface to the air.

The section met on Saturday forenoon, when the following papers, chiefly botanical, were taken:—(1) Report of the committee on the legislative protection of wild birds' eggs. This was read by Dr. Vachell, and supported by Prof. Newton, who urged the necessity of making known to the schoolboy which birds' eggs ought to be protected. (2) On the ætiology and life-history of some vegetal galls and their inhabitants, by C. B. Rothera. The author traced out the life-history of certain typical galls, those of *Cynips kollari*, *Teras terminalis*, and *Biorhiza aptera* being specially dealt with. He gave a series of facts positive and negative, which point to the action of the embryo, and not to the deposit of a special virus by the parent *Cynips*, as the direct and necessary agent in the production of the gall. He therefore discards the hypothesis of a specific virus deposited by the parent, and attributes the genesis and metamorphoses of the gall to the activities of the living embryos combined with the normal forces of the plant. (3) Report of the Committee on the Botanical Laboratory at Peradeniya, Ceylon, where a good deal of the apparatus requires to be renewed. (4) On some new features of nuclear division, by Prof. J. B. Farmer. This paper, illustrated by microphotographs, included some new results of researches on the centrogomes and the behaviour of the achromatic spindle. (5) Variations of fecundity in *Trifolium pratense* and its varieties, and *Trifolium medium*, by W. Wilson. This paper detailed some observations made as to varieties of clover, contrasting them with hybrids as regards fertility. (6) Lime salts in relation to some physiological processes in the plant, by Dr. J. Clark. The action of lime salts may modify the effect of low temperatures in seed germination. The author had succeeded in finding a *Bacillus* which is capable of breaking up the calcium oxalate, which is at one time precipitated in the plant. (7) On the cortex of *Tmesipteris tannensis*, by R. J. Harvey Gibson. This gives an account of the histology of the cortex of the stem, with special reference to the origin and nature of the "brown deposit" seen in the cells.

On Monday a joint meeting with Section C was arranged, when a discussion on "Coral Reefs" was opened by Prof. W. J. Sollas, F.R.S.

Prof. Sollas said that the problem before the Sections was to explain the presence of large groups of atolls in the deep ocean, every atoll in some of the groups, save for the land piled up by the breakers, rising just up to the level of the sea. The two fundamental difficulties which had to be met were the existence of a submarine bank and the presence of a lagoon, which sometimes attained a depth of 60 fathoms or more. Volcanoes had once been supposed to furnish by their cones the bank, and by their craters the lagoons. Possibly some individual atolls might be explained in this way, but not whole groups. Chamisso, postulating a submarine bank, accounted for the lagoon by the fact that corals grow fastest in the wash of the surf. In this way a lagoon 9 or 10 fathoms in depth might be formed, and some of the Florida reefs might be so explained. Dr. Murray accounted for submarine banks by the precipitation of organic sediment on volcanic cones, and for the lagoon by an explanation similar to Chamisso's, which he supplemented by supposing that the central part of the shoal was removed by solution. There was, however, no evidence that lagoons were deepened by solution, and much opposed to it. Deposition, and not solution, occurred in the lagoon, and so long as an atoll remained stationary the lagoon tended to become filled up.

Darwin, instead of meeting each difficulty by a separate assumption, proposed a theory which, by a single assumption, in itself very probable, accounted for all the facts. One of the gravest objections to Darwin's view had been the apparent absence of coral reefs resembling atolls in ancient systems of rocks. That had been removed by the labours of geologists, who were able to point to atoll-like limestones, from 400 to 800 fathoms in thickness, in the Tyrol, the Eastern Alps, and elsewhere. Elevation had recently affected some existing atolls, as might naturally be expected in an unstable area. That fringing reefs, barrier reefs, and atolls should occur together in a single area proved, when the facts were examined in detail, to furnish a striking confirmation of the theory, since these different kinds of reefs were not confusedly intermingled, but arranged along lines which showed a progressive change from elevation at one end to subsidence at the other. The arrangement of atolls in linear series, curving in the Pacific, and straight in the Indian Ocean, was in accordance with the outlines of the surrounding continents, and pointed to deep-seated structure in the earth's crust. Most remarkable in connection with this was the fact that individual atolls were elongated in the same direction as the group of which they formed a part. This was readily explicable on Darwin's theory, but not by the supposition that the elongation was determined by oceanic currents, since these cut the atolls in various directions, not correlated with that of their longest diameter. Further, the areas in which subsidence had occurred were in many cases just those where geologists had reason for supposing that land had existed in secondary times. Particularly was this true of the Indian Ocean, across which, as Neumayer had shown, a great tract of land had probably extended in the Jurassic period.

Dr. Hickson (Section D) said that he agreed with Prof. Sollas in thinking that the Darwinian hypothesis was both clear and beautiful, but that that was about the only point in which he

found himself in agreement with the opener of the debate. In his opinion it seemed to be quite possible that some barrier reefs and atolls had been formed during subsidence of the land but in the majority of cases there was very good evidence of recent elevation, and the Darwinian hypothesis would not hold good. Contrary to the statements that are usually made, the outer edge of the reef is seldom, if ever, precipitous, and the evidence tends to show that in most cases the reefs are growing seawards on the talus of their own *débris*. There is a great difference of opinion amongst geologists as to the origin of the Dolomites, and there is no evidence of any fossil coral reef more than a few hundred feet in thickness. In conclusion Dr. Hickson urged upon the combined Sections the importance of initiating some investigations upon the causes regulating the growth and destruction of living coral reefs.

Dr. Rothpletz (Munich) criticised the diagrams and explanation given by Prof. Sollas of the supposed coral reefs of the Dolomites. He did not consider them to be coral reefs.

Mr. Gilbert Bourne confined himself to a few criticisms of Prof. Sollas. It had been stated that reef-building corals flourished best where the breakers are heaviest on the edge of the reef. His own experience was that at these points only a few true corals grow, and that the gardens of coral described by Prof. Sollas were only to be found in quieter spots where the corals were sheltered from the force of the breakers, but bathed by a gentle and uniform current. Photographs of luxuriant coral-beds bore out this assertion. Nor did he agree with the statement that the rocks of which atolls were composed was formed by masses of coral flung over the edge of the reef by the waves. Dr. Guppy had shown that the large masses torn off at the edge of the reef tended rather to roll down the seaward face of the reef, and to form a talus slope. It had been said that soundings of lagoons invariably showed a filling-up and shallowing of the lagoon. On what evidence did this assertion rest? Probably no atoll had been so thoroughly surveyed as the one with which the speaker was personally acquainted, Diego Garcia. He had very carefully compared the soundings made by Captain Moresby in 1837 with those made by H.M.S. *Rambler* in 1885, and found that in every case the soundings were nearly identical, with the exception of a few channels in which, on the whole, the *Rambler* soundings showed greater depths. After referring to Semper's discovery, in the Pelew Islands, of atolls, barrier reefs, fringing reefs, and recent elevated reefs, all found in the same area, the speaker showed that the information just given by Prof. Rothpletz fully corroborated the assertions made over and over again by Murray and Agassiz, that the upward growth of submarine banks was largely due, not to coral growth, but to the accumulation of the calcareous skeletons of mollusca and echinoderms on those banks. Finally, he pointed out that while Prof. Sollas had revived the old theories of a Lemuria and an Atlantis, and had used the existence of the coral islands of the Indian Ocean as evidence of a previously existing continent, he had given no explanation of the fact that the tropical regions of the Atlantic Ocean, across which the old Atlantis was supposed to have stretched, are almost entirely destitute of coral formations.

Prof. Bonney replied to some of Dr. Hickson's criticisms. He cited Masamarhu as a case of a steep slope. He thought judgment on the Dolomites must be reserved. He asked, Was a growing reef ever found deeper than twenty-five fathoms? for that was a point of primary importance.

Sir H. Howorth confined himself to whether coral reefs are now in regions of upheaval or of subsidence. The Pacific islands consist of two regions, the Sandwich Islands, which are an old land surface, and the rest, which have very recently risen from the sea, and so are in an area of elevation, although atolls. This is fatal to Darwin's theory, which depends upon the correlation of reef-building and subsidence.

Mr. Stebbing pointed out that as the young coral animals might settle down on rising or sinking areas indifferently, so reefs might be begun on either, but that only those on an area of subsidence would be under favourable conditions for growth. He also stated that it could not be said that all naturalists who had recently lived on coral reefs were agreed, as Mr. Saville Kent endorsed Darwin's view.

Mr. H. O. Forbes stated that in the Keeling Islands in the Indian Ocean he had found undoubted evidence of elevation, both between two of the islets, and also in the constitution of Horsburgh Island, the largest of the group.

Prof. Sollas briefly replied, and adhered to his original contention.

Section D then took the following, chiefly zoological, papers:—(1) Report on work carried on at the Zoological Station, Naples, viz.—On the action of coloured light on assimilation, by C. C. Duncan, and on the function and correlation of the pallial organs of Opisthobranchiata, by J. D. F. Gilchrist. (2) Report on work carried on at the Biological Station, Plymouth, viz., on Turbellaria, by F. W. Gamble; on decapod larvæ, by E. J. Allen; and how fishes find food, by Gregg Wilson. (3) Report on the production of an index generum et specierum animalium. (4) On seals and whales seen during a voyage to the Antarctic, by W. S. Bruce. (5) On the penguins of the Antarctic, by C. Donald. (6) On the development of the molar teeth of the elephant, with remarks on dental series, by Prof. Cleland, who exhibited a specimen showing the sacular condition.

On Tuesday the remaining papers were taken, viz.:—(1) On cytological differences in homologous organs, by Prof. G. Gilson, dealt chiefly with differences in nephridia.. (2) The lateral canal system of fishes, by W. E. Collinge, showing the modification effected by this system in the cranial elements and nervous system, and the evidence the sensory organs afford of the development of the higher sense organs. (3) On the ovipositor of the cockroach, by Prof. Denny. This shows that the ovipositor represents the eighth and ninth sterna, while the two pairs of gonapophyses are developed in connection with these sterna. (4) On a new butterfly, by Mrs. White. (5) On certain grégarinidæ, and the possible connection of allied forms with tissue changes in man, by Dr. C. H. Cattle and Dr. J. Millar. In this important paper the authors described the changes caused in the rabbit's liver by *Coccidium oviforme*, and compared them with the changes produced in glandular organs by cancer. The authors gave reasons for believing the bodies found in cancer to be parasites allied to *Coccidium*. (6) The wings of *Archæopteryx* and of other birds, by Dr. C. H. Hurst. The author regards the two large digits of a bird's wing as IV. and V. (7) The starch of the chlorophyll granule, and the chemical processes involved in its dissolution and translocation, by Horace T. Brown, F.R.S. The author gave an account of the work done by himself and Dr. Morris on the formation of starch and its dissipation. He showed that cane sugar was the first carbohydrate recognisable in the leaf, and that the starch, both in green and colourless parts of the plant, is formed from pre-existing carbohydrates. (8) On nuclear structures in the hymenomycetes, by H. Wager. The author finds, in contradiction to Rozen's results, that during karyokinesis in hymenomycetes an achromatic spindle exists, and the process is nearly similar to what obtains in higher plants.

CONFERENCE OF DELEGATES OF CORRESPONDING SOCIETIES.

FIRST CONFERENCE, SEPTEMBER 14.

THE Corresponding Societies' Committee was represented by Dr. Garson (in the chair), Mr. Topley, Mr. Symons, and Mr. T. V. Holmes (secretary).

Dr. Garson, the chairman, gave a hearty welcome to the delegates present. These conferences were begun at Aberdeen, in 1885. At that time only twenty-four delegates were appointed, while last year there were forty-two. The number of Corresponding Societies had also increased. This was evidence that the attempt to bring to a focus, as it were, the efforts of the various Corresponding Societies had met with considerable success. But there was also evidence that the societies did not always sufficiently value their privileges. When circulars were sent from the office of the British Association, the majority of the secretaries of the Corresponding Societies did not fill up and return them until they were written to a second time. Again, out of more than sixty societies, only forty-two thought it worth while to send delegates, though it could hardly be a difficult matter to find members able and willing to serve. It was a very great advantage to the workers in the various local societies to have the titles of their papers printed and published in the Annual Reports of the British Association. Then, the Transactions of the various Corresponding Societies were bound and kept for reference in the library of the British Association at Burlington House, while papers read before other local societies

were likely to remain unknown or unconsulted. It was most desirable that the British Association should be brought into closer communication with the societies. It had been usual hitherto for representatives from the different Sections to attend the conferences and to mention anything that had been done, such as the appointment of a committee for some special purpose, in which the co-operation of the Corresponding Societies would be advantageous. It would be a good thing that there should be better means of communication between the Corresponding Societies and the secretaries of the various committees appointed by the British Association. A good example of a committee especially needing the assistance of the Corresponding Societies was that appointed by Section H to make an ethnographical survey of the United Kingdom. The first report of this committee had just been presented to the delegates, and Mr. Brabrook, the secretary, would shortly call their attention to it. At their last meeting at Edinburgh some delegates had asked whether the council of the Association might not be able to obtain greater facilities from the railway companies for members travelling to and from these meetings. The council, consequently, appointed a committee, of which Sir Frederick Bramwell was an active member, to see what could be done. The result, however, could not be deemed satisfactory.

The Chairman proposed to take the report, which had been circulated, as read, and would be glad to hear any remarks from delegates regarding the work done during the past year.

Meteorological Photography.—Mr. Symons (Section A) was much indebted to the delegates for the number of photographs of clouds sent in to him up to the present time. He did not press for more, as the committee appointed by the British Association for the Elucidation of Meteorological Phenomena by the application of photography had the very considerable collection of 1467 to deal with. They proposed to select the typical ones, reduce them to a uniform scale, and print perhaps 100 copies of them. They were hoping to publish the atlas during the year, and would then be glad if the meteorologists would take copies. They would be pleased to have additional photographs of lightning.

Mr. A. S. Reid said that the Geological Photograph Committee of the British Association were publishing their fourth report that year. During the year they had received more than 40 new photographs, making the total collection 846. They were all British. Their appeal to the Corresponding Societies had been more successful than in any previous year, but there was still much to be done, and he hoped the delegates would stir up their societies on this point. As to the best camera, the smallest was to be preferred. He had also to report that many prints had been sent in without the names of the societies sending them, that of the photographer, or that of the place photographed. They had decided not to lend any more photographs to the societies, and they would recommend the societies to send duplicate copies. Mr. Jeffs, the secretary of the Geological Photographs Committee, had unfortunately been ill during nearly the whole of the year, and this had seriously hampered their work.

Mr. P. F. Kendall remarked that not one of the Corresponding Societies had given any information to the British Association Committee appointed to record the character and position of Erratic Blocks, though appeals for help had been made. There were whole counties strewn with blocks of which not a single report had been sent.

Mr. Topley inquired whether any society had made researches like those brought before the Conference last year by Mr. Watts in the neighbourhood of Rochdale, as to the quantity of material brought down streams in flood.

Mr. Watts' work had been confined to the Rochdale district, and it was desirable that the results in other districts should be noted. Any local society wishing to do similar work should consult Mr. Watts.

Mr. Slater (Section D) said that it was an interesting fact that a member of the Yorkshire Naturalists' Union recently found the wild maidenhair fern on the northern portion of Morecambe Bay. It would not be desirable that the exact spot should be given. He would also remark that it was better to obtain seeds from these rare plants than to take the plant itself.

In Section E, Mr. M. H. Mills said that a paper on the subject of ordnance maps had been read before the Federated Institute of Mining Engineers by Sir Archibald Geikie, whose chief conclusion seemed to be that nothing could be done without increased funds.

Mr. Eli Sowerbutts said that their member, Mr. Cooke, went before the Departmental Committee, appointed to consider the state of the Ordnance Survey, in order to give evidence. He had suggested to Mr. Cooke that he should write a report on what had been done by the Departmental Committee, which might be presented at the next year's meeting of delegates. The examination on geography mentioned in the report of the Conference of Delegates at Edinburgh did not take place. They would, however, conduct some examinations next year, and he would be glad if the delegates would make their intentions widely known. It was a curious fact that there was no cheap book in existence giving a fairly good account of Yorkshire. The examinations were open to all public and private schools. There would be one on Canada for secondary schools. The latter had been found to know nothing about geography last year, and he looked for some improvement next time.

Mr. Hembry said that he had learned that in a certain county children attending schools were not taught geography in any way. He would like to know if this was the case anywhere else.

Mr. Andrews replied that geography was not a class subject, and was not compulsory. As regards the ordnance maps, the archæologists of Warwickshire, acting on the advice of Mr. Whitaker, forwarded a list of thirteen ancient works to the Ordnance Survey Office, Southampton, ten of which had since been inserted in the map.

Mr. Hembry thought that geography should certainly be a class subject. In secondary schools they absolutely ignored it; but he had been astonished to find that an immense advance had been made in the teaching of geography in primary schools. In many of the latter, museums of commercial products were now being formed.

In Section G, Prof. Merivale had nothing to report about flameless explosives.

Mr. Brabrook (Section H) made some remarks on the progress made by the committee appointed to make an ethnological survey of the United Kingdom, whose first report was in the hands of the delegates. The committee had, he said, obtained, by communication with the Corresponding Societies, a list of nearly 300 villages, with some account of their leading features and peculiarities, all of which were worthy of special examination by the committee. For this result, which was much beyond their anticipations, the Ethnographical Committee gave its most hearty thanks to the members of the corresponding societies who had helped them so efficiently. The next step taken by the committee had been to draw up a brief code of directions for the guidance of those who had been kind enough to offer assistance. This code would be found at the end of the report.

SECOND CONFERENCE, SEPTEMBER 19.

The Corresponding Societies' Committee was represented by Dr. Garson (in the chair), Mr. Galton, Mr. Symons, and Mr. T. V. Holmes (secretary).

The Chairman announced that he had received a letter from the President of the Cardiff Natural History Society, stating that Dr. Vachell was unable to attend as a delegate, and that Prof. Viriamu Jones, Principal of University College, Cardiff, had been appointed in his place. He thought it would be best to take first any discussions upon the committees appointed in the various sections.

Mr. Symons (Section A) said that the work of the Earth Tremors Committee was going on under the care of Mr. Davidson, and he did not think that there were other committees connected with Section A that bore upon the work of the delegates. With regard to the report of the Earth-Tremors Committee, he should like to hold it in suspense for a while, in the hope of co-operation with some of the corresponding societies.

In Section C, Mr. A. S. Reid said he had been asked by the Committee to make some remarks. The Underground Waters Committee would present its final report next year, and would be glad to receive further information up to the date of publication. The Geological Photographs Committee thought that the size of photographs should be left to the donors. As to the best camera, further comments from practical photographers were invited; also remarks as to the best methods

of printing. With regard to publication, negotiations respecting the proposed album of representative photographs were then in progress. The Erratic Blocks Committee had presented a report, and they were going to publish as much as they could as soon as possible, The Coast Erosion Committee had not sent in a report, though they had plenty of material in hand. The Committee on Type Specimens in Museums was making arrangements for the registration of those specimens, and information was required as to where those specimens were housed.

In Section D, Mr. T.V. Holmes (secretary) read a letter from Dr. Vachell stating that he had come to Nottingham in order to present the Report of the Birds' Eggs Protection Committee that morning, September 16, and regretted he should be unable to stay till the conference on the 19th.

Mr. Slater thought it was high time something was done to protect the eggs of wild birds. Influence might be brought to bear upon boys. He also deprecated the wanton shooting of gulls.

The Chairman stated that the committee had been re-appointed, and that the delegates would in due time receive a final communication on the question.

Mr. Holmes then read a letter from Mr. W. Cole, hon. sec. Essex Field Club, on the maintenance of local museums. Mr. Cole thought that if an annual sum for the maintenance of local museums could be obtained from the Technical Education grants in each county, there would be no great difficulty in obtaining substantial sums towards buildings and fittings. The fear that a museum might not be permanent often kept back subscriptions. Donations, both of money and of specimens, would rapidly come in when once the public felt that the museum would be permanent. And in no way could a portion of the Technical Education grant be better expended than in placing on a satisfactory footing the local museum of the county.

The Chairman hoped that members of the Corresponding Societies would occasionally read papers on the specimens in their local museums, each writer keeping to a certain department. These papers would be catalogued in the societies' list, and brought before the notice of many workers in the same subject elsewhere. They would also be available for reference at headquarters in London.

In Section H, the Chairman commended the Ethnographical Survey (the first report of which had been placed in their hands at the previous meeting) to the attention of the delegates and the societies they represented, and explained in what ways they could assist the committee. Local physical, intellectual and moral characteristics, folk-lore, manners, customs, dialect, and ancient monuments might all be noted by various observers, and the results sent to the Ethnographical Committee. Ancient human remains should be carefully preserved, together with any pottery and implements found with them. If any difficulty occurred with regard to the best mode of making any exploration, information might always be obtained at the Anthropological Institute, 3, Hanover Square, London. In some cases he had known pottery and implements had been carefully preserved, and bones thrown away or buried; in others skulls had been kept by the explorer, and the large bones thrown away. The Anthropological Institute was always ready to advise or to send some one down to examine the remains found. It was better to leave barrows, &c., as they were, unless people were prepared to examine them thoroughly and systematically.

After some remarks on a proposed excursion of the delegates, a vote of thanks to the chairman closed the proceedings.

THE GEOLOGICAL SOCIETY OF AMERICA.

THE fifth summer meeting of the Geological Society of America was held at Madison, Wisconsin, on August 15 and 16; vice-presidents J. C. Chamberlain and John J. Stevenson presiding, in the absence of the president, Sir J. W. Dawson.

The popular feature of the meeting was an illustrated lecture in the Assembly Chamber of the Capitol, by Prof. H. F. Reid, on "The Gravels of Glacier Bay, Alaska." The stereopticon views gave quite the best exhibit of this interesting glacial region that has yet been presented.

The papers presented included a description of a new species of *Dinichthys*, a new *Cladodus* from the Cleveland shale, and a remarkable fossil jaw from the Cleveland shale, by Prof. E. W. Claypole, who is carrying on the work begun by the late Prof. J. S. Newberry on Devonian fossil fishes. The remains described are those of new and remarkable species, one of them showing a degree of specialisation quite surprising for that low horizon. The author even surmised that some of the remains may be amphibian.

Prof. J. J. Stevenson, in his paper on the origin of the Pennsylvania anthracite, seemed to have actually subverted the accepted dogma, that the metamorphosis into anthracite was caused by disturbances of the strata. He showed that the difference between anthracite and bituminous beds is due to circumstances connected with deposition; the former having been laid down rapidly and in thick beds, and having been long under water; they are also earlier than the bituminous beds.

G. Frederick Wright and A. Frederick Wright, in their respective papers on extra-morainic drift in New Jersey, and on the limits of the glaciated area of New Jersey, admitted the correctness of Prof. Salisbury's first announcement that these were genuine glacial deposits, though occurring beyond the limits of the glaciated area.

Edward H. Williams, Jun., in a paper on South Mountain glaciation, described a similar formation in Pennsylvania, where he found transported Medina sandstone and glacial striation.

The programme also included papers on the study of fossil plants, by J. W. Dawson; the Manganese series of the North-Western States, by C. W. Hall and F. W. Lardeson; on the succession in the Marquette Iron district of Michigan, by C. R. Van Hise; terrestrial subsidence south-east of the American Continent, by J. W. Spencer; evidences of the derivation of the kames, eskers, and moraines of the North American ice-sheet, chiefly from its englacial drift, and the succession of pleistocene formations in the Mississippi and Nielson River basins, by Warren Upham; the cenozoic history of Eastern Virginia and Maryland, by N. H. Darton; the Arkansas coal measures in their relation to the Pacific carboniferous province, by James P. Smith; glaciation of the White Mountains, N.H., by C. H. Hitchcock; dislocation in the strata of the lead and zinc region of Wisconsin, and their relation to the mineral deposits, with some observations upon the origin of the ores, by W. P. Blake; geology of the sand hill region in the Carolinas, by J. H. Holmes; notes of geological exhibits at the World's Fair, by G. N. Williams.

BLEEDING BREAD.

THE phenomenon known in Germany as "Blut im Brode," and to us as bleeding bread, has appeared in this country, to no little dismay of the peaceful inhabitants. The subjects of this visitation are not only bread and biscuit, but also boiled potatoes, rice, and other farinaceous substances, on which red stains appear, which resemble blotches of blood. In former times, before their nature was known, these blood stains created much consternation amongst the superstitious as portents of calamity. The first modern naturalist who described it in scientific terms was Dr. Sette, of Venice, who recorded its appearance in Padua, in 1819, and gave it the name of *Zoogalactina imetropha*. In this instance it is stated that "a peasant of Liguara, near Padua, was terrified by the sight of blood stains scattered over some polenta, which had been made and shut up in a cupboard on the previous evening. Next day similar patches appeared on the bread, meat, and other articles of food in the same cupboard. It was naturally regarded as a miracle and warning from heaven, until the case had been submitted to a Paduan naturalist, who easily recognised the presence of a microscopic plant."[1] Subsequently Ehrenberg saw the same production near Berlin, in 1848, and, as usual with him under like circumstances, referred it to the animal kingdom, under the name of *Monas prodigiosa*; but during the same year it occurred in the experience of Dr. Camille Montagne, who saw it on cooked fowls and cauliflower, at Rouen, and it was regarded as an Algoid, under the name of *Palmella prodigiosa*. The first definite record of its occurrence in Britain appears to have been in 1853, when H. O. Stephens communicated an account of it to the Bristol Microscopical Society, and submitted specimens to the late Rev. M. J. Berkeley, who declared it to be identical with the organisms described by Ehrenberg and Montagne, but which he regarded as a fungus.

The record of its appearance at Bristol is to the following

[1] Trouessart, "Microbes, &c." London, 1889, p. 126.

effect[1]:—"I observed at table the under surface of a half round of boiled salt beef, cooked the day before, to be specked with several bright carmine-coloured spots, as if the dish in which the meat was placed had contained minute portions of red currant jelly. Suspecting what these might turn out to be, I directed the beef to be placed aside. On examination the next day the spots had spread into patches of a vivid carmine-red stratum of two or more inches in length. With a simple lens the plant appears to consist of a gelatinous substratum of a paler red, bearing an upper layer of a vivid red hue, having an uneven or papillated surface. The microscope shows this stratum to consist of generally globose cells, immersed in, or connected by, mucilaginous or gelatinous matter. The cells vary in size, and contain red endochrome; they seem to consist of a single cell-membrane, and contain a nucleus. Treated with sulpho-iodine they become blue."

As to its place in the organic kingdom, Mr. Stephens was of opinion that it was a *Palmella* closely allied to *Palmella cruenta*, but distinct, the cells or granules of the latter differing from it, not only in their colour but size, being very much smaller than those of *P. prodigiosa*. As to its propagation, he further remarks that it seems to extend itself by elastically spurting a sort of jet or column of red particles, which Berkeley compared to a jet of blood from an artery, and by this method it was suggested that the extraordinary rapidity with which a large surface becomes covered can be explained. The vitality of the cells is not impaired (within a certain time) by desiccation, even at a high temperature, and when dry they retain their germinating powers for a considerable period.

The spherical cells are filled with a reddish oil, which gives to them a peach-blossom tint, and when transferred to raw meat they assume a splendid fuchsia-colour, resembling spots of blood. The plant is only developed in the dark, and the nitrogen necessary for its nutriment must be derived from the air, especially when developed upon bread. About 1886 an epidemic appearance on the Continent was attributed to this source. Pieces of cooked meat presented a singular carmine-red colouration, and stained vividly the fingers or linen with which they came in contact. These phenomena prevailed regularly for a period of three months. Food cooked over-night was found the next morning covered with red patches, and it then underwent rapid alteration. Coincident with a sudden and considerable fall in the temperature the epidemic ceased, and did not reappear.[2]

Fresenius records the result of his examination of this organism, in his "Beitrage," to the effect that "he took four boiled potatoes, and placed them in a drawer, having previously rubbed two of them slightly here and there with the red substance. After about twenty-four hours, the two potatoes which had not been rubbed, and which had not been in immediate contact with the other two, were affected with fresh spots of the red substance, whilst the spots upon the two which had been rubbed had increased in extent. The spots showed themselves in the form of irregular groups of blood-red drops of different size, which in some places were distinct, and in others had run into one another. The individual bodies of which the spots consist are mere molecules, their diameter varying from one two-thousandth to one four-thousandth of a line. They are mostly round, occasionally oval, and sometimes slightly constructed in the middle, by way of preparation for increase by division into two small round cells. By far the greater number of them, when brought under the microscope in a drop of water, remain at rest—they lie close together in large numbers; when they are more dispersed in the fluid they have a motion which is not distinguishable from ordinary molecular motion. When the drop of water moves they are carried mechanically over the stage like other molecules, and when this motion ceases they remain at one spot in a sort of quivering state until a fresh current carries them in another direction. If the eye be kept carefully upon a part of the stage where the small bodies are thinly dispersed, it will be observed that they passively follow the current of the water, nor, when the current has become sluggish, or has even altogether ceased, are individual bodies ever seen to detach themselves from the group, and take a contrary direction, which real monads would do with great activity."

The present determination of this organism, according to some, is *Micrococcus prodigiosus*, but according to others it is *Bacillus prodigiosus*, and consequently one of the *Schizomycetes*. It has been pointed out that as the temperature rises this *Bacillus* loses its power of forming a pigment, and if it is grown on potato or bread-paste, in an incubator at blood heat, instead of at the temperature of the room, the colour is gradually lost, and the culture no longer smells of herring brine, but the power of forming lactic acid from milk-sugar, with the accompanying precipitation of the casein, is frequently considerably increased; so that it would appear that the energy required for the building-up of the pigment substance was, in this case, diverted into another channel, and lactic acid, and perhaps other substances, are produced in place of the usual pigment.[1]

The reappearance of this organism in this country, during the late hot weather, and especially on cooked potatoes, gives interest to its history, and is sufficient apology for these observations.

M. C. COOKE.

[1] H. O. Stephens, on *Palmella prodigiosa* in *Annals of Nat. Hist.* vol. xii. December, 1853.

[2] *Pharmaceutical Journal*, January 29, 1887, p. 610.

FORTHCOMING SCIENTIFIC BOOKS.

THE autumn publishing season has opened with announcements of forthcoming books to suit all requirements. From this year's list we see that many works of high scientific importance are in the press, but the chief feature is the large number of text-books announced. The work of the Technical Instruction Committees of our County Councils has naturally resulted in the preparation of books on various arts and handicrafts, and since the authors of these books are usually well versed in the technicalities of their subjects, it may be presumed that the 'prentice hand will derive benefit from their literary efforts.

The following books are announced by Messrs. MACMILLAN AND CO:—The Collected Works of Thomas Henry Huxley, F.R.S., in monthly volumes, from October 1. Vol. i. "Methods and Results" (just published); vol. ii. "Darwiniana"; Vol. iii. "Science and Education"; vol. iv. "Science and Hebrew Tradition"; vol. v. "Science and Christian Tradition"; Vol. vi. "Hume." "Systematic Survey of the Organic Matters," by Drs. G. Schultz and P. Julius, translated and edited, with extensive additions, by Arthur G. Green, Examiner in Coal Tar Products to the City and Guilds of London Institute. "Text-Book of the Diseases of Trees," by Prof. R. Hartig, translated by Dr. R. Somerville, Lecturer on Agriculture at Durham College of Science, with a preface by Prof. H. Marshall Ward, F.R.S., with numerous illustrations. "Methods of Histological Research," for the use of students and physicians, by Dr. C. V. Kahlden, Lecturer in the University of Freiburg, translated by H. Morley Fletcher. "Materials for the Study of Variation in Animals." Part i. "Discontinuous Variation," by William Bateson, Balfour Student and Fellow of St. John's College, Cambridge, illustrated. "Handbook of British Marine Fauna," vol. i. Tunicata, Polyzoa, and Echinodermata, by Prof. W. A. Herdman, F.R.S., with numerous illustrations. "The Romance of the Insect World," by Miss L. N. Badenoch, with illustrations. "A Text-Book of Pathology," systematic and practical, by Prof. D. J. Hamilton, vol. ii. "Handbook of Public Health and Demography," by Edward F. Willoughby, Diploma in State Medicine of the London University, and in Public Health of Cambridge University. "The Practitioner," an index to vols. 1–50 of the *Practitioner*, a journal of therapeutics and public health. The three following volumes have been designed to suit the requirements of the examinations of the Department of Science and Art:—"Organic Chemistry for Beginners," by Dr. G. S. Turpin; "Physiography for Beginners," by J. E. Marr, F.R.S., and Alfred Harker, M.A.; "Physiology for Beginners," by Prof. Michael Foster, F.R.S., and Dr. L. E. Shore. "Geometrical Conic Sections," by Charles Smith. "Geometrical Conic Sections," by Asutosh Mukhopadhyay, Fellow of the University of Calcutta. "Geometrical Conics," Part ii., the Central Conic, by John J. Milne and R. F. Davies. "Elementary Trigonometry," by H. S. Hall, Master of the Army Class, Clifton College, and S. R. Knight. "Sketches in Sport and Natural History," by the late Dr. George Kingsley; "The Beauties of Nature," by the Right Hon. Sir John Lubbock, Bart., F.R.S., new edition without illustrations; "The Theory of Heat," by Thomas Preston, with illustrations; "Researches on the Propagation of Electrical Force," by Prof. Heinrich Hertz, of Bonn, authorised translation by Prof. D. E. Jones, with preface by Lord Kelvin, P.R.S.,

[1] Dr. G. S. Woodhead, "Bacteria and their Products" (1891), p. 9.

illustrated; "A Text-book on Electro-Magnetism and the Construction of Dynamos," by Dugald C. Jackson, Professor of Electrical Engineering, University of Wisconsin; "The Mechanics of Hoisting Machinery, including Accumulators, Excavators, and Pile Drivers," by Dr. Julius Weisbach and Prof. Gustav Hermann, with 177 illustrations, authorised translation from the second German edition, by Karl P. Dahlstrom, Instructor in Mechanical Engineering at the Lehigh University; "Hydrostatics," by A. G. Greenhill, F.R.S., Professor of Mathematics to the Senior Class of Artillery Officers, Woolwich; "Essays in Historical Chemistry," by Prof. T. E. Thorpe, F.R.S.; "The Rise and Development of Organic Chemistry," by the late C. Schorlemmer, F.R.S., translated and edited by Prof. Smithells, Yorkshire College, Leeds; "Popular Lectures and Addresses," Vol. ii., contributions to Geology, by Lord Kelvin, P.R.S.; "The Life of Sir A. C. Ramsay," by Sir Archibald Geikie, F.R.S.; "A Text-book of the Physiological Chemistry of the Animal Body, including an Account of the Chemical Changes occurring in Disease," by Dr. Arthur Gamgee, F.R.S., Brackenbury Professor of Physiology in the Owens College, with illustrations, Vol. ii.; "Boot and Shoe Manufacture," by C. W. B. Burdett, Head Master City and Guilds of London Leather Trade Schools, with numerous illustrations; "Lead Work," by W. R. Lethaby, with illustrations; "Gold-Milling," with illustrations, by H. Louis; "Elementary Course of Practical Science," by Hugh Gordon.

The CAMBRIDGE UNIVERSITY PRESS announce:—"The Scientific Papers of John Couch Adams," Vol. i., edited by Dr. William Grylls Adams, F.R.S., &c., Professor of Natural Philosophy in King's College, London, late Fellow of St. John's College, Cambridge, with a memoir by Dr. J. W. L. Glaisher, F.R.S., &c., Fellow of Trinity College, Cambridge; "A Treatise on Spherical Astronomy," by Sir Robert S. Ball, F.R.S., Lowndean Professor of Astronomy and Geometry; "A Treatise on the Theory of Functions of a Complex Variable," by Dr. A. R. Forsyth, F.R.S., Fellow of Trinity College, Cambridge; "Plane Trigonometry," by S. L. Loney, Part i., up to and including the Solution of Triangles, is published separately; "Solutions of the Examples in a Treatise on the Elements of Statics and Dynamics," by S. L. Loney, late Fellow of Sidney Sussex College, Cambridge: "Elementary Hydrostatics," by John Greaves, Fellow and Lecturer of Christ's College; "The Steam Engine and other Heat Engines," by J. A. Ewing, F.R.S., Professor of Mechanism and Applied Mechanics in the University of Cambridge; "Elementary Palæontology for Geological Students," by Henry Woods; "Practical Physiology of Plants," by F. Darwin and E. H. Acton. Pitt Press Mathematical Series:—"Euclid's Elements of Geometry," Books v. and vi., by H. M. Taylor, Fellow and formerly Tutor of Trinity College, Cambridge; "Solutions to the Exercises in Euclid," Books i.-iv. (Pitt Press Mathematical Series, by H. M. Taylor), by W. W. Taylor. The Cambridge University Press are also about to publish a series of Natural Science Manuals, which will cover a wide field, some of the books being adapted for beginners, whilst others will deal with special topics, and will be useful only to more advanced students. The series will be divided into two sections, a Biological and a Physical. The former will be published under the general editorship of Mr. Arthur E. Shipley, Fellow and Tutor of Christ's College, Cambridge; it will include "A Manual of Invertebrate Palæontology," by Mr. H. Woods, Demonstrator of Palæobotany at Cambridge, which is now ready; "A Text-book on the Practical Physiology of Plants," by Mr. Francis Darwin, of Christ's College, and Mr. E. Hamilton Acton, of St. John's College, which is in the press; "Works on Physical Anthropology," by Prof. Alexander Macalister; "On the Vertebrate Skeleton," by Mr. S. H. Reynolds, of Trinity College; "On Fossil Plants," by Mr. A. C. Seward, Lecturer in Botany in the University, and "An Introduction to the Study of Botany," by Mr. Francis Darwin, which are in preparation. Other volumes will shortly be announced. The volumes of the Physical Series already arranged for include three by Mr. R. T. Glazebrook, F.R.S., Assistant-Director of the Cavendish Laboratory, on "Light and Heat," "Electricity and Magnetism," and "Mechanics and Hydrostatics"; these will be elementary text-books, based on the Practical Courses of Physics for Medical Students at the Cavendish Laboratory. The volume on "Light and Heat" is in the press, and the other volumes are in preparation.

Messrs. CHARLES GRIFFIN AND CO.'S announcements include:—"A Text-book of Ore and Stone Mining for the Use of Mine-owners, Mine-managers, Prospectors, and all interested in Ore and Stone Mining," by Dr. Clement Le Neve Foster, F.R.S., Professor of Mining, Royal College of Science, H.M. Inspector of Mines; a new Metallurgical series, edited by W. C. Roberts-Austen, C.B., F.R.S., Chemist and Assayer of the Royal Mint, Professor of Metallurgy in the Royal College of Science. (1) "Introduction to the Study of Metallurgy," by the Editor; third edition. (2) "Gold (The Metallurgy of)," by Thos. Kirke Rose; (3) "Copper (The Metallurgy of)," by Thos. Gibb; (4) "Iron and Steel (The Metallurgy of)," by Thos. Turner; (5) "Metallurgical Machinery: the Application of Engineering to Metallurgical Problems," by Henry Charles Jenkins; (6) "Alloys," by the Editor. Technological Manuals: "Oils, Fats, Waxes, and Allied Materials, and the Manufacture therefrom of Candles, Soaps, and other Products," by Dr. C. R. Alder Wright, F.R.S.; "Agricultural Chemistry and Analysis: A Practical Handbook for the Use of Agricultural Students," by Dr. J. M. H. Munro, Professor of Chemistry, Downton College of Agriculture; "Dairy Chemistry: A Practical Handbook for Dairy Managers," by H. Droop Richmond; "Cements: A Practical Handbook on their Manufacture, Properties, Testing," &c., by Gilbert R. Redgrave; "Petroleum: A Treatise on the Geographical Distribution, Geological Occurrence, Chemistry, Production, and Refining of Petroleum; its Testing, Transport, and Storage; and the Legislative Enactments relating thereto; together with a Description of the Shale Oil Industry," by Boverton Redwood, assisted by Geo. T. Holloway. With maps and illustrations. The special features of Mr. Redwood's work will be (1) the hitherto unpublished descriptions of undeveloped sources of petroleum in various parts of the world; and (2) that the testing, transport, and storage from the point of view of legislation, and the precautions which experience in this and other countries has shown to be necessary in the interests of public safety. "A Text-book of Physics: including Properties of Matter, Heat, Sound and Light, Magnetism and Electricity," by Dr. J. H. Poynting, F.R.S., late Fell. of Trinity Coll., Cambridge; Prof. of Physics in the Mason Coll., Birmingham, and J. J. Thomson, F.R.S., Fell. of Trinity Coll., Cambridge; Prof. of Exper. Physics in the Univer. of Camb.; "The Mean Density of the Earth: An Essay to which the Adams Prize was adjudged in 1893 in the University of Cambridge," by Dr. J. H. Poynting, F.R.S., in large 8vo, with bibliography, illustrations in the text, and lithographed plates; "Marine Engineering Rules and Tables (A Pocket-book of): for the use of Marine Engineers, Naval Architects, Designers, Draughtsmen, Superintendents, and all engaged in the design and construction of Marine Machinery, Naval and Mercantile," by A. E. Seaton and H. M. Rounthwaite, with illustrations; "Gas, Oil, and Air Engines: A Practical Text-book on Internal Combustion Motors without Boiler," by Bryan Donkin, with illustrations; "Sewage Disposal Works," by W. Santo Crimp. Second edition, with additional plates; "Engineering Drawing and Design: A Practical Manual for Engineering Students," by Sidney H. Wells, Principal, Battersea Polytechnic Institute, late of Dulwich College. Part I.—Geometry: Practical, Plane, and Solid. Part II.—Machine and Engine Drawing and Design. Complete in one vol., with numerous illustrations and folding-plate; "Applied Mechanics (An Advanced Text-book of)," by Prof. Jamieson, Glasgow and West of Scotland Technical College, with very numerous illustrations.

Messrs. SWAN, SONNENSCHEIN AND CO.'S forthcoming works are chiefly text-books. We note:—"A Student's Text-book on Botany," by Dr. Sidney H. Vines, Professor of Botany in the University of Oxford, editor of "Prantl's Botany," copiously illustrated; "Text-book of Embryology, Invertebrates," by Drs. Korschelt and Heider, of the University of Berlin, translated and edited by Dr. E. L. Mark, Professor of Anatomy in Harvard University, and Dr. W. M. Woodworth, Instructor in Microscopical Anatomy in Harvard University, Part I., illustrated; "The Cell, its Anatomy and Physiology," by Dr. Oscar Hertwig, of the University of Berlin, translated and edited by Dr. H. J. Campbell, illustrated; "Text-book of Palæontology for Zoological Students," by Theodore T. Groom, illustrated; "Lectures on Human and Animal Psychology," by Wilhelm Wundt, Professor of Philosophy in the University of Leipzig, translated and edited by James Edward Creighton, Instructor in Philosophy to the Cornell University, Ithaca,

New York, and Edward Bradford Titchener, of the Cornell University; "Handbook of Systematic Botany," by Dr. E. Warming, Professor of Botany in the University of Stockholm, translated and edited by M. C. Potter, M.A., Lecturer on Biology and Botany in the Durham College of Science, illustrated; "Town Flowers," by J. W. N., with a preface by Canon Benham and Prebendary Webb-Peploe; "Zoology," by B. Lindsay, illustrated; "Fishes," by the Rev. H. A. Macpherson; "Flowering Plants," by James Britten, editor of the *Journal of Botany*; "Grasses," by W. Hutchinson; "Mammalia," by the Rev. H. A. Macpherson; "The Natural History and Antiquities of Selborne," by Gilbert White, Bennett's edition, with notes by J. E. Harting, illustrations by Bewick, Harvey, &c., new edition.

Messrs. CROSBY LOCKWOOD AND SONS have in preparation and in the press.—"Machinery for Metalliferous Mines: a Practical Treatise for Mining Engineers, Metallurgists, and Managers of Mines," by E. Henry Davies (illustrated); "The Practical Engineer's Year-book for 1894, comprising Modern Engineering Formulæ, Rules, Tables, and Memoranda, in Civil, Mechanical, Electrical, Marine, and Mine Engineering," by H. R. Kempe; "Practical Building Construction: a Handbook for Students Preparing for the Examinations of the Science and Art Department, the Royal Institute of British Architects, the Surveyors' Institution, &c., designed also as a Book of Reference for Persons engaged in Building" (1000 illustrations), by John Parnell Allen; "Concrete: Its Nature and Uses: a Book for Architects, Builders, and Clerks of Works" (with numerous illustrations), by George L. Sutcliffe; "Tramways: Their Construction and Working, embracing a Comprehensive History of the System; with an exhaustive Analysis of the various Modes of Traction, a description of Rolling Stock, and details of Cost and Working Expenses" (with plates and other illustrations), by D. K. Clark. new edition, in one volume, rewritten and revised; New Volumes of Hasluck's Series of "Handybooks for Handicrafts," viz.: "The Woodworker's Handybook: a Practical Manual on the Tools, Materials, Appliances and Processes employed in Woodworking" (with 100 illustrations); "The Metalworker's Handybook: a Practical Manual for use in Technical Classes and Workshops" (with 100 illustrations); "Wall Paper Decoration" (with numerous illustrations), by A. S. Jennings; "An Astronomical Glossary; or Dictionary of Terms used in Astronomy, with Tables of Data and Lists of Remarkable and Interesting Celestial Objects," by J. Ellard Gore.

Messrs. CASSELL AND CO. promise the following books:—"The Story of the Sun," by Sir Robert S. Ball, F.R.S., Lowndean Professor of Astronomy in the University of Cambridge, about 380 pages, with 8 coloured plates and other illustrations; "The Story of our Planet," by T. G. Bonney, F.R.S., Professor of Geology in University College, London, Fellow of St. John's College, Cambridge, with 6 coloured plates and maps and about 100 illustrations; "The Dawn of Astronomy, a Study of the Astronomy and Temple Worship of the Ancient Egyptians," by J. Norman Lockyer, F.R.S.; "Our Railways, their Development, Enterprise, Incident, and Romance," by John Pendleton, illustrated; "Electricity in the Service of Man, a Popular and Practical Treatise on the Applications of Electricity in Modern Life," with nearly 850 illustrations, new edition, revised by Dr. R. Mullineux Walmsley; "Cassell's New Technical Educator," an entirely new Cyclopædia of Technical Education," with coloured plates and engravings, Vol. ii.; "The Book of the Horse," by S. Sidney, thoroughly revised and brought up to date by James Sinclair and W. C. A. Blew, with 17 full-page collotype plates of celebrated horses of the day, specially produced for this edition, and numerous other illustrations.

The following are included in Messrs. GEORGE PHILIP AND SON'S list of forthcoming publications:—"The Mineral Resources of Western Australia, with full descriptions of the Goldfields," by Alfred F. Calvert; "Philips' Anatomical Model," a Pictorial Representation of the Human Frame and its Organs by means of superimposed Plates printed in colours, with descriptive text by Dr. Schmidt, English edition by William S. Furneaux; "Philips' Geological Map of the Environs of London, extending about twenty miles round Charing Cross, showing the Nature of the Soil and the Elevation of the Land," by George Philip (scale, one inch to a mile); "Lessons on Woodwork for Evening Classes, comprising Exercises in the Principles of Joinery, and Studies and Designs for Wood-Carving," with numerous illustrations and explanatory letter-press; published under the direction of the Technical Education of the Hants County Council.

In addition to a number of books of travel, Messrs. SAMPSON LOW, MARSTON AND CO.'s publications will be:—"A History of Scandinavian Fishes," described by B. Fries, C. Y. Ekström, and C. Sundevall, with coloured plates painted from living specimens, and engraved on stone by Wilhelm von Wright, besides numerous text illustrations, second edition, thoroughly revised and completed by Prof. F. A. Smitt; "A School Course in Heat," revised and enlarged, by W. Larden, Assistant Master in the R.N.E. College, Devonport, late Science Scholar, Merton College, Oxford, numerous illustrations, fifth edition; "Chemistry for Beginners," adapted for Elementary Stage of the Science and Art Department's Examinations in Organic Chemistry, by R. L. Taylor, fifth edition, thoroughly revised and partly rewritten.

Messrs. CHAPMAN AND HALL have in hand:—"About Orchids: a Chat," by Frederick Boyle, with numerous illustrations; a book by Mr. Charles Dixon, entitled "Jottings about Birds"; "Woodworking Positions," by W. Nelson, with twelve illustrations by Herbert Cole; "A Text-book of Mechanical Engineering," by Wilfrid J. Lineham, Head of the Engineering Department at the Goldsmiths' Company's Institute, New Cross, late Professor of Engineering at the School of Science and Art and Technical College, Newcastle-on-Tyne; "Illustrations of the Principal Natural Orders of the Vegetable Kingdom," prepared for the Science and Art Department, by Dr. D. Oliver, F.R.S., with 109 plates by W. H. Fitch; "Food, some Account of its Sources, Constituents, and Uses," by A. H. Church, F.R.S., Professor of Chemistry in the Royal Academy of Arts in London, new edition, revised.

The following works will be published by Mr. YOUNG J. PENTLAND:—"Atlas of Diseases of the Skin, in a Series of Coloured Illustrations from Original Drawings, with Descriptive Letterpress," by Dr. H. Radcliffe Crocker; "Manual of Practical Anatomy," by Dr. D. J. Cunningham, Professor of Anatomy and Surgery, Trinity College, Dublin; "Hygiene and Diseases of Warm Climates, in a Series of Articles by Eminent Authorities," edited by Dr. Andrew Davidson, author of "Geographical Pathology," illustrated; "Beri-Beri, Researches concerning its Nature and Cause, and the Means of its Arrest," by C. A. Pekelharing, Professor in the Faculty of Medicine, University of Utrecht, and C. Winkler, Lecturer in the University of Utrecht, translated by James Cantlie; "Atlas of Ophthalmoscopy, a Series of Coloured Plates from Original Drawings, with Text," by W. Adams Frost.

Mr. W. B. CLIVE (University Correspondence Press) will publish:—"Elementary Qualitative Analysis," by William Briggs and Dr. R. W. Stewart; "An Elementary Text-book of Geometrical Conics," by G. H. Bryan; "Geometrical Deductions," by T. W. Edmondson; "Geometry of the Simpler Figures and the Plane, Euclid VI. and XI.," by C. W. C. Barlow; "An Elementary Text-book of Hydrostatics," by William Briggs and G. H. Bryan; "Examples in Magnetism and Electricity," by C. H. Dibb; "An Elementary Text-book of Mechanics," by William Briggs and G. H. Bryan; "The Elements of Trigonometry," by William Briggs and G. H. Bryan; "Co-ordinate Geometry, Part II.," by G. H. Bryan.

In Mr. MURRAY'S list of forthcoming books we find:—"The Life of Prof. Owen, based on his Correspondence, his Diaries, and those of his Wife," by his grandson, the Rev. Richard Owen, with portraits and illustrations. 2 vols. "A Manual of Naval Architecture, for the Use of Officers of the Navy and Mercantile Marine, Ship-owners, Ship-builders, and Yachtsmen," by W. H. White, C.B., F.R.S., Assistant-Controller and Director of Naval Construction, Royal Navy. Third edition thoroughly revised and in great part rewritten, with 150 illustrations.

The announcements of the CLARENDON PRESS include "Mathematical Papers of the late Henry F. S. Smith," Savilian Professor of Geometry in the University of Oxford, with portrait and memoir, 2 vols.; "A Manual of Crystallography," by M. H. N. Story-Maskelyne, F.R.S.; "Observations on some Points connected with Hospital Construction," by Sir Douglas Galton, K.C.B. F.R.S.; "A Monograph on the Oligochæta," by Frank E. Beddard, F.R.S.; "Adler's Alternating Generations,

a Biological Study of Oakgalls and Gallflies," authorised translation, by C. R. Straton.

Messrs. LONGMANS, GREEN AND CO. have in preparation:—"Agricultural Analysis, a Manual of Quantitative Analysis for Students of Agriculture," by Frank T. Addyman; "The Outdoor World, or the Young Collector's Handbook," by W. Furneaux, with 546 illustrations, including 16 coloured plates; "Eskimo Life," by Fridtjof Nansen, author of "The First Crossing of Greenland," translated by William Archer, with illustrations.

Camille Flammarion's "Popular Astronomy" is being translated by Mr. J. Ellard Gore, and will be published by Messrs. CHATTO AND WINDUS. This firm will also publish "The Sagacity and Morality of Plants: a Sketch of the Life and Conduct of the Vegetable Kingdom," with coloured frontispiece and 100 illustrations; "Our Common British Fossils, and Where to Find Them, a Handbook for Students," with 331 illustrations; "The Playtime Naturalist," with 366 illustrations.

The volumes on scientific subjects announced by Messrs. RIVINGTON, PERCIVAL AND CO. are:—"The School Euclid," by Mr. Daniel Brent; "The Beginner's Text-Books of Science": "Chemistry," and "Heat," by Mr. G. Stallard; "Geology" and "Physical Geography," by Mr. C. L. Barnes; "Electricity and Magnetism" and "Mechanics (Treated Experimentally)," by Mr. L. Cumming; "Light," by Mr. H. P. Highton; "Practical Physics," in three parts, by Prof. W. F. Barrett; "Practical Lessons and Exercises in Heat," by Mr. A. D. Hall.

In the list of books about to be published by Messrs. W. H. ALLEN AND CO. we find:—"The Naturalist's Library," each section rewritten by well-known naturalists, edited by Dr. R. Bowdler Sharpe, in 20 vols.; "Handbook of British Hepaticæ, containing Descriptions and Figures of the Indigenous Species of Marchantia, Jungermannia, Riccia, and Anthoceros," by Dr. M. C. Cooke, author of "A Manual of Structural Botany," &c.; "The Flowering Plants of Western India," by the Rev. Alexander Kyd Nairne.

Messrs. KEGAN PAUL AND CO. announce a new volume of "Modern Science Series": "The Fauna of the Deep Sea," by Sydney J. Hickson, Downing College, Cambridge (with illustrations); also a new volume of the "International Scientific Series": "The Dispersal of Shells: an Inquiry into the Means of Dispersal possessed by Fresh-water and Land Mollusca," by H. Wallis Kew, with a Preface by Dr. Alfred Russel Wallace, F.R.S., &c. (with illustrations).

Messrs. GEORGE BELL AND SONS propose to issue Vol. iii. of the "British Fungus-Flora, a Classified Text-book of Mycology," by George Massee, author of "The Plant World," with numerous illustrations; "The Elements of Applied Mathematics, including Kinetics, Statics, and Hydrostatics," by C. M. Jessop: "Elementary Analytical Geometry," by the Rev. T. G. Vyvyan.

Messrs. FREDERICK WARNE AND CO. announce:—"The Royal Natural History," edited by Richard Lydekker, with preface by P. L. Sclater, illustrated with seventy-two coloured plates, and upwards of sixteen hundred wood engravings, by W. Kuhnert, J. Wolf, T. Specht, Gambier Bolton, P. J. Smit, &c., to be issued in monthly parts, beginning this month.

Messrs. METHUEN AND CO. will add to their University Extension Series a popular introduction to modern physical astronomy, entitled "The Vault of Heaven," by R. A. Gregory; and "Meteorology; the Elements of Weather and Climate," by Mr. H. N. Dickson.

From Messrs. A. AND C. BLACK will come "Investigations in Microscopic Foams and on Protoplasm," by Prof. O. Bütschli, translated from the German by E. A. Minchin, illustrated; and the remaining two parts of Prof. Newton's "Dictionary of Birds."

The following are among the educational announcements of Messrs. BLACKIE AND SON:—"Text-book of Heat," by Dr. C. H. Draper; "Students' Introductory Handbook of Systematic Botany," by J. W. Oliver; "Elementary Hydrostatics and Pneumatics," by R. Pinkerton.

Messrs. W. AND R. CHAMBERS will add to their list:—"Electricity and Magnetism," by Prof. Cargill G. Knott; "Organic Chemistry," by Prof. Perkin; "Elementary Science," by S. R. Todd; "Navigation," by J. Don.

Among Messrs. WILLIAMS AND NORGATE'S forthcoming books is "A Pocket Flora of the Edinburgh District," by C. O. Sonntag, of the Edinburgh High School, with an Analytical Key to Orders and Genera.

Messrs. J. HUGHES AND CO. announce "Honours Physiography," by R. A. Gregory and H. G. Wells, and a second edition of Prof. Walker Overend's "Elements of Physiology."

The RELIGIOUS TRACT SOCIETY announce "The Romance of Electricity," by John Munro, with illustrations.

TRILOBITES WITH ANTENNÆ AT LAST!

MR. W. D. MATTHEW[1] is to be warmly congratulated on being the first to describe Trilobites with visible antennæ. His detailed and illustrated description of a rich find (some sixty specimens) of *Triarthrus Beckii* with antennæ, made by Mr. Valiant in the Hudson River shales near Rome, N.Y., must naturally cause excitement among biologists all over the world.

The complete absence of all traces of visible antennæ, and, further, the failure of Walcott, after the most patient research by means of sections, to discover any antennal system at all, have resulted in the Trilobites remaining without abiding home in the zoological system. They have been Isopods, Phyllopods, and even Arachnida. And now, at last, Trilobites have been found with very pronounced antennæ! The first question we naturally ask is, what light do these antennæ throw upon the affinities of this mysterious group?

According to the description, these organs are long, many-jointed, typical crustacean antennæ. "They come out close together from just under the centre of the anterior border of the head shield." . . . . "Their point of origin seems to be under the front part of the glabella, as they can be traced a little way under the head shield, where they almost coalesce, then turn upwards and outwards and disappear." . . . . "Just over the spot where they come out, the anterior margin of the head shield is arched slightly upwards, seemingly to give room for them to play to and fro."

From these details we deduce the following:—

(1) All Trilobites had antennæ, which except, as far as we know, in the case of *Triarthrus Beckii* alone remained shut in under the head shield.

(2) These ventrally placed antennæ were inserted, approximately, one on each side of the labrum.

It seems to me that these natural conclusions from the facts go far to establish the relationship between the Trilobites and the Apodidæ originally maintained by Burmeister, and recently elaborated by the present writer ("The Apodidæ," "Nature Series," 1892). But however weighty the arguments (amounting, it seemed to me, to a proof) in favour of this relationship, the inability actually to demonstrate the existence of the antennæ was a felt weakness. That weakness has now been finally removed, and my arguments have been fully confirmed, by the finding that the Trilobites had antennæ in practically the same position as the anterior pair in the Apodidæ.

The Trilobites may therefore take a firm place at the root of the Crustacean system, with the existing Apus as their nearest ally.

The modern Crustacea, with their two pairs of antennæ arranged in a group with the eyes at the most anterior end of the body, have then to be deduced from primitive forms in which the antennæ were placed ventrally at the sides of the labrum, and were shut in under a large head shield. *Triarthrus Beckii* shows us one attempt to bring the antennæ forward. A pair of antennæ (presumably the anterior pair) lengthened considerably, and, without apparently changing their places of insertion, projected from under the head shield through a median groove. In spite of this actual discovery, I still think that the method of attaining the same end proposed by me (*loc. cit.*) was the method finally adopted. I suggested two grooves, one on each side of the median line, along which the antennæ moved bodily to the front. This would allow both pairs to act as anterior feelers, whereas the method adopted by Triarthrus would apparently only allow one pair to do so. Further, the piece between the grooves would account for the rostrum, which we know was very early developed. The antennæ in the early Phyllopod *Ceratiocaris papilio* were not long and filiform as in the Trilobite Triarthrus, but look exactly like a pair of Apus antennæ moved bodily to the front.

Whether the remarkable resemblance of the Isopods to the

[1] "On the Antennæ and other Appendages of *Triarthrus Beckii*." (*American Journal of Science*, August, 1893.)

Trilobites is due to direct descent, or is a case of convergence, cannot here be discussed.

We shall wait with impatience for further details of these important discoveries, inasmuch as there seems great promise that the soft black shale to which we owe the fine preservation of the antennæ has also preserved for us further details of the organisation of these interesting fossils. The fragments of limbs shown in the drawings make us eager for more.

H. M. BERNARD.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

AN influential and well-attended Conference on Secondary Education was opened on Tuesday in the Examination Schools, Oxford. The subjects considered were the need of various types of secondary education in England, with special reference to (1) the curricula and gradation of first grade schools (classical and modern), second grade schools, and higher grade board schools respectively; (2) the provision of preparatory schools for the upper grade of secondary schools; and (3) the relation between secondary schools and the Universities.

MR. A. AUSTEN LEIGH, Provost of King's College, Cambridge, was admitted Vice-Chancellor on September 30. Dr. Peile, in resigning office, commented on the events of the University year. He called special attention to the straitened finances of the scientific departments, and trusted that help might be obtained from external sources. The departments of Engineering, Geology, Astronomy, and Pathology appear to be those most urgently in need of additional resources. The Senate would be asked to appoint a syndicate for conducting Examinations in Agricultural Science, being strongly moved thereto by the County Councils and the Royal Agricultural Society. The Galileo Tercentenary at Padua, the Harvey Centenary in Cambridge, and the appointment of Mr. H. Y. Oldham as University Lecturer in Geography, in the room of Mr. Buchanan, were sympathetically referred to.

MR. R. A. SAMPSON, Fellow of St. John's College, and Isaac Newton Student in Astronomy, Cambridge, has been appointed Professor of Mathematics in the Durham College of Science, Newcastle.

A NEW course of lectures on "The Physiology of the Special Senses, chiefly the phenomena of Vision," will be given this term by Dr. W. H. R. Rivers, of St. John's College, Cambridge, beginning on Monday, October 16. The lectures will be accompanied by practical work in the Psychophysical Laboratory.

THE Technical Instruction Committee of the Bolton County Council has issued a syllabus of day and evening classes for the session 1893-4. The youth of Bolton can obtain instruction in many of the arts and most of the sciences at their Technical School, and judging from the well-equipped workshops illustrated in the syllabus, excellent courses of manual training are given.

THE Entrance Scholarships in Science at St. Bartholomew's Hospital have recently been awarded. The scholarship of £75 in biology and physiology has been given to E. C. Morland, of Owens College, Manchester; the scholarship of £75 in chemistry and physics has been gained by R. H. Bremridge; the junior open scholarship of £150 in biology, chemistry, and physics has been gained by H. A. Colwell; and the preliminary scientific exhibition has been awarded to J. E. Robinson. The Jeaffreson exhibition in classics and mathematics has been gained by G. V. Bull.

A DIGEST of the University Extension Science Lectures, to be delivered this autumn, shows that the movement is doing good work in many parts of the country. In connection with the Cambridge University Extension Syndicate, nine courses will be delivered on Botanical subjects, seven on Natural History, seven on Hygiene and kindred matters, six on Chemistry, and two on the History of Science, while single courses have been arranged in Agriculture, Electricity, and Geology. The programme of the London Society for the Extension of University Teaching shows six courses on Chemistry, four on Astronomy, three on Geology, and the same number on Hygiene. The Oxford University Extension Delegacy have made arrangements for the delivery of sixteen courses on Chemistry, twelve on Hygiene, nine on Agriculture, four on Astronomy, three on Geography, three on Geology, two on Electricity, two on Physiography, one on Light, and one on the Forces of Nature.

SCIENTIFIC SERIALS.

THE *American Meteorological Journal* for August contains an important investigation on the movements of the air at all heights in cyclones and anticyclones, as shown by cloud observations made at Blue Hill Observatory. A record was made of the kind of each cloud visible, its direction of motion and relative velocity, and the observations, classified into five levels, were plotted by means of arrows on maps prepared for the purpose. The increased velocity of the wind near the centre of the cyclone and the decreased velocity near the centre of the anticyclone are distinctly shown. The arrows also show that the inclination of the wind to the centres of the two is not the same on all sides. In the cyclone the winds blow most nearly tangential south-east of the centre, and most nearly inward north or north-east of the centre; while in the anticyclone the winds are most tangential north-west of the centre, and most nearly outward south or south-east of the centre. In the cumulus region the cyclonic and anticyclonic circulation are still visible, but the general westward drift has become much stronger, while above that region that circulation is entirely masked by the drift. The diagrams also show that the currents do not all turn to the right as one ascends into the atmosphere, as is usually stated; when the winds have a northerly component, they show that the currents turn to the left as one ascends. The tables show that the circulation of the air is much more rapid in the higher regions than near the earth's surface, both in cyclones and anticyclones.

Bulletin de l'Académie Royale de Belgique, No. 8.—Determination of the constant of aberration, of the parallax of Polaris, of the velocity of the solar system, and of the constants of diurnal nutation, by means of the latitude observations of Gyldén and Peters at Pulkowa, by F. Folie. A further discussion of the evidence for diurnal nutation claimed as discovered by the author, and other deductions from the Pulkowa latitude observations. Among the latter is the R.A. of the apex of the sun's way, 277°, the positive parallax of 0″·05 for Polaris, and the negative correction for the constant of aberration, 0″·037, which harmonises the velocity of light and the parallax of the sun.—Correct determination of the constant of aberration by observations in the prime vertical, by the same author. This shows that the accepted formula for the reduction of prime vertical observations is faulty, and substitutes a corrected one.—Researches on the mono-carbon derivatives, by Louis Henry. This portion of the researches contains a preliminary account of the ammoniacal derivatives of methyl aldehyde.—On a simple method of measuring retardation in minerals cut in thin plates, by G. Cesaro. A compensating quartz prism is placed between the microscope and the mineral, and moved across the field by means of a screw permitting a displacement of 0·05 mm. The tints utilised for the determination of the amount of retardation experienced by the extraordinary ray are those known as sensitive tints, which easily change from a bluish to a reddish violet.—On the nutrition of the echinoderms, by Marcelin Chapeaux. The author maintains that the amibocytes of the cœlomic cavity of starfishes play an important part in the continuation of the process of digestion originated by the radial glands. Small drops of the oils emulsified by the radial glands traverse the epithelium and enter the body cavity. They are then absorbed by the amibocytes, and their duplication is carried out in the interior of these phagocytes, under the influence of an acid ferment.

Bulletin de la Société des Naturalistes de Moscou, 1892, No. 4.—Contributions to the fauna of the Aral Steppes, by A. Nikolsky. List of mammals and birds collected or noticed in the Steppes, with very short remarks.—*Astragalus Uralensis*, a new species, by D. Litwinow.—On the cold of January, 1893, note by B. Sresnewskij.—To the memory of N. I. Koksharoff and A. W. Gadolin, by W. Vernadsky. An excellent summary of Gadolin's work.

1893, No. 1.—On some ecto- and ento-parasites of the Cyclopides, by Dr. W. Schewiakoff (with a plate). A new species, *Trichophrya cordiformis*, is described, also the ento-parasitic slimes of the cyclopides.—On the anatomy of *Siredon pisciformis*, by W. Zykoff (with a plate).—Notes on a new skull of *Amynodon*, by Marie Pavloff (with a plate). The skull has been received from America, and was found in the miocene of the Black Hills, South Dacota.—Catalogue of Lepidoptera of the Government of Kazan (third paper), by L. Krulikovski, containing the Noctuæ.—On the molecular

forces in the chemically simple bodies, on the basis of thermodynamics, being the third part of a remarkable memoir by J. Weinberg.—On the development of the ocean, by Prof. H. Trautschold. An attempt to prove that the ocean, at its first appearance, must have been very poor in chlorides as well as in carbonates and other salts.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, October 2.—M. Lœwy in the chair.—On the Serpent d'eau of the Rhône at Geneva, by M. H. Faye. This paper contains a description of a peculiar phenomenon seen at a weir near Geneva. It is a species of whirl in a vertical plane produced by a recoil of the water from the top of the barrier to a distance of 1·5 m. The axis of the whirl is horizontal, and parallel to the barrier. A delicate experiment performed by the late M. Colladon proved that this "serpent" exercises in its interior a considerable aspiration or suction. The phenomenon is complicated by the superposition of another whirl round a vertical axis in the neighbourhood of places where the barrier is interrupted, and the water is allowed a free fall. In these places conical tubes are formed whose apices descend to the bottom of the river, and into which air is noisily precipitated. Light objects—wood, paper—thrown into the whirlpool, descend, turning upon themselves with extraordinary speed. The whole phenomenon is very transitory and unstable. M. Faye does not share M. Colladon's view that the phenomenon is analogous to an ascending tornado. It has no analogy to a tornado, although it essentially requires a descending whirl for its production.—Observations of the comet Rordame-Quénisset, made with the great equatorial of the Bordeaux Observatory, by MM. G. Rayet, L. Picart, and F. Courty.—Values of the magnetic elements determined by the polar expedition of the Imperial Russian Geographical Society to the mouth of the Lena, by M. le Général A. de Tillo. The values for the magnetic elements at Sagastyr, as found by Captain Jurgens, are the following :—

Declination	4·7° E.
Dip	83·2°
Horizontal intensity	0·072°

G. Neumayer's map shows the greatest error in the declination, which it gives at 11·0° E.—Influence of the state of the surface of a platinum electrode upon its initial capacity of polarisation, by M. J. Colin. The results of M. Colin's experiments are in agreement with M. Blondlot's proposition that gases, and hydrogen in particular, are the cause of changes in the capacity of a platinum-water surface. If, in conformity with this hypothesis, the presence of hydrogen diminishes the capacity, the capacity of an electrode having served as kathode in the decomposition of water is very small; conversely, that of an electrode which has served as an anode, must be very great, since the oxygen set free must have eliminated the hydrogen with which the platinum might have been charged. Chromic acid, being a powerful oxidiser, must act in the same sense.—The fixation of iodine by starch, by M. G. Rouvier. The weights of starch remaining the same, as well as the other circumstances of the experiment, if the quantity of iodine added is increased, the quantity fixed rises at first. If the iodine is employed in sufficient quantity a compound is obtained whose percentage of iodine is always near 19·6, corresponding to the formula $(C_6H_{10}O_5)_{16}I_5$. A higher percentage was never obtained. If the weights of iodine and starch remain the same, as well as the other circumstances of the experiment, and the volume of the mixture increases, the quantity of iodine fixed diminishes, on condition that no more iodine is employed than is necessary to obtain the percentage 19·6. Otherwise, the volume may increase, and yet this percentage may be obtained.

SYDNEY.

Royal Society of New South Wales, August 2.—Prof. T. P. Anderson Stuart, President, in the chair.—The following papers were read :—Notes on the Bingera diamond field, by Rev. J. Milne Curran.—On the occurrence of a chromite-bearing rock from the Pennant Hills Quarry, near Paramatta, by W. F. Smeeth, J. A. Watt, and Prof. T. W. E. David.—Note on the occurrence of barytes at the Five Dock Sandstone Quarry; and note on the occurrence of calcareous sandstone allied to Fontainebleau sandstone from Rock Lily, near Pittwater, by Prof. T. W. E. David.

Linnean Society of New South Wales, August 30.—Prof. Haswell, Vice-President, in the chair.—The following papers were read :—Notes on Australian Coleoptera, with descriptions of new species, part xiv., by Rev. T. Blackburn.—Note on *Colina Brazieri*, Tryon, by Prof. Ralph Tate.—Descriptions of some new species of *Araneidæ* from New South Wales, No. iii. by W. J. Rainbow.—Notes on aboriginal stone weapons and implements, No. xviii.-xx. by R. Etheridge, Junr.—Three additional types of womerah, or throwing-stick, by R. Etheridge, Jun.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—A Manual of Telephony: W. H. Preece and A. J. Stubbs (Whittaker).—The Principles of Fitting: A Foreman Pattern Maker (Whittaker).—Dissections Illustrated: Part 2, C. G. Brodie, (Whittaker).—An Elementary Text-book of Coal Mining: R. Peel (Blackie).—Biologia Centrali-Americana, Part 3, Text and Plates, Archæology; Part 4, Plates, Archæology: A. P. Maudslay (Porter).—Selections from the Philosophical and Poetical Works of Constance C. W. Naden: compiled by E. and E. Hughes (Bickers).—Our Reptiles and Batrachians, new edition: Dr. M. C. Cooke (W. H. Allen).—The Zambesi Basin and Nyassaland: D. J. Rankin (Blackwood).—Some Salient Points in the Science of the Earth: Sir J. W. Dawson (Hodder and Stoughton).—A Text-book of Physiology, 7th edition, Part 1: Dr. M. Foster (Macmillan).—The "Thumb" Prayer-book (Frowde).—Marine Boiler Management and Construction: C. E. Stromeyer (Longmans).—An Elementary Text-book of Agricultural Botany: M. C. Potter (Methuen).—Pêches et Chasses Zoologiques: Marquis de Folin (Paris, Baillière).—Lectures on the Comparative Pathology of Inflammation: E. Metchnikoff, translated by F. A. Starling and Dr. E. H. Starling (K. Paul).—Machine Drawing: T. Jones and T. G. Jones (J. Heywood).

PAMPHLETS.—The Upper Hamilton and Portage Stages of Central and Eastern New York: C. L. Prosser.—The Climate of Chicago: H. A. Hazen (Washington).—Mikroskopische Vivisektion: Dr. A. Gruber (Freiburg).—Restoration of Coryphodons: O. C. Marsh.—Massachusetts Institute of Technology, a Register of Publications of the Institute, &c. 1862–93, 3rd edition (Boston).

SERIALS.—Gazzetta Chimica Italiana, Anno xxiii. 1893, Vol 2, fasc. 9 (Palermo).—Engineering Magazine, October (New York).—Observatory, October (Taylor and Francis).—Popular Astronomy, September (Wesley).—Himmel und Erde, October (Berlin).—L'Astronomie, October (Paris).—Journal of the Chemical Society, October (Gurney and Jackson).—Journal of the Statistical Society, September (Stanford).

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