THURSDAY, FEBRUARY 17, 1887

THE ORIGIN OF MOUNTAIN RANGES

The Origin of Mountain Ranges considered Experimentally, Structurally, Dynamically, and in Relation to their Geological History. By T. M. Reade, C.E., F.G.S. (London: Taylor and Francis, 1886.)

THAT the skin of our mother Earth's face is wrinkled and shrivelled, is one of the common facts of geology. True it is that with fine feminine instinct she strives to hide the ravages of time beneath a fair covering of grass, moss, and herbage, and gracefully does her best to make her old age comely; and we love her for her skill in covering up the signs of her years. But we are fain, directly we look below the surface, to admit that the wrinkles are there. And the parallel is not a fanciful one, for it has long been a favourite theory among geologists that the wrinkled skin of old age, and the foldings and bendings which are everywhere to be discerned in the layers of the skin of the earth, are due to similar causes. In both cases, something underneath the skin, which in youth kept it stretched and tense, has shrunk away, and the skin has shrivelled up. In the case of the earth it is the gradual contraction of the interior as it cools, which has caused it to draw away from the outer shell; and the crust, as it follows down the shrinking nucleus, has to pack itself into a smaller space, and consequently becomes crumpled up. This explanation is known as the "Contraction Hypothesis." Numbering as it does many supporters, it has had at the same time some vigorous opponents. In his "Physics of the Earth's Crust," the Rev. Osmond Fisher was led to the conclusion that the contraction hypothesis would not furnish anything like the amount of elevation that has actually occurred in the case of the earth. We admire the ingenuity and elegance of Mr. Fisher's mathematical work, but we cannot help recollecting Prof. Huxley's warning, that mathematics is like a mill, and that what you get out of it depends entirely on what you put in. Mr. Fisher puts in a supposition made by Sir W. Thomson, as to the way in which the earth cooled. There have been people bold enough to think that in making this supposition a great master of physics for once lent his name to an hypothesis which is in itself physically not very probable; and these same people are inclined to hold that probably Mr. Fisher's calculations tend to show that this is the case, rather than that the contraction hypothesis is inadequate.

Capt. Dutton, of the United States Geological Survey, is another doughty opponent of the contraction hypothesis. His notion as to what that hypothesis is appears in the following passage, which is quoted in the volume before us (p. 126, note):—

"The line of argument which is relied upon to sustain a cooling globe proves, when pushed to its consequences, that the great interior of the earth has not as yet undergone any sensible amount of cooling. The only cooling which that argument admits of has been located in a thin external shell. . . . In short, the cooling would be only skin deep, while the nucleus is about as hot as ever."

This may be called "pushing an argument to its consequences"; but if it be, that phrase certainly means, in plain English, putting, of course unintentionally, into your opponents' mouths, statements which they never made. If it is asserted that the crust cools faster than the nucleus, which is all the supporters of the contraction hypothesis ask for, is this the same as saying that the nucleus does not cool at all?

Now Mr. Mellard Reade joins the attack, and in an elaborately illustrated volume of some 300 pages gives us his reasons for dissenting from the contraction hypothesis, and for preferring a modified form of the explanation put forward originally by Scrope and Babbage. These geologists pointed out that whenever a great thickness of sedimentary deposits was laid down the subterranean surfaces of equal temperature would necessarily rise, the increase in temperature would cause expansion, and as a result of this a rise in the surface would follow. Mr. Reade maintains that vertical elevation would not be the only result, but that pressures would be set up in the mass competent to produce folding, contortion, inversion, crushing, and all the violent disturbances which are found in mountain-chains and other disturbed portions of the earth's crust.

The book has two merits: it takes nothing for granted, and it does not err on the side of assuming too much knowledge on the part of its readers. But it is a question whether virtue may not run to excess, and there is reason to fear that this has been the case here, for a very large part of the volume is taken up with the establishment and illustration of physical facts of the most elementary character, and of geological truths which are to be found in every text-book. For instance, Chapters III. and IV. are devoted to the establishment of the facts that metals and stone expand when their temperature is raised; that, when they are prevented by constraint from relieving themselves by lateral expansion, they buckle up; and that if their elasticity, or, as the author prefers to call it, their tensile strength, is small, they do not return to their original shape on cooling. The cases quoted, and the experiments which are illustrated by six full-page plates, are apt and to the purpose; they would be admirably suited for illustrating class-teaching in an elementary school. But it is hard to believe that any one could have seriously thought they would be required by the class of readers to whom the book is presumably addressed.

Chapter V. opens with the statement that "It has been a subject of remark and wonder to more than one eminent geologist that all the greatest mountain ranges are, geologically speaking, so comparatively modern." A broad generalisation like this deserves to have stress laid upon it, but it has been so long one of the common truths of geology, that it has ceased to be, if it ever was, a source of wonder to any one who has an elementary knowledge of the science. Indeed, there is an air of *naïve* surprise running through the book which now and again moves a kindly smile as we read, and we feel it refreshing to discover that truths, which have grown somewhat hackneyed to the majority of geologists, still retain a certain charm of novelty for the author. Thus Mr. Reade seems in more than one passage to take a little credit to himself for having discovered that what are generally called "anticlinals" are really elongated ellipsoidal domes—a fact which is rapidly brought home to any one who happens to work for a few weeks in a country where the rocks are moderately folded, and which was insisted on and fully illustrated in a manual of geology published fourteen years ago, and then could hardly have been said to be new. The distinctive characters of mountain chains are treated of in the same spirit. Little, if anything, is here added to the masterly summary of these characters which Dana gave us years ago, but much space is taken up with illustrations of truths which every one admits, in the form of long quotations from sundry sources. All this speaks to much reading and patient industry, and we cannot but admire the conscientious care with which Mr. Reade has striven to inform himself of all that has been said and done on the subject of which he is treating; but we cannot help asking ourselves whether it was necessary to print at length the contents of his note-books. This accumulation of evidence, where it is not needed, has brought with it an attendant evil: it has swelled the book to an undesirable size. Now in these busy days, and in the interest of readers, if there is one thing against which, more than anything else, a resolute stand ought to be made, it is unnecessary printing. The day is yet far distant when every page of printed matter shall contain something that is new, and nothing that is not new; but this is the impossible ideal, the asymptotic consummation, which all writers should ever keep prominently in view.

But we would not press this point, because, even if the author has given us rather an excess of matter that is not new, what he has given is good of its kind; and it is of more importance to weigh his arguments against the contraction hypothesis, and in favour of the Scrope-Babbage explanation with the additions he suggests to it. Holding as he does that expansion by heat is the main factor in producing the disturbances of the earth's crust, he made experiments to determine the coefficients of expansion of sundry rocks. He arrives at a mean which agrees very nearly with that found by Mr. Adie. Mr. Reade's experiments ranged from temperatures of 60° to 220° F., and he assumes that the coefficient of expansion will be the same for the enormously higher temperatures with which he has to deal when considering the case of the earth—a risky proceeding, to say the least. But he has fallen into a far more serious mistake: he has assumed that rocks weighted with a thickness of twenty miles of overlying strata will expand to the same extent for a given increase of temperature as rocks under atmospheric pressure. The oversight involved in this assumption so thoroughly vitiates all his numerical results that no conclusion can be drawn from them.

In Chapter XI. we have the objections to the contraction hypothesis succinctly stated. The numerical results we put aside for reasons just given, but in his general argument the author does not seem to us to realise the full meaning of the hypothesis. He seems to hold that according to the contractionists crumpling is produced by unequal contraction *in the solid shell itself*, which certainly is not their view. And he entirely omits all reference to the one fact which is the life and soul of the hypothesis, that the earth's crust is not strong enough to stand by itself without support, a fact which admits of rigid mathematical demonstration. It is a decided case of a seriously mutilated representation of the play of "Hamlet."

We cannot therefore admit that Mr. Reade's arguments are very damaging to the hypothesis against which they are directed; and we cannot see how expansion due to rise of temperature could alone produce the results which he attributes to it. The strains produced in this way would tend to be relieved by yielding in the direction of least resistance—that is, vertically; and if there were no impediment to the perfect transmission of strain, the yielding would be wholly in this direction. In the actual case a certain amount of deformation would doubtless be produced within the heated mass itself, but hardly enough, it would seem, to cant over a huge anticlinal, and lay it nearly flat on its side. The machinery invoked by the contraction hypothesis may or may not have been the means by which such overthrusts were brought about, but it is the only machinery yet suggested which seems competent to produce them. "Seems," we say throughout, for the question between rival hypotheses is as yet only one of probability.

And we think no one will contend that the Scrope-Babbage hypothesis ought to be entirely put on one side when we speculate on the cause of earth-movements; great broad folds, such as those of the plateau-region of Utah, described by Capt. Dutton, and figured on Plate 39 of the book, may have been caused by the bulging up of heated masses below, though they can be explained equally well by the contraction hypothesis.

It remains to notice that the book is rich in figured illustrations. A number of the plates are devoted to somewhat diagrammatic landscapes of contorted rocks, and these bring out well the points they are intended to illustrate; but they do not add to the stock of our knowledge. They would be serviceable to a geologist, if such a one there be, who had never stirred out of the fen-country, but he of course would do still better if he took an excursion ticket to some of the localities from which the views are taken.

A. H. GREEN

ORGANIC EVOLUTION

The Factors of Organic Evolution. By Herbert Spencer. (London and Edinburgh: Williams and Norgate, 1887.)

MR. HERBERT SPENCER has done well to reprint in a permanent form his two articles on the "Factors of Organic Evolution," which were published last year in the *Nineteenth Century*; for, although they present substantially the same doctrines as are to be met with upon this subject in his "Principles of Biology," they do so in the light of fuller knowledge and more matured judgment.

The object of the essay is that of taking stock, so to speak, of natural selection as compared with other "Factors." Mr. Spencer's treatment of this subject is admirable, and ought to be read by all working naturalists who have any interest in the problems of evolution. The literature of Darwinism has now become so extensive that even first-rate naturalists who are engaged on other lines of work are apt to get left behind, or, with respect to Darwinism, themselves to become examples of what are now called "vestiges": their ideas are the superseded survivals of some previous phase of evolutionary science. And most of all is this true with regard to the fundamental question so ably discussed by Mr. Spencer. As he remarks, "Nowadays most naturalists are more Darwinian than Mr. Darwin himself," by which he means that most naturalists attribute more to the agency of natural selection than was attributed to it by the final judgment of its discoverer. The reason of this is that most naturalists have neither read with any care the later editions of Mr. Darwin's works, nor probably even so much as heard of the sundry essays which led him to modify his views upon the comparative importance of natural selection and other factors of organic evolution. Such naturalists, therefore, are not true Darwinians. Still believing in natural selection as almost the only factor of organic evolution, they are archaic enough to suppose that distinctions of specific value are almost universally of an adaptive kind. In this respect, indeed, they share what is no doubt still the popular impression of Darwinism, but an impression, nevertheless, which does a great injustice to the genius of their master. In order that there may be no mistake upon this matter, we will here supply a few quotations from the latest editions of Mr. Darwin's works, over and above the numerous extracts which Mr. Spencer has selected for the same purpose.

"I now admit, after reading the essay by Nägeli on plants, and the remarks recently made by various authors with respect to animals, more especially those recently made by Prof. Broca, that in the earlier editions of my 'Origin of Species' I perhaps attributed too much to the action of natural selection, or the survival of the fittest. I have altered the fifth edition of the 'Origin' so as to confine my remarks to adaptive changes of structure; but I am convinced, from the light gained during even the last few years, that very many structures which now appear to us useless will hereafter be proved to be useful, and will, therefore, come under the range of natural selection. Nevertheless, I did not formerly consider sufficiently the existence of structures, which, so far as we can at present judge, are neither beneficial nor injurious; and this I believe to be one of the greatest oversights as yet detected in my work." ("Descent of Man," 2nd edition, p. 61. He goes on to explain how he was led to the "tacit assumption that every detail of structure, excepting rudiments, was of some special, though unrecognised, service," and concludes by remarking that "any one with this assumption in his mind would naturally extend too far the action of natural selection.")

"In the earlier editions of this work I underrated, as it now seems probable, the frequency and importance of modifications due to spontaneous variability" ("Origin of Species," 6th edition, p. 171). "It appears that I formerly underrated the frequency and value of these latter forms of variation, as leading to permanent modifications of structure independently of natural selection. But as my conclusions have lately been much misrepresented, and it has been stated that I attribute the modification of species exclusively to natural selection, I may be permitted to remark that in the first edition of this work, and subsequently, I placed in a most conspicuous position—namely, at the close of the Introduction—the following words: 'I am convinced that natural selection has been the main but not the exclusive means of modification.' This has been of no avail. Great is the power of steady misrepresentation; but the history of science shows that fortunately this power does not long endure" (*Ibid.* p. 421).

"When, from the nature of the organism and of the conditions, modifications have been induced which are unimportant for the welfare of the species, they may be, and apparently often have been, transmitted in nearly the same state to numerous, otherwise modified, descendants. . . . A structure, whatever it may be, which is common to many allied forms, is ranked by us as of high systematic importance, and consequently is often assumed to be of high vital importance to the species. Thus, as I am inclined to believe, morphological differences, which we consider as important—such as the arrangement of leaves, the division of the flower or of the ovarium, the position of the ovules, &c.—first appeared in many cases as fluctuating variations, which sooner or later became constant through the nature of the organism and of the surrounding conditions, but not through natural selection; for, as these morphological characters do not affect the welfare of the species, any slight deviation in them could not have been governed or accumulated through this latter agency" (*Ibid.* pp. 175, 176).

These quotations are added to those which have been supplied by Mr. Spencer, in order still further to advance the "motive" with the expression of which his essay concludes. After directing attention to the present views of Prof. Huxley upon the subject—viz. "How far natural selection suffices for the production of species remains to be seen"; and "Science commits suicide when it adopts a creed"—Mr. Spencer closes with the following remarks:—

"Along with larger motives, one motive which has joined in prompting the foregoing articles has been the desire to point out that already among biologists the beliefs concerning the origin of species have assumed too much the character of a creed; and that while becoming settled they have become narrowed. So far from further broadening that broader view which Mr. Darwin reached as he grew older, his followers appear to have retrograded towards a more restricted view than he ever expressed. Thus there seems occasion for recognising the warning uttered by Prof. Huxley as not uncalled for. Whatever may be thought of the arguments and conclusions set forth in this article and the preceding one, they will perhaps serve to show that it is as yet far too soon to close the inquiry concerning the causes of organic evolution."

Of these two articles the first is devoted to a consideration of use and disuse as causes of such evolution, while the second treats of the influence of surrounding conditions. The latter is the more highly speculative, and therefore may be here considered in fewer words. The idea is that all external parts of organisms, being exposed to different physical conditions from the internal parts, must be differently affected thereby: natural selection apart, there must here be recognised the differentiating agency of a direct or purely physical kind. Hence a certain rough analogy is drawn between a cell-wall, or cuticle, and the oxidised exterior of an inorganic body. Many of the differentiations undergone by the epiblast in the course of organic evolution may, it is argued, be best explained by the immediate action of external agencies—just as we know that a surface of mucous membrane, when brought into permanent relation with such agencies, changes from cylinder epithelium to squamous epithelium: "the effect of the medium is so great that, in a short time, it overcomes the inherited proclivity, and produces a structure of opposite kind to the normal one." Many other examples of the same general principle are given; but the essay as a whole is ingenious rather than convincing. Not, of course, that we dispute the principle—which, indeed, is recognised by Mr. Darwin, in one of the passages above quoted, and elsewhere—but it is of too general a kind to admit of being clearly traced in particular instances, where we have to do with all the other elements in the complex of living material.

The main question, however, with which Mr. Spencer is concerned is as to the place which should be assigned to use and disuse as factors of organic evolution. This long-standing question is one of fundamental importance to the whole philosophy of evolution; and as it has now reached a critical phase, the publication of Mr. Spencer's essay furnishes a fitting opportunity for considering its present position in all its bearings. This, therefore, we shall endeavour to do at an early date, in the form of a general article dealing with all the more important literature upon the subject. GEORGE J. ROMANES

TEXT-BOOK OF BRITISH FUNGI

An Elementary Text-book of British Fungi. By William Delisle Hay, F.R.G.S. Royal 8vo, cloth, illustrated. (London: Swan Sonnenschein, Lowrey, and Co., 1887.)

WE have little sympathy with such publishers as produce books written "to order" for the purpose of utilising illustrations, or matching. Still, we cannot help feeling some sympathy with, and pity for, the poor unfortunate who is called upon to perform such an unthankful office as the preparation of "copy." In so far as the book before us corresponds with such conditions our author commands our sympathy, perhaps he deserves it, for even in the preface he seems to fall on his knees, and sue, *in formâ pauperis*, for pity from readers and critics alike. There is doubtless a history connected with this volume. The woodcut blocks which accompany the text, but do not illustrate it, formerly did duty in the "Hand-book of Fungi" published more than fifteen years ago. In the way of business they were transferred, and, in order to utilise them, the "Text-book" seems to have been projected. There are 64 pages of figures and 238 pages of letterpress, but only about 16 pages of the plates have anything to do with the letterpress, and are not even mentioned, so that there are no less than upwards of 40 plates which are supplementary to the letterpress, and have nothing whatever to do with it, except to increase the bulk of the book. We do not know what purchasers would expect to meet with in "an elementary text-book of British fungi," but we suspect that they would scarcely be satisfied with a "treatise on edible and poisonous fungi," or, as set forth in the preface, an attempt "to cover as comprehensively and accurately as possible the entire subject of fungi, considered as aliment." Indeed, it would have been more correct to call this "An Elementary Text-book of some Species of British Fungi."

The professed object of this book, in so far as its writer was concerned, was to present a guide, which above all things should be safe and trustworthy, on the subject of fungus-eating—"so far as toadstool-eating goes," he writes, "I believe I have a right to speak with authority"—and hence if this professed object is not attained, the book must be confessedly a failure. "For the most part," he says, "subsequent authors have added little to what Dr. Badham had advanced." The inference must be that he was ambitious of making a considerable advance, "directed and inspired by a wide acquaintance with mycological literature." After this spontaneous confession it is surprising to find him stating as a fact that "some four hundred and fifty species of the genus *Agaricus* are recorded as occurring in Great Britain," on the faith of a work published now sixteen years ago; his knowledge of mycological literature having stopped short of the fact that nearly 700 species have already been figured, and the latest work on British fungi records 782 species as British, so that the total is nearly double that which his "wide acquaintance with mycological literature" had revealed to him. Leaving, however, such trivial details, let us turn to the "Comprehensive Catalogue of Esculent British Fungi." The first thought is naturally one of order. To assist in reference, and in producing favourable results, one would have hoped to see some method in the grouping of the 221 supposed esculent species. Scientific method there is none, for the white-spored, pink-spored, and brown-spored Agarics are jumbled together in glorious confusion. This would be tolerable if in compensation the species had only been grouped in sequence, or in sections according to their esculent value, but even this has not been done. In two or three instances, however, the species of a given genus are classed in the alphabetical order of their specific names.

Space will not permit of our remarking upon all the individual species included in this miscellaneous list of fungi recommended for common consumption by one who "believes he has a right to speak with authority." For ourselves, we should not have recommended *Agaricus asper*, for with considerable experience we do not remember to have met with it but once in thirty years; nor *Agaricus cæsareus*, for we venture to declare that it has never been found in the British Islands at all, and the same must be said of *Polyporus corylinus* and *Polyporus tuberaster*. Why, then, are they included in a "Catalogue of Esculent British Fungi"? Worse still—because far more dangerous—why are such species included as *Agaricus sinuatus*, which nearly killed Mr. Worthington Smith, and *Lactarius piperatus*, *Lactarius turpis*, and *Lactarius torminosus?* If there are such things as dangerous fungi at all, these are of them. If this writer is really acquainted with these species, and pronounces them edible, let him eat them and enjoy them, but not recommend them to an unsuspecting public. It is our firm and conscientious belief that a book which seriously recommends such things as articles of food might produce calamitous results, if widely circulated, or even, if not, in the event of other books or journals repeating upon its authority that these may be eaten. We read in the preface these significant words: "It has never been my privilege, as yet, to meet with any person versed in mycology from whom I could derive instruction." When the writer meets with such persons we advise him to propose to them an experiment in eating *Lactarius piperatus*, or *Lactarius torminosus*, or even *Agaricus sinuatus*, and we rather fancy that such mycologists will have but little faith in his practical mycology. We sincerely hope that he will not meet with "persons versed in mycology" for the first time in a coroner's court, over a case of poisoning induced by his recommendations. It would have given infinitely more satisfaction, and been far safer for his reputation, had the list of esculent fungi been confined exclusively to species known to be good eating and worth the trouble of collecting, excluding such minute species as *Agaricus clavus*, and *Agaricus esculentus*, and *Agaricus griseus*, with a cap as large as one's little finger nail, and a stem but little thicker than a horsehair, and including *Agaricus elvensis* and *Agaricus hæmorrhoidarius*, with a few others, large, fleshy, and as safe and delicious as the finest mushroom ever cultivated. But perhaps, though known to mycologists, they were disregarded by the writer of the "Text-book," or contemptible in his eyes beside such delicacies as *Agaricus sinuatus* and *Lactarius piperatus*. Perchance some mycologist, hesitating whether to purchase or not, may read this notice. Let us state for the information of such a one that the hard, woody *Polyporus fomentarius*, which grows on old trunks, and the equally well-known *Polyporus squamosus*, are with all seriousness and gravity introduced into the "Catalogue of Esculent British Fungi;" that the excellent *Agaricus sylvaticus*, which we are only too glad to get the chance of eating, is condemned to the "Catalogue of Poisonous British Fungi," together with *Agaricus lacrymabundus*, which is at least a considerable ingredient in the modern "mushroom catsup," as sold in the shops; and, if he seeks further evidence of "vast experience," he will find it in the novel information that *Agaricus mucidus* is rare, that *Cortinarius cinnamomeus* may be used as a substitute for cinnamon, that the difference between *Agaricus giganteus* and *Agaricus maximus* is only nominal, that *Lactarius subdulcis* is easily confounded with *Lactarius rufus*, that *Lactarius camphoratus* smells of camphor (when ?), and that *Russula decolorans* is common under beeches and is "a good comestible."

Finally, we must protest against the wholesale manufacture of new names, many of them barbarous enough, and some of them ridiculous, under the vain supposition that they will become popular names for the species of edible and poisonous fungi. The old "fairy-ring champignon" is to be called the "oread," the common mushroom is the "white pratelle." The *Russula emetica* is "the sickener," and *Russula fragilis* is the "sickener's sister." In one place we are told "how to prepare parasols," but not whether this includes umbrellas, or whether it is based on the principle that "it's never too late to mend." Earnestly we hope it is, for there is vast scope for amendment in this book, and the sooner it is commenced the better. As it stands, it is difficult to determine whether it should be classed with comic literature, novels, or ancient history.

M. C. C.

OUR BOOK SHELF

The Structure and Life-History of the Cockroach (Periplaneta orientalis). An Introduction to the Study of Insects. By L. C. Miall, Professor of Biology in the Yorkshire College, Leeds, and Alfred Denny, Lecturer on Biology in the Firth College, Sheffield. (London: Lovell Reeve and Co., 1886.)

THIS volume forms the third of a series of studies in comparative anatomy, the object of the authors being to lead the student, by the investigation of some one animal form, to an interest in, and a comprehension of, other kindred forms. While it will be generally conceded that this is a sound method of research, it is evident that its success will very much depend on the special forms selected, and we think that it may be open to some doubt whether, in selecting the cockroach for an introduction to the study of the Insecta, the authors have not selected a too little specialised form, since they have been obliged to omit the investigation of so characteristic a feature of insect life as that of metamorphosis. Nevertheless, they have given us a very fully detailed and interesting account of an easily obtained insect, and we hope it may be the means of encouraging many others to follow up the subject for themselves. As an introduction to this volume, we have a short account of the writings of those wonderfully patient pioneers in the field of minute anatomy—Malpighi, Swammerdam, Lyonnet, and Straus-Durckheim. This is followed by a sketch of the zoological position and the life-history of the cockroach. In this latter there is a brief record of the internal parasites of this insect—a record that might be greatly extended. The chapters on the outer skeleton, the myology, the neural system, the alimentary canal, and the organs of circulation and respiration, are well written and illustrated. The section relating to the respiratory movements of insects is written by Prof. Felix Plateau; that on the embryonic development, by Joseph Nusbaum, who very pertinently remarks that the inexperienced embryologist will find it more profitable to examine the eggs of bees, of Aphides, or of such Diptera as lay their eggs in water. Indeed, the difficulties in the way of the investigation of the eggs of the cockroach are so great that even the author has had to pass over the early stages of segmentation. A chapter on the cockroach of the past, from the able and experienced pen of Prof. S. H. Scudder, concludes a volume which, though not exhaustive of its subject, nor yet quite even in its treatment of all the branches of that subject, may be placed with the greatest safety and advantage in the student's hands. The authors tell us, in their preface, that, from the description of the cockroach in Huxley's "Anatomy of Invertebrated Animals," came the impulse which has encouraged them to write the present work. We hope that it will in its turn encourage many another to undertake equally honest researches.

The Administration Report of the Meteorological Department, India, 1885-86.

MR. BLANFORD'S Report, as usual, gives a good account of work. It commences with the actinometric observations. The records from Leh for twenty-three months were not found to be as valuable as had been expected, the climate having turned out unfavourable. The results have been sent home to the Solar Physics Committee, and meanwhile the observations are being continued at Dehra Doon and Mussooree, under the superintendence of Colonel Haig.

In the matter of forest observations, considerable activity is recorded; pairs of stations, on the system devised by Ebermayer for Bavaria, have been established at Dehra Doon and Ajmere. These observations have, however, been going on for too short a time for the results to be worth quoting, but much is to be expected from these investigations in India.

Mr. Blanford gives an account of his forecast of the character of the monsoon rains of 1885 from the character of the Himalayan snowfall, and he shows that the facts fully carried out his theory. The Report goes on with a brief notice of the theory of the South-west Monsoon, which, Mr. Blanford says, he is in a position to show, by his forthcoming Indian Ocean wind-charts, is not the South-east Trade simply drawn across the equator.

The remainder of the Report is occupied by details of the observational system, which seems to be in a good state of efficiency.

LETTERS TO THE EDITOR

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

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

Mr. Romanes on Physiological Selection

I HAVE just seen Mr. Romanes's article in the *Nineteenth Century*, and his letter specially replying to myself in your issue of January 13 (p. 247). I do not propose to continue the discussion, but ask leave to make a few observations on some features of his reply in both the article and the letter.

On the question of the "inutility of specific characters," he appeals to authority against me, and especially to Darwin's very cautious remarks, which seem to me to support my view much more than they do those of Mr. Romanes; but in any case this is a matter in which I decline to accept authority as an infallible guide. The impossibility of proving a negative is proverbial, but my opponent declares that his negative—the uselessness of specific characters—wants no proving, but must be accepted till in every case the affirmative is proved. Here, again, is a canon of criticism the validity of which I wholly deny.

As to the swamping effects of intercrossing, there is again an appeal to authority, and Mr. Romanes now explains away (in the *Nineteenth Century*) what he had said about "simultaneous variations," by asking me to show such variations as the occurrence of an incipient spur on a duck's foot or horn on the head of a racehorse, in the belief, apparently, that these are the class of characters which are distinctive of closely-allied species! Such a demand, seriously made, appears to me so preposterous as to render further discussion of the matter with such an adversary out of the question.

The argument to show that the supposed physiological variations would be perpetuated, seems to me as weak and unsatisfactory as ever. The question is really not worth further discussion till the required variations are proved to exist in the requisite abundance and possessing the peculiar relations to each other and to the rest of the species which would alone give them any chance of survival.

I now leave the question, as between myself and Mr. Romanes, to the consideration of those naturalists who may be able to bestow upon it the requisite time and attention.

ALFRED R. WALLACE

Washington, U.S.A., January 30

Instantaneous Shutters

IN reference to the interesting paper by Mr. Mallock in NATURE (February 3, p. 325), I quite agree with him in his condemnation of a drop-shutter of any form.

But I would point out a form of shutter that I have myself found of the greatest value—one, namely, working horizontally across the lens. It has the very great advantage in landscape work that it can carry an aperture of this form ∇ or any modification thereof, the advantage gained thereby being that the sky receives a far shorter exposure than the foreground, a point of much importance in landscape photography. The ∇ piece is loose, and any shape cut out of black cardboard or paper can be inserted. Of this power I have frequently availed myself when photographing snow-clad mountains.

The shutter can be made to pass across the lens at any speed, from the most instantaneous flash to slower motions, and it has the further advantage of working immediately behind the lens—the proper place, I think, for a shutter.

H. STUART-WORTLEY

South Kensington Museum, February 4

Svastika Cross and Sun

Is there any evidence that the *svastika* represents the sun? and is it not a simple conjecture? (NATURE, February 10, p. 345).

The *svastika* 卐 is a complex emblem, and there is a possible origin which has not been investigated. It decomposes into two ʅ, and this is a character to be found extensively distributed throughout the syllabic and alphabetic systems. If ʅ is a symbol for man and fish, it will not be related to sun immediately.

The theory of Mr. Haliburton and others, and mythological conformity, give the cross or Tau as naturally derived from the Pleiades, and not from the sun. The cross is also a symbol for the nose in prehistoric sculpture.

HYDE CLARKE

32 St. George's Square, S.W., February 12

Life-Energy, or the Dynamics of Health and Disease

SINCE it is admitted that matter is indestructible, it is obvious that life can be only the manifestation of that energy which is set free by the reduction of compounds embodying more energy to states of combination which embody less energy.

Life therefore is the result of the continuous interchange of partners between the compound molecules constituting chemical and organic compounds.

"In any transformation which takes place without the application, or the giving out, of work, the heat developed is the equivalent of the excess of the original over the final potential energy due to the chemical affinities involved; the *final state of every combination is that in which the potential energy of chemical affinity is a minimum*" (Tait).

If these words formulate the law which governs those combinations of elementary substances known as inorganic compounds, how much more must they refer to the combinations of the same elementary substances which go to form organic compounds?

Life thus becomes an expression for the sum of the difference between the original potential energy of the food and the final potential energy of the excretions. All change in the configuration of matter, whether physical or chemical, must be accompanied by either the evolution of, or the absorption of, energy.

Energy, as far as is known, has but one source, the sun.

Whether that energy act by direct impingement of solar rays producing the ascending scale of effects from genial warmth to fatal sunstroke, or whether it be second-hand, from the decomposition of vegetable matter, or third-hand, from the decomposition of animal substances which obtained it from vegetable substances, its origin is still the same.

Assuming then the universality of this energy, which shows itself in all the intangible forms of life, and growth, and all organic change, it will be the effort of the writer to adduce evidence to prove that much which is still mysterious in both health and disease is due to its subtle action too.

The vibrations of direct solar energy which fall upon the optic nerve give rise to those molecular disturbances which produce the subjective sensation of light.

Physical change is thus originated by an immaterial agent. Work is done, and cannot continue to be performed without renewal of the material acted on.

But when the vibrations of direct solar energy fall upon the tissues of a growing plant, energy is incorporated into those tissues. This energy so attunes the atomic vibrations in the plant molecules as to bring them into combining harmony with the carbon and hydrogen atoms present in the forms of carbonic acid and water.

The hydrocarbon compound, starch, is formed, and embodies within itself the energy which made it starch.

Each molecule of starch maintains its individuality as starch only so long as it retains within itself that solar energy under the influence of which it became starch; as soon as part of that energy is lost the starch is degraded to its original condition of carbonic acid and water. Yet that energy which works such molecular miracles is sought for among the products of decomposition in the form of heat only, and if not recognisable as such is put out of count in the world's work.

While it is thus evident that the vegetable kingdom lives a constructive life, storing up energy from an extra-terrestrial source, it is equally demonstrable that the animal kingdom lives a destructive life, unable to add aught to the sum of energy required for the work of the planet. Consequently an approximate expression for the value of the energy incorporated in the plant may be found in the work done, as a result of its consumption, by the animal.

4500 grains of plant carbon are daily excreted by every average man in the form of carbonic acid. Carbon and oxygen independently embody a greater sum of original energy than is found in the compound formed by their union; therefore the result of their combining together must be a loss of energy: the value of this energy is estimated by the heat evolved. The heat recognisable on the combination of 4500 grains of carbon with the required equivalent of oxygen amounts to 118 units, and represents in foot-pounds the raising of 40 tons one foot high.

Such, then, is the enormous supply of solar energy obtained by a man when he compels the elementary atoms of carbon and oxygen to enter into a combination of greater stability and less energy, and to surrender their surplus energy that he may live.

But the converse of this is also true, viz. that when a plant proceeds to utilise this carbonic acid for the reproduction of 4500 grains of carbon, it can do so only by obtaining from some external source energy equivalent to the raising of 40 tons one foot high and adding this to the rates of vibration already existing in the carbonic acid. Thus the condition of energy of the carbonic acid is altered till finally the oxygen and carbon atoms are compelled to dissociate themselves and to resume their elementary forms of less stability and greater energy. They then become available for plant assimilation, and fix in its tissues the energy which forced them apart.

If, then, the union of oxygen and carbon in the human body sacrifices such energy that man can live thereby, is it not obvious that under whatever circumstances that union takes place the same energy must appear? If that be so, the question must arise whether in estimating the effect of vegetable decomposition upon the health of man too much notice has not heretofore been taken of the carbonic acid and kindred stable products given out, and too little attention paid to the energy evolved,—in fact, whether from the surface of every seething swamp there be not poured forth streams of that powerful energy which originally fed the growing plants, and which when eliminated within the body of man is known by the name of Life. To assume that such energy is powerless is to assert that the mother's heat is not the force that hatches out the egg.

That the theory which attributed all noxious influence to the gaseous resultants of decomposition did not satisfy the requirements of science is shown by the greedy acceptance of the germ theory which now prevails. But this, after all, is but coming one step nearer to the action of that universal energy which is the inseparable concomitant of all material interchange. For has not Dr. Burdon Sanderson well said, "Bacterial life is a middle term between chemical antecedents and consequents"? They reduce all unstable compounds in the world to final stable products, and live with vigour or in apathy in proportion to the effect upon themselves of the energy evolved from the medium they destroy. Thus, too, is produced much of that form of secondary energy recognised as heat of decomposition, and while this heat is known to possess marvellous influence over vegetable germination it has up to the present been credited with but little action on the life of man.

The gaseous consequents and the bacterial agents have borne the blame of every human ill, while that energy which ruled the universe before the first vegetable cell had varied towards animal functions is allowed to go unchallenged.

If, then, suspicion can be legitimately directed towards this heat as a factor in physiological change hitherto overlooked, it becomes necessary to pursue the subject of heat in all its latest developments.

Dr. Doherty, in his "Organic Philosophy," says: "Light is nothing but the velocity of a force which in slow motion is called heat." From the facts that are known in relation to light it may be possible to deduce by analogy much that is yet unproven with regard to heat.

It has been shown that light consists of certain colours which, when taken together, produce the sensation of light; each of these colours acts upon certain specialised molecules of the optic nerve and not upon the remainder, just as Professor Tyndall has shown that the invisible heat rays, "powerful as they are, and sufficient to fuse many metals, can be permitted to enter the eye and to break upon the retina without producing the least luminous impression."

May it not therefore be inferred that heat consists of a series of velocities of force which when taken together produce the sensation of heat, yet each of which is capable of acting upon certain specialised molecules of the nerves of sensation, while being unperceived by the remainder?

Light has been proved by Captain Abney to be the visible velocities of wave-lengths from 38,000 to the inch to 60,000, and within this range from 38,000 to 60,000 to the inch all the varied sensations of colour are produced; nevertheless, by the higher velocities, from 60,000 to 120,000 wave-lengths to the inch, the great chemical actions of the world are performed. Is it not evident, then, that if the recognition of wave-lengths from 38,000 to the inch and upwards depended solely upon the subjective sensation of light all appreciation of them must cease at the 60,000 wave-lengths, and that the great powers of the ultra-violet wave-lengths must have remained in darkness for ever?

But Captain Abney has also shown that there are measurable wave-lengths extending downwards from 38,000 to 10,000 to the inch; if, therefore, these are credited with such action only as is recognisable by the subjective sensation of heat, is it not equally possible that powerful influences which change for good or ill the configuration of the molecules of the nerves of sensation may be left unregistered?

It is therefore allowable to infer from this analogy that in the dark region descending from the fading red to the cold of zero there may be many rates of velocity, some of which, harmonising with some phase of life, produce the most potent physiological effects without at the same time exciting the molecular resistance which corresponds to the sensation of heat.

In other words, is it not probable that in estimating the actions of the forces of Nature upon the animal system some most subtle influences have been overlooked because unrecorded by the index of the thermometer?

Professor Tait says: "The energy of vibrational radiations is a transformation of the heat of a hot body, and can be again frittered down into heat, but in the interval of its passage through space devoid of tangible matter, or even while *passing unabsorbed through tangible matter, it is not necessarily heat.*" And Mr. Pattison Muir in his work on "Thermal Chemistry" asks: "Must all energy which is lost by a changing chemical system during a definite operation make its appearance in the form of heat? Energy appears in chemical operations in forms other than that of heat, electrical energy for instance; we must distinguish in chemical processes between that part of chemical energy which is freely changeable into other forms, and that which can leave the system only in the form of heat."

The most recent researches thus point to the probability that while the bacterium carries on through Nature its never-ending work of reducing chemical antecedents to chemical consequents it must as continuously set free energy in forms other than that of heat.

One of the most pregnant discoveries made of late is that which demonstrates that, even in the case of the powerful friction requisite for boring iron, heat ceases to be recognisable as heat when the iron operated on is strongly magnetised; that is, that heat developed by friction in a magnetic field disappears in some form other than heat. By this the idea is suggested that heat energy impinging upon the sentient extremity of a nerve in action may be taken up and carried in a form other than heat to the central brain, just as sound is conveyed in a form other than sound across the interval between the telephone and the receiver; and if the multiple wave-lengths which produce the subjective sensation of heat can be thus transferred from the surface to the centre, why not fractions of that multiple which when taken together make the whole?

Since, then, science cannot specify the difference between the energy contained in dead carbonic acid and that of the living hydrocarbon, neither can it draw a line more definite than the equator between those series of decompositions which on the one side are termed life, and on the other are designated death. In each and all the compound descends from instability towards stability, and in every degradation is energy evolved.

Yet that energy, no matter in what companionship it may be found, or through how many existences it may have transmigrated, has still but one original source, and consequently it is impossible to conceive a condition in which that energy, primarily possessed of such "phenomenal modes of action," can be regarded as absolutely inert.

So far, then, it is claimed that grounds have been established for asserting that from the surface of every decomposing swamp forms of energy must be momentarily poured forth, the potency of which is as yet unknown.

Again, while it is at present impossible to isolate the fractions of energy the sum of which make heat, still it would contribute vastly to the proof of their independent existence if it could be shown that the nerves of sensation are specialised in sections, each reacting separately, to different gradations of heat.

This has been apparently accomplished.

"Dr. Goldscheider at a meeting on April 9 of the Physiological Society of Berlin discussed the action of menthol on the sensory nerves; he therefore concluded that the sensations in some places of cold and in other places of heat, produced by menthol, were purely subjective, and consequent on the direct stimulation of *the special nerves of temperature, those usually cognisant of cold* being far more sensitive to its influence than were those adapted to receive impressions of higher temperatures."—*Brit. Med. Journ.*, August 21, 1886.

Here, then, is strong evidence that the sentient nerve-endings over the surface of the body are graduated to respond to the various rates of energy that may impinge thereon; and if so, how can it be admitted that the varieties of energy by which these nerve-endings are stimulated must be limited to those already identified?

That some such idea has shaped itself in the minds of observers may be gathered from the independent opinions expressed by several of the members of the Cholera Commission of 1885.

Prof. Aitken sums up his valuable contribution in these words:—

"Some influence (as yet unknown, and therefore so far mysterious) seems to create in cholera times and places an epidemic activity. It is probable that this may be due rather to some meteorological condition—some peculiar state of the atmosphere, electrical or other—combined with unwholesome conditions of surroundings, and conditions of life; a co-existence of physical phenomena rather than anything in the individual. It is well known that electrical conditions such as prevail in a thunderstorm will cause milk to become sour, the formation of the acid being associated with, or due to, the formation of the bacterium lactis, and thus confined to very definite areas."

In the last paragraph lies the key to some of the foregoing mystery.

The mode in which to use it can be learned from the marvellous researches of Pasteur.

It is obvious that if the cause of sourness be the bacterium, the cause of greater sourness will be the bacterium still, and that the reason for the increased reduction by the bacterium of chemical antecedents to chemical consequents, which produces the additional sourness, must lie in some condition affecting the life of the bacterium too.

Pasteur has shown that a fundamental difference exists in the mode of action of the beer and grape ferments when "the introduction of the free oxygen of the atmosphere is permitted and when such introduction is prevented." When free oxygen is admitted, "the ferment shows an activity *even more extraordinary* than it did in the deep vats; the life of the ferment is singularly enhanced, *but* the proportion of the weight of the decomposed sugar to that of the yeast formed is absolutely different in the two cases: while, for example, in the *deep vats* a kilogramme of ferment sometimes decomposes 70, 80, 100, or even 150 kilogrammes of sugar; in the *shallow* troughs 1 kilogramme of the ferment will be found to correspond to only 5 or 6 kilogrammes of decomposed sugar. In other words, the more free oxygen the yeast ferment consumes the less is its power as a ferment; the more, on the contrary, the life of the ferment is carried on *without the presence of free oxygen* the greater is its power of decomposing and of fermenting the saccharine matter."

Here, then, is the clue to the cause of the increased sourness of milk during electrical conditions such as prevail in a thunderstorm. The bacterium lactis evidently finds itself in a situation in which the free oxygen of the atmosphere has, owing to some atomic disturbance in its molecules, become less available as an energy-provider.

The organism is consequently compelled to revert to the *condition of the ferment in the deep vats*, and to find in the increased decomposition of the constituents of the milk that energy which is necessary for its existence.

Further, it is known that electricity does affect the condition of oxygen, that the conversion of its molecules from the di-atomic to the tri-atomic state can be brought about by its influence, and that this latter state has been recognised as ozone.

If, then, it can be thus proved that the presence or absence of oxygen so materially alters the mode of existence of microscopic organisms, is it not reasonable to accept changes in the lives of the organisms as evidence of the altered condition of oxygen? and since certain conditions of free energy are thus found to interfere with the mode of nutrition of the minutest forms of life, can it be doubted that similar forces may exercise a material influence upon the most complex being, who, after all, is but a larger multiple of the original protoplasmic element?

Thus it becomes possible that energy existing in forms other than those of light or heat exerts a power which has up to the present been ignored.

By this reasoning too, based on the altered mode of nutrition of the bacterium lactis during a thunderstorm, much that has been hitherto obscure in the history of the diseases, or blights, of the vegetable world becomes intelligible.

When it is found that all the bacteria lactis over a considerable area at the same moment change their mode of existence, and, from leading a comparatively sluggish life in the milk substance, suddenly break up almost the whole of that substance at a time when electrical disturbances are present, it is easily conceivable that in the case of potato-blight, which is almost invariably accompanied by obvious atmospheric changes, like conditions may arise; in fact, that the universally present bacteria, which, under ordinary circumstances, continue to exist without apparent injury to the tuber and leaves with which they are in contact, may, when driven by the stress of altered atmospheric conditions, turn upon the tissues of the plant for nutrition as the bacterium lactis upon the milk.

If, then, these effects of certain unrecognised forms of energy be established, it will go far to help the elucidation of the mysterious subject of cholera.

Dr. Bryden, from prolonged study of the cholera statistics of India, arrived at the following conclusions: "That the disease was endemic in the Soonderbunds, and that its cause was *earth-born* and *air-borne*;"—to repeat the words of Prof. Aitken, "due rather to some meteorological condition, some peculiar state of the atmosphere, to a co-existence of physical phenomena;" and Deputy-Surgeon-General Marston has added: "Cholera spreads along rivers, but against their current in Bengal. It invariably advances from Bengal proper to the Himalayas, and never the reverse."

Here, then, are the conclusions arrived at by some of the most skilled observers on this subject.

It is thus admitted that cholera is endemic in the Soonderbunds, and that its track from thence lies in a north-westerly direction; that is, that its home is a surface of 12,000 square miles of decomposing tropical vegetation, and its direction that from whence the Ganges and its tributaries flow.

From this it may be inferred that its cause is such that it can be carried atmospherically, and that its course is the line of the least resistance.

Were the cause of cholera solid or liquid, it would doubtless long ere this have been demonstrated. Were it gaseous, it must follow the law of the diffusion of gases. What, then, remains to be sought for over the surface of the Soonderbunds? Naught but some form of that universal energy which fell as a sunbeam upon the growing plant, but which, when filtered through its substance, is evolved in a less vivid but still a potent form from its decaying structure.

That such returned energy has the power of incorporating itself with water, till it passes upward as a vapour, every steaming dung-heap shows; and in what prodigious force it can be again eliminated may be understood from the calculation of Prof. Haughton, that the condensation of vapour sufficient to afford one gallon of rainfall gives out sufficient heat to melt 45 pounds of cast iron.

From this may be estimated the enormous output of bottom heat which must day and night pass from a decomposing surface of 12,000 square miles to the vapour-carrying air above.

To comprehend the distance to which this energy may be transported before doing visible work it is only necessary to consider the Gulf Stream, which is described by Prof. Tait as "a vast convection current whereby the solar heat of the tropics is carried into the North Atlantic;" and to measure the work done thereby it needs but to weigh the luxuriant vegetation of the United Kingdom against the frigid barrenness of Labrador.

If, then, such vast stores of force can be transported from the tropics to England, it cannot be irrational to assert that from the surface of the Soonderbunds, and like places, much of the energy of decomposition must ascend with the rising vapour, and that whether drawn landward by the heated earth-surface, or pushed inward before the advancing monsoon, this vapour must follow the line of least resistance along the course of the river beds.

Again, when it is remembered how intense are the effects on the nerves of the animal body of the chemical affinity evolved as electricity from a few square inches of decomposing zinc, it may well be contended that the energy of chemical affinity evolved from so great an area of decomposing organic substances cannot be innocuous, and that the fact of its action not being acknowledged by the subjective sense of feeling is no proof that it is non-existent.

Thus it becomes conceivable how the energy evolved in the Soonderbunds may, when vapour-borne across the interval, affect the inhabitants of Oude, and so alter the individual condition as to admit of local causes producing foreign effects.

Many of the most careful observers have asserted that malarious fevers arose from chill; yet, while this did not solve the question, it at least established one fact, that malarious fevers arose under circumstances which necessitated vapour condensation, one gallon of which would set free energy sufficient to melt 45 pounds of cast iron.

Familiarity with malaria will furnish many arguments in support of the contention that fever infection is at least coincident with vapour condensation. A boat's crew ashore at night on a West African station will often be affected, while those but a few miles seaward will remain exempt.

In the deep valleys of Zululand leading from the St. Lucia swamp, fever is contracted at a distance of many miles inland, while high ground much nearer to the swamp may be occupied with impunity. In the Terai, at the foot of the Himalayas, a night's sojourn brings to the unseasoned traveller certain fever, while a day journey is almost free from risk.

Since, then, the search for a material cause of cholera and of malaria has been as unsuccessful as if one sought a material cause for sunstroke, it may legitimately be suggested that, as the more rapidly fatal affection is the result of the action of direct solar energy upon the sentient nerve-endings, so the less rapid maladies may result from subordinate rates of the same energy acting upon subdivisions of the nerve-endings, which, as Dr. Goldscheider has shown, are specialised to respond to lower velocities of that force, and that the chill to which so many attribute the origin of fever is really the acknowledgment, by what Dr. Goldscheider terms "the special nerves of temperature usually cognisant of cold," of that obscure energy hitherto unregarded as a factor in the production of disease, but which the investigations of thermo-electricity may one day bring within the ken of man.

NATHL. ALCOCK

Military Prison, Dublin

THE CRUISE OF THE "MARCHESA"[1]

THIS is one of the most interesting books of trave that it has been our good fortune to meet with for several years. Apart from its excellent maps and wealth of illustration, it commends itself by a charm of style not usually to be met with in works of this nature, and by the judgment shown in the narrative. Many countries were visited which lie in the well-beaten track of every tourist round the world, but these have not even been alluded to. The attention is riveted to the details of discoveries among little-known scenes, and sometimes in quite unexplored regions.

The *Marchesa*, an auxiliary screw schooner of 420 tons, Mr. C. T. Kettlewell, captain and owner, was commissioned in the Clyde in November 1881, and left Cowes on the 8th of the January following. She reached Colombo on April 24, having touched at Socotra and Oolegaum Island, one of the Maldive group, on her way from Aden. From Ceylon she proceeded *viâ* Singapore to Formosa; and, coasting along the south-eastern side of Formosa, she visited the small Island of Samasana. While she was running nearer to the coast at Chock-e-day, the stupendous cliffs of this part of Formosa were seen rising, to a height of some 5000 feet, upright from the water's edge.

The little-known islands of the Liu-Kiu group were next visited. These lie some 250 miles to the east-north-east of Formosa; they are partially volcanic, and lie just north of the tropic. The account of the short sojourn at Napha, and of the wonderfully successful visit to Shiuri, the capital, where are the ancient palaces of the Liu-Kiu kings, will be found in Chapters II. and III. Some time was spent at Japan, then the yacht's head was turned northwards for Kamschatka, and on the morning of August 13, when the fog lifted, the sharp peak of Vilutchinska Volcano enabled them to steer for Avatcha Bay, within which lies the once well-known little harbour of Petropaulovsky.

"Avatcha Bay is one of the finest harbours in the world, if not actually the finest. Rio and Sydney have no mean claims for this position of honour, but those of us who had seen both were unanimous in awarding the palm to their Kamschatkan rival. A nearly circular basin of some nine miles in diameter, and within a narrow entrance opening to the south-south-east, it is roomy enough to accommodate the navies of the world. It is entirely free from dangers, has an even depth of ten or twelve fathoms, and owing to its affording excellent holding ground and being well protected from all winds it is perfectly safe in all weathers. But the ordinary traveller will be struck not so much with its nautical excellences as with the superb scenery with which it is surrounded. To the south rises the Vilutchinska Volcano, now quiescent, a graceful cone of about 7000 feet; and a little farther eastwards a huge flat-topped mass exceeding it in height by a thousand feet or more obtrudes itself, as a rare exception to the rule of cone-shaped mountains which seems to obtain throughout the country. It is nameless in the charts, for we are in the land of volcanoes and it is only 8000 feet in height! On either hand on entering are the two secondary harbours, Rakova and Tareinska—the latter nearly five miles in length—and within them again are others on a still smaller scale. Nature here at least has treated the mariner right royally. The iron-bound coast without may be as bad a lee shore as any skipper need wish to see, and the Pacific Ocean may too often belie its name, but here he can rest quietly, and sleep *sur les deux oreilles*, until such time as he weighs anchor for the homeward voyage" (vol. i. p. 67).

In spite of its imposing name, it did not take the explorers long to see all the sights of Petropaulovsky, and a plan was soon formed to make an expedition into the interior. Travelling northwards from Avatcha Bay, they soon struck the head waters of the great Kamschatka River, on which they floated down to the sea. The well-known naturalist Dr. Dybowski gave them great assistance in their undertaking. The yacht was to remain in harbour for some six weeks, and then to proceed, as it did, to the mouth of the river to await their arrival. Of this delightful river journey our space will permit us to give no details. As far as Narchiki, where they met the river, they journeyed on ponies, and then they floated down its stream, sometimes in boats, sometimes on rafts, until, after many an adventure, and, indeed, many a trial, they reached Ust Kamschatka in safety. In places, the river swarmed with salmon; bears were in abundance; the weather, though not always of the best, was generally bright and clear; but the natives were very difficult to deal with—always exorbitant in their charges, and often placing the travellers in sad dilemmas; and constant rows took place about the hire of the canoes. One morning, after a harder fight than usual with the Mashura men, with much time and some temper lost, they came in sight of the magnificent range of volcanoes on the lower reach of the great river. The five already-known volcanoes have elevations of from 11,700 to nearly 19,000 feet, and there were two much lower cones, now first described, which they called after Gordon and Herbert Stewart. The account of the travellers' first view of these mighty peaks must be told in their own words.

"We floated silently down stream for a couple of hours or more, thinking over the discussions that we knew only too well would be renewed at the earliest opportunity,

[1] "The Cruise of the *Marchesa* to Kamschatka and New Guinea; with Notices of Formosa, Liu-Kiu, and various Islands of the Malay Archipelago." By F. H. H. Guillemard, M.A., M.D. (Cantab.), &c. With Maps and numerous Illustrations. Two Volumes. (London: John Murray, 1886.)

when turning a sudden corner we found ourselves face to face with a view that banished all thought of past and future annoyances in a moment. Before us, eighty miles or more away, stood one of the grandest groups of volcanoes in the known world. Others there are, it is true, that are higher, although in most cases the elevation of the ground from which they take their rise detracts in no little degree from their apparent height. But here, from a base elevated scarce a hundred feet above the sea, a series of cones of the most exquisitely symmetrical shape

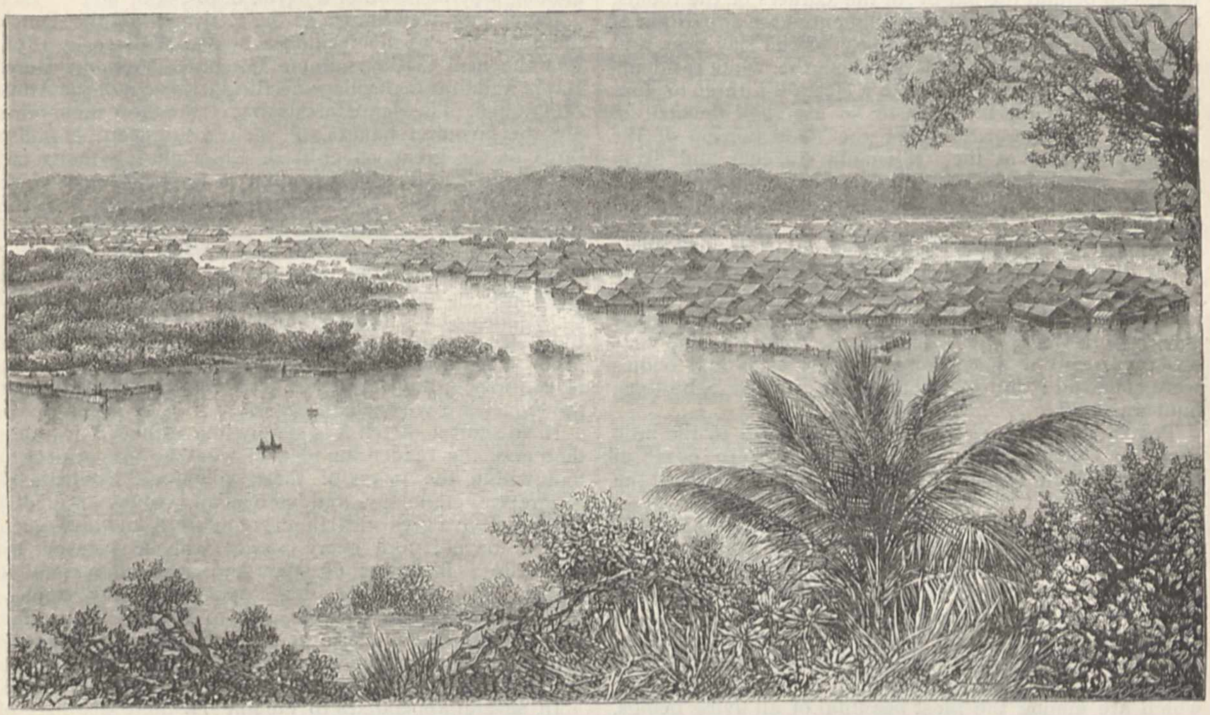
The Volcano of Kluchefskaya.

rose in heights varying from twelve to seventeen thousand feet. They were three in number. Nearest us was Tolbatchinska, dog-toothed in shape, with its apex on the western side, a long thin puff of white smoke drifting from its shoulder; and beyond, apparently in close proximity to one another, rose the twin peaks of Kojerevska and Kluchefskaya, perfect in their outline, pyramids of the purest snow, before which one felt how poor was all language to express the sense of their perfect beauty. Snow mountains were no novelty to us. We had seen the

Andes and the Alps, and had watched the sun rise on Cotopaxi, on Etna, on Fujiyama, and a dozen other mountains of equal note. But here all questions of comparisons would have been a sacrilege; and floating noiseless over the unruffled surface of the river, we sat spellbound drinking in the view. The sun sank slowly as we crept along, and slope and peak, at first a dazzling white, turned slowly to a glowing gold. On either hand the fast-approaching night had changed the glories of the autumn tints to a sombre shade of violet, and behind us the river was a mere streak of light. The glow of the fire upon the other raft lit up the bearded faces of our Russian guides around it; and when the daylight had fairly waned, the head of Kluchefskaya stood out a pale greenish white—a spectral mountain against the fast-darkening sky. Come what might, even if we were never again to get a glimpse of them, we had seen the great volcanoes, and we felt that the sight was one that we should not easily forget for many years to come" (vol. i. p. 149).

After rejoining the yacht the party visited the well-known breeding-places of the fur seal at Bering Island; from thence back to Kamschatka, and then to Yokohama to refit and repair. A brief history of Russian discovery in these seas, and a record of a little-known defeat of the allied forces of England and France in 1854 at Avatcha, will also be found in this volume.

In Volume II. the scene changes from the snowy north to the tropics, where for a long time the *Marchesa* wandered from one island of the Indian Ocean to another. The little-known Island of Cagayan Sulu is described as perhaps the most beautiful of all tropical islands. A revised chart of the island is given; and its three crater-lakes, one of the most interesting phenomena to be met with in the Eastern seas, were visited and described. The third lake had escaped the notice not only of Admiral Keppel, who had twice visited this island, but also of Captain Chimmo, who had in 1871 surveyed Cagayan Sulu. This lake was of rather smaller size than the others, being two-fifths instead of three-fifths of a mile in diameter; but the basin was perfectly circular, and filled with water to about the level of the second lake. Thick jungle clothed its precipitous sides, but the latter, instead of running sheer down into the water, left room for a small beach on which wild bananas were growing.



Brunei.

The islands of the Sulu Archipelago are described in Chapters II. to IV. of this volume. Natural history rambles were made over Sulu; and the Sultan, with and without his wives, visited the yacht. Some days were spent with the Spaniards at Jolo, a fortress on the northern side of the island. The fauna and flora of the Philippines and Borneo are contrasted with those of Sulu, and the Sulu Archipelago is determined to be, zoographically, purely Philippine, the Sibutu Passage forming the boundary line.

The newly-acquired territories of the British North Borneo Company were next visited, and some details are given of the existing state of things in this new colony. The colony at Labuan was found to be retrogressing. The Sultan was interviewed; and Brunei, the Venice of the East, in which, except its market, there is little of interest, was explored. The great dexterity of the boatmen in the use of their paddles is noted. "From a rapid and beautifully clean stroke of forty or more to the minute, they would drop instantaneously to a long steady swing of twenty, without any apparent signal having been given, and without a hair's-breadth of deviation from the perfect time."

We pass over the chapter on Sumbawa, and next find the yacht at Celebes. Macassar is the Hong Kong of the Dutch, and is not attractive from the sea.

"The town is much as other Dutch Malayan towns. A row of white shops and merchants' offices lines the sea; and dust of a lightness and powderiness that is not excelled even in California or the Diamond Fields covers the streets to the depth of an inch or more. These are otherwise clean enough, and the spare time of the native servants, and they appear to have plenty of it, is occupied in perpetual watering. There is of course a fort, and equally of course a '*plein.*' The cemetery is significantly full. Almost all the tombs are kept whitewashed, and as many of them are curious chapel-like erections with flying buttresses, the effect at a distance is something between an ice palace and a clothes'-drying ground. The houses of the Dutch residents, shadowed in peepul or galela trees, stand back a little distance from the road, long, low, and cool, with thick white posts at their entrance gates. A long avenue of magnificent overarching trees leads eastwards from the pier, adown which the Governor may be seen driving any afternoon in a four-in-hand, with sky-blue reins. It is lighted by means of lamps hung midway between the trees, for the Hollander, even although gas may be unattainable, considers civilisation incomplete without these adjuncts. Then too there is the club, with its zinc-topped tables set out *café*-fashion beneath the trees. It is called the 'Harmonie,' as is every Dutch club in Malaysia, and within all is dark and deserted and cool during the mid-day heat. The servants are curled up asleep behind the bar or in the corners of the rooms, and would stare in dumb astonishment at the apparition of a European; for the early business of the day over, and the *rijst tafel*, or lunch, despatched, the white residents get into their *pyjamas* and take a siesta till three or four o'clock. A couple of hours or so are then devoted to business, and towards sunset the male portion of the population meet at the 'Harmonie' to chat and drink *pijtjes*. Billiards is the most violent exercise taken; cricket, bowls, and lawn-tennis are unknown" (vol. ii. p. 156).

Among the pleasant reminiscences of the travellers about their travels in the north of Celebes will doubtless be those of their visits to the Tondano Lake with its pretty waterfall; to Talisse Island, where at "Wallace Bay" the habits of the maleo (*Megacephalon maleo*) were observed, and a good store of their eggs and bodies were collected; and to Kema, where a great babiroussa hunt was held.

The name Moluccas, at one time restricted to the little chain of volcanic islets lying off the western coast of Gilolo, of which Ternate is the chief, now includes all the islands between Celebes and the Papuan group. As regards magnificence of scenery, Ternate is perhaps the finest harbour in the Dutch Indies. The Resident, Mr. Morris, kept a large aviary of rare birds, amongst which the gems were two superb specimens—both full-plumaged males—of the twelve-wired bird of paradise. These exquisite creatures were fed on the fruit of the pandanus, with an occasional cockroach as a *bonne bouche*. "The feelings of admiration with which I watched these birds, which are among the most beautiful of all living beings, I need not," says the writer, "attempt to describe." The concluding chapters of this volume bring us to New Guinea, the very home of paradise birds. The portion of this great island visited was the western half, that claimed by the Dutch; which, from the variation in species from island to island, and the peculiarity of these birds of paradise, is perhaps the most interesting to a naturalist. A safe anchorage was secured at the extreme east end of the Island of Batanta, in "Marchesa Bay." The first ramble on shore was unsuccessful. Scrambling over the mangroves' slimy roots, and struggling up to their knees in liquid ooze, they found that the land was hard to reach; the shore rose steeply from the sea; and the dripping wet jungle made progress all the more difficult. The party returned disappointed to the yacht, to find that some of the hunters were already back, equally empty-handed. Presently, however, "Usman and his *compagnon de chasse* appeared triumphant, carefully carrying a prize that we had hoped, but hardly expected, to obtain—the curious and exquisitely lovely little *Diphyllodes wilsoni*, smallest of all the birds of paradise. Behind the head, a ruff of canary-coloured feathers stands erect above the scarlet back and wings. The breast is covered by a shield of glossy green plumes, which towards the throat are marked with metallic green, and violet spots of extraordinary brilliancy. The two centre feathers of the tail, prolonged for five or six inches beyond the others, cross one another, and are curved into a complete circle of bright steely purple. But the chief peculiarity of the bird is the head, which is bald from the vertex backwards, the bare skin being of the brightest imaginable cobalt blue (the figure in Gould's 'Birds of New Guinea' gives no notion of the extreme brilliancy of the colouring of this part). The *bizarre* effect thus produced is still further heightened by two fine lines of feathers which, running lengthways and from side to side, form a dark cross upon the brilliant azure background. I could hardly make up my mind to skin this little ornithological rainbow, whose exquisite plumage it seemed almost a sacrilege to disarrange, but the climate of New Guinea allows of but little delay in this operation, and I set about my task at once. The bird had been scarcely injured by the shot, and I succeeded in making a perfect skin of it" (vol. ii. p. 254).

Dorei Bay, well known as the settlement of the Dutch missionaries, and the residence of Mr. Wallace in 1858, was the next station. Some few miles south of Dorei Bay is Andai, a small village nestling at the foot of the Arfak Mountains. The dense forests that clothe these mountains are the favoured haunts of such magnificent paradise birds as the great velvet-black Epimachus, with its tail a yard in length; the Astrapia, in its uniform of dark violet, faced with golden-green and copper; and the orange-coloured Xanthomelus. There D'Albertis had shot his Drepanornis, with its two fan-like tufts, one flame-cloured, the other tipped with metallic violet; and there Beccari braved the climate and made such splendid collections. The summits of the mountains were less than ten miles from where the yacht was, and yet this land of promise could not be entered. Our readers must seek the reason why in the narrative: here we can only add that the homeward voyage had begun.

In so short a sketch it is simply impossible to do more than give the reader an idea of what he may expect to find within the pages of these volumes. Students of geography, ethnology, and, above all, zoology, will discover therein a great deal that is of interest, and also much that is novel; and every reader will be pleased by the writer's freshness of style and keen enjoyment of Nature. To enjoy travelling, especially in the tropics, one must be of an equable, not to say of a cheerful, frame of mind. We close the perusal of Dr. Guillemard's delightful volumes with the impression that the company on board the yacht *Marchesa* was certainly of this kind.

In several appendixes to Volume II. there are lists of the birds met with in the various regions visited, and of the shells. There is also a list of the Rhopalocera collected in the Eastern Archipelago, and of the languages of Sulu, of Waigiou, and of Jobi Island. Tables are given of the total export in 1884 of the chief articles of produce in the Netherlands India, North and South Celebes, Amboyna, and Ternate.

THE SMITHSONIAN INSTITUTION

THE annual Report of Prof. Baird, Secretary of the Smithsonian Institution, has just been issued. It relates to the period from July 1, 1885, to the close of June 1886, and includes, in addition to the account of the operations of the Institution itself, a summary of the work done by the branches of the public service placed by Congress under its charge, namely, the National Museum and the Bureau of Ethnology. To this is added a sketch of the work of the U.S. Fish Commission, which is also under Prof. Baird's charge, and of that of the U.S. Geological Survey, which, although independent of the Smithsonian Institution, is in close relation with it by reason of its field of exploration, and especially through the valuable accessions of material furnished by it to the National Museum.

With regard to the Smithsonian Institution itself there is not much to be said, except that its usual operations were steadily carried on during the year, with a marked increase in routine work. In the way of explorations there was less activity in the year 1886 than there has been in some previous years, but important collections of objects of scientific interest were received from various parts of America and Asia. Of the different classes of works issued by the Institution, the most valuable are the quarto "Contributions to Knowledge." A work in this series, entitled "Researches upon the Venoms of Poisonous Serpents," by Dr. S. Weir Mitchell and Dr. E. T. Reichert, was printed during the past year, and will soon be ready for distribution. Among the "Smithsonian Miscellaneous Collections" of 1885-86 may be mentioned "A Catalogue of Scientific and Technical Periodicals (1665 to 1882), together with Chronological Tables, and a Check-List," "The Scientific Writings of Joseph Henry" (not yet published, but entirely stereotyped), "Index to the Literature of Uranium, 1789-1885" (one of a series of bibliographies especially directed to the indexing of chemical literature), and "Accounts" of the progress of astronomy, chemistry, physics, geography, anthropology, and other sciences in 1885. The Smithsonian Institution has also issued the Bulletins and Reports of the Proceedings of the National Museum, and valuable publications of the Bureau of Ethnology.

It is well known that in bequeathing to the United States the fund with which the Smithsonian Institution was established, Mr. Smithson stipulated that his bequest should be devoted to "the increase and diffusion of knowledge among men." The Institution has always complied with this condition in a most liberal spirit, and now its system of "free exchanges" has reached vast proportions. For the year ended June 30, 1886, the receipts for foreign transmission were 94,093 packages, weighing 195,404 pounds. The transmission filled 764 boxes, having an aggregate bulk of 5208 cubic feet. For domestic exchanges the number of parcels received and distributed during the fiscal year was 14,496, of which 2533 parcels (or about one-sixth) were received for the library of the Institution. Twenty years ago the Institution was made by law the agent of the United States Government for conducting the international exchanges of public official documents between it and foreign Governments, and during the past year 29 boxes, containing 56,229 packages, were received for Government exchanges, and 114 boxes were sent abroad. The exchange system of the Institution is found to be of so much public service that Congress supports it by an annual grant of 10,000 dollars.

Perhaps the most interesting part of the report is that which relates to the National Museum. It is five years since the work of moving into the new Museum building was begun. Two years ago the Director reported that the packing-boxes, several thousand in number, containing the accumulations of many previous years, had for the most part been unpacked, and that the entire floor space of the building would soon be occupied by exhibition collections. During the past year this result was attained, and (with the exception of one corner of one of the central halls still occupied by one or two collections received at the close of the New Orleans Exhibition, and which have not been opened on account of delay in preparation of cases for their reception) the entire floor space of about 100,000 square feet is open to the public, and the collections arranged in accordance with the provisional plan of installation. The work of mounting and labelling is still in progress, and each month shows marked advances.

The development of the Museum during the past year was unexpectedly great. About fifteen hundred separate lots of specimens were received. A certain proportion of these were obtained from Government expeditions and surveys, and material of perhaps equal value through exchange, but by far the largest part of the increase, both in quantity and value, was in the form of gifts.

A census of the collections made in 1884 showed an estimated total of 1,471,000 "lots" of specimens in the Museum. The number at the present time is 2,420,934. The total number of "lots" of specimens received during the year and separately entered on the record of accessions was 1496, including 6890 separate packages. The construction of cases was constantly in progress, and during the year there were received and fitted for use and placed in the exhibition halls 84 cases, chiefly of the standard patterns. Forty-five storage cases were made for use in the laboratories, 5400 wooden drawers and trays, and 54,000 pasteboard trays. There were also purchased 3504 glass jars, for storage and exhibition of alcoholic specimens, and 24 barrels (1115 gallons) of 98 per cent. alcohol.

The distribution of duplicates was much the same as in previous years. About twenty-four thousand specimens were sent out to 118 institutions and societies: those to institutions in the United States are generally gifts, though many were sent in the way of exchange. For all foreign sendings, equivalents in the way of exchange were received or promised.

Many interesting details are given as to the various Departments in which the collections of the Museum are grouped. In the Department of Arts and Industries a prominent place is held by the section of textiles, which includes a very full series of the animal and vegetable fibres used throughout the world, together with good representations of devices for spinning and weaving, and of the various products of the textile industries. This collection is nearly all permanently installed, provided with printed labels, and illustrated by diagrams. For lack of room, fully half of the material ready for exhibition has been stored away, and the cases prepared for its display are in boxes in the Armoury building. The space assigned to the exhibition series is still so crowded that the objects cannot be satisfactorily examined. To the collection of food substances, in the same Department, is assigned a large quantity of unassorted material. The few cases now on exhibition contain the foods of the North American Indians, of Japan and China, and some of the more curious and unusual articles of diet. There are also two cases of educational importance, which exhibit graphically the composition of the human body and its daily expenditure of tissues, and the manner in which this is compensated for by daily rations of food. This collection is modelled after the famous collection of a similar character prepared by Dr. Lankester and others for the Bethnal Green Museum in London. It is, however, based upon an entirely new series of analyses, and upon a revised plan prepared by Prof. W. O. Atwater, of the Wesleyan University and corresponds to the latest views in physiological chemistry. The collections in chemical technology already have a good nucleus, and the increase during the year in the collections of materia medica was greater than during any previous year except the first. The fisheries collection was opened to the public in May 1884, and since that time there has been constant improvement in the condition of the material exhibited. Some gaps in the series of illustrations of foreign fisheries have been filled by collections received from the Governments of Siam and Japan, and by the extensive collections from Great Britain, Sweden, Spain, France, Holland, and Greece, acquired at the close of the London Exhibition.

Of the collection of historic relics in the Department of Arts and Industries, we learn that it includes several hundred objects of national interest connected with the history of soldiers, statesmen, and important events. Closely related to the historical collection is the series illustrating the history of steam transportation, under the charge of Mr. J. E. Watkins, of Camden, N.J. The "John Bull" engine, imported from England in 1831, the model after which all subsequent American engines have been constructed, has been given to the Museum by the Pennsylvania Railroad Company, and placed on exhibition; and adjoining this is a case in which there are already assembled about forty objects illustrating the beginnings of the American railroad system. The collection of scientific instruments owes its interest at present chiefly to the historical associations of most of the apparatus displayed, including, as it does, instruments used by Priestley, Henry, and Hare. The original telegraphic instrument of Morse and Vail is also here shown. The collections of musical instruments, modern pottery, and porcelain, lacquer, and the process of engraving are partially displayed, and when cases and floor space shall become available, will soon develop into important features.

The Department of Ethnology, although one of the youngest, is one of the largest in the Museum; and its growth during the last year was very great. Certain large classes of objects, such as weapons of war and the chase, implements of agriculture, and other primitive industries, have been carefully grouped. In addition to these great series of objects, classified according to function, other groups of objects have been arranged in accordance with another idea of classification, which is deemed of equal importance, namely, that of race. The Eskimo collection, for instance, has been arranged in table cases in one of the exhibition halls, in accordance with the ethnic idea, although, in the minor details of classification, function and form, as well as geographical distribution, have been followed. A preliminary study of the collection of basketry has been completed. A paper upon the baskets of uncivilised peoples, with numerous illustrations, was published in the Museum Report for 1884, and a representative series placed on exhibition with provisional labels. The throwing-sticks and sinew back-bows have been the subject of papers, and are now on exhibition. The curator has in progress investigations upon several groups of objects, notably the history and technology of archery; upon transportation as effected by man without the aid of domestic animals or mechanism; upon the peculiar industries of several handicrafts; upon the Hoopah Indians of California. The underlying ideas in these investigations, a first instalment of which was published in the last Report of the Museum, are (1) that the methods of strict classification and nomenclature already applied in the other natural sciences are equally applicable to anthropology; (2) that a trustworthy and minute study of modern savage and barbarous *technique* is absolutely requisite to the archæologist and technologist in reconstructing the history of civilisation.

The collections in the Department of American Aboriginal Pottery have continued to increase with astonishing rapidity, and the extensive accessions which have been received through the Bureau of Ethnology, and from other sources, have been of the greatest scientific importance and popular interest. One of the four large central halls of the Museum is devoted entirely to this subject, and the removal of the collections of South American aboriginal pottery and of the extensive collections from the mounds which have for many years been accumulating in the Archæological Hall of the Smithsonian building, have filled it up to such an extent that it is difficult to find room for the new material as it comes in. During the year a portion of the hall was thrown open to the public. The exhibition case surrounding the walls of this room is probably the largest in existence in any museum, being 260 feet in length, 4 feet 9 inches in depth, and, being double throughout, its entire length is virtually 520 feet. Double the space now allotted to this Department is necessary for its proper display, and the value of the material here concentrated is practically inestimable; since even the modern tribes, who are still making pottery similar in its general character to that which is here preserved, have deteriorated to such a degree in their artistic capacity or skill that their products are not an exponent of their original artistic capabilities. So exhaustive is this collection that it is impossible that any thorough work can be done upon the American aboriginal pottery which shall not in great part be based upon it.

The total number of accessions in the Department of Antiquities was 2751; and all excepting eighty-four were of sufficient importance to be added to the exhibition and study series, which now include over 40,000 specimens. Dr. Rau, the Curator of this Department, is engaged upon the preparation of an illustrated work on North American prehistoric objects, which is designed to serve as a guide for visitors to the Department, and as an explanation of the terminology of North American archæology. This will bear the title, "A Classification of the North American Prehistoric Relics in the United States National Museum." This book will be fully illustrated, and, it is hoped, will be published in the ensuing year.

The most important accessions to the Department of Mammals, as in previous years, were in the shape of single specimens sent from zoological gardens and menageries, which have shown a great deal of liberality to the Museum in this respect.

The growth of the Department of Birds during the year was very satisfactory, the number of specimens added to the collection being 4147. The largest single accession was the collection made by the U.S. Fish Commission steamer *Albatross* in the Bahamas, of 1000 specimens and about 75 species, of which 5 were new to science. Another valuable collection, 243 specimens, 81 species, 1 new to the fauna of North America, was obtained in Alaska by Mr. Charles H. Townsend, while on a mission for the Fish Commission. Mr. Henry Seebohm, of London, gave to the Museum 171 specimens, 68 species, chiefly from Siberia, and of great value to the collection. The number of specimens in the collection is now 55,945, 7000 of which have been set apart for the exhibition series.

Very much was accomplished during the year in the classification and arrangement of the collection of eggs and nests of birds. The total number of specimens added is 2556, in 253 lots, and there are now more than 44,000 specimens in the collection, of which 1491 are in the exhibition, and 31,124 in the reserve collection, the remainder having been set aside as duplicates.

The remaining Departments of which accounts are presented are those of Reptiles, Fishes, Mollusks, Entomology, Marine Invertebrates, Comparative Anatomy, Invertebrate Fossils, Fossil and Recent Plants, Minerals, Lithology and Physical Geology, and Metallurgy and Economic Geology. In dealing with the Department of Entomology, the author of the Report has to record a fine instance of the generosity and public spirit for which the best class of American citizens are famous. In October last, Dr. C. V. Riley formally presented to the Museum his private collection of North American insects, representing the fruits of his own labours in collecting and study for over twenty-five years. This collection contains over 115,000 pinned specimens, and much additional material unpinned and in alcohol. This generous gift to the Government had long been contemplated by Dr. Riley, who wishes to be, as far as possible, instrumental in forming a national collection of insects. In his letter of presentation he remarked:—"While the future of any institution dependent on Congressional support may not be so certain as that of one supported by endowment, I make this donation in the firm belief and full confidence that the National Museum is already so well established in public estimation that it must inevitably grow until it shall rival, and ultimately surpass, other institutions in this country, or the world, as a repository of natural history collections

If there shall in the future result the concentration here at the national capital of the extensive entomological material which naturally comes here, and which in the past has been scattered among specialists in all parts of the country, so that in the future the student may find valuable material to further his work in any order, I shall feel amply rewarded for the action I have taken."

The Curators of all the Departments complain that in the new Museum building there is not nearly room enough for the display of the treasures placed under their care, and Prof. Baird presses upon the attention of the Board of Regents the urgent necessity for "additional quarters." One of the arguments used by him may, perhaps, not be without effect on public opinion. Efforts are being made to secure that in 1892—the four hundredth anniversary of the discovery of America by Columbus—there shall be an exposition, presenting a complete illustration of the New World at that date, and of its progress in the arts and industries in the 400 years intervening. Prof. Baird points out that the collections of the National Museum for the most part tend towards such a display, and expresses his belief that if the new building for which he asks were erected it would be a very easy matter to organise and arrange it with this object in view, without unnecessary labour or great expense, and by the date mentioned, as the result of the current work of the Museum, without any spasmodic or unusual effort.

Of the Bureau of Ethnology we need only say that, during the fiscal year 1885-86, it continued its ethnologic researches among the North American Indians. Enthusiastic investigators carried on mound-explorations, explorations in ancient and modern stone villages, and general field studies. Much good office work was also done. This was, as usual, to a large extent the supplement to, and discussion of, the results obtained by exploration, and was executed by the same officers who had previously sought for materials and information in the field.

We have not space for further details, but probably we have said enough (as far as possible in the words of the Report itself) to indicate the very flourishing condition of the Smithsonian Institution and the establishments associated with it. The Institution is one of which Americans have good reason to be proud, and we cannot doubt that the claim for a new building, advanced by Prof. Baird on behalf of the National Museum, will be promptly and very carefully considered by Congress.

NOTES

PROF. BÉCLARD, Dean of the Medical School of Paris, died a few days ago of pneumonia. He was buried with great ceremony on the 12th inst. A large number of professors and students attended the funeral. His best work is on the thermic phenomena accompanying muscular contraction. He was a pleasant man, of fluent and happy eloquence, and a good writer. His place will probably be filled by Ch. Richet, the editor of the *Revue Scientifique*.

THE Academy of Vienna intends to have a special meeting for the celebration of the centenary of the death of Father Boscovich, the astronomer. A similar ceremony will take place at Ragusa, his native place.

WE have received a proof copy of the annual address to the Asiatic Society, Calcutta, delivered by Mr. E. T. Atkinson, the President, on the 2nd inst. It is an able and very interesting survey of the work done by the Society in the past year, and of the progress made outside the Society in the subjects to which the attention of its members is directed.

THE sixth annual meeting of the Sanitary Assurance Association was held at the offices, 5 Argyll Place, W., on Monday last. Mr. Joseph Hadley, Secretary, read the annual Report, from which it appeared that the business of the Association during 1886 was much greater than in any previous year. The Report said that, of all the properties inspected, in only two cases of first inspection had the arrangements been such that the Council could certify the sanitary condition of the property without alteration. The Executive Council reported having held several meetings for the purpose of revising the Sanitary Registration of Buildings Bill of 1886, and a new Bill had been prepared for presentation to the House of Commons. In the new Bill, the principle of compulsory registration would be restricted to schools, colleges, hospitals, asylums, hotels, and lodging-houses. On the motion of Mr. Mark H. Judge, seconded by Mr. H. Rutherfurd, the following resolution was unanimously passed:—"That, as soon as the Sanitary Registration of Buildings Bill, 1887, is in the hands of members of the House of Commons, the President of the Local Government Board be asked to receive a deputation in support of the Bill."

ON Tuesday last the forty-first session of the General Medical Council was opened, and an address was delivered, as usual on such occasions, by the President, Dr. Acland, F.R.S. Starting with a reference to the Jubilee, he traced some of the changes which have taken place during the last fifty years in medicine and in the methods of medical education.

LORD RAYLEIGH will begin a course of six lectures on "Sound" on Saturday, February 26, at the Royal Institution.

IN the latest of his annual reports, President Eliot, of Harvard University, refers to the present position of science in the secondary schools of America. "A serious difficulty," he says, "in the way of getting science well taught in secondary schools has been the lack of teachers who knew anything of inductive reasoning and experimental methods. This he attributes in part to the fact that "good school methods of teaching the sciences have not yet been elaborated and demonstrated," and he urges that "it is the first duty of University departments of science to remove at least this obstacle to the introduction of science into schools."

WE have received the third part of the first volume of "The Proceedings of the Linnean Society of New South Wales," second series. It contains the papers read at the meetings held in July, August, and September 1886, and there are four plates. Among the contents are the fifth part of a "Catalogue of the described Coleoptera of Australia," by Mr. George Masters, an elaborate paper on the "Revision of Australian Lepidoptera," by Mr. E. Meyrick, and "Miscellanea Entomologica: No II. The Genus Liparetrus," by Mr. William Macleay.

IN the United States there is a very much larger number of female than of male teachers. According to the *Woman's Journal*, men are hardly ever employed in elementary schools in cities, save as principals or as teachers of some special branch. In the ten cities of Baltimore, Boston, Brooklyn, Chicago, Cincinnati, New Orleans, New York, Philadelphia, San Francisco, and St. Louis together, there are 12,719 public-school teachers, of whom 11,540 are women. The average percentage of male teachers in these cities is 9.

DR. M. TREUB, Director of the Botanical Gardens in Buitenzorg (Java), will be on furlough in Holland from the beginning of March till the end of November. In Dr. Treub's absence Dr. W. Burck will serve as Acting Director of the Gardens. Only the correspondence about the *Annales du Jardin Botanique de Buitenzorg*, together with private correspondence, is to be addressed to Dr. Treub himself (Voorschoten, near Leyden, Holland).

A FRENCH translation has just been issued of Preyer's "Physiology of the Embryo." This book is a valuable one, dealing with a very obscure subject, and also one of great interest to the physician as well as to the psychologist and physiologist. All the functions of the adult being are in turn considered in the embryo, the differences and similitudes being well pointed out. M. Preyer understands the value of a good method.

MM. CHARCOT AND RICHER have issued an interesting book on "Les Démoniaques dans l'Art," that is, on hysteria studied in art manifestations of the past. The book contains quite a number of pictures after the old masters, which show that all the convulsions and attributes due to hysteria had been noticed and accurately pictured, although the manifestations were ascribed to diabolical influence The scenes figured in this book relate especially to exorcising and similar feats, and very well illustrate the power of observation of many of the old painters.

A NEW medical paper is to be published shortly in Paris, under Prof. Grancher's direction, at a very low price, containing much matter and appearing twice a week. It will be called the *Univers Médical*, and the editor intends to devote a much larger part to foreign news than is usually given in French papers.

M. DUCLAUX, Professor in the Faculty of Sciences, issued on February 12 the first number of a new scientific periodical, the *Annales de l'Institut Pasteur*, of which he is editor, with a Committee comprising Messrs. Chamberland, Grancher, Nocard, Roux, and Straus. This periodical is to be published monthly, and will contain papers on bacteriology, physiologically and clinically considered. The first number contains a letter from Pasteur, giving very encouraging and positive facts concerning the efficacy of preventive inoculations, obtained in his own laboratory and in those of Russia and Italy.

HERR W. ENGELMANN, of Leipzig, has issued the first number of a monthly scientific periodical called *Zeitschrift für physikalische Chemie*. The editors are Profs. W. Ostwald, of Riga, and J. H. van't Hoff, of Amsterdam.

ACCORDING to the *American Meteorological Journal*, an attempt is about to be made at St. Augustine, Flo., to sink a 12-inch artesian well to a depth sufficient to obtain water hot enough to heat buildings, pure enough for domestic purposes, and with pressure enough to run heavy machinery. Water can be found in Florida by boring 250 feet; and it is known that the artesian wells in that State have considerable pressure, and from a depth of 600 feet send water of warm temperature to a height of 45 feet when piped. The earth's internal heat is already forced into practical service at Pesth, where the deepest artesian well in the world is being sunk to supply hot water for public baths and other purposes. This well supplies daily 176,000 gallons of water heated to 158° F., and the boring is to be continued until the temperature of the water is raised to 176°. Heavy machinery is run by artesian well power in many parts of France, and the experience of the French shows that the deeper the well the greater the pressure and the higher the temperature. At Grenelle, a well sunk to the depth of 1802 feet, and flowing daily 500,000 gallons, has a pressure of 60 lbs. to the square inch, and the water from this well is so hot that it is used for heating the hospitals in the vicinity.

THERE is now ample evidence that the use of oil may be of considerable service in lessening the effect of dangerous seas. In one case the "slick" made by the oil extended 30 feet to windward, and the U.S. Hydrographic Office concludes that the oil is of use when the vessel is reaching ahead at the speed of eight or nine knots, with a beam wind and sea.

HERR SCHILLER, a well-known German architect, reports some facts which are of interest as indicating the radius of the circle of protection of good lightning-rods. On June 17 last, at the village of Mottingen, lightning struck a pear-tree 33 feet high. On one side, 115 feet away, was a school-house, with a rod 56 feet high. On the other side was a church, 328 feet away, and having a lightning-rod reaching up 154 feet. Both rods are well placed, and had worked well when tested, and the level of the foot of the tree is about the same as that of the two buildings. It is evident, then, if the facts have been accurately reported, that the radius of the circle of protection is not more than twice the height of the rod.

ANOTHER earthquake is reported from Aquila. On the night of February 3, three shocks were felt, two of which were accompanied by strong undulatory motion.

EARTHQUAKES are also reported from the Vilayet Konia, in Asia Minor. On January 8, a subsidence of the ground was noticed at Holan Gola (Feneke district), accompanied with loud subterranean noises; many landslips took place in the adjacent hills. The shocks continued for six days, and the inhabitants of Feneke and the neighbouring villages took refuge in the fields. The earthquakes have destroyed seven villages.

ON January 15 the Hawaiian volcano Mauna Loa began to discharge. Frequent shocks of earthquake were felt. A letter written on January 19 says:—"There have been thirty-six hours' continuous earthquakes. The lava flows down the south slope, and if its course be unchanged it will flow into the sea without doing much damage."

THE Russian traveller M. Ogorodnikoff was told at Meshed that there are tin mines near that city and in various parts of Khorassan. In an article in the *Revue Scientifique* M. Berthelot points out that this accords with a passage in Strabo, who speaks (book xv. ch. ii. 10) of tin mines in Drangiana, the ancient name for the region now called Southern Khorassan. If there really have been tin mines in this district from time immemorial, there can be little doubt that they supplied the tin for the bronzes of ancient Egypt and Assyria.

THE first zoological station in the tropics has been founded by Dr. Sluiter, at Batavia. This gentleman is already well known by his works on the fauna of the Sunda Islands. The Natural History Society of the Dutch Indies has presented Dr. Sluiter with sufficient means to establish three work-tables with the necessary apparatus, and to purchase a sailing-boat.

MR. ABBOTT KINNEY writes to the Los Angeles *Weekly Tribune* that the floods in Southern California are becoming every year more violent and destructive. The testimony on this point, he says, is uniform, complete, and unimpeachable. The streams now nearly all bring down more sand, gravel, and boulders, rise more rapidly, cut away more land, and dry up more quickly than formerly. Valuable valley lands are thus cut away or covered up, and in some cases the streams have spread out and deposited great fan-shaped mounds of sand and boulders. Mr. Kinney attributes the change chiefly to the destruction of forests. The brush and forests on the hills and mountains have been to a large extent swept away, and the result is that there is nothing to hold the water back. The rains do not penetrate into the soil and rocks which supply the springs, but rush suddenly off the mountains as from a roof, carrying the soil first, and then the gravel and boulders with them. The springs, deprived of their supply, diminish. The principal agent in the destruction of the natural verdure and protection of the mountains has been fire. Fires accidentally lighted, fires made by stock-men, bee-men, and fools, are, according to Mr. Kinney, producing effects that must eventually make Southern California a desert.

It is proposed that a school of hygiene shall be established at the University of Michigan, and the State Legislature is about to be asked to authorise the necessary expenditure. The scheme was suggested by the State Board of Health. The school would include in its curriculum climatological studies, air analyses and ventilation.

Last week there was a Convention of Photographers in the Hall of the Society of Arts, and the attendance was good and representative. The proceedings in the morning were opened by a few remarks from Capt. Abney, the President, who, in the afternoon, delivered a more elaborate address, projecting on a screen a succession of diagrams and pictures illustrative of his statements. At a dinner in the evening the toast of the Camera Club was proposed by Mr. V. Blanchard, who, in recalling the time when he made his first practical acquaintance with photography by watching a friend develop a paper negative, expressed the opinion that photographers might perhaps return to the use of paper negatives.

Prof. Liversidge, of the University of Sydney, who is about to return to England on leave of absence, has been requested by the Minister of Public Instruction of New South Wales to inquire into and report upon the mode of teaching natural science in the elementary schools of Great Britain and Ireland.

New South Wales will be represented at the Conference of Astronomers to be held in Paris in April next, by Mr. H. C. Russell, the Government Astronomer.

A valuable "Report on the Medusæ collected by the U.S. Fish Commission Steamer *Albatross*, in the Region of the Gulf Stream in 1883–84," by Mr. J. Walter Fewkes, has lately been reprinted, at the Government Printing Office, Washington, from the Annual Report of the Commissioner of Fish and Fisheries for 1884. Mr. Fewkes is not sure that certain of the Medusæ recorded by the *Challenger* from great depths do not also live and flourish at or near the surface. There is need, he thinks, for greater accuracy in the determination of the exact depth from which a deep-sea Medusa is taken, and for an improvement of the apparatus used in this kind of collecting. In the case of fixed hydroids, or such Medusæ as *Cassiopeia* and others, which live upon the bottom, the determination of the depth at which they live is an easy task. With such genera as *Atolla*, *Rhizophysa*, and others, this determination is more difficult. Mr. Fewkes points out that it is of great importance, from a morphological stand-point, that the question whether Medusæ are confined to certain depths, should be definitely answered. "I can at present," he says, "imagine no place on the globe where the uniformity of conditions under which Medusæ are placed can be the same as at great depths of the ocean. I do not mean necessarily on the floor of the ocean, since that may be raised or depressed, and the varieties of conditions which come from such motions may result, but in the depth of the sea, separated from the surface by a wall of water of great depth, and from the ocean-bed by a similar wall of equal amount. Here, if anywhere, may we look for the continuance of ancestral features unmodified by environment. On this account the determination of the bathymetrical limits of free Medusæ, no less than that of those animals which inhabit the bottom, is a most important thing, and from it should be eliminated all possibility of error."

Dr. Otto Hermes has just published the results of some interesting investigations concerning the phosphorescence of marine fish. He wished to ascertain whether the phosphorescence was caused by the same Bacillus which Dr. Fischer, an eminent authority on Bacteria, has discovered and brought from the West Indies. Marine fish are easily rendered phosphorescent after death by being moistened with a little sea-water. Dr. Hermes took a fragment of a specimen of *Gadus callarias*, which had been made strongly phosphorescent in this manner, to the laboratory of Councillor Koch; and Dr. Frank, a pupil of the latter, was enabled to isolate it after a few days. This is undoubtedly a new species. Like Dr. Fischer's Bacillus, it can be transferred upon sterilised fish, and after forty-eight hours it emits an emerald-green light; the sea-water is also rendered phosphorescent. A point of difference is that the Bacillus of Dr. Fischer develops best in a high temperature (20°–22°), while that of Dr. Hermes develops better in a low one. Examined microscopically, the latter is much smaller than the former. Dr. Hermes has given it the name of *Bacterium phosphorescens*.

The German Fishery Association lately asked the German Chamber of Commerce to put a premium on seals, it being maintained that these animals are most destructive to the fisheries. The petition was refused. The Association, in support of its views, stated that a full-grown seal requires 10 lbs. of fish a day for its food, making 3650 lbs. in a year. At the same rate, 1000 seals would consume the enormous quantity of 3,650,000 lbs. a year. As the seal is a faithful attendant upon herring-shoals, it causes enormous havoc among a species of fish which is one of the greatest sources of revenue to the fishermen on the North German coast. It is maintained that these depredations have greatly decreased the quantity of fish in recent years. Complaints of the serious destruction of fish by seals have also lately been made by Swedish fishermen in the Baltic.

The additions to the Zoological Society's Gardens during the past week include a Green Monkey (*Cercopithecus callitrichus* ♂) from West Africa, presented by Mr. Charles W. Demprey; a Bonnet Monkey (*Macacus sinicus* ♂) from India, presented by Mr. G. S. Copeland; a Common Otter (*Lutra vulgaris*), British, presented by Mr. John Hall; two Rufous Tinamous (*Rhynchotus rufescens*) from Brazil, presented by Mr. Francis Monckton; two White-throated Finches (*Spermophila albogularis* ♂ ♀) from Brazil, deposited; a Collared Fruit Bat (*Cynonycteris collaris*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

A Method for the Determination of the Constant of Aberration.—Referring to M. Lœwy's plan for the determination of the constant of aberration by measuring the relative positions of stars situated in distant parts of the sky at successive epochs by means of a double mirror placed in front of the object-glass of an equatorial (Nature, vol. xxxv. p. 282), M. Houzeau points out (*Comptes rendus*, tome civ. No. 5) that the same idea occurred to him some years ago, and that the fundamental principle of the method, and an enumeration of the advantages attending its application, were published by him in 1871, in a paper entitled "Considérations sur l'Etude des petits Mouvements des Etoiles," which appeared in tome xxxviii. of the Mémoires de l'Académie de Belgique. It appears, therefore, that M. Lœwy's method cannot, strictly speaking, be considered a new one, though we believe it has never been put into actual practice—a work which we hope to see before long accomplished at the Paris Observatory.

The Application of Photography to the Determination of Stellar Parallax.—In the *Monthly Notices* for January 1887, Prof. Pritchard publishes the results of his measurements of the photographs of 61 Cygni and neighbouring stars, taken on fifty nights ending December 7, 1886, with a view to the determination of the parallax of this well-known star. Using measures of distance only, the relative parallaxes of each of the components, referred to each of four comparison-stars, are :—

Star	Parallax of 61^1 Cygni	Probable error	Parallax of 61^2 Cygni	Probable error
	"	"	"	"
a	0·4412	0·0154	0·4204	0·0229
b	·4529	·0330	·4139	·0185
c	·4433	·0197	·4721	·0215
d	·4158	·0161	·4574	·0252

The means for the parallaxes thus obtained for the four independent sets of measures of 61[1] and 61[2] Cygni respectively are as follows :—

For 61[1] Cygni, 0''·438 ; for 61[2] Cygni, 0''·441.

Prof. Pritchard explains that this determination is to be regarded as provisional only, and that the work will be continued to the end of the annual cycle. The method certainly appears to be a most promising one, and the publication of the full details of the Oxford researches will be awaited with interest.

OBSERVATIONS OF VARIABLE STARS IN 1885.—No. 151 of Gould's *Astronomical Journal* contains Mr. Edward Sawyer's observations of variable stars made in 1885. The following epochs of maximum brightness were observed :—R Andromedæ, 1885 January 10 ; R Leonis, about 1884 December 24 ; R Leo. Min., 1885 June 26 ; R Boötis, 1885 May 16 ; R Ursæ Majoris, July 1 ; S Ursæ Majoris, May 7 ; U Herculis, July 8 ; *g* Herculis, June 4, August 2 (?), October 16 ; S Coronæ, May 11 ; χ Cygni, 1886, January 10 ; R Scuti, 1885 June 17, August 10 (?), and November 16 ; Mira Ceti, February 10 ; R Aquarii, January 4. β Pegasi and α Cassiopeiæ appeared constant, and ρ Persei nearly so, during the observations. R Coronæ was well observed, and showed numerous but slight fluctuations of light. An unusally bright phase, 6·2 m., occurred on August 15, followed by a rather faint minimum, 7·4 m., on October 13. T Monocerotis was well observed : last minimum, April 20, 15h. 26m. Camb. M.T. ; last maximum, April 27, 15h. 55m. U Monocerotis was observed at minimum on April 1, and at maximum on April 14. W Cygni was observed at maximum on August 20 and December 16, giving a period of 118 ± days, and at minimum on October 30.

THE ALLEGED ANCIENT RED COLOUR OF SIRIUS.—Mr. Lynn, in the current number of the *Observatory*, shows that the evidence for this star having formerly been of a red colour is much less strong than has frequently been supposed. Prof. Schjellerup had pointed out in his notes on his translation of Sûfi, that the designation ὑπόκιῤῥος applied to the star in our editions of Ptolemy was probably an error of transcription for σείριος ; whilst it had been suggested long ago that, for the word "rub r" which we find used in reference to it by Seneca, we should really read "fulgor." It certainly has always seemed improbable that a star of such vast dimensions as Sirius must be should have so entirely changed its colour in less than 2000 years.

BRIGHT LINES IN STELLAR SPECTRA.—Mr. O. T. Sherman, in No. 149 of Gould's *Astronomical Journal*, brings together various observations of the bright lines which have been observed by Vogel or Copeland in the spectra of β Lyræ, γ Argûs, R Geminorum, and some smaller stars, and compares them with Hasselberg's observations of the low-temperature spectrum of hydrogen and the high-temperature spectrum of oxygen, and draws the inference that the stellar bright lines belong to these spectra. The inference seems scarcely warranted, however, for, on the one hand, the lines in the spectrum of hydrogen are so numerous that, wherever the star-lines lay, it would be easy to find lines near them, so that the accord would have to be very close for any such deduction to be safely based upon it ; and, on the other, the observations of the lines in the stellar spectra are less accurate than Mr. Sherman seems to think. The slight differences in the recorded positions of the bright lines as given by different stars are probably indications simply of a roughness in the readings, and the lines are most likely the same in general in the different spectra. The following may be taken as rough mean positions for the bright lines in these interesting spectra : 600 mm., 581, 568, 540, 466, together with the F line of hydrogen, and, in some cases, D_3 and the third line of hydrogen at 434, assuming that the lines are the same in the various spectra of the type. The close correspondence of the bright lines in R Geminorum to those observed by Cornu in Nova Cygni, 1876, indicates that we probably have there the coronal line 1474 K, the principal chromospheric lines, and the typical nebular line at about 500.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1887 *FEBRUARY* 20-26

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

At Greenwich on February 20

Sun rises, 7h. 6m. ; souths, 12h. 13m. 56·7s. ; sets, 17h. 21m. ; decl. on meridian, 10° 55′ S. : Sidereal Time at Sunset, 3h. 22m.

Moon (New on February 22) rises, 5h. 52m. ; souths, 10h. 25m. ; sets, 15h. 2m. ; decl. on meridian, 17° 6′ S.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian ° ′
Mercury	7 33	12 58	18 23	7 34 S.
Venus	7 49	13 27	19 5	4 59 S.
Mars	7 38	13 9	18 40	6 23 S.
Jupiter	23 16*	4 17	9 18	12 11 S.
Saturn	12 59	21 8	5 17*	22 23 N.

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

Feb.	h.	
20	2	Jupiter stationary.
22	—	Annular eclipse of the Sun ; visible only in parts of South America, Australia, and the South Pacific Ocean.
24	17	Venus in conjunction with and 1° 17′ north of the Moon.

Variable Stars

Star	R.A. h. m.	Decl. ° ′		h. m.	
U Cephei	0 52·3	81 16 N.	Feb. 20,	20 38	*m*
			,, 25,	20 17	*m*
Algol	3 0·8	40 31 N.	,, 25,	6 5	*m*
W Virginis	13 20·2	2 48 S.	,, 22,	23 0	*M*
δ Libræ	14 54·9	8 4 S.	,, 24,	0 31	*m*
U Coronæ	15 13·6	32 4 N.	,, 20,	23 19	*m*
S Libræ	15 14·9	19 59 S.	,, 21,		*m*
U Ophiuchi	17 10·8	1 20 N.	,, 20,	3 27	*m*
			and at intervals of	20 8	
β Lyræ	18 45·9	33 14 N.	Feb. 24,	4 0	*m*
W Cygni	21 31·8	44 52 N.	,, 24,		*m*
T Pegasi	22 3·4	11 59 N.	,, 20,		*M*
δ Cephei	22 25·0	57 50 N.	,, 23,	21 0	*m*

M signifies maximum ; *m* minimum.

Meteor-Showers

February 23–25, near β Trianguli, R.A. 30°, Decl. 35° N. Also from Monoceros, R.A. 120°, Decl. 5° S.

GEOGRAPHICAL NOTES

IT would seem that Dr. Oscar Lenz is only to leave Zanzibar this week. The *Times* Vienna Correspondent is mistaken in thinking that the Royal Geographical Society expects Dr. Lenz to come direct to London. He must, of course, first render his account to the Vienna Society, which sent him out ; but after that, it is hoped, he will come to London and tell his story. It is possible that before leaving Zanzibar he may have an opportunity of giving Mr. Stanley the benefit of his experience. Mr. Joseph Thomson, in a letter to the *Times*, endeavours to show that Mr. Stanley is taking a too rosy view of the prospects of his expedition. Mr. Thomson naturally insists on the superiority of the Masai Land route over all others. Certainly Mr. Stanley exaggerated the difficulties of this route, and we are inclined to believe that, had it been selected, the expedition might have reached Emin Pasha sooner than by the Congo. It should be remembered that, even if all the vessels on the Middle and Upper Congo are available, they could not possibly convey a thousand people in one journey—a good authority assures us that there must be at least three journeys ; so that, unless Mr. Stanley starts on his land journey with only one-third of his caravan, instead of 35 days after leaving Stanley Pool it will take 100 days to reach the mouth of the Aruwimi. At the same time we must believe that Mr. Stanley knows what he is about, and is not likely to lay himself open to the reproach of being so far out in his calculations.

IN the official report, just issued, on the administration of Lower Burmah during 1885-86, and Upper Burmah during 1886, there are some interesting passages relating to the resources of the new British province. Agricultural products, such as rice, wheat, maize, and other cereals, are grown in large quantities. The country is believed to be rich in mineral resources, and the subject is at present under the examination of the Geological Survey. Meanwhile it is known that the country to the north-east of Mandalay is the richest, if not the only, rubyproducing tract yet discovered. As to gold and silver, nothing trustworthy is known. Jade and amber are found in parts. But the most valuable of the Upper Burmah minerals is likely to be coal, of which there are certainly four fields, one of which has already yielded excellent fuel.

DR. HOLUB, whose murder to the north of the Zambesi is doubtfully announced, may be remembered as the author of "Seven Years in South Africa," published about six years ago. He set out some three years ago to march from the Cape to Cairo, partly for purposes of exploration, and partly to open up markets in Central Africa for Austrian commerce. He does not seem to have made much speed.

PROF. MIGUEL MARAZTA has made what seems a curious anthropological discovery in the valley of Rebas (Gerona) at the end of the Eastern Pyrenees. There exists in this district a somewhat numerous group of people, who are called *Nanos* (dwarfs) by the other inhabitants, and as a matter of fact are not more than four feet in height (1·10 to 1·15 metres). Their bodies are fairly well built, hands and feet small, shoulders and hips broad, making them appear more robust than they really are. Their features are so peculiar that there is no mistaking them among others. All have red hair; the face is as broad as long, with high cheek-bones, strongly developed jaws, and flat nose. The eyes are not horizontal but somewhat oblique, like those of Tartars and Chinese. A few straggling weak hairs are found in place of beard. The skin is pale and flabby. Men and women are so much alike that the sex can only be told from the clothing. Though the mouth is large, the lips do not quite cover the large projecting incisors. The *Nanos*, who are the butt of the other inhabitants, live entirely by themselves in Rebas. They intermarry only among themselves, so that their peculiarities continue to be reproduced. Entirely without education, and without any chance of improving their condition, they lead the life of pariahs. They know their own names, but rarely remember those of their parents, can hardly tell where they live, and have no idea of numbers.

JOHN HUNTER

THE Hunterian Oration was delivered on Monday afternoon in the theatre of the Royal College of Surgeons by the President, Mr. Savory, F.R.S., Senior Surgeon to St. Bartholomew's Hospital. After a few introductory remarks, Mr. Savory proceeded to say that surgeons with one voice have proclaimed the supremacy of Hunter above all who have ever studied surgery. Students of science have acknowledged him to be among the chief of those who have in any age advanced human knowledge. He was, and is, beyond and above all surgeons, a philosopher in surgery. His idea of the subject of his thoughts was far more adequate than that of other men. He was supreme in the scope and method of his work. He understood much better than those around him how to engage in the interpretation of Nature; he knew best how to approach and to disclose truth. For he not only understood that the problems which lay immediately before him were, of all, the most complex and difficult to solve, but he could see also that they were not isolated but dependent ones. He saw in the necessary relation in which they stood to others the only means by which they could be worked out; and on this understanding he resolved to investigate the questions he desired to answer. Mr. Savory next spoke of the passion of Hunter for collecting. His museum included, he said, not only—to use the words of Professor Flower—"illustrations of life in all its aspects, in health and in disease; specimens of botany, zoology, palæontology, anatomy, physiology, and every branch of pathology; preparations made according to all the methods then known; stuffed birds, mammals, and reptiles, fossils, dried shells, corals, insects, and plants; bones and articulated skeletons; injected dried and varnished vascular preparations; dried preparations of hollow viscera, mercurial injections, dried and in spirit; vermilion injections; dissected preparations in spirit of both vegetable and animal structures, natural and morbid; undissected animals in spirit, showing external form or awaiting leisure for examination; calculi and various animal concretions; even a collection of microscopic objects, prepared by one of the earliest English histologists, W. Hewson; but it extended to minerals, coins, pictures, ancient coats of mail, weapons of various dates and nations, and other so-called 'articles of *vertu*.'" Hunter's labours in surgery were next referred to. He was ever searching for principles, but strove to reach them only through facts. Facts always first, but never facts only; from facts to principles. He understood that all progress mainly depends on the power of grouping and uniting for some new purpose facts that have been discovered independently and that are daily being revealed, yet with little or no reference to the principles they are found to support. He saw that surgery, in his time, was but a rude, empirical art, consisting of little else than a knowledge of many facts which stood in no visible relation to each other, and of many more opinions which, for the most part, had no relation, or but a very distant one, to any facts whatever. He held that surgery should be raised from a collection of such creeds to the rank of a science, but this could be only by founding its practice upon some principles. The discovery of some, at least, of these principles was Hunter's final aim. But those principles could not be reached by guessing. They could be approached only through the orderly investigation of facts. But then an explanation of these facts themselves could be only through the truths of physiology. The signs of disease could be understood only by him who had studied the laws of life and health. An intelligent interpretation of the one could be only in proportion to a previous knowledge of the other. But the problems of life, of health, are presented to us in man in their most complex form—in a form so difficult that even Hunter could not solve it. They must be reduced to simpler terms through a study of the lower forms of life. Thus, with the ultimate aim of relieving human suffering, Hunter studied the phenomena of motion in plants. Nay, he went further, to crystals and other forms of inorganic matter; and he says: "The better to understand animal matter, it is necessary to understand the properties of common matter, in order to see how far these properties are introduced into the vegetable and animal operations." The singleness of purpose with which Hunter worked is made evident, Mr. Savory continued, not only in the actual result of his labours, for no human being with divided interests could rival such achievements, but in the record, as we have it, of the life he led. He gave not only the whole of his time—yes, the whole of it in no mere conventional sense—and all his great powers, his mind and body alike, to the one object of his life; but to this he sacrificed all that he possessed, all that he could gain. To this he devoted, without stint or scruple, his money, his friendships, all his other interests. What any other man would have considered impossible, he made practicable. And this to no personal end. He was careless of all rewards save that which was to him paramount, the discovery of truth. A noteworthy point in the character of Hunter appears to be found in the relation which, in him, thought bore to action. He combined in himself in a singular degree the power of conception and of execution. He not only saw much further, but he was able to do much more than most others. He saw as Bacon saw—and the idea was probably as original with him as with Bacon—that the systematic and thorough examination of facts was the first thing to be done in science, "and that, till this had been done faithfully and impartially, with all the appliances and all the safeguards that experience and forethought could suggest, all generalisations, all anticipations from mere reasoning, must be adjourned and postponed; and further, that, sought on these conditions, knowledge, certain and fruitful, beyond all that man then imagined, could be obtained." But he went immeasurably further than the great prophet of science in putting his conceptions to the proof in imperishable work on the lines he had laid down. "I only sound the clarion," said Bacon, proudly, "but I enter not into the battle." Hunter sounded a clarion the echoes of which are reverberating still, but he entered into the battle also, and was always found where the blows fell thickest, and we are in possession of the spoils. In his museum there is, at once, the clearest evidence of the idea and the richest fruits of execution. In speaking of Hunter's general education, Mr. Savory proceeded to say that if Hunter had received a good general education in early years he would have been all the better for it. He would have lost nothing. His mental powers could have been in no way impaired; on the contrary, enhanced. He would have recorded the results of his labours in better order, with more light and greater effect, and we should have had the advantage of a clearer revelation of his thoughts. But all this is very far from saying that Hunter was not, in the strictest sense, an educated man. He was not, indeed, a scholar. If the subtle rendering of a Greek poet, or the skilful turning of a Latin verse be the sole test of culture, he gave no sign of it. Of ancient lore he was sadly destitute. In *Literis Humanioribus* he could have had no place. But if a transcendent knowledge of Nature and her ways, if a firm and ample grasp of her noblest truths, be accounted education, if the devotion through a lifetime of gigantic intellectual powers and of a truly loving heart to the reverent study of God's works be culture, then Hunter, though not a man of letters, was surely a highly educated man. The fame of Hunter, after all, falls far short of him. It may, without exaggeration, be said that he is really greater than to most men, even to most surgeons, he appears to be. It is only after a review of the whole of his vast labours, in their mutual relation, not merely after a study of the merits of his numerous papers, each taken by itself, but in an attempt to apprehend the scheme to which all his labours were subservient, that we are in any measure able to realise the strength of Hunter's genius. Then, as the chief merit of his work is not of a character to catch at once the eye, even of one who searches for it, so his subject is not one of widespread or popular interest. Of all men who have achieved greatness, Hunter requires to be studied with most diligence, the more so because of the absence of all literary skill. And there can be no doubt that he shared the fate of all those who have been, like him, in advance of their time. He was so far beyond his contemporaries as to be, for the most part, out of their reach, and therefore they left him alone; and even his successors have not always found him out. It may, indeed, be said to have been almost by an accident that, in association with the possession of his museum, we have periodically a festival in honour of his memory. Such, then, at least in the eyes of one who, though from afar, has long and earnestly looked up to him, was John Hunter. Beyond all cavil, if the word have any meaning for us, he was a man of genius—a man supremely endowed with power and faculties for the discovery of truth. With little education at the outset of life, without the advantage of the schools, he found himself face to face with the deepest and most mysterious problems of Nature, and he was forthwith able to take full measure of the magnitude of the task. It seems never to have occurred to him that he could snatch an answer by surprise; that a solution could be reached by any short or sudden means. But his survey assured him that upon one plan only, but by that abundantly, could success be made certain. So with patience, which of itself has been called genius, he went back to the beginning. It was genius too, and that of the highest order, to discern, at so vast a distance, where the beginning lay. But there he placed himself, and from that point went forward only when he had made each footstep sure. Who shall say that his imagination was not fertile, or that he faltered in the use of it? Yet no seductive theory tempted him into undue haste, and though sometimes drawn aside by a specious speculation, he seems hardly ever to have been lost in an unsound conclusion. And when he fell, the treasures he had won were found not only in the multitude of facts he had garnered, or even in the principles which, by virtue of the facts he had discovered, were made plain, but also in the very plan and purpose of his work. For, from the height on which at length he stood, not only can the path he trod be clearly traced, but the highway thenceforward is disclosed. So is the greatness of John Hunter to be estimated, not only by what he discovered, but rather by the lesson and example of his work. Truly it may be said of him that he did much. Truly it may be said of him that he showed how much more there is to be done. "He being dead yet speaketh," still speaks to us as no other man before or since has spoken. But when and where can his voice be heard most plainly? Are the spirits of those who have shaken off "this muddy vesture of decay" permitted to revisit the scenes of their earthly labours? Can they still be with us on our way? If the soul of this mighty son of science is ever in our midst, surely his favourite haunt must be now within these walls—in the museum which will soon almost surround us, at once his most graphic and glorious monument. The memory of Hunter, like the memory of the greatest men of every age, is imperishably enshrined. Art, in her noblest efforts, has striven to make his form familiar to us. His name is stamped in indelible characters on the records of human progress. But, before all, he lives in, and draws the breath of life from, his own immortal works. And of these none can be so truly a memorial of the very man as this; no other can so resemble him, can possess so much of him, can tell so fully of what he was; can so perpetuate him in the vast store of facts, in the purpose for which they are set forth, in the illustration of principles, in the suggestion of truths beyond those it can show, above those it can reach—in all this, I say, no memorial, however majestic, can rival our museum. The foundation of this with his own hand and his whole heart he laid; it has grown, and still is growing, from his strength, and it must be made for ever worthy of his name.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—The following new Examiners have been appointed in the Natural Science School: Mr. V. H. Veley (Chemistry), Dr. W. H. Gaskell and Prof. Ray Lankester (Biology), Mr. J. V. Jones (Physics). Mr. W. W. Fisher and the Rev. F. J. Smith are to be Examiners in the Pass Schools.

The Sibthorpian Professorship of Rural Economy is now vacant, and canditates for it are requested to send in their applications to the Registrar of the University before March 10.

The Board of the Faculty of Medicine has issued a list of subjects to be offered in the first examination for the B.M. degree under the new medical statutes.

Scholarships in Natural Science are announced for competition at Merton, Corpus, and Queen's, and at New College.

SCIENTIFIC SERIALS

American Journal of Science, January.—The Muir glacier, by G. Frederick Wright. The paper contains an exhaustive study of this interesting glacier, which lies in the Alpine region of Alaska at the head of Muir Inlet, Glacier Bay, in 58° 50′ N. lat., 136°40′ W. long. It forms a frozen stream some 5000 feet wide by 700 deep, entering the inlet at a mean rate of 40 feet, or 140,000,000 cubic feet, per day, during the month of August. The vertical front at the water's edge is from 250 to 300 feet, and from this front icebergs are continually breaking away, some many hundred feet long, with a volume of 40,000,000 cubic feet. The glacier appears to be rapidly retreating, there being indications that even since the beginning of this century it has receded several miles up the inlet, and fallen 1000 or 1500 feet below its former level.—On the age of the coal found in the region traversed by the Rio Grande del Norte, by C. A. White. The carboniferous beds occurring at various points in this region vary greatly in quality, but none of them appear to be earlier than late Cretaceous age.—The viscosity of steel and its relations to temper (continued), by C. Barus and V. Strouhal. Among the chief results of the authors' further experiments, as here described and tabulated, is the light thrown on the crucial importance of the physical changes which steel undergoes during annealing at high temperatures between 500° and 1000° C. Within these limits occur several nearly coincident phenomena: such as Gore's sudden volume expansion; Tait's sinuously broken thermoelectric resistance; Gore-Baur's sudden disappearance of magnetic quality; the passage of carbon from uncombined to combined; Jean's critical cementation temperature; and the authors' own unique maximum of viscosity.—On the nature and origin of lithophysæ, and the lamination of acid lavas, by Joseph P. Iddings. The data upon which the conclusions here stated are based were obtained from a study of the various forms of structure and crystallisation assumed by acid lavas in cooling, as observed while prosecuting the work of the United States Geological Survey in the Yellowstone National Park under Mr. Arnold Hague. The lithophysæ, composed of prismatic quartz, tridymite, soda-orthoclase, fayalite, and magnetite, appear to be of aqueo-igneous origin, having been produced by the action of the absorbed gases upon the molten glass from which they were liberated during the crystallisation consequent upon cooling. It also seems highly probable that the differences in consistency and in the phases of crystallisation producing the lamination of this rock were directly due to the amount of vapours absorbed in the various layers of the lava and to their mineralising influence.—The latest volcanic eruption in Northern California, and its peculiar lava, by J. S. Diller. The volcanic district here described is that of the so-called "Cinder Cone," near Snag Lake, North California, where the recent character of the eruptive phenomena is most striking as compared with other outbursts in the same region. The lava field, some three square miles in extent, is of basaltic type, but remarkably anomalous in containing numerous grains of quartz, and very high percentages of silica and magnesia with correspondingly low quantities of the oxides of iron. — On the texture of massive rocks, by

George F. Becker. From his researches the author infers that porphyries may form at any depth and no matter how slowly the temperature of the magma may sink, while granular rocks can scarcely ever have been thoroughly fluid or homogeneous, but have often consolidated at pressures extremely moderate compared with those at which it is certain that porphyries would form.—A fifth mass of meteoric iron from Augusta County, Virginia, by George F. Kunz. This specimen, which comes from the same place where was found the largest of the three masses first described by Prof. Mallet, yielded, on analysis: iron 90·293; nickel, 8·848; cobalt, 0·486; phosphorus, 0·243; carbon, 0·177; with traces of copper, tin, sulphur, silica, manganese, chromium, and chlorine.—Note on the origin of comets, by Daniel Kirkwood. It is argued that, although most comets are of interstellar origin, some of short period may have had their rise within the solar system.—The bichromate of soda cell, by Selwyn Lewis Harding. The experiments here described tend to show that this is a most efficient cell, whose effectiveness, as far as its constancy is concerned, might be materially increased by interchanging the positions of the electrodes with their surrounding liquids, after the fashion of the Fuller cell.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 13.—"Supplementary Note on the Values of the Napierian Logarithms of 2, 3, 5, 7, and 10, and of the Modulus of Common Logarithms." By Prof. J. C. Adams, F.R.S.

In vol. xxvii. of the Proceedings of the Royal Society, pp. 88-94, the author has given the values of the logarithms referred to, and the value of the modulus, all carried to 260 places of decimals.

The calculations in that paper were carried to several more decimal places, but the application of an equation of condition which supplied the means of testing the accuracy of the whole work, showed that errors had crept into the work which vitiated the results beyond 263 places of decimals.

Through inadvertence, however, the results were printed in the above paper exactly as they were given by the calculations, although several of the later decimals, especially in the value found for the modulus, were known to be wrong.

The author has now succeeded in tracing and correcting the errors which occurred in the former calculations, and the equation of condition which tests the accuracy of the work is now satisfied to 274 places of decimals.

The present paper gives the parts of the several logarithms concerned which immediately follow the first 260 decimal places as already given in the former paper, and likewise the corrected value of the modulus, which is found to be—

M=·43429 44819 03251 82765 11289 18916 60508 22943 97005 80366
65661 14453 78316 58646 49208 87077 47292 24949 33843 17483
18706 10674 47663 03733 64167 92871 58963 90656 92210 64662
81226 58521 27086 56867 03295 93370 86965 88266 88331 16360
77384 90514 28443 48666 76864 65860 85135 56148 21234 87653
43543 43573 17253 83562 21868 25

which is true to 272 or 273 places of decimals.

February 10.—"Contributions to the Metallurgy of Bismuth." By Edward Matthey.

"An Inquiry into the Cause and Extent of a Special Colour-Relation between certain Exposed Lepidopterous Pupæ and the Surfaces which immediately surround them." By Edward B. Poulton.

Linnean Society, February 3.—W. Carruthers, F.R.S., President, in the chair.—Dr. M. C. Grabham and Capt. G. Wingate were elected Fellows of the Society.—Mr. G. Maw exhibited a *Narcissus cyclamineus* grown by him from bulbs sent by Mr. A. W. Tait, of Oporto. The plant in question was known to Parkinson (1640), afterwards was lost of, and rediscovered by Mr. Johnston, near Oporto, in 1885.—Mr. Maw showed a drawing of *Crocus Karducharum*, and another, for comparison, of *C. zonatus*, from the Taurus, to which it is allied.—Brigade-Surgeon J. E. T. Aitchison read a paper on the fauna and flora of the Afghan boundary. The zoological collection obtained comprised, in round numbers, 20 species of mammals, 130 species of birds, 35 species of reptiles, 7 species of fish, and over 100 species of insects. Among these, many were new to science. Of special interest is the mole-like rat, *Ellobius fuscicapillus*, hitherto only known from the type obtained forty years ago at Quetta. In certain places the ground is riddled with the burrows of this and other rodents. The geographical range of the tiger goes east and north to Bala Murghab; that of the cheetah to the valley of the Heri-rud. A pheasant (*Phasianus principalis*) and woodpecker (*Gecinus gorii*) are new. With some exceptions, the birds are chiefly migratory, their arrival in spring following each other in quick succession. The Brahmini duck (*Casarca rutila*), unlike its congeners, nests and remains throughout the year. The most abundant species of birds are, among the genera *Saxicola*, *Lanius*, *Sylvia*, *Motacilla*, and *Emberiza*. An adult fine example of *Naia oxiana* is a museum acquisition, as the species heretofore has only been recognised from young undeveloped specimens. Regarding the insects, 20 are new, though, taken as a whole, the insect fauna resembles that of Arabia and North Africa, rather than that of India proper. The botanical collections amount to 800 species, and probably 10,000 specimens of plants. Over 100 are new to science. The author gave some account of the physical features of the districts traversed, and of the climate. Taking these into consideration, he states that the plants do not represent what is generally recognised as an Oriental flora, being chiefly composed of northern Persian and Arabian forms, augmented by Central Asian and Siberian types, with a few West Himalayan or Tibetan, and still fewer representing the Punjab or Scind. Beside these are a fairly representative local flora; say, one-sixth of the collection. *Juniperus excelsa* is the only indigenous conifer; neither oaks nor species of *Æsculus*, *Olea*, or *Myrtus* were met with. *Populus Euphratica* forms forests in the river-beds, but as long as the tree is situated near water it is indifferent to altitude. Out of 75 natural orders, Compositæ and Leguminosæ greatly preponderate over the others, containing 81 and 80 species respectively. In Compositæ, *Cousinia* heads the genera with 18 species; *Centaurea* has 10 species. Of 80 species of Leguminosæ, 39 belong to the genus *Astragalus*, 14 of these being new. Of 61 species of Gramineæ, all are well known. The Cruciferæ collected number 56 species; several are new. Chenopodiaceæ follow with 39 species, Labiatæ with 35, Boraginaceæ 32, Umbelliferæ 30, Caryophyllaceæ 30, Rosaceæ 27, Lilliaceæ 26, Euphorbiaceæ 16, Polygonaceæ 15, Ranunculaceæ 14, Rubiaceæ and Cyperaceæ each 13, Scrophularineæ and Plantagineæ 10 and 11 respectively. The orchards at some of the villages are surrounded with high walls, inside which is a row of mulberry-trees grown for the breeding of silkworms. In the Afghan gardens, beetroot, carrots, turnips, cabbages, radishes, and tomatoes are raised, and these are of excellent quality. In the fields, besides wheat, rye, and barley, opium, tobacco, melons, and certain oil-seeds are cultivated. Cotton is grown, but the quality of the fibre is poor. Several plants of pharmaceutical value flourish—Galbanum, Ammoniacum, &c., and of these the author gave a full account.

Zoological Society, February 1.—Dr. St. George Mivart, F.R.S., Vice-President, in the chair.—Mr. F. Day exhibited and made remarks on a hybrid fish supposed to be between the pilchard and the herring, and a specimen of *Salmo purpuratus* reared in this country.—Mr. W. L. Sclater exhibited and made remarks upon some specimens of a species of *Peripatus* which he had obtained in British Guiana during a recent visit to that country, and added some general observations on the distribution and affinities of this singular form of arthropods.—Mr. A. Thomson read a report on the insects bred in the Society's Insect House during the past season, and exhibited the insects referred to.—A communication was read from Dr. B. C. A. Windle, containing an account of the anatomy of *Hydromys chrysogaster*.—Mr. Martin Jacoby read a paper containing an account of the Phytophagous Coleoptera obtained by Mr. G. Lewis in Ceylon during the years 1881, 1882. About 150 new species were described and many new generic forms.—Mr. F. E. Beddard read some notes on a specimen of a rare American monkey, *Brachyurus calvus*, which had died in the Society's Gardens.—Mr. Oldfield Thomas read a note on the mammals obtained by Mr. H. H. Johnston on the Camaroons Mountain.—A paper was read by Capt. Shelley, containing an account of the birds collected by Mr. H. H. Johnston on the Camaroons Mountain. The collection contained thirty-six specimens referable to eighteen species, and of these four were new to science.—Mr. G. A. Boulenger read a list of the reptiles collected by Mr. H. H. Johnston during his recent visit to the Camaroons Mountain.—Mr. Edgar A. Smith read a paper on the Mollusca collected at the Camaroons Mountain by Mr. H. H. Johnston, and gave the description of a new species of *Gibbus*, proposed to be called *Gibbus johnstoni*, of which specimens were in the collection.—A communication was read from Mr. Charles O. Waterhouse, containing a list of some coleopterous insects collected by Mr. H. H. Johnston on the Camaroons Mountain.

Geological Society, January 12.—Prof. J. W. Judd, F.R.S., President, in the chair.—The President announced the sad loss which the Society had sustained since the last meeting by the death of Mr. John Arthur Phillips, F.R.S., who had been for several years a valuable member of the Council, and one of the Vice-Presidents of the Society.—The following communications were read:—The Ardtun leaf-beds, by J. Starkie Gardner, with notes by Grenville A. J. Cole. The description of these beds by the Duke of Argyll thirty-five years ago indicated that enormous tracts of trap in the Inner Hebrides were of Tertiary age. Prof. Edward Forbes, who described the leaves, inclined to the idea that they might be Miocene; but in estimating the value of this conjecture, we must remember that at the time the existence of Dicotyledonous leaves of similar aspect, but of undoubtedly Cretaceous age, was quite unsuspected, and that no typical Eocene flora had then been properly investigated or described. Prof. Heer adopted the opinion that the age of this formation was Miocene, and unfortunately extended its application to formations containing similar floras in Greenland and elsewhere. The writer of the present communication tried to show that instead of belonging to the Miocene, these floras are of Eocene age, and in fact older than the Thanet beds. He also re-described the plant-beds, and maintained that they are part of a rather extensive series of sedimentary rocks intercalated among the traps.—On the Echinoidea of the Cretaceous strata of the Lower Narbadá region, by Prof. P. Martin Duncan, F.R.S.—On some Dinosaurian vertebræ from the Cretaceous of India and the Isle of Wight, by R. Lydekker.—Further notes on the results of some deep borings in Kent, by W. Whitaker.

January 26.—Prof. J. W. Judd, F.R.S., President, in the chair.—The following communications were read:—On the correlation of the Upper Jurassic rocks of the Jura with those of England, by Thomas Roberts.—The physical history of the Bagshot Beds of the London basin, by the Rev. A. Irving. The author, in reviewing the position taken up by him, attempted to estimate the value of such palæontological evidence as exists, and insisted on the importance of the *physical* evidence in the first place. He gave reasons for considering the evidence of pebbles, pipe-clay, derived materials, irony concretions, percentages of elementary carbon (ranging in the more carbonaceous strata up to nearly 2½ per cent.) taken together with the evidence of carbon in combination, as adduced in former papers, *fresh-water Diatoms* (now, perhaps, recorded for the first time in the Middle and Lower Bagshot), and the microscopic structure of the sands and clays, as furnishing such a cumulative proof of the fluviatile and delta origin of the majority of the Middle and Lower Bagshot Beds, as can hardly be gainsaid; while he regarded the wide distribution of the Sarsens as indicating, along with the fauna, a much greater areal range formerly of the Upper Bagshot than of the strata below them.

Mineralogical Society, January 11.—Mr. L. Fletcher, President, in the chair.—Messrs. A. Pringle, G. T. Prior, and J. M. Thomson, were elected Members.—The following papers were read:—On a specimen of meteoric iron found at Yundagin, West Australia, in 1884, by Mr. L. Fletcher, President.—Additional notes on the feldspar from Kilima-njaro, by Mr. L. Fletcher, and Mr. H. A. Miers.—On the occurrence of greenockite in a new locality, by Prof. M. F. Heddle.—Note on a form of calcite from Heilim, Sutherlandshire, by Prof. M. F. Heddle.—Note on the occurrence of bismutite in the Transvaal, by Mr. H. Louis.—Notes on celestine from Gloucestershire and on apatite from East Cornwall, by Mr. R. H. Solly.—Note on the presence of lead in calcite from Leadhills, by Mr. J. Stuart Thomson.—On the use of gnomonic projection, by Mr. H. A. Miers.—Prof. Judd exhibited a specimen of a new terrestrial alloy of iron and nickel (Ni_2Fe) discovered in New Zealand by Prof. Ulrichs.—Colonel MacMahon exhibited a crystal of sapphire from a vein which had been revealed by a landslip in the south-east of Cashmere, about the year 1880.

PARIS

Academy of Sciences, February 7.—M. Gosselin, President, in the chair.—Movements of a bird's wing represented according to the three dimensions of space, by M. Marey. In continuation of his first communication on the flight of birds, the author here shows, by a series of chrono-photographic images, how the movement of the wing is made according to the three dimensions of space. One of the illustrations gives a synoptic view of the projections of the wing on three different planes at ten successive instants of a single revolution, thus containing all the elements necessary to determine the continuous action of the wing. Further chrono-photographic experiments are promised, which will convey a complete representation of all the alar movements, and in general of all notions relating to the kinematics of flight.—On the red fluorescence of alumina, by M. Lecoq de Boisbaudran.—On the composition of the ashes of cider, by M. G. Lechartier. The study of the composition of the ashes which ciders yield by incineration is here undertaken, both for its scientific interest and on account of the indications it may give of their purity. The author inquires whether this composition presents uniform distinctive characters whatever its local origin, and finds that the ashes of the cider apple are in no way modified by the nature of the soil. He also shows the differences existing between the ashes of the fruit, the leaf, and the wood of the apple-tree.—Experiments relative to the anti-phylloxeric disinfection of the grape-vine, by MM. Georges Couanon and Etienne Salomon. The varying results of M. Balbiani's already-described process are here reported from various districts throughout France for the year 1886. Although generally satisfactory, the remedy was found in some cases to be as bad as the evil, the failure being attributed either to the unhealthy state of the plant or to climatic or other local conditions.—Fresh researches on the action exercised by cuprous preparations on the development of the Peronospora of the vine, by MM. Millardet and Gayon. These experiments, carried out last September, fully confirm the conclusion already anticipated by the authors, that in these mixtures the essential prophylactic agent is the copper dissolved by rain-water and dew.—Memoir on the developments of naval geometry, with application to the calculations of stability, by MM. Guyou and Simart. The authors consider their method as a distinct improvement on those of their predecessors, Charles Dupin, Bravais, Rankine, Reech, Leclert, and Daymard. Thanks to their new formulas, the still laborious calculations which are required even by Daymard's method (recently crowned by the Academy) are much shortened.—Geographical co-ordinates of Punta-Arenas, by M. Cruls. For this important station the following values have been recently determined: Latitude 53° 9′ 38″·6 S.; Longitude 4h. 43m. 36·09s. west of Greenwich.—Equatorial observations of the new comets, Brooks and Barnard, made at the Observatory of Algiers with the 0·50m. telescope, by MM. Trépied and Rambaud.—On entire algebraic series, by M. L. Lecornu.—Some experiments on aërial eddies, by M. Ch. Weyher. The experiments here described deal with waterspouts in the open air, with whirlwinds in an inclosed space, with the attraction produced by vortices, and with the variation of temperature in an eddy.—On the electrolysis of alkaline solutions, by M. Duter. In the electrolysis of aqueous solutions of potassa, soda, baryta, or lime, the volume of oxygen liberated on the positive electrode is considerably less than half that of the hydrogen liberated on the negative electrode. But with a wide platina plate for positive and a fine platina wire for negative electrode, the author obtains one volume only of oxygen for four of hydrogen. In the electrolysis of alkaline solutions there appear to be formed small quantities of a superoxygenated compound combined with an alkali in such a way that it cannot be liberated by ebullition but only by an acid. This appears to be a peroxide of hydrogen, by the existence of which M. Berthelot explains various reactions, such as that of the permanganate of potassa on oxygenated water.—The principle of maximum labour and the laws of chemical equilibria, by M. H. Le Chatelier. It is shown that under a single law may be reduced all the phenomena without exception of vaporisation, allotropic transformation, and dissociation from − 200° C., boiling-point of oxygen, to + 1000° C., point of dissociation of the oxide of iridium.—Action of the oxide of lead on some dissolved chlorides, by M. G. André. Some true oxychlorides are here described, which the author has obtained by studying the action of certain oxides on the solutions of the alkaline earthy chlorides.—Combinations of the glycerinate of potassa with the monatomic alcohols, by M. de Forcrand. The glycerinates here studied are those of methylic, ethylic, propylic, amylic, and isobutylic potassa.—On phosphoplatinous chloride, $PhCl_3PtCl_2$, by M. E. Pomey.—On a combination of orthotoluidine and the bichloride of copper, by M. E. Pomey. The formula of the combination here determined is shown to be $CuCl_2 . 5(C_7H_9N . 4Cl)$.—On the hydrochlorate and platinochlorate of di-isobutylamine, and the platinochlorate of tri-isobutylamine, by M. H. Malbot. These substances, apparently not hitherto produced, have for formulas: $HCl . N(C_4H_9)_2H$; $PtCl_4 . 2HClN(C_4H_9)_2H$; and $PtCl_4 . 2HClN(C_4H_9)_3$.—On gluconic acid, by M. L. Boutroux. The author has succeeded in preparing sufficient quantities of this acid by means of the process indicated by MM. Kiliani and Kleemann.—On the characteristic properties of olive oils, by M. Albert Levallois. It is shown that the most constant character of olive oils prepared in the laboratory from various berries from the south of France is density. A simple method is described for distinguishing these from the oils of sesame, cotton, colza, linseed, and cameline.—On sardine-fishing, by M. Launette. The abundance and scarcity of this fish on the west coast of France is shown to be intimately associated with the animal refuse drifting across the Atlantic from the Newfoundland cod-fisheries.—On the formation of the so-called "red wood" (*bois rouge*) in the fir and Epicea, by M. Emile Mer. The occasional development of these hard and yellow-coloured layers in the relatively soft and white wood of the fir and Epicea is here attributed to the superabundance of nutritive elements at certain points under various conditions of growth.—On the Miocene vertebrate fauna of Grive-Saint-Alban, Isère, by M. Charles Depéret. Amongst the most interesting remains of this fauna is an anthropoid ape, Sansan's *Pliopithecus antiquus*, whose molars point to a relationship with the present gibbons.—Synthetic experiments on the abrasion of rocks, by M. J. Thoulet. These experiments have been carried out to determine the laws regulating the weathering of rocks under the action of drift sand.—On the age of the bauxite deposits in the south-east of France, by M. Louis Roule. This formation seems to have been deposited on the bed of the lake formerly stretching between Provence and Languedoc, and belongs to the lacustrine series closing the Chalk epoch in this region.—On the distribution of mean cloudiness on the surface of the globe, by M. L. Teisserenc de Bort.

Berlin

Physiological Society, December 10, 1886.—Prof. du Bois-Reymond in the chair.—Dr. Hermes showed the luminous Bacillus brought some time ago with marine fish from the West Indian Ocean and bred in pure cultures. In nutrient gelatine the Bacillus formed funnel-shaped cultures at the surface. Inoculated into sterilised fish it rendered them luminous to a very high degree. The Bacillus developed also in fresh-water fish, but only when these were placed in salt water. In fresh water the Bacillus disappeared. At temperatures below 15° Celsius, the luminosity ceased. It was easy with this fish-Bacillus to render a large quantity of sea water luminous. If, however, the water were allowed to stand for twenty-four hours, only the surface was luminous; but by stirring it up the whole mass again became luminous in consequence of the interpenetration of the air.—Prof. Zuntz reported on experiments which, in conjunction with Dr. Berder, he had instituted with a view to ascertaining the effect of alcohol on metastasis in man. The respiration was especially examined. An essential preparatory condition for such experiments was the complete cessation of all muscular activity, which increased the absorption of oxygen and the formation of carbonic acid, as was also protection against the too rapid cooling, promoted by the flow of blood in the skin, consequent on the operation of the alcohol. With the moderate use of alcohol (20 ccm.), so as to produce no perceptible sign of intoxication, the absorption of oxygen was somewhat increased without corresponding increase in the formation of carbonic acid, a relation corresponding with the combustion of the alcohol, in which two molecules of carbonic acid are formed for every three molecules of oxygen consumed. —Dr. Wurster described a new reagent for the demonstration of active oxygen in the living organism. Tetramethylparaphenylenediamine and dimethylparaphenylenediamine were colourless substances not liable to be changed in the air; but with active oxygen, in form of ozone, peroxide of hydrogen, or nitrous acid, they formed colouring matters, the tetramethyl-compound giving a blue colouring matter, which with an excess of active oxygen again lost its colour; whilst the dimethyl-compound with a little oxygen yielded a red colouring matter, and with excess of oxygen a violet colouring matter. The speaker had saturated paper with these substances. Reagent papers of this description were admirably adapted in all cases for the detection of active oxygen. In cutaneous evaporations, and, in particular, in perspiration, copious quantities of active oxygen were in this way capable of being demonstrated. The presence of such active oxygen might further be demonstrated in the saliva of healthy persons, and in the sap of plants, especially in the milky juices of plants. Seeing that in all these cases ozone was absent, otherwise it would have been recognised by its odour, only peroxide of hydrogen or nitrous acid could be present. By means of other reactions it was shown that in these cases there was no question of anything but peroxide of hydrogen.

January 14.—Prof. Munk in the chair.—Dr. Gad communicated the results of some experiments, which had been carried out by him in conjunction with Dr. Wurster, respecting the active oxygen in the animal organism. By means of the two reagents in active oxygen discovered by Dr. Wurster—dimethylparaphenylenediamine and tetramethylparaphenylenediamine, the properties of which were demonstrated by Dr. Wurster at the last meeting of the Society—animal fluids and tissues were tested in respect of the presence in them of active oxygen. On the skin the reagent papers either remain colourless, or they become coloured symptomatic of slight oxidation, or they become rapidly coloured and rapidly discoloured, which was an invariable phenomenon in the case of stronger oxidation of the diamines. Blood produced no change on either the dimethyl or the tetramethyl, whereas fresh muscles, and even flesh bought at the butcher's, yielded a very strong reaction, an energetic oxidation. If moderate quantities of a solution of the two diamines were injected subcutaneously into frogs or rabbits, or into their venous system, then they got completely oxidised in the body and were no longer capable of being demonstrated. They were altered into colourless combinations; and only in the heart, in the liver, and at the places of application were strong colorations discernible. The stomach was coloured at all places to which the oxygen of the air had entrance; the places, on the other hand, which were protected from the air were colourless, and became coloured only when they were exposed to the air. The brain presented a colouring of olive-green—a phenomenon which would have to be more particularly investigated, seeing that the colourings of oxidation under dimethyl were red or blue, under tetramethyl, blue. In consideration of the fact that the living protoplasm of the cells did not readily take up foreign substances, and taking account of the fact above demonstrated, that the blood did not oxidise either of the two substances in question, the speaker assumed that the complete consumption occurring after the introduction of the two bodies into the living organism was accomplished by the juices of the tissues, or by the fluids which secreted the protoplasm of the cells. The objection made against the experiments, that the diamins were not found because they were not absorbed, was refuted by the fact that the animals operated on always showed the phenomena of intoxication proceeding from the central nervous system. Experiments would be further continued by Dr. Gad and Dr. Wurster. The experiments had hitherto yielded the important fact that in the living organism the protoplasm worked in an especially oxidising manner.

Physical Society, December 17, 1886.—Prof. von Bezold in the chair.—Prof. Neesen exhibited a tuning-fork of variable pitch of tone. It had a hollow stem and hollow prongs, so that it could be filled with quicksilver to any desired height. With the increasing mass of the vibrating-fork the pitch of its tone changed. The excitation was effected by electro-magnetic methods.—Dr. Aron developed the theory of the inductionless coils constructed by him. In this task he pursued the practical object of putting an end to, or at least very much reducing, the spark arising from the extra-current on the interruption of the electric current, and very soon rendering the contacts unavailable. The induction exercised by the iron-nucleus on the windings might, as was well known, be obviated by a copper case, and the induction of the different windings of the spirals on one another was overcome by the speaker by intercalating a tin-foil layer between each layer of windings and embedding the isolated wires in a good conductor. The speaker showed theoretically that by this encasement the heat, and consequently the opening spark, became considerably reduced, especially in the case of weak currents. The efficacy of this method of procedure was confirmed by the experience that a contact which had been in constant operation for two years remained unchanged.—Dr. Richarz spoke of the formation of peroxide of hydrogen by electrolysis. If a current were conducted through diluted sulphuric acid, then there was formed at the positive electrode a strongly oxidising substance, formerly taken for peroxide of hydrogen, but demonstrated by M. Berthelot to be per-sulphuric acid, S_2O_7. In experiments on the electrolysis of concentrated solutions of sulphuric acid with wire-shaped platinum electrodes, the speaker had obtained in the solution, beside per-sulphuric acid, ozone and peroxide of hydrogen, and assumed that all three bodies made their appearance at the positive electrode. This assumption had been disputed by Traube, and, on the ground of experiments with diluted acids, he had maintained that the peroxide of hydrogen arose only at the negative electrode by reduction of the atmospheric oxygen. Dr. Richarz repeated his experiments, and found that in concentrated sulphuric acid, on electrolysis, peroxide of hydrogen occurred always at the positive electrode when per-sulphuric acid was formed; but that it occurred temporarily later on, and was not a direct product of the electrolysis, but arose through secondary chemical reactions, by oxidation of water through the per-sulphuric acid. The following experiment served as a proof thereof:—A 40 per cent. sulphuric acid solution was subjected to electrolysis, and thereby, on account of too great attenuation, no peroxide of hydrogen, but only per-sulphuric acid, came to view. If, now, into the 40 per cent. sulphuric acid 60 per cent. acid were poured, after the electrolysis was finished, then did peroxide of hydrogen show itself in the fluid.—Dr. Dieterici communicated how he rendered galvanometers insensible to the disturbances of the earth's magnetism by surrounding with an iron cylinder, and setting in an iron box provided with suitable apertures for observation, the windings of the galvanometer up to the height of the mirror set above the needle. Residual magnetism, which was readily recognised, was easily removed by heating and by adjusting the mutual position of the two parts of the iron case.

Meteorological Society, January 4.—Prof. von Bezold in the chair.—The yearly report having been read by the Secretary, and officials elected, Dr. Zenker explained the arrangement and contents of the meteorological calendar edited by him.—Dr. Sprung then read a paper on Hadley's principle. Starting from the phenomenon, now and again observed, of an air-current proceeding in the direction of the meridian, while the gradients of atmospheric pressure operated in a direction perpendicular thereto, the author referred to the circumstance that Hadley had last century resolved the direction of the trade-winds into the simultaneous action of the difference of temperature and of the earth's rotation resulting in a mean course, an explanation which first obtained general acceptance through Dove. The derivation of the curve described by a mass-particle on the earth when it had received an impulse to the north and was rotating in a parallel with the earth had been attempted in two different ways—one way by Mousson and another by Schmidt. The speaker discussed such derivations for the simplest case—that of a rotating disk and of a mass-point thereupon impelled with a certain energy and free from friction towards the centre. Through analytical development of the results, he adopted the method of taking as approximately accurate Schmidt's derivation, which presupposed the force in the direction of the meridians to be a constant value, but the force in the direction of the circle of parallel to augment with the time. After further consideration of the centrifugal force, a basis for the mechanics of atmospheric currents on the earth might be determined by Hadley's principle.

Chemical Society, January 10.—Prof. A. W. Hofmann, President, in the chair.—Prof. Rud. Weber communicated the results of his experiments on some compounds of sulphuric anhydride with phosphoric and iodic anhydrides; he has isolated compounds of the composition $P_2O_5 + 3SO_3$ and $I_2O_5 + 3SO_3$, and he describes their preparation and analysis.—O. N. Witt described a new method of producing the azines; they can be obtained from the decomposition of the azo-compounds produced from diazobenzenesulphonic acid and phenyl-, paratolyl-, and xylyl-β-napthylamine.—C. Friedheim criticised the method recommended by Weil for the volumetric determination of hydrogen sulphide; the method is not only troublesome and complicated, but the reaction does not take place in the manner assumed by Weil. The author gives analytical results showing that the method cannot be depended on.—Prof. Pinner read abstracts of papers by Liweh, and Ramsay and Young.

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