THURSDAY, JANUARY 9, 1902.

ANALYSIS OF MEMORY.

Memory: an Inductive Study. By F. W. Colegrove, Ph.D., D.D., Professor of Philosophy in the University of Washington. With an introduction by G. Stanley Hall, LL.D. Pp. xi + 369. (London: G. Bell and Sons. New York: Henry Holt and Co., 1901.) Price 6*s*. net.

THE title of this book—"An Inductive Study"—leads us to expect an exposition of fundamental and derivative generalities based on a logical arrangement of thoroughly criticised facts. Facts and generalities there are in plenty, but the criticism is not adequate, neither is the arrangement conspicuously logical. The result is that, in spite of Dr. Stanley Hall's commendation, the book as a whole leaves on one an impression of chapters loaded with detail yet not adding much to the scientific study of memory. Prof. Colegrove has taken great pains, but he has attempted too much in a small book, and his standpoint is neither frankly scientific nor frankly popular. In Chapter i.—"Historical Orientation"—he makes a rapid sweep from the Greeks to the moderns, indicating the transit from the unsystematic *aperçus* of the earlier schools to the positive methods of the later. The conception is good, but the space available makes even a tolerable sketch impossible. Even the characterisations given are sometimes more than doubtful. It is quite inaccurate, for instance, to say that in contrast with Kant's "masterly analysis of mind," "Reid, Stewart and Hamilton are wholly metaphysical" (p. 10). Then, the account of Bain's formula for the nervous seat of reproduced feelings—"the renewed feeling occupies the very same parts, and in the same manner, as the original feeling, and no other parts, nor in any other assignable manner"—becomes "mental impressions depend upon the renewal of the feeling which accompanies the same part and in the same manner as the original feeling" (p. 14), which is practically unintelligible. Badly done summaries are worse than none, and the above—which involves a fundamental doctrine—does not alone suffer by the compression. The references, however, are, as a rule, given; the student will therefore not be misled, but the general reader also would prefer accuracy in his "orientation."

In Chapter ii.—"Biological Orientation"—we have a mass of facts, partly anecdotal, about animal intelligence generally, instincts, habits, natural selection, memory and some other things. The purpose is to lead up to the general theory of "organic memory" (Hering) and "racial memory" (p. 89). We are left without any clear conception as to whether "racial memory" implies (*a*) cumulative use-inheritance (Spencer), or (*b*) selected variations (Weismann). The difference is said to be "in part a war of words" (p. 87). Possibly, but the words are of Sibylline importance. "Organic memories refer to the ability to conserve racial experiences by a congenital modification of the organism" (p. 90) leaves the question very much an open one, even if the wording were unexceptionable. The use made of "racial memory" and "organic memory" elsewhere makes one long to have Locke's onslaught on "innate ideas" written up to date.

In Chapter iii.—"Diseases of Memory"—Prof. Colegrove recapitulates familiar clinical facts regarding word-blindness, word-deafness and other forms of aphasia. He adds one or two striking records of traumatic loss of memory with gradual recovery (pp. 126 *et sqq.*), and illustrates the theory of "inhibition" amnesia. His general conclusion that Ribot's "law of regression" demands modification, if, indeed, it holds at all, is not borne out by the cases he records. There is as much difference between the physiological sequence in normal memory decay and the shattering due to gross lesions like cerebral hæmorrhage as there is between progressive muscular atrophy and a broken leg. To make the sporadic dissociations correlated with hæmorrhage illustrate the normal sub-involution of progressive senility requires much more minute evaluation of clinical facts than we get here. The work of M. Pierre Janet would have assisted Prof. Colegrove to what we mean, but he nowhere refers to Janet.

The next chapter—"Brain and Mind"—could not, perhaps, be avoided, but it should have been reduced. Prof. Colegrove, however, takes the "correct" attitude towards the metaphysical theories he mentions, namely, that they are not in the province of psychology. The formula of "genetic parallelism," which simply means that mind and body emerge together and develop together, and "functional interaction," which means that now the physical, now the psychical, is uppermost, may be accepted as a variant on the "double-faced unity" or "parallelism" theory; but in Chapter v. the mode of expounding this relationship frequently lapses, verbally if not in content, from its presuppositions. On p. 176, where it is held that (*a*) the "neural discharge" and (*b*) the "conscious element" may, each on occasion, "take the initiative," the language seems to imply that the "conscious element" is wholly divorced from any "neural discharge." This transit in terminology from physical to psychical and *vice versâ* is made again and again. The general result of the chapter is that there are "memories," not a "memory" (p. 198). This, however, is only to say that the various grades of the nervous system have each their appropriate variety of retentiveness and reproduction. In his exposition the author plays off "organic memory" against the more limited psychological "memory." He does not maintain much order in his sequence of "memories." Nor is his language always exact. That "muscular memories depend *chiefly* upon the nervous system" (p. 198) suggests a question that is not solved by the following sentence:—

"By exercise a muscle acquires new power, which is due in part to a change in the muscles themselves, but such memories are associated with the nervous system. This is possible because the motor nerve terminates in the centre of the muscles and throws off branches in all directions" (p. 199).

There is not much "orientation" here. Prof. Colegrove would have profited by a more intensive study of the good "psychologies," which would have enabled him to use the matter of this chapter to more purpose.

In Chapter vi.—"Individual Memories"—we have the

only "inductive" effort in the book. The chapter contains a large number of moderately well-sifted facts. The author's *questionnaire* included 1658 persons of various ages and races. Some of the facts are valuable, but they are not so arranged as to elicit any striking generality. They are, indeed, like the "facts" of many other *questionnaires*, apt to be the bad observations of untrained observers. The minute study of a few cases would have been more fruitful of "inductions" than these somewhat content-less percentages of commonplace recollections. One reasonably looks for more from an "inductive" study than this on the question of "taking notes":—"There is a wide diversity of opinion as to how full notes a student should take, and almost all degrees of copiousness are indicated" (p. 270). The true inference is that most students are poor psychologists. The extremely varied suggestions for teaching a "boy to remember things *on time*" (p. 271) only show that practical pedagogy in America, as elsewhere, is more ready to punish the boy than to study his mind—punishment being as effective, on the average, as it is useless in some particular cases.

Chapter vii.—"Apperception and Association"—includes sections on recognition times, attention and interest. This chapter is one of the best in the book. The essence of Chapter viii.—"Pedagogical Applications"—is that good memory depends on attention and the attentive multiplication of associations. There is not much novelty.

Of the book as a whole, it must be said that it suffers, in every chapter, from a want of clear definition of terms and a clear analysis of the phenomena to be investigated. The references, however, are valuable and the bibliography is good. W. LESLIE MACKENZIE.

A LUNAR ROMANCE.

The First Men in the Moon. By H. G. Wells. Pp. 312. (London: George Newnes, 1901.) Price 6*s*.

IT is many years now since Jules Verne wrote his imaginary account of a journey to the moon. He supposed a party of three men enclosed in a projectile shot by a huge gun towards the moon, which they never reached; they fell back to earth and escaped in a marvellous manner to tell the tale. The work was imaginative enough to hold the attention, but full of scientific blunders and improbabilities of the most glaring character. Mr. Wells has produced a book of a very different character; he has made himself master of the little we know about the moon, and thought out the possibilities with the greatest care, and the result is a narrative which we will venture to say is not only as exciting to the average reader as Jules Verne's, but is full of interest to the scientific man. We do not mean that the astronomer is likely to learn any new facts from this *résumé*, for which he himself furnished the material; but he will be astonished to find how different the few scientific facts with which he is familiar look in the dress in which a skilful and imaginative writer can clothe them, and it is worth reading the book with minute care to see if one cannot catch Mr. Wells in any little scientific slip. Some writers are so easy to catch that the game is not worth playing; but Mr. Wells is a worthy opponent, and we are glad to see that his scientific rank has been recognised by the Royal Institution, who have invited him to lecture on January 24.

The visit to the moon is made possible by the discovery of a substance (cavorite) impervious to gravitation. This interesting property comes to cavorite only at a critical temperature (60° F.), after "the paste has been heated to a dull red glow in a stream of helium," and the suddenness with which the imperviousness arrives causes interesting events at first. When the new conditions are better realised, a glass sphere is built and covered with cavorite blinds which can be put up or down. When all are down the sphere is entirely free from attraction, and when any particular blind is up it is only attracted by the stars or planets seen in that direction. It is obvious that in these circumstances a comfortable voyage through space is manageable. The two occupants of the sphere journey to the moon and land upon it near the terminator, on a snow drift of frozen air. With sunrise they find that the air melts and evaporates, and there is enough for them to breathe, so that they emerge from the sphere. They find their weight a trivial matter and leap twenty or thirty yards at a step, and a wonderful fungus vegetation springs up before their eyes. In the exhilaration of exploring they lose their sphere and are thus thrown on their own resources. Presently they come across the Selenites, who emerge from the interior of the moon, where they have been spending the lunar night. The first to emerge are those herding the moon calves—great beasts 200 feet long, that browse in a vividly described and rather disgusting manner ("like stupendous slugs") on a speckled green mossy plant. The cowherd was a "mere ant" by comparison, and the intelligent Selenites generally turn out to be a sort of insect, varied physically in a grotesque manner at will. After various adventures in and on the moon, one of the voyagers recovers the sphere and gets back to earth; the other stays in the moon and sends messages by ethereal telegraphy describing it more fully; and the interest never flags throughout. Following similar writings, Mr. Wells sometimes allows himself a sly hint at terrestrial matters in describing lunar affairs. He describes a lunar artist thus (p. 302):—

"Love draw. No other thing. Hate all who not draw like him. Angry. Hate all who draw like him better. Hate most people. Hate all who not think all world for to draw."

And two pages on there is a similar burlesque description of a mathematician. It is even easier to see the point than to find the pun in the following:—

"And since the density of the moon is only three-fifths that of the earth, there can be nothing for it but that she is hollowed out by a great system of caverns. There was no necessity, said Sir Jabez Flap, F.R.S., that most entertaining exponent of the facetious side of the stars, that we should ever have gone to the moon to find out such easy inferences, and points the pun with an allusion to Gruyère . . ."

Of a book so full of unfamiliar things it is impossible to give a complete account. We will conclude this notice by heartily recommending the book to readers both scientific and unscientific, and by giving, with a triumph

not free from trepidation, an instance where we think Mr. Wells has been caught napping. When the cavorite blinds are closed and the sphere starts on its journey, he describes the curious effects of the absence of external gravitational attraction—all the material occupants of the sphere slowly collect in the interior by their *mutual* attractions, and there is no "up" or "down." Then a window is opened towards the moon and promptly everything gravitates towards the moon—the direction towards the moon is *down*wards, though the attraction is slight. Surely this is a slip? With bodies moving freely in space only the *differential* attraction would be felt, and this would be negligible compared with the mutual attraction of the occupants of the sphere. Even if it were not so small it could not act in the manner specified; its tendency would be to *separate* bodies (as in the case of the tides), not to bring them together, and thus a man near a "floor" would not fall towards it but would rise from it. But Mr. Wells is so wonderfully careful in general that we make this criticism with far less confidence than we should have felt in another case; we have an uneasy feeling that he may dexterously transfer the supposed slip from his account to ours.

A POPULAR WORK ON FISHES.

The Story of Fish Life. By W. P. Pycraft. Pp. 210. (London: G. Newnes, Ltd., 1901.) Price 1s.

THIS book, which is one of the shilling series published by Messrs. Newnes, is divided into fourteen chapters and illustrated by seventeen text figures and a frontispiece. Its contents are generally interesting and well arranged, but there is recognisable throughout its pages a leaning towards the racy and sensationally attractive, as, for example, in the method of dealing with the habits of the sword-fish and the feeding process generally. The mode of treatment is mainly physiological, the consideration of function preponderating over that of structure and development. Migration and "transformation" are in turn dealt with, the latter with a commendable emphasis of the part played in Nature's operations by "substitution."

Much attention is given to the skeletal organs and especially the teeth, and the author loses no opportunity of forcing home the lesson of the tooth-scale homology. The effort, however, is somewhat weakened by the assertion that, while fish-scales are (p. 29) typically "horny plates," they are (p. 31) in "the most primitive form" bony. The statement that the bony fin supports (p. 68) have been formed by the fusion of clusters of original "hair-like" rays is equally misleading; and in dealing with the terms expressive of types of tails, the author falls into the prevailing fallacy of applying them to the fins and not to the fishes themselves. In declaring that in the typical fish the dorsal fins are two in number, the fact that there may be three dorsals is ignored, it being implied (p. 58) that the codfish has but two. And error is further evident in the assertion that the adipose fin is "without supporting structures."

The mode of description is in places none too well chosen. Such declarations as that the "beauty" of the Cestracion's teeth is "entirely an accidental feature" and that in deglutition the "touch" of the swallowed food "signals" through the closed-up gullet to the nerves, are to be deprecated in a book of this kind; while a greater regard for the facts of morphology would have been in places acceptable, as in the mode of treatment of the types of so-called external gills. The existence of these in the Teleostei is denied; but while we excuse the non-allusion to those said to occur in the loaches, we consider it strange that, on a later page, the author incidentally refers to the African fishes obtained by Budgett, in which they have been proved to be abundantly present, without mentioning them. Nor is he more fortunate with his treatment of the internal gills and respiration, for nowhere in the book are the numerical limitations of the former even stated, nor is there mention of the "breathing valves," to which attention has but recently been redrawn.

In the aforenamed and other equally important matters, which, under the scheme adopted, should have found recognition in the book, the author is not up to date, as, for example, in his declaration that nothing is known of the chimæroid development. In the organological sections of the book sufficient use is never made of extremes of modification, such, for example, as those which render clear the real differences in the composition of the gills of the bony fishes and elasmobranchs, expressed in the terms pectino- and cysto-branchiæ. Particularly is this the case with the alleged distinctions between the two chief groups into which the author would divide the fishes as a whole. He gives, for this purpose, a classification, which is neither that of the author to whom he ascribes it nor an accurate statement of Huxley's observations, upon which it is based. "Hyostylic" and "autostylic" are the terms which denote the distinctive characters of his two great "branches," but the former is wrongly construed. Neither the author of the present work nor he whom he names acknowledge the condition termed by Huxley the *amphistylic*; and the author himself does not even mention the Notidanidæ, of which, alone among living fishes, it is diagnostic. These and the Port Jackson shark (which exhibits a marvellously transitional condition of the parts in question, for which alone a distinctive term might well be introduced) are not typically hyostylic. They are lower than those fishes which are. Without recognition of them and the amphistylic state Huxley's system cannot be adequately set forth. So important is this morphologically that advantage might be gained by associating the Notidanidæ with at least the Hydodonts and Pleuracanths among fossil forms, in a distinct order, in preference to the retention of the name "Ichthyotomi" for the latter alone. In the present case, in the non-recognition of these amphistylic forms and the absence of all reference to the hyomandibular element, the essential point is lost. In the spread of scientific knowledge, the more elementary that imparted the more precise should be the diagnoses employed.

There is a closing chapter on palæichthyology, of a very cursory type.

The present book is the second which the author has contributed to the series to which it belongs. The first, on "The Story of Bird Life," was in every way a success and as a popular treatise exemplary. Comparison shows that the striking differences between the two books are due to the fact that with the first of them alone the

author's knowledge was based on a thoroughly practical acquaintance with the animals with which he dealt. While we fully admit the difficulties of the task of compilation of the second, the present work, we regret we cannot recommend it with the confidence extended to its predecessor.

THE PROBLEM OF TRUTH.

Das Wahrheitsproblem unter Kulturphilosophischem Gesichtspunkt—Eine philosophische Skizze. Von Dr. Hermann Leser. Pp. iv + 90. (Leipzig: Dürr'sche Buchhandlung, 1901.) Price 2 marks.

THE author of this work is not a "jesting Pilate." His book contains rather a thorough discussion of the problem of truth in some of its widest issues. The standpoint is essentially Kantian, but with a difference. The question raised in the "Critique of Pure Reason" was, How are pure mathematical science and pure natural science possible?—in other words, on what principles can it be maintained that the ordinary experience of man *quâ* intellectual gives him truth? Dr. Leser contends that the problem should be stated more widely in the form, How is truth in general possible, the truth of all the higher spiritual life of man, of religion, morality, art, as well as science? And it is claimed for the work before us that, as compared with Kant's, it is more concrete in treatment, that it goes nearer the heart of things, and that while including and remaining true to Kant's results it gives a more satisfactory basis for future development.

The first part deals with a deepened idea of experience, for which the author employs the term "Kulturhistorische Erfahrung." By this he appears to mean the higher spiritual experience of the race as exhibited by history in such things as institutions, codes, systems, standards of judgment. In the development of this view, naturalism is subjected to some telling criticism. Finding nothing anywhere but "bare results, finer complications of natural process," naturalism would exclude all facts which do not coincide with, or cannot be reduced to, the facts of ordinary natural science. In dealing with the institutions in which the spiritual life has found expression, naturalism pays regard only to the crystallised form, not to the spiritual potencies which have been at work. It attaches exclusive value to what is genetically original, and denies, for example, the characteristic distinction between good and bad by deriving it from the distinction between the useful and the harmful. Such a psychogenetic method can never get beyond brutal actuality to norms or standards of judgment; it is only a transcendental method (the author maintains) which can disclose the organisation of "rulers and subjects," for example, the subordination of what is first in time to what is ideally fundamental.

The latter part of the book is concerned with the problem of truth from the new standpoint thus gained. It is pointed out that Kant replaced the old objectivity (supposed to exist entirely out of relation to a subject) by transcendental-subjectivity, than which no more secure objectivity can be found. This means that truth is to be found by "turning to one's own depths"; but if it is to be depths and not shallows, to be *transcendental*-subjectivity in the right sense and not bare subjectivity in the wrong sense, we must have recourse to "Kulturhistorische Erfahrung." It is only as experience is writ thus large that the potencies at work can be discovered. One of the chief of these potencies is personality. Personality Dr. Leser opposes on the one hand to bare individualism, and on the other to the equally bare disregard of the personal factor. The great man is neither the heaven-sent hero dear to the soul of a Carlyle nor the hollow pipe through which the "Zeitgeist" pours such music as it listeth. Or, as our author puts the latter point: "The man is more than the product of his time; planting himself on the original truth which he has found within him, it is he who first makes a new height attainable."

The work is not unnecessarily stiff. At times, perhaps, a little vagueness is felt, and the technical terms, as usual, can rarely be translated by single words. But his readers will doubtless welcome another book from this careful and suggestive writer. R. G. N.

OUR BOOK SHELF.

Catalogue of the Lepidoptera Phalaenae in the British Museum. Vol. iii. "Catalogue of the Arctiadæ (Arctianæ) and Agaristidæ in the Collection of the British Museum." By Sir George F. Hampson, Bart. Pp. xix + 690. Plates xxxvi–liv. (London: Printed by Order of the Trustees, 1901.)

FOR a long time after the study of exotic butterflies began to grow popular in England, that of moths continued to be much neglected, though moths, taken as a whole, are equally beautiful and far more numerous than the butterflies. But after the pathway had been smoothed by the useful, though much abused, catalogue of Walker, the works of Moore, Butler and Druce, and especially by Kirby's "Catalogue of Lepidoptera Heterocera: Sphinges and Bombyces," published in 1892, the Trustees of the British Museum decided to issue a general descriptive catalogue of the moths of the world, which bids fair to become one of the largest and most profusely illustrated of all their publications on natural history.

The work was entrusted to Sir George F. Hampson, and three thick volumes have already been issued. According to the table of families in vol. i. the author admits fifty-two, which, deducting seven for the butterflies, leaves forty-five for the moths, of which only the first three are monographed in the portion of the work already published, so that little more than the fringe of the subject has yet been touched. Of course some of these families only include a few species; but, on the other hand, there are several very much more extensive than the Arctiadæ, which alone fill up the greater part of vols. ii. and iii. The plates are published separately, and can be bought separately, a useful arrangement which will enable students who require an additional copy of the book for working purposes to purchase it without the additional and unnecessary cost of a duplicate set of coloured plates. In addition to these coloured plates, drawn by Mr. Horace Knight and chromolithographed by West, Newman and Co., the book is further illustrated by text-illustrations of types of genera, showing both the pattern and the most important generic details, and of these compound figures there are no less than 294 in vol. iii., in which 946 Arctianæ and 225 Agaristidæ are described, of which a considerable number are new species. At the end of the volume is a short list of species which the author has not been able to identify from the published descriptions. Should further information respecting these be forthcoming, we presume that

these, and any other casual omissions, will ultimately be dealt with in an appendix.

The next family to be monographed, if the author continues to follow the arrangement prefixed to his first volume, will be the extensive family of Noctuidæ, which alone may be expected to occupy several volumes.

To the technical portion of the book we can scarcely refer here in detail. It is a work that appeals mainly to specialists, and only specialists will be able to appreciate the time and labour involved in its production at their full value.

Psychology Normal ana Morbid. By C. A. Mercier, M.B. Pp. xvi+578. (London: Swan Sonnenschein and Co., Ltd., 1901.) Price 15*s*.

MR. MERCIER'S "morbid" psychology is, as one would naturally expect, the best part of his book, and almost as good is the general discussion of the questions raised by pleasure-pain and by emotion. The author dissents from Prof. James's "back-wave" theory of emotion on much the same grounds which have led to its rejection by Stout and other contemporary psychologists, and, like Stout, rightly insists that the dependence of emotion upon an object beneficial or injurious to the organism must be the starting-point of any theory of its nature. An interesting feature of the discussion of pleasure-pain is the writer's belief that there are no reproduced ideas of pleasure and pain. The present reviewer is inclined to agree with him, but the question is a difficult one. In his general theorising Mr. Mercier is far too ready to accept associationist views which are virtually dead in the scientific psychology of to-day. This is specially true of his account of perception, which is identical with Spencer's, but quite at variance with the doctrine (which pathological cases as well as the study of animals seem to demand) that "ideas" are subsequent to precepts.

The weakest part of the book is the long section on logic, which is also, strictly speaking, irrelevant in a treatise on psychology. The axiom formulated on p. 86 would justify the inference, "Solomon is the son of David, and David the son of Jesse, therefore Solomon is the son of Jesse." The furious attack upon the mathematical doctrine of probability also rests largely upon the pure misconception that the statement of chances is put forward by mathematicians as a measure of the actual strength of our belief. A. E. T.

A Record of the Progress of the Zoological Society of London during the Nineteenth Century. Edited by the Secretary. Pp. 248. (London: Clowes and Sons, Ltd., 1901.)

UNDER the auspices of a committee consisting of Mr. Sclater, Dr. Smith Woodward, Prof. Howes and Mr. Beddard, Mr. Scherren has prepared an excellent account of the principal doings of the Zoological Society since its foundation in 1826. The statements made are partly financial and partly relate to the number of the public who have availed themselves of the opportunity of entering the gardens, as well as to the papers read before the Society and to the lectures delivered in the gardens. It is curious to note the gradual growth of the popularity of the Zoological Gardens as a place of resort, a growth which is not altogether *pari passu* with the increasing population of the country. Thus from 1872 to the present day the number of visitors has always exceeded 600,000, and in two notable years, viz. 1876, when His Majesty the King, then Prince of Wales, deposited the animals brought back by him from India, and again in 1882, the year of the "Jumbo-mania," exceeded the usual maximum by a hundred or two hundred thousand. From 1864 to 1871 the numbers were 500,000 and upward, while in earlier years the average number was not more than 300,000 to 400,000, with the exception of the phenomenal years 1851 and 1863, when the admissions rose to more than 600,000. The earliest year in which these numbers are recorded is 1829, when only 98,605 persons visited the gardens. The numbers then rose and again fell during the 'forties. During these seventy-four years there have been eight presidents, seven secretaries and three vice-secretaries. The late Earl of Derby and the late Sir William Flower held their office of president for the longest period, viz. twenty years, and next in order of tenure come the Prince Consort and the Marquess of Tweeddale, who occupied the chair for ten years each. This volume contains also a list of the present Fellows of the Society and the charter and bye-laws.

Leitfaden der Landschafts-Photographie. By Fritz Loescher. Pp. v + 162. (Berlin: Gustav Schmidt, 1901.) Price Mk. 4·50.

WITH so many books in the English language on the subject of landscape photography, the amateur or professional may not think it worth while to read any new German work on the subject. This, however, should not be the case, for from such a volume as the one under notice it is possible, not only to obtain useful hints familiar on the Continent and unknown here, but at the same time to acquire facility in reading a foreign language.

The reader will certainly not be disappointed when he spends a few hours in becoming acquainted with what Herr Loescher has to say in these 162 pages, for although the author goes, for the main part, over familiar ground, yet here and there a subject or object is seen from a new point of view.

The book is logically divided into three parts, namely, before the exposure, the exposure and after the exposure. The first deals with the apparatus generally employed in tripod and hand-camera photography, touching on the use and determination of the speed of shutters, perspective as produced by the objective, various kinds of and uses for photographic plates, and useful hints as regards packing, &c., for those who make long tours with cameras.

The second portion is restricted to the choice of the subject and the best way to photograph it, the author here giving some valuable suggestions on the consideration of distance, foreground, trees, sky, illumination and minor accessories to the picture. In the third and last portion of the book the treatment and after treatment of the exposed plate are described, the latter including all such manipulations as intensifying, retouching, copying, mounting, framing, enlarging and lantern-slide making.

Accompanying the text are twenty-four autotype reproductions from the author's own negatives.

Inductive Sociology. By F. H. Giddings, Ph.D., LL.D., Professor in Columbia University, New York. Pp. xviii+302. (London: Macmillan and Co., Ltd., 1901.) Price 8*s*. 6*d*. net.

THE object of this book, in the words of the author, is "to present a scheme of inductive method, a somewhat detailed analysis and classification of social facts, and a tentative formulation of the more obvious laws of social activity." It is not in any way a mere discussion of the possibilities of census taking, but an attempt to formulate a general scheme for the statistical, or quasi-statistical, description of a nation or "society," using materials from every available source. Thus the description covers the features of the area inhabited, the nature and sources of the food supply, the density, multiplication, migration, &c., of the population, and its racial composition; the political activity, cooperation for social ends, and general organisation of the society; its social security and administration of justice; wealth and its distribution; education; vitality and morality. The work is prefaced by four introductory chapters on the study of sociology and the inductive methods to be used.

It is gratifying to find a writer on sociology acquainted with modern mathematical methods of statistics, and one who clearly recognises the value of such methods, but the definitions given in Chapter iii. of the introduction require some rewording. The word "number" on p. 21 is apparently used in the sense of "magnitude of the variable" instead of in the more natural sense of "frequency," but even in this sense it would not be correct to define the median as "the number midway between the lowest and highest"; it is correctly defined by the statement that magnitudes greater and less than the median occur with equal frequency, so that the median will not in general coincide with the middle of the observed range. Again, it is hardly correct to speak of a measure of variation as the "*mode* of the deviation"; mode is used in the sense of "most frequent value," and the most frequent deviations in the case of symmetrical distributions will be those approximating to zero. The term "standard deviation" was defined by Prof. Pearson, its introducer, in the sense of root-mean-square deviation, and it is apt to lead to misunderstanding if used in a vague sense, as in the text. The section on the "law of sympathy," pp. 108–110, would also be the better for, at least, some additional explanation; it is from its curtness almost incomprehensible as it stands, and some of the symbols used appear to be only defined in the appendix.

The book is suggestive of many possible lines of research by means of indirect statistical index-numbers, but we cannot help feeling that the author has tried to cover ground too wide for a single volume. The work as it stands is so abstract that it is almost impossible to estimate the practical value of the author's ideas, and such abstractness alienates the sympathy of the statistician. A much more liberal discussion of examples in the text would be both valuable and refreshing.

G. U. Y.

Optical Lanterns and Accessories. Edited by Paul N. Hasluck. Pp. 160. (London: Cassell and Co., Ltd., 1901.)

THIS handbook forms one of a series of practical manuals, and it brings together the more important and useful information in relation to the construction and management of optical lanterns. For the main part the editor has utilised material which has been published from time to time in the weekly journal *Work*, and has coordinated it in such a form that it will be found very serviceable to those who have much to do with lanterns. There are also chapters on the making of ordinary photographic, coloured and mechanical lantern slides, and some useful hints regarding the management of kinematographs. The book is well illustrated and should be found very handy.

Plane Geometrical Drawing, including numerous Exercises and Army Examination Papers, with Solutions. By R. C. Fawdry, M.A. Pp. xi+185. (London: E. and F. N. Spon, Ltd., 1901.) Price 6*s.* net.

THIS is a work of quite an elementary character, and very well suited to candidates for admission to Woolwich and Sandhurst. A good feature of the book is that it either gives a proof for each construction or refers to the particular proposition of Euclid on which the construction is founded. In addition to constructions relating to right lines, triangles, polygons and circles, there is a short chapter on the ellipse, which, in a second edition, might very well include a treatment of the parabola, inasmuch as the parabola is at once one of the simplest and the most useful of curves in the applications of mathematics. There are two good chapters on the use and construction of scales, and the book concludes with several specimens of papers set in the subject at the Woolwich and Sandhurst examinations, together with the solutions of the questions.

LETTERS TO THE EDITOR.

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

The "Chestnuts" of the Horse.

THESE structures are well known and have been variously interpreted. But I believe that a suggestion as to their nature which I shall now put forward has not yet been made. Some months since I called attention in this Journal (vol. lxii. p. 523) to the general prevalence among mammals that use their fore limbs as grasping or climbing organs—in fact, in all other ways excepting as mere organs of progression—of a tuft of long hairs upon the wrist. I have since that time examined a large number of mammals, and find these vibrissæ in a considerable number of genera belonging to the orders Marsupialia, Rodentia, Carnivora, Lemuroidea (in which latter group the vibrissæ in question were first noted by Mr. Bland Sutton). They are absent from the Ungulata with the exception of hyrax, an admittedly ancient type of ungulate. Usually, but not always, a stout branch of the radial nerve of short extent ends in this patch of integument which bears the vibrissæ. The vibrissæ are quite similar to those found upon the head of the same mammals, for example the "whiskers" of the cat. The general occurrence of this carpal tactile (?) organ makes it, at least on *a priori* grounds, reasonable to suppose that traces might be met with in the ungulates, other than hyrax, where it unquestionably exists. There might not at first sight appear to be much in common between the callous pad, such as is the "chestnut" of the horses and asses, and this tuft of vibrissæ; but the conditions which I found to obtain in an armadillo (*Dasypus villosus*) suggested the comparison. In that animal the carpal tuft of vibrissæ is present; but instead of being a closely compacted tuft of about six hairs, as is usually the case, the hairs in the armadillo are not much larger than those of the skin generally, and are spread over a patch of integument of about half an inch in length and are more numerous. The patch of skin which bears them is thickened. If this were to proceed further the more strongly cornified epidermis would cease to bear vibrissæ, which would be, so to speak, driven into a corner beyond the specially thickened tract of skin. This stage, moreover, is not hypothetical; for in *Lemur catta* precisely this state of affairs exists, *i.e.*, a callous tract of skin close to which is a tuft of vibrissæ. If the latter were lost we should have the "chestnut" of the horse. The chestnuts on the fore feet, be it observed, occupy the right position, a little above the wrist.

FRANK E. BEDDARD.

Frost Patterns.

AS I was responsible for opening the discussion in these columns in 1892 and as I am able to confirm Dr. Catherine Raisin's observation as to the recent recurrence of the phenomenon on December 15, I am glad of the present opportunity of sending a few lines on the same subject in order to rectify an omission. In 1873 Prof. Joseph Henry, of the Smithsonian Institution, Washington, forwarded to Prof. Tyndall on behalf of Prof. Lockett, of the Louisiana State University, a beautiful photograph of "plumes produced by the crystallisation of water," the said pattern having been formed in the coloured sediment in the bottom of a basin in which the water had frozen during the night. This photograph is reproduced as a plate in Tyndall's "Lectures on Light" (I have only the second edition, 1875). It escaped my notice during the correspondence in 1892 or I should certainly have called attention to it.

R. MELDOLA.

Roads and National Welfare.

IN NATURE of December 19, 1901 (p. 149) is given a criticism of a work, in which some essential points in the making and maintenance of roads are strongly insisted on. At p. 156 of the same number there appears an excellent commentary on Mr. Balfour's speech to the students of the Goldsmiths' Institute at New Cross on December 12. With your comments I am in thorough sympathy, and would beg leave to point out that the two subjects are far more closely connected than might at first appear. Excellence and superiority

in manufactures and commerce depends on very many elements, as you know, one of the most important of which is the "item" "carriage or transport." British superiority in many manufactures and markets has depended, and will henceforth largely depend, on that one item principally (take the case of iron ores), and to maintain superiority it must receive in the immediate future more careful attention and scientific treatment. Roads in their different forms enter largely as factors into the general question of "transport," and if trade superiority is to be maintained they must be looked after and treated, all over these countries, in a more scientific and skilled manner than that now prevalent in the United Kingdom. For that end there must be attained, as soon as possible, uniformity of make, treatment and control, and the highest efficiency as regards care and maintenance, and to ensure these results they should be placed under the charge of a body of trained engineers, such as those of the "ponts et chaussées" of France. The question to a certain extent resembles that of the currency of the realm, and as there is a perfectly uniform coinage for every part of it, so should the make and use of the roads be of one standard all over the kingdom, in the best interests of all who travel or convey goods. The Board of Trade controls the railways, why not a Board or Department for the roads? and thus obviate the many absurd and scandalous practices which exist and are allowed to prevail, to the great discomfort and loss of the community. Allow me to give my experience of what is taking place in the township of Pembroke (Dublin). The road "metal" mostly in use is simply the coarser riddlings from the drift gravel so abundantly and cheaply worked in the neighbourhood of the Town Hall. The stones, perfectly rounded, incapable of taking bond and largely composed of entirely rotten elements, are loosely thrown here and there, where prominent holes appear. Mr. Beete Jukes, the former head of the Geological Survey of Ireland, remarked when he saw the material used, that boiled potatoes might as well be employed, and the rapid wear fully bears out the correctness of this judgment, and hence a large staff of scavengers and carts, discomfort for all classes of road-users, and steady increase of rates. In a southern county I have seen the road surface worn into the form of the section of an inverted arch, and was informed by a competent authority that the county surveyor, a Whitworth scholar, secured the place as the result of a Civil Service examination, the pay being about 800*l.* per annum, and thus secured, proceeded to develop a private practice as civil engineer, leaving the roads to attend to themselves. Many other examples of this nature might be given. As to the importance of good roads from a military point of view, it should be unnecessary for me to refer to it. I see from time to time the Dublin garrison companies and battalions out on marching exercise and notice the draggled appearance in which the men come home when the weather is in any way moist or rainy, and reasonably associate this condition with the bad state of the roads about Dublin. The Romans certainly knew better on this branch of military engineering, and might still be copied. As for agriculture, the Americans have gone thoroughly and systematically into the question, and are taking effective measures to put their road systems into a proper working state, and to have them kept up to it. I trust, Sir, that you will excuse these rather extended observations and that you will see your way to urging the pressing importance of a uniform and general system of road making and maintenance for the kingdom on the grounds of high State utility, commercial importance and agricultural necessity.

J. P. O'REILLY.

Dublin, December 28, 1901.

Preoccupied Names in Zoology.

THIS afternoon I spent a little more than half an hour over the "Zoological Record" for 1899, looking for preoccupied generic names proposed in that year. The result was as follows:—

Baris, Loos, for a plathelminth in the alimentary canal of Chelonia is untenable because of Baris, Germ., a genus of beetles.

Astia, Loos, for a worm in gut of Tetrodon; *nec* Astia, Koch, an arachnid.

Brotella, Roverto, new name for Acrostoma, which was preoccupied; *nec* Brotella, Kaup, in fishes.

Cumopsis, Roverto, new name for Cuma, Humph., preoccupied; *nec* Cumopsis, Sars, Crustacea.

Eichwaldia, Smitt, new subgenus of Gobius; *nec* Eichwaldia, Bill., Mollusca.

Goniopsis, Melichar, new genus of Fulgoridæ; *nec* Goniopsis, Haan, Crustacea.

Halticella, Jacoby, new genus of beetles; *nec* Halticella, Spinola, Hymenoptera.

Xenus, Péringuey, new genus of beetles; *nec* Xenus, Kaup, in birds.

I left off with the feeling that by taking time such instances could be multiplied almost indefinitely!

This is a condition of affairs which is becoming intolerable. None of the authors of the above names had even taken the trouble to consult the "Nomenclator Zoologicus." Such names become current for a number of years, until someone happens to discover that they have been used before. The result is an inconvenient though necessary change and a useless synonym. Sometimes authors will not even correct these errors of nomenclature when their attention is directed to them, and if they do propose a substitute there is no telling whether it will be valid.

Would it be practicable for some representative body, such, for instance, as the staff of contributors to the "Zoological Record," to examine every new generic name proposed and issue from time to time a list of substitutes for names found untenable? Or, if it were preferred, the author in each case could be asked to propose a substitute, and then all the substituted names could be given in an appendix to the "Zoological Record." Whatever is done, it seems necessary that these errors should be promptly corrected, and equally plain that this cannot be left to the unaided intelligence of authors.

T. D. A. COCKERELL.

East Las Vegas, New Mexico, U.S.A., December 16, 1901.

A Luminous Centipede.

MR. R. I. POCOCK, to whom I sent the subjoined extract from notes made by me on June 5, 1897, has suggested that the observation would be of interest to readers of NATURE. He remarks: "The two new facts you have observed—namely, the defensive purpose of the substance and its irritating properties—are, I think, sufficiently important to put upon record." The notes are as follows:—

"Under the entrance gate, in the gravel, I saw a light of a brilliant greenish-bluish tint; it moved forward, leaving behind a trail of light which, gradually separating, became a scattered mass of brilliant points. The leading light had the form of a living, curving thread. A lighted match soon showed what the scattered points of light in its trail were, a dozen or so of red ants pursuing the Geophilus; one was clinging to it, each ant shone like a spark in the gravel, the centipede had discharged its fluid over them. I picked up the centipede and dropped it into a tumbler, where it splashed out a mass of light. Hurriedly placing my hand over the tumbler to prevent the insect from escaping, I felt suddenly a strange prickly sensation such as is caused by a slight contact with electricity, so that I hastily removed my hand, calling to a friend who, placing her hand over the tumbler, felt the same thing.

"I lit another match and watched the Geophilus writhe the light out of its body in blue-green flashes. It soon ceased to shine, having probably exhausted all the luminosity on its enemies.

"Defence seems certainly to be one of the uses of this secretion, attributed by some authors merely to purposes of attraction.

ROSE HAIG THOMAS.

"The White House, Basildon, Reading."

The New Planetoid.

THE note on Prof. Pickering's announcement of the discovery of a new planetoid moving in a very elliptic orbit, in the Astronomical Column of your issue of December 19, 1901, was read by me with much interest.

I should, however, like to point out that the orbit of the new planetoid is not the most elliptic yet known, that place being held, I believe, by Æthra (132), for which ϕ amounts to 22° 32′ (Watson's orbit), while for the new planetoid ϕ is 22° 8′.

Andromache (175) might also be included among those for which ϕ exceeds 20°, in addition to the two named in the note, Eva and Istria, its excentricity being 0·348 (Watson).

S. B. GAYTHORPE.

Prospect Road, Barrow-in-Furness.

SCIENTIFIC BALLOONING.

THE exploration of the upper air has become increasingly attractive as a branch of meteorological inquiry, and the soundings of the ocean of air, to use Mr. Rotch's expression, may be held to include observations at high-level stations, records obtained from instruments carried by kites or unmanned balloons, as well as observations made by travellers in free balloons. Of these the last mentioned offer most attractions for the adventurous, and they form an essential part of scientific inquiry, because eye observations can be taken of clouds and other atmospheric phenomena from a point of view not otherwise attainable, and experiments that throw light upon the working of various instruments can be carried out under conditions which cannot be exactly imitated on the earth's surface. For meteorological purposes the usefulness of a free balloon is, however, to a certain extent limited by the fact that the balloon is an aërostat; it is carried with the stratum of air supporting it and the only motion relative to the atmosphere is a vertical one. Wind as understood at the surface is therefore beyond the scope of observation of the balloonist, and all meteorological observations that are dependent upon the motion of air are not primarily suitable for the car of a balloon, where the air is calm and still even in a rapidly moving atmosphere.

The traveller can in clear weather estimate the rate at which he is borne along by noting the places over which he passes, and he can obtain permanent records of his voyages by photographs taken from his car, which suggest a curious reminiscence of old-fashioned maps. A photographic camera is indeed the first and most natural item in the equipment of a balloonist, whether the aim of his voyage be scientific inquiry or merely adventure. One of the most novel and successful departments of the Paris exhibition of 1900 was the aëronautical section, which gave full opportunity for the display of the powers of aërial navigation. During the exhibition fourteen competitions were held, in which a hundred and fifty-six ascents were made. The competitions were of four kinds; for altitude, for duration of voyage, for distance and for descent at a specified spot. The competitors were exclusively French; the greatest height reached was 8417 metres, the longest voyage in time lasted 35·45 hours and covered also the longest distance, namely, 1925 kilometres; the nearest approach to a given point was within 400 metres, after a voyage of 32 kilometres. Of the 156 voyages, 137 were completed within France, ten extended to Germany, three to Belgium and three to Holland, while three were not terminated until the Russian frontier was passed. It is satisfactory to note that all were conducted without accident either to aëronaut or spectator. Among the many interesting photographs obtained during these expeditions is one of the neighbourhood of the Panthéon, Paris, taken from a height of 500 metres and reproduced (Fig. 1) from an article by

FIG. 1.—Neighbourhood of the Panthéon, Paris, photographed from an altitude of 500 metres.

Commandant Renard in the *Bulletin* of the Société d'Encouragement pour l'Industrie Nationale. For the purpose of comparison, a photograph of Berlin from a height of 2000 metres, taken in 1893 on one of the voyages of the ill-fated balloon *Humboldt*, is also reproduced (Fig. 2). It shows the Belle Alliance Platz in the centre, but the scale is evidently very small. A slightly larger view (Fig. 3) of the central portion, taken on another occasion, is here reproduced from the frontispiece of Prof. Assmann's memoir, "Die Modernen Methoden zur Erforschung der Atmosphäre mittels des Luft-ballons und Drachen," which appeared in the March and April numbers of *Himmel und Erde* last year.

Among the best known establishments for exploring the upper air are those of M. Teisserenc de Bort at Trappes for "ballon sondes" and kites and Mr. Lawrence Rotch for kites at Blue Hill, Massachusetts; but the general use of balloons for scientific purposes has been carried out most effectively at Berlin. By means of funds supplied

by the Emperor William, a very complete establishment for the exploration of the upper air has been installed there. The first balloon acquired was the *Humboldt*, which made its first voyage on March 1, 1893. It was fired by

FIG. 2.—South-west Berlin (Belle Alliance Platz), photographed from an altitude of 2000 metres.

an electric spark and destroyed on landing after its sixth voyage. Through the Emperor's generosity it was replaced by the *Phönix*. Prof. Assmann, in the work already referred to, gives some particulars of the arrangements and results, but the subject is more fully dealt with in a work consisting of three handsome volumes published last autumn and entitled "Wissenschaftliche Luftfahrten ausgeführt vom Deutschen Verein zur Förderung der Luftschiffahrt in Berlin" (Braunschweig: F. Vieweg und Sohn). This contains the account of seventy-five voyages and a number of flights of unmanned balloons, together with the material collected in the course of the expeditions, maps of the regions traversed and a volume of results. The meteorological interest of these voyages is very great, but the work is too elaborate for brief summary. A single example may give some idea of the possibilities of investigation of this kind. On July 6, 1894, the *Phönix* started from Berlin at 6.32 p.m. and travelled north-west to Jutland in nineteen hours; the unmanned balloon *Cirrus* was started at the same time from the same place and was carried by an upper current to Bosnia.

The primary meteorological question to be determined by balloon ascents is the rate of variation of temperature with height. For some time after Glaisher's celebrated voyage of 1862, which concluded his balloon work, the matter was regarded as settled. The Berlin work has reopened it on the ground that the thermometers used by Glaisher were not sufficiently ventilated or screened from radiation. Glaisher was aware of the necessity for precautions, although he discarded special apparatus for ventilation, and his immense experience in the use of thermometers might enable him to obtain results, as, for example, with Daniell's hygrometer, where others of less skill and experience would fail. In the balloon investigations by Berson, Assmann's ventilation thermometer, with special mounting to avoid the car's interference, was used, and every precaution was taken to make the circumstances otherwise comparable with those under which Glaisher made his memorable ascent from the Crystal Palace. M. Berson carried these precautions even to the length of making an ascent from the Crystal Palace itself on September 15, 1898, while a simultaneous ascent was made at Berlin, to make sure that the observed differences were not due to climatic differences between the air over Germany and over England. The day was remarkably hot in England, the temperature being 10° C. above that of Berlin, but the zero isotherm was found within a few hundred metres of 6000 metres at each station. Further trial was made by reproducing Glaisher's arrangement from his description and comparing its readings with the Berlin arrangements. The results were only accepted as conclusive after careful consideration of all the measurements of temperature obtained from the numerous flights of manned and unmanned balloons. In the end Berson was satisfied that the difference of the observations was to be laid to the account of instrumental errors in Glaisher's observations.

The comparison of Glaisher's and Berson's results for the rate of fall of temperature with height, as given by Assmann, is as follows:—

Height in metres.	Rate of fall in Centigrade degrees per thousand metres.	
	Glaisher.	Berson.
0–1000	7·5	5·0
1000–2000	6·5	5·0
2000–3000	5·0	5·4
3000–4000	4·2	5·3
4000–5000	3·8	6·4
5000–6000	3·2	6·9
6000–7000	3·0	6·6
7000–8000	2·0	7·0
8000–9000	1·8	9·0

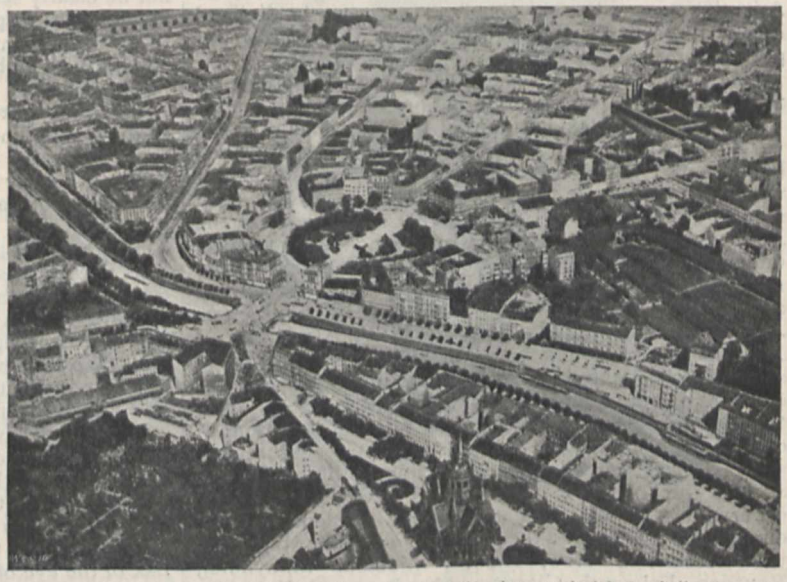


FIG. 3.—Neighbourhood of the Belle Alliance Platz, Berlin, photographed from a balloon.

It will be noticed that whereas Glaisher's observations lead to the conclusion that a constant temperature is indicated at no very great height, Berson's numbers show increasing rate of fall with height, so that the difference

in the results is one of fundamental importance. Berson's numbers clearly do not go to the end of the matter, for with a little play of the imagination in the region of extrapolation, his results bring absolute zero within sight at the very moderate height of some thirty miles, whereas −68° C. is the lowest temperature recorded in the flight of the unmanned balloon *Cirrus* from Berlin, which is reported to have reached a height of 18,000 metres. This, by a curious coincidence, is identical with the lowest temperature recorded at the earth's surface. It was registered at Werchojansk, in Siberia, on January 15, 1885; a still lower temperature, −70° C., is given in the *Meteorologische Zeitschrift* for June as registered by the apparatus of an unmanned balloon started from Vienna on January 10 of last year. Kite observations also afford information as to the rate of fall of temperature under varied meteorological conditions. But the height which they can attain does not give them a final voice in the determination of the question of the lowest limit of atmospheric temperature.

Another quantity for the determination of which balloon observations are specially appropriate is the constant of solar radiation, but the results are not yet final and the subject is too wide for this occasion.

It would be a matter for congratulation if Glaisher's exploration of the upper air could be continued by his own countrymen. Investigations have, indeed, been made recently by the Rev. J. M. Bacon, and, under the auspices of the Aëro Club, by the Hon. C. S. Rolls. But for the use of balloons on any considerable scale these islands are not very suitable. It will hardly yet be forgotten that some years ago an attempt to pursue scientific investigation in this manner resulted in the loss of a valuable life. Work with kites even is not without its dangers, but it is satisfactory to note that the Royal Meteorological Society has taken up this mode of investigating the upper atmosphere, and has not only moved the British Association to devote a sum of money for the purpose, but has secured the active interest of the president of the Society, Mr. W. H. Dines, in the undertaking. The British Isles occupy such an exceptional position with regard to the passage of weather changes from the Atlantic Ocean that the results of a properly directed inquiry of this character can scarcely fail to throw important light on many meteorological questions.

One of the results of the Congress of Meteorologists at Paris in 1900 was an international arrangement for the simultaneous exploration of the upper air in the various countries of Europe by means of unmanned balloons carrying self-recording instruments. An ascent was to be made on a fixed day in the first week of each month. Prof. Hergesell, of Strassburg, chairman of the Aëronautical Committee of the International Conference, undertook the collection and the working out of the results. The ascents have been regularly carried out and brief reports have appeared in the *Meteorologische Zeitschrift*. In this country Mr. P. Y. Alexander, of Bath, has carried out ascents of unmanned balloons on some of the appointed days, and has made provision for observations in manned balloons by Mr. Spencer. With the balloon observations are associated observations of clouds. We have no system of systematic measurement of cloud movements, but in connection with the balloon ascents the following observatories have furnished eye observations of the form and motion of clouds on the days of the ascents and the preceding and following days, viz. Greenwich, Kew, Oxford, Bidston, Stonyhurst, Rousden, Falmouth, Glasgow, Aberdeen and Valencia. The returns have been sent to the Meteorological Office to be forwarded to Prof. Hergesell. The details of the ascents of November 8, 1900 (the tenth of the whole series of international ascents) have already been published, and they show in a very effective manner the initial increase of temperature with height in the region of the anticyclone which covered the continental stations, Paris, Strassburg, Berlin, Vienna and St. Petersburg, at which ascents took place. Inversions of temperature are also very marked in the discussion of the Vienna observations for the ascent of January 10 by J. Valentin in the *Meteorologische Zeitschrift* for June.

For meteorological purposes balloons will be much more serviceable when the means for converting them from aërostats into airships are perfected. It is fifteen years since Commandant Renard, who with his brother has been so active in all that concerns military ballooning in France, published his lecture, "Sur la Navigation Aérienne," before the Société de Secours des Amis des Sciences, in which he lays down with true French clearness the dynamical conditions for the airship as distinguished from the aërostat. The publication is illustrated with a picture of an airship corresponding very closely with those of the airship of M. Santos Dumont that have attracted so much public attention within the last few months. At present airships are at best fair-weather vessels, and fair weather is a dull subject for meteorologists.

W. N. SHAW.

GUN-SIGHTS FOR LARGE AND SMALL ORDNANCE.

UP to quite recent times but little has been done by those interested in gunnery to improve in a really practical way the method of aiming either a rifle or gun. The usual method of aiming is much the same as that employed long ago in using the mediæval crossbow. The object aimed at, the fore-sight and the back-sight, are brought into line by the eye of the marksman, always with this defect, viz., that the eye is out of focus with respect to two of the points mentioned when focussed on the third. We know well that, if we fix our attention on a distant object, our eye will automatically focus itself on that distant object; and only an indistinct image of the foresight will be present. Again, should we focus the eye on the fore-sight, then the object aimed at will not be clearly seen. This is also true in an accentuated manner with respect to the back-sight, since it is nearer to the eye than the fore-sight. The operation of thus aiming, even in the best circumstances of light, is obviously unsatisfactory.

The gun-sight problem has been attacked by several leading experimentalists, and in the majority of cases some apparatus in which lenses are employed has been used. An early form of optical gun-sight consisted of a small telescope attached to the gun, the telescope being furnished with an eye-piece and cross-lines or webs, similar to those used in the surveyor's level or theodolite. This telescope is attached to the rifle by a joint at one end, the other end being raised or depressed to suit the range by means of a milled headed micrometer screw. The telescope-sight has been applied to field and other guns, and to it has been added an inclinometer, so that an angle inclination either above or below the horizontal line can be given to the gun.

Objections have been raised to the telescope-sight, and it has been urged that the field is limited, so that it is not easy to "pick up" the object to be hit, and that the object appears to be moving with a speed greater than its real one, also that when heavy charges of gunpowder are used, and the recoil is considerable, there is a risk of the eye of the marksman being injured by the cap of the eye-piece when it is driven back, and also that the adjustment of the telescope may be thrown out, by the concussion on firing the piece. With respect to the first objection, in the case of a man with short sight, the telescope-sight is of great use since it enables him to see the object as clearly as a man with normal vision. When the telescopic method is used for laying field guns, the

sight is placed in a geometric bracket for aiming and removed immediately before the gun is fired, as otherwise it would be injured by concussion.

The gun-sight invented by Sir Howard Grubb, F.R.S., is free from imperfections inherent in the old form of telescope-sights used on rifles. The new instrument is called by him the "Collimating-telescope Gun-sight," and a paper on the subject in the *Transactions* of the Royal Dublin Society (March 20, 1901) at once shows what considerations led up to the invention of the new form of gun-sight. In it the inventor pictures an ideal sighting arrangement thus:—He imagines a ring or cross to be carried on a very long, weightless and rigid rod forming a prolongation of the gun-barrel, so that the ring or cross would always be situated in the prolongation of the axis of the gun, and each shot, if the trajectory were quite flat, would pass through the ring. The inventor goes on to show that such an ideal rod might be realised by using a fine beam of light, which might be projected on to the object and indicate the direction of the axis of the gun. This end is in practice obtained by projecting a "virtual" image upon the object on which the gun is aimed. By means of the gun-sight now to be described a "virtual" image of a small bright cross or circle is projected on to the object aimed at. The earliest form

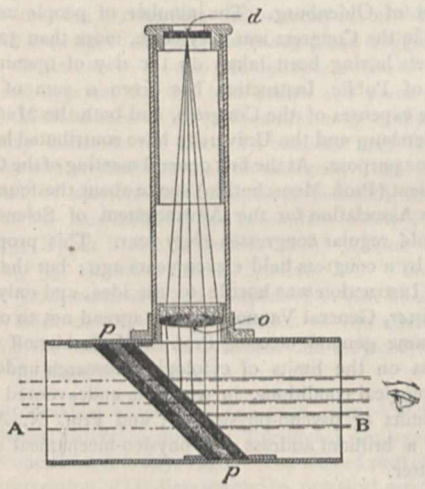


FIG. 1.

in which the gun-sight was made is shown in Fig. 1, in which the object aimed at is viewed through a piece of tube of square section AB, open at each end, a piece of parallel glass, *pp*, being fixed at an angle of 45° to the axis of the tube. In another tube at right angles to the former a diaphragm *d* is fixed, made of glass coated with an opaque substance, through which fine lines are scratched in the pattern of a cross or star or circle. *o* is an achromatic lens, and the distance between the cross and the lens equals the principal focus of the lens; so that rays of light passing through the cross, on reaching the lens, are by it made parallel, they are then reflected by the plates *pp* as parallel rays to the observer's eye, and the observer sees a "virtual" image of the cross coinciding with the object aimed at, and apparently at the same distance as the object. This optical device causes the cross to be seen sharply defined, with the same focussing of the eye required for viewing the distant object, and all straining of the eye, as is the case in the old system, vanishes; also there is no parallax, and therefore the eye need not be kept in one position. This "virtual" image of the cross, forms a fore-sight projected to a long distance in front of the rifle, as if it were carried upon an invisible, imponderable and inflexible prolongation of the barrel. This form of apparatus not being of convenient shape for practical use, the gun-sight eventually assumed the form shown in Fig. 2, in which *d* is the cross, which is reflected by the mirror C, on to a curved glass surface *rr*, coated with a very thin layer of galena, the ray is reflected as a parallel beam to the eye, and at the same time the

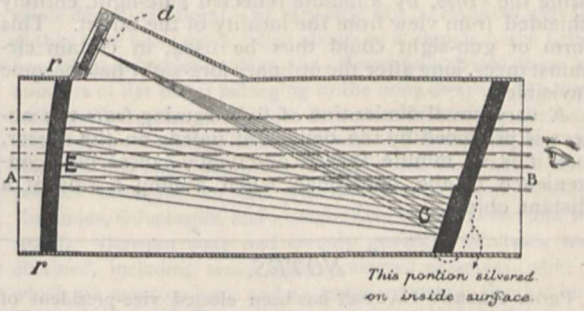


FIG. 2.

object is seen through the coated surface. The radius of curvature of *rr* equals twice the distances *d*C and CE. When the eye is placed anywhere near the axis of the gun-sight the bright cross is seen superposed on the object, and the usual effort required in the attempt to focus two objects not at the same distance is entirely avoided. The photograph (Fig. 3), taken by a camera

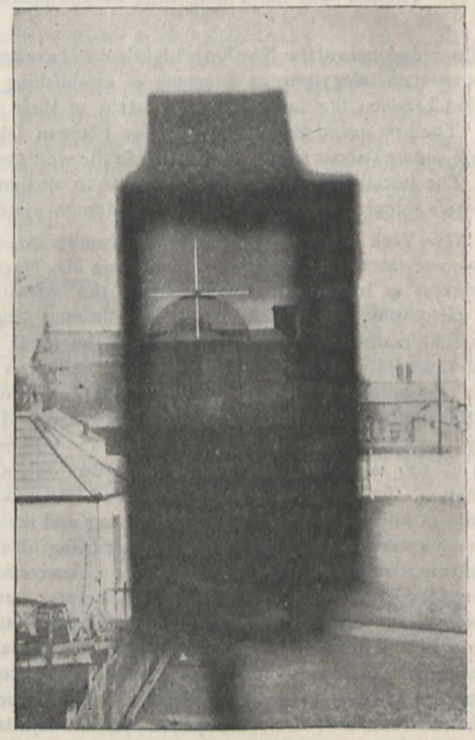


FIG. 3.

placed behind the gun-sight and focussed on the dome of a building, shows how perfectly the cross coincides with the object, both the object and cross being in perfect focus.

The gun-sight is mounted on a graduated metal arc attached to the rifle, by means of which it is adjusted for various ranges. The sight may be used either with or without a telescope or monocular, since the same focus

suits both the object and the image of the cross; also by cutting divided scales on the diaphragm glass, useful estimates may be made of both distance and windage.

In an experiment made on a gun-sight, kindly lent to the writer of this article by Sir Howard Grubb, good shooting was made on a white target when it was dusk, and an ordinary fore-sight could not be seen, by illuminating the cross, by a minute reflected side-light, entirely shielded from view from the locality of the target. This form of gun-sight could thus be used, in certain circumstances, long after the ordinary fore-sight had become invisible.

A very small diminution of light coming from the object is produced by the deposit of galena on the mirror, but it is so minute, that it practically causes no inconvenience to the marksman when aiming a rifle at a distant object.

NOTES.

PROF. ALBERT GAUDRY has been elected vice-president of the Paris Academy of Sciences for the year 1902.

THE Symons Gold Medal of the Royal Meteorological Society will be presented to Dr. A. Buchan, F.R.S., at the annual meeting of the Society to be held on Wednesday, January 15.

WE regret to see that Prof. Virchow met with an accident on Saturday evening while alighting from an electric tramway car in Berlin. The injuries are described as a wrench to the hip joint and various contusions on the legs, in consequence of which Prof. Virchow will for a long time be confined to his room.

THE Commissioners of the Northern Lighthouses have decided to adopt wireless telegraphy as a means of establishing communication between the mainland and certain of their lighthouses. The first installation will be at the Flannan Islands, which are situated about sixteen miles outside the west coast of Lewis. The installation, which will be made in conjunction with Lloyd's shipping agency, will be on the Marconi system.

THE New York *Electrical Review* for December 21, 1901, contains some interesting particulars concerning Mr. Marconi's recent success in transmitting signals across the Atlantic by wireless telegraphy. It appears that before leaving England Mr. Marconi made arrangements for having the letter "S" signalled repeatedly at frequent intervals for three hours daily from his transmitting station at Poldhu. The power of the transmitting arrangements in Cornwall had been increased considerably since Mr. Marconi had succeeded in bridging a distance of 200 miles. At St. John's there was only a temporary station, the aërial wire being suspended from a kite at an altitude of about 400 feet. The transmitting and receiving arrangements were carefully tuned, the receiver being of a new type recently developed. On December 14 a succession of "S's" was received with unmistakable distinctness, and a similar series was received on the next day, but this time not quite so distinctly. Mr. Marconi attributes the variability partly to fluctuations in the height of the kite, bad weather prevailing at the time, and partly to the fact that the receiver had to be extremely sensitive and required constant adjustment. The erection of a permanent station in America and the increase in the power of the transmitters should remedy these two defects. It is now almost exactly 150 years since Franklin's classical experiment with a kite, which now, therefore, figures for a second time as important in the history of electrical development.

THE following news from Baron Toll's Arctic Expedition was received by the chief of the Central Meteorological Observatory at St. Petersburg, in a telegram, dated Yakutsk, December 4/17:—"On September 11/24 caught by winter in Nerpichiya Bay, 75° 22′ N. and 137° 16′ (E. longitude). From November 1 have opened meteorological station, with hourly observations. All right, all well. Sending greetings to Central Observatory. *Zarya*, October 25 (November 7), 1901." It will be remembered that the expedition started last summer on board the steamer *Zarya* with the intention of wintering somewhere on the Arctic coast of Siberia, so as to begin in the spring the exploration of the New Siberia Islands.

THE Russian newspapers publish the following official telegram, dated Yakutsk, December 28:—"The expedition which was sent out by the Academy of Sciences, under the zoologist Hertz, to examine the mammoth remains discovered in the district of Kolymsk, has reached Sredne Kolymsk, after a very difficult journey, bringing the mammoth with it. The animal was a male and apparently middle-aged. Its skeleton and skin have been preserved nearly intact. The tail was short and covered with long hair. In the stomach, between the teeth and on the tongue, remains of undigested food were found. The different parts of the mammoth have been conveyed to St. Petersburg in a frozen condition."

THE eleventh Congress of Russian Naturalists and Physicians was opened at St. Petersburg on January 2 by the Grand Duke Alexander of Oldenburg. The number of people anxious to take part in the Congress was very large, more than 3250 members' tickets having been taken on the day of opening. The Minister of Public Instruction has given a sum of 500*l.* to defray the expenses of the Congress, and both the Municipality of St. Petersburg and the University have contributed large sums for the same purpose. At the first general meeting of the Congress, the president (Prof. Menschutkin) spoke about the foundation of a Russian Association for the Advancement of Science, which would hold regular congresses every year. This proposal was accepted by a congress held eleven years ago; but the Ministry of Public Instruction was hostile to the idea, and only now the new Minister, General Vannovsky, has agreed not to oppose it. At the same general meeting Prof. S. M. Lukianoff delivered an address on the limits of cytological research under normal and pathological conditions, in which he endeavoured to establish the limits of psycho-physiology; and Prof. N. A. Umoff delivered a brilliant address on a physico-mechanical model of living matter.

THREE pleasure cruises have been arranged by our contemporary the *Revue générale des Sciences* to take place this year. At Easter there will be an excursion to Greece and the Greek Isles, in charge of M. C. Homolle, director of the French School at Athens, and M. G. Fougères, of the University of Paris. At the end of September there will be a trip to Syria and Palestine, directed by M. C. Diehl, and in November an excursion will be made to Egypt, up to the second cataract, under the direction of a well-qualified Egyptologist.

ON Tuesday next, January 14, Prof. A. Macfadyen will deliver at the Royal Institution the first of a course of six lectures on "The Cell, its means of Offence and Defence, Immunity." On Thursday, January 16, Dr. A. S. Murray will begin a course of three lectures on "Recent Excavations at Delphi and in the Greek Islands." The Friday evening discourse on January 17 will be delivered by Lord Rayleigh, his subject being "Interference of Sound." On January 24 Mr. H. G. Wells will give a discourse on "The Discovery of the Future," and on January 31 Prof. A. Crum Brown one on the "Ions of Electrolysis."

THE Decimal Association has sent us a list of 172 members of Parliament who have notified their approval of the compulsory adoption of the metric system of weights and measures into Great

Britain, and have promised to give their support to any measure brought forward with this end in view. The Association points out that, in the interests of our foreign trade, it is most desirable that we should at once carry this reform into effect, as the constantly reiterated statements of British consuls prove that much trade is lost because our weights and measures are not understood in countries where the metric system is in force. In Australia, Canada and Cape Colony the change would be welcomed; and seeing how easily so serious an impediment to commerce can be removed, it is hoped that the Government will give more attention to the subject in the coming session of Parliament than it has so far done.

IT is announced that a large sum of money—about 200,000*l.*—has been placed at the disposal of His Majesty the King for charitable or utilitarian purposes by Sir Ernest Cassel. This money, by the King's direction, is to be devoted to the erection of a sanatorium for tuberculous patients in England. For the carrying out of this purpose His Majesty has appointed an advisory committee consisting of Sir William Broadbent, Sir Richard Douglas Powell, Sir Francis Laking, Sir Felix Semon, Sir Hermann Weber and Dr. C. Theodore Williams, with Dr. Horton-Smith and Dr. John Broadbent as honorary secretaries. The institution is to accommodate 100 patients, and will be fully equipped with all requirements for scientific research. In fact, it is intended to construct the sanatorium on the best lines which past experience and original thought can suggest, and in order to obtain the most valuable opinions a sum of 800*l.* will be awarded in prizes for the best essays and plans upon the subject. Medical men of all nationalities may compete. The papers may either be the work of a medical man or the joint production of a medical man and an architect. All essays and plans must be sent, postage paid, on or before April 15, 1902, to one of the secretaries of the committee:—Dr. P. Horton-Smith, 15, Upper Brook Street, London, W.; or Dr. John Broadbent, 35, Seymour Street, London, W. Three money prizes, of 500*l.*, 200*l.* and 100*l.* respectively, will be awarded in order of merit on the recommendation of the advisory committee for the three best essays, provided they come up to the requisite standard of excellence.

AN astronomical observatory has been erected and equipped by the Bengal Government at the Presidency College, Calcutta, and was opened a few days ago. The idea of providing means for the instruction of Indian youths in practical astronomy was conceived about five years ago, when the Maharaja of Tipperah presented to the Presidency College an equatorial telescope by Grubb, 4½-inch aperture. On Dr. J. C. Bose's representation, the Government of Bengal agreed to provide a building suitable for observations. But it was not until after the eclipse of January, 1898, when the professional and amateur astronomers who visited India caused active interest to be taken in building the observatory. From an article in the *Pioneer Mail* we learn that the chief instrument of the observatory is a 7-inch equatorial by Sir Howard Grubb, with an electrically controlled driving clock and with electric lights for all the graduated circles. The telescope will generally be used for eye observations, but the object-glass may be adapted to photography, and the mounting of the telescope is of a strength that will admit of its being used for spectroscopic examination of the sun or the brighter stars. The equipment will allow a considerable number of students to become familiar with the elements of astronomy in its most practical form. It is hoped that the Presidency College Observatory will yet be equipped with more instruments through private liberality.

THE Geological Survey of the Colony of the Cape of Good Hope has recently been working in Pondoland, and has secured a very fine collection of fossils from the Cretaceous rocks which occur along the coast near Natal. The most interesting find of all was one of a pair of lower jaws belonging to a large reptile allied to Mosasaurus. The large trenchant teeth are set, each in a cylindrical socket and arranged in such a way that there is a series of teeth firmly anchylosed to the socket and other successional teeth that are loose and have fallen into the hollow of the fixed teeth. Many detached bones were also found, but the whole deposit is littoral, and very little can be made out of these, as they have been much rolled about on a shingle beach before becoming imbedded. With the Mosasaurus bones there are numbers of flat plates belonging to the bony carapace of a turtle such as Protosphargis as well as such characteristic chelonian bones as the Y-shaped one composed of the scapula and procoracoid. A large number of sharks' teeth occur between the pebbles belonging to the genera Corax, Lamna, Otodus, Enchodus, Odontaspis, and a single Elasmobranch vertebra was found. Between sixty and seventy genera of Mollusca were obtained, including many finely preserved examples, some of which are new to science and a great many new to South Africa. Echinoderms and Polyzoa also occur, and eight species of Foraminifera, belonging to the genera Vaginulina, Nodosaria, Virgulina, Discorbina, Truncatulina, Textularia. The collection is now in the South African Museum, Cape Town, where the greater part is exhibited.

ALMOST nothing is known of the amount of rain on the mountains in Arctic regions. Mr. Hamberg has placed large permanent pluviometers on some high mountains in Swedish Lapland and has observed that much more snow and rain fall there than in adjacent low ground.

IN the *Popular Science Monthly* for December, 1901, Mr. H. Helm Clayton, of the Blue Hill Meteorological Observatory, discusses the influence of rainfall on commerce and politics. He gives a table of the annual departure from the normal rainfall in the Ohio and Mississippi valleys for a large number of years, showing, not only that every severe financial panic has been closely associated with persistent deficiency of rainfall, but that (with one exception) no period of protracted drought has occurred without a financial panic.

The Geographical Journal for November last contains a paper by Mr. H. N. Dickson on the mean temperature of the atmosphere and the causes of glacial periods. The conclusions of the author tend to show that considerably smaller changes of temperature and of the distribution and amount of precipitation, caused by the assumption of a lowering of mean temperature taking place by cooling in the polar regions, than has generally been supposed, enable us to account for the nature and distribution of glacial phenomena, as they are at present known to us.

THE only countries which took part in the international balloon ascents during September, October and November were Austria, France, Germany and Russia. Some of the greatest altitudes were attained from M. Teisserenc de Bort's observatory at Trappes, near Paris:—On September 5 (night ascent), 14,178 m., temperature −55°·2 C., on ground 5°·6; on October 3 (night ascent), 14,500 m., temperature −58°, on ground 8°·1; (day ascent) 13,150 m., temperature −53°, on ground 11°; November 7 (night ascent), 13,200 m., −62°, on ground 2°·4. From Berlin, on this day, an altitude of 12,010 m. was attained, temperature −58°·4, ground 6°·5. A manned balloon which left Berlin, height 1100 m., temperature +1°, experienced a wind velocity of 80 kilometres (50 miles) an hour.

IN our notes columns we recently directed attention (p. 110) to a paper by Prof. Lebedew in which he described an experimental investigation of the pressure of light radiation. We have now received a paper on the same subject, by Messrs.

E. F. Nichols and G. F. Hull, which was read at a joint meeting of the American Physical Society and the American Association for the Advancement of Science on August 29, 1901, and is published in the *Physical Review* for November last. The experimental methods adopted by Messrs. Nichols and Hull are similar to those employed by Lebedew, the chief difference being that whereas the former used a bolometer to measure the incident energy the latter employed a calorimeter, but the investigation is not as yet of so complete a nature. The observations already completed are, according to the authors, sufficient to prove experimentally the existence of a pressure of the nature and order of magnitude of radiation pressure. The results agree to within about 30 per cent. with the theoretical value: a certain amount of inexactness is introduced as the authors did not experimentally determine the reflecting power of the vanes employed. Lebedew in his investigation claims to have obtained results agreeing to within 10 per cent. with the calculated values of the Maxwell-Bartoli pressure.

In view of the trials now being made by one of the London water companies with ozonised air as an agent for water purification, the following details of the experimental plant erected by Siemens and Halske at Martinikenfelde, near Berlin, are of interest. This plant was erected in 1898, and is adapted for treating 240 cubic metres water per twenty-four hours. The ozonisers are of the Siemens and Halske plate and tube type, and yield 20-25 grams ozone per E.H.P. hour, with an E.M.F. of 12,000 volts. The air passing from the ozonisers under these conditions contains $2\frac{1}{2}$–3 grams ozone per cubic metre. An air-pump is used to force the air through the drying chamber into the ozonisers, and it passes thence into the sterilising tower. This tower is a simple square structure packed with flints, and as the ozonised air passes upwards it comes into contact with a descending stream of water. The remainder of the plant at Martinikenfelde consists of a water-pump, a sand filter for preliminary filtration of the water with which the sterilising tower is fed, and various storage tanks for the filtered and unfiltered water. Tests made with water from the River Spree show that the numbers of bacteriological organisms were reduced from 600,000 to 10 per cubic centimetre. The permanganate absorption figure was reduced 18 per cent., and the aëration of the water was increased from 10 per cent. to 12 per cent. The consumption of ozone amounted to two grams per cubic metre. The cost of treatment for an installation treating 120-150 cubic metres per hour was estimated to be 1·726 pfg. per cubic metre, and the total cost, when interest and depreciation charges on the distributing system are included, 5·031 pfg. per cubic metre (equal to 1*s.* 5*d.* per 1000 cubic feet). The capital outlay upon an installation capable of treating 150 cubic metres per hour was estimated to be 6750*l.*, of which total 3750*l.* represented the expenditure upon the ozonisers and sterilising tower. Further details will be found in an article by Dr. Erlwein in the *Zeitschrift für Electrochemie*, November 14, 1901.

Mr. Seale, in *Occasional Papers* (vol. i. No. 4) of the Bernice Pauahi Bishop Museum, Honolulu, describes and figures several new Hawaiian marine fishes.

In the *Comptes rendus* of the Swiss Society of Natural Science for 1900 Dr. Fatio adds two vertebrates—the lesser shrew (*Sorex pygmaeus*) and the Grecian frog (*Rana graeca*)—to the fauna of Switzerland.

In an article published in the *Revue Scientifique* (*Revue Rose*) of December 28, 1901, M. Hugo de Vriès discusses the mutations of species and the periods required for such mutations. He mentions that since certain plants have apparently remained unaltered since the date of the building of the pyramids (approximately 4000 years), this period may be taken as a minimum unit in estimating the time required for specific modification.

To the eighty-third volume of the *Verhandlungen* of the Swiss Naturalists' Society Prof. C. Keller communicates a very interesting dissertation on a peculiar breed of domesticated sheep with goat-like horns formerly kept by the natives of the Bünden Oberland, Switzerland, and hence locally known as the Bündnersch. The breed is known to be of great antiquity, but now appears to be almost exterminated owing to crossing with other strains. In 1862 the late Prof. L. Rütimeyer called attention to the peculiarity of this breed, and indicated its near affinity with the so-called peat-sheep (*Torfschaf*) of the Swiss lake-dwellings, of which it appears to be the direct descendant. The author expresses the hope that efforts may be made to save the breed from extinction.

We are glad to have the pleasure of congratulating the editor of the *Zoological Record* on the completion of the volume for 1900. Year by year his task grows more onerous, the volume before us exceeding its predecessor by 180 pages. Very noticeable is the length of the list of new generic and subgeneric names, which contains no less than 2102 entries, the maximum having been previously 1707, in 1895. The increase in the bulk of the volume is largely due to the insect record, which comprises 354 pages against 276 in 1899. The yearly growth in the size of the volume is, of course, largely to be attributed to the practice of naming local races of animals, which has come so largely into vogue of late. The various recorders appear to have done their work with great care and thoroughness, although we notice in the mammal part that one paper (No. 200) is credited to a writer other than its author. Uniformity in regard to the "introduction" to the different "records" is still a desideratum, this important element being altogether omitted in some instances, while in one case it has been allowed to reach an altogether disproportionate length. It is a decided improvement in the "get-up" that in this year's issue the edges have been cut. We are glad to hear that there is a good prospect of the promised "index volume" of generic names making its appearance early in the year.

None have laboured more earnestly on the land and freshwater Mollusca of Pleistocene and recent times in Britain than Messrs. A. S. Kennard and B. B. Woodward. Their latest work, "The Post-Pliocene Non-Marine Mollusca of the South of England," has just been published by the Geologists' Association (*Proc.* vol. xvii. November 1901). In this the lists from various localities have been carefully checked and revised whenever possible from an examination of the actual specimens recorded. Doubtful records are omitted from the general list, in which are tabulated the species from seven Pleistocene and thirteen Holocene localities. There is also a column showing the species which occur in Pliocene deposits, and another giving all the living British species. Of the 139 living species no less than 129 occur in the south of England, and of the ten extinct forms seven have been found in the same area. The authors have expressed their opinion that the Pleistocene molluscan fauna was a finer one than that of to-day. The non-marine Mollusca have reached this country from various sources. In their opinion a large number are boreal, and of these some travelled hither along the now sunken land to the north of Scotland, whilst others may have journeyed through Siberia and the Continent; some have come from the south by the old land connection between England and the Continent; while others, the so-called Lusitanian forms, have reached us from south-west Europe; a few species may be endemic. Some changes in nomenclature are noted, but the authors justly remark that the identity of the shell is of more

importance than the absolute correctness of the name from a "priority" point of view.

IN *Publication* No. 56 of the Field Columbian Museum Dr. G. A. Dorsey describes the results of a fortnight's digging in the island of La Plata, Ecuador. It seems probable that for a very long period the island was visited by people from the mainland for ceremonial purposes, as none of the pottery appears to have had any utilitarian use, practically all being of the nature of images of the human form ranging in height from six to twenty inches, and most of them were provided with whistles. There were found numerous engraved and plain rectangular and circular discs and other problematical objects. In a tongue of detrital soil near the shore was found a grave which, from its contents, belonged to another occupation of the island, and there can be little doubt that invaders from Peru previous to the Spanish conquest were buried in this little island so remote from their home. In the grave excavated by Dr. Dorsey were found two gold human figures, one of silver, one of bronze and one of copper, besides a gold cup and several objects in gold, silver and copper, twelve earthenware vessels and a magnificent ceremonial highly polished stone axe, 19½ inches long and less than three-quarters of an inch thick, which may be considered as one of the most remarkable stone implements ever found. The paper is illustrated with sixty-three excellent plates and several figures. The letterpress is exceptionally condensed; a little more amplification would have been an improvement, and the sizes of the objects should have been given. An English observer fails to see why what appears to be a very evident alligator which surmounts a fragment of a human head in pottery should be termed a "serpent head-dress." The prominent valvular nostrils, the character of the eye, the keeled dorsal scutes and the limbs are essentially crocodilian, as is also the prominent lateral tooth in the upper and *lower* jaw; the latter cannot be the "projectile fangs of a serpent."

AT a recent meeting of the Linnean Society, Prof. S. H. Vines gave the results of his recent investigations of the proteolytic enzymes of plants, especially that of the pitchers of Nepenthes. The application of a chemical test—the pink or violet colour produced by the addition of chlorine water—shows that the enzyme in Nepenthes is tryptic, and not peptic; and this is probably the case with all ferments found in the vegetable kingdom. Prof. Vines proposes the term nepenthin for the ferment of Nepenthes.

THE *Journal* of the Royal Microscopical Society for December, 1901, contains the usual annual list of new biological terms (zoology and botany) introduced during the year. In the *Transactions* of the Society is a paper by Miss A. Lorrain Smith, on work carried on in the laboratory of the Royal Agricultural Society, on fungi found on farm seeds when tested for germination. A new genus of fungi, Stemphyliopsis, is described.

THE bulky part of the *Journal* of the Royal Horticultural Society for December contains a full report of the Lily conference held in the Gardens at Chiswick on July 16, 1901. The wide spread of the lily-cult is shown by the fact that at that meeting no fewer than eighteen papers were read, on the culture of lilies, their species and varieties, their diseases, &c. The most important original paper in this number is one by Sir James Blyth, on vine culture as exemplified at the Paris Exhibition.

THE Imperial Department of Agriculture for the West Indies has just published pamphlet series Nos. 12 and 13. The former, "Seedling and other Canes in the Leeward Islands, 1900–1901," is a summary of the report on sugar-cane experiments conducted at Antigua and St. Kitts recently noted here. The other, "Seedling and other Canes at Barbados, 1901," is a summary of an address delivered to the Barbados Agricultural Society by Prof. D'Albuquerque and Mr. Bovell, giving the results of the experimental cultivation of selected canes during last year. In the earlier stages of the experiments the weather seems to have been all that could be desired, and things looked so promising that a bumper crop was predicted; but at the critical moment, when good rains were essential for the complete fulfilment of the prediction, an all but universal drought settled down on the island and lasted until the canes were reaped. When the harvest time arrived the wind dropped so light that the windmills could not be worked. The canes were therefore growing long after they ripened, and when cut they were often standing some days at the mill door waiting for the wind to crush them. This combination of adverse weather had much to do with the poor quality of sugar that in many instances was turned out for sale. Seedling B. 208 proved the best all-round cane, the indicated muscovado sugar yield being 2·6 tons per acre (being second in 1900 with 3·02 tons). White Transparent was second with 2·5 tons (in 1900 it was eighth with 2·41 tons), and B. 147 third with 2·4 tons (in 1900 first, with 3·1 tons). B. 156, B. 306, B. 347 and Rock Hall cane produced impure juice and D. 130 and D. 145 yielded such a small tonnage of canes that their further experimental cultivation is undesirable.

MESSRS. PENROSE AND CO. have sent us a copy of their new, strongly bound and most luxurious catalogue of their apparatus and supplies, which contains particulars of almost every appliance or material known to be used in photo-mechanical processes, and is the most complete catalogue of process appliances with which we are acquainted. The book, which consists of 272 pages of matter printed on excellent paper, contains also 750 illustrations, many of which are by the half-tone process, and there are also 1260 references in the index. It may be added that the catalogue is supplied free of charge to regular customers and will be sent to prospective customers on receipt of half a crown, which will be refunded on the first order for goods to the value of one pound or upwards.

A VALUABLE collection of books and tracts on pure mathematics exists in the Central Library, Newcastle-upon-Tyne, and the catalogue prepared by Mr. Basil Anderton, chief librarian, and just issued by the Newcastle Public Libraries Committee, should be the means of making the collection more widely known than it is. Only works on purely mathematical problems are included, but the extent of the collection may be judged by the fact that the titles of such books and tracts in the reference library occupy forty-five closely printed quarto pages. The works are arranged alphabetically according to authors, and, so far as possible, related writings by the same author have been brought together. The committee of the Library is anxious that the books should be abundantly used, and the catalogue has been issued with this end in view.

THE Annual Report of the Smithsonian Institution for 1900 was received a few days ago, and, like the reports of previous years, it is a volume which commands admiration. The account, given by Dr. S. P. Langley, of the position and progress of the Institution occupies 117 pages and is naturally of restricted interest; but following it are no less than forty-three papers, occupying 643 pages, with numerous plates, selected from the scientific publications of the year because of their importance in illustrating directions of scientific thought, and containing trustworthy accounts of progress in physical and biological discovery. It is scarcely too much to say that every subject in which the world of science is interested finds its way in the course of time into Dr. Langley's comprehensive repertory. The articles which are reprinted or translated are chiefly by men of science of first

rank engaged in the extension of natural knowledge. The present volume contains reports upon scientific work, as, for example, those by Dr. Langley upon observations of the solar eclipse of May 28, 1900, the new spectrum, and the Langley aërodrome; scientific articles from magazines, as Sir Norman Lockyer's account of the progress of astronomy during the nineteenth century, Prince Kropotkin's article on unsuspected radiations, and the late Dr. J. Fiske's reminiscences of Huxley; presidential addresses, as Prof. W. J. Sollas's address on evolutional geology, delivered before the British Association in 1900, and Dr. G. M. Sternberg's address on malaria; several papers read before scientific societies, as one by Prof. V. B. Lewes on incandescent mantles, and Mr. E. S. Grogan's paper, read before the Royal Geographical Society, on his journey through Africa from the Cape to Cairo; original articles on Chinese folklore, and the restoration of extinct animals, and several translations, among which we notice a paper by Dr. Janssen on the progress of aëronautics, and one by Dr. F. Delitzsch on discoveries in Mesopotamia. In addition to these articles there are a number of others dealing with the progress of various branches of science during the nineteenth century. We are grateful to Dr. Langley for collecting these contributions to scientific literature from many sources and rendering them easy of access in his annual anthology.

THE additions to the Zoological Society's Gardens during the past week include a Bonnet Monkey (*Macacus sinicus*) from India, presented by Mr. L. E. Carmalt; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mr. W. H. Sheridan; a Black-eared Marmoset (*Hapale penicillata*) from South-east Brazil, presented by Mrs. Augusta Ryland; a Common Squirrel (*Sciurus vulgaris*), British, presented by Mr. R. B. Hatfield; a Red-faced Spider Monkey (*Ateles paniscus*) from Guiana, a Barnard's Parrakeet (*Platycercus barnardi*) from South Australia, five Conical Eryx (*Eryx conicus*), a Long-snouted Snake (*Dryophis mycterizans*), a Hamilton's Terrapin (*Damonia hamiltoni*) from India, two Black-headed Terrapins (*Damonia reevesi unicolor*) from China, deposited; two Coscoroba Swans (*Coscoroba candida*) from Antarctic America, purchased.

OUR ASTRONOMICAL COLUMN.

THE ANNULAR ECLIPSE OF THE SUN, NOVEMBER 11, 1901.—The successful observation of this eclipse by M. A. de la Baume Pluvinel at Cairo was announced by telegram some time ago, and his complete report of the operations appears in the *Comptes rendus* (vol. cxxxiii. pp. 1180–1185). Although the results were in general successful, the conditions were somewhat unfavourable owing to the low altitude, about 15°, of the sun at mid-eclipse.

Three lines of investigation were attempted.

(1) The examination of the solar spectrum at grazing incidence on the moon's surface. This was done with a powerful grating spectrograph, using an image of the sun about 14 mm. diameter on the slit plate. No variation in the various groups of lines examined could be detected, and it was concluded that this rendered the existence of any lunar atmosphere extremely improbable.

(2) Photographs of the crescents presented at second and third contacts were obtained in the hope of detecting any difference in constitution between the chromosphere and the outer photospheric layers. These were taken with a small prism spectrograph, having condenser, collimator, and camera objectives all about 0·60 metre focal length. A considerable number of arcs were obtained, and a list is given showing their wave-lengths in comparison with Young's chromospheric lines. The main series of arcs corresponded to a chromospheric layer about 20″ of arc in height, but beside these there appeared a series of more feeble images corresponding to a layer some 40″ high. The absence of the hydrogen series so conspicuous in the chromospheric spectrum is attributed to the mutual action of chromospheric radiation and photospheric absorption.

(3) Attempts to photograph the corona in presence of sunlight. This had appeared feasible in consequence of the impressions obtained several seconds after totality during the eclipse of January 1898, in India. For this work he employed a Cooke triple photo-visual objective of 1·5 ometres focal length. This instrument and the image lenses of the two spectrographs were fed by 3 plane mirrors mounted on a single cœlostat.

As the diameters of sun and moon differed by 1′ 24″ there were about 16/100ths of the sun's disc still visible at mid-eclipse. Two photographs, with 3 seconds and 10 seconds exposure, were obtained, but the aureole shown is not thought to be truly coronal.

Attempts were also made to detect the corona by utilising the action of the calorific rays on phosphorescent substances, but with negative results.

THE MAMMALS OF NORTH AMERICA.

AMONGST the recently issued publications of the Field-Columbian Museum of Chicago we find a list of the land and sea mammals of North America, north of Mexico, prepared by Mr. D. G. Elliot, curator of the department of mammals in that institution. The list is stated to contain the names of all the forms of North American mammals found on land or in the adjacent seas which had been described up to the date of publication (June 10, 1901), at any rate all those that "under the most lenient treatment are entitled to any sort of consideration." This most useful catalogue serves to show us very plainly the great activity of the American zoologists in this particular department of their science during recent years. In the late Prof. Baird's work on North American mammals, published in 1857, only 220 terrestrial species of this class (not including the bats) were recognised as occurring in the northern portion of the American continent, besides thirty-six others which were considered as of doubtful authenticity. Mr. Elliot's list contains the names of 628 species besides 368 subspecies, so that, if we take it as correct, the number of recognisable forms of North American mammals has been enormously increased of late years. It will be interesting to ascertain in what groups of the class of mammals this great augmentation has mainly taken place. This is shown in the following tabular statement:—

		Elliot, 1901			Baird, 1857
		Sp.	Subsp.	Total	Sp.
Order	i. Marsupialia	2	1	3	2
,,	ii. Edentata	1	—	1	1
,,	iii. Sirenia	2	—	2	—
,,	iv. Cetacea	46	2	48	—
,,	v. Ungulata	25	11	36	15
,,	vi. Rodentia	380	255	635	130
,,	vii. Carnivora	88	62	150	46
,,	viii. Pinnipedia	14	—	14	—
,,	ix. Insectivora	47	22	69	26
,,	x. Chiroptera	23	15	38	—
		628	368	996	220

In considering these figures it must be remarked that as Baird did not include the three groups of marine mammals or the Chiroptera in the scope of his work no complete comparison can be made. But it will be obvious, on a glance at the comparative tables, that it is the smaller mammals, the Rodents and Insectivores, that have so greatly increased in multitude, according to the present fashion of dealing with them. The Rodents, of which Baird only recognised 130 in North America, are now supposed to number 380 species, besides 255 subspecies,

and the Insectivores have risen from 26 species to 47 species and 22 subspecies. It is, of course, only natural that a considerable increase of species should have taken place in both these groups, as numerous and active collectors sent out by the United States National Museum and by the Agricultural Department at Washington have of late years traversed every part of the large western States and the adjoining districts of Mexico, where the members of these two groups are found in abundance. The collections thus made have been worked out by Dr. C. Hart Merriam, Mr. Allen and other well-known American naturalists, who have specially devoted their energies to the study of these groups of mammals. It may be fairly stated that in the opinion of many naturalists (who perhaps in these days would be pronounced to be somewhat old-fashioned) the process of the subdivision of species (vulgularly called "splitting") has, in some cases, been carried too far, especially as regards subspecies. At the same time there is no doubt about the high character of the work executed so diligently by Dr. Merriam and his *confrères*. We may point out, however, that the same kind of subdivision has been carried on also, to a certain extent, amongst the larger mammals. On turning over the pages of Mr. Elliot's "List" it will be noticed that the reindeer (*Rangifer*) of North America, which the old-fashioned naturalists have hitherto classed as being specifically inseparable from the European form (*R. tarandus*), is now held to consist of seven different species, and that the Rocky Mountain sheep, of which, until lately, only a single species was generally recognised, has been split into four or five species. Referring to the Carnivora, we find the southern lynx (*Felis rufa*) divided into nine subspecies, and the Virginian fox (*Canis virginianus*) into seven subspecies. The bears of North America, according to Mr. Elliot's "List," now consist of nine species, besides three subspecies. We in Europe have been accustomed to refer them all to three species only. In a similar way the skunks of North America (*Mephitis*) of which Baird only recognised five species, are now held to number no less than twenty species and four subspecies, divided into three genera.

What we have stated (to which more remarks of a similar character might easily be added) will serve to show that a great revolution is now taking place in the mode of treating the mammals by American workers. Symptoms of the same class of work have also occurred in Europe, but the process has not been carried on here to so great an extent, nor has it met with such general acceptance. Whatever may be its results it will certainly be necessary to add greatly to the space now occupied by the mammals in museums of natural history, for it is only a very large series of specimens that will enable the conscientious student to decide between the opposing claims of the "splitters" and the "lumpers," and to decide what are species and what are subspecies.

PRIZE SUBJECTS OF THE PARIS ACADEMY OF SCIENCES.

THE *Comptes rendus* of the Paris Academy of Sciences for December 16, 1901, contains a list of the prizes proposed for the years 1902, 1903, 1904, 1905 and 1906. The subjects proposed for the current year include the following :—

Geometry.—The subject proposed for the grand prize of the mathematical sciences is to perfect, in an important point, the application of the theory of continued groups to the study of partial differential equations; for the Bordin prize (3000 fr.), to develop and perfect the theory of surfaces applicable to the paraboloid of revolution; the Francœur prize (1000 fr.) and the Poncelet prize (2000 fr.) will be awarded for works useful to the progress of pure or applied mathematics.

Mechanics.—The Plumey prize (2500 fr.) for an improvement in the steam engine or any other invention contributing to the progress of steam navigation; a Montyon prize (700 fr.) for invention or improvement of instruments; extraordinary prize of 6000 fr. for any invention tending to improve the efficacy of the French naval forces.

Astronomy.—The subject announced for the Damoiseau prize (1500 fr.) is the completion of the theory of Saturn as given by Le Verrier, publishing the rectifying formulæ and establishing the agreement between theory and observation; the Janssen gold medal for an important discovery in physical astronomy; and the Lalande (540 fr.) and Valz (460 fr.) for general work in astronomy.

Geography and Navigation.—The Binoux prize (3000 fr.) will be awarded for the best work on this subject.

Physics.—The Hébert prize (1000 fr.) for a practical application of electricity.

Statistics.—A Montyon prize (500 fr.) for a memoir on the statistics of France.

Chemistry.—The Jecker prize (10,000 fr.) for work tending to the progress of organic chemistry.

Mineralogy and Geology.—The Fontannes prize (2000 fr.), to the author of the best palæontological publication.

Physical Geography.—The Gay prize (2500 fr.) for a memoir on the progress realised in the nineteenth century in the study and representation of the earth.

Botany.—The Desmazières prize (1600 fr.) will be awarded, independently of nationality, to the author of the best work on cryptogams; the Montagne prize (500 fr.) for a memoir on the anatomy, physiology or development of the lower cryptogams.

Anatomy and Zoology.—The Savigny prize (1500 fr.) for the assistance of young travelling zoologists, not receiving Government assistance, who occupy themselves especially with the invertebrates of Egypt and Syria; the Vaillant prize (4000 fr.) for the study of the fauna of an Antarctic island of the Indian Ocean; the Thore prize (200 fr.) for the best work on the habits and anatomy of a species of European insect.

Medicine and Surgery.—A Montyon prize for works useful in the art of healing; the Barbier prize (2000 fr.) for a valuable discovery in surgical, medical or pharmaceutical science; the Breant prize (100,000 fr.) for the discovery of a radical cure for Asiatic cholera, or for indicating in an indisputable manner the causes of Asiatic cholera in such a manner as to lead to its suppression, or, failing this, the interest on the capital sum will be awarded for a rigorous proof of the existence in the atmosphere of matter capable of taking part in the production or propagation of epidemic diseases, or for the discovery of a radical cure for herpes or for clearing up its etiology; the Godard prize (1000 fr.) for the best memoir on the anatomy, physiology or pathology of the genito-urinary organs; the Serres prize (7500 fr.) for the best work on general embryology, applied, as far as possible, to physiology and medicine; the Bellion prize (1400 fr.); the Mège prize for an essay on the causes which have retarded or favoured the progress of medicine from the oldest times to the present day; the Lallemand prize (1800 fr.) for work on the nervous system; and the Baron Larrey prize (1000 fr.) for the best work presented to the Academy treating of military medicine, surgery or hygiene.

Physiology.—A Montyon prize (750 fr.); the Pourat prize (1400 fr.) for a memoir on the comparative study of the mechanism of respiration in mammals; the Martin-Damourette prize (1400 fr.) and the Philipeaux prize (880 fr.) for work in experimental physiology.

General prizes.—The Arago medal is awarded by the Academy in recognition of a work or discovery of the first rank; the Lavoisier medal is awarded without distinction of nationality to chemists who have rendered eminent service to their science; a Montyon prize (unhealthy trades) for discoveries or inventions diminishing the dangers of any unhealthy trade; the Wilde prize (4000 fr.), awarded without distinction of nationality, for that work or discovery which, in the opinion of the Academy, is best worthy of recompense in astronomy, physics, chemistry, mineralogy, geology or experimental mechanics; the Tchihatchef prize (3000 fr.) for exploration in the lesser-known parts of Asia; the Delalande-Guérineau prize (1000 fr.) for services rendered to French science; the Jérome Ponti prize (3500 fr.); the Houllevigue prize; the Cahours prize (3000 fr.) for the encouragement of young men already known for their work, especially in chemistry; the Saintour prize (3000 fr.); the Trémont prize (1100 fr.); the Gegner prize (3800 fr.); the prizes founded by Mme. la Marquise de Laplace and by M. Félix Rivot.

Of these prizes some are explicitly and others tacitly restricted to Frenchmen; among those expressly stated to be offered without restriction of nationality are those bearing the names of Leconte, Tchihatchef, Wilde, Lavoisier, Arago, Desmazières, Delesse, La Caze, Lalande and Pierre Guzman.

PHOTOGRAPHS OF SNOW CRYSTALS.

MR. W. A. BENTLEY, of Jericho, Vermont, U.S.A., has devoted twenty years to the study of snow crystals, with special reference to the relation between their forms and the atmospheric condition at the time of their fall. He gives in the U.S. *Monthly Weather Review* a short account of the results of his investigations; and a number of beautiful reproductions of photo-micrographs of snow crystals secured by him accompany his paper. By the courtesy of Mr. Willis L. Moore, chief of U.S. Weather Bureau, we are able to give several of these pictures and an abstract of Mr. Bentley's contribution referring to them. So far as we are aware, no more beautiful or complete collection of photographs of snow crystals has ever been obtained than that produced by Mr. Bentley's patient work, and the fact that he has prosecuted his studies in somewhat difficult circumstances for so long is an excellent testimony to his scientific enthusiasm. We understand that he is preparing a volume upon the photographs, and the results of his studies of them. An album containing prints of all his drawings and photographs, with a short description of the methods and conclusions, would certainly be of great scientific value. The following notes are abridged from his paper in the *Monthly Weather Review*.

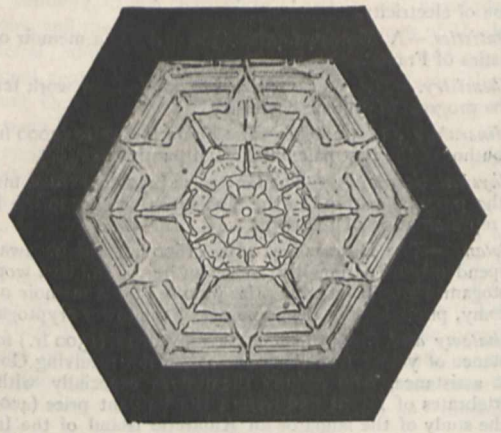


FIG. 1.—1895, February 8. Wind north-west, temperature −4° F.

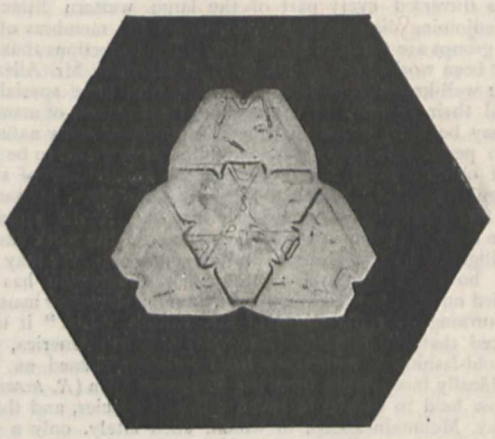


FIG. 2.—1900, February 18. Wind west to north-west, temperature 11°.

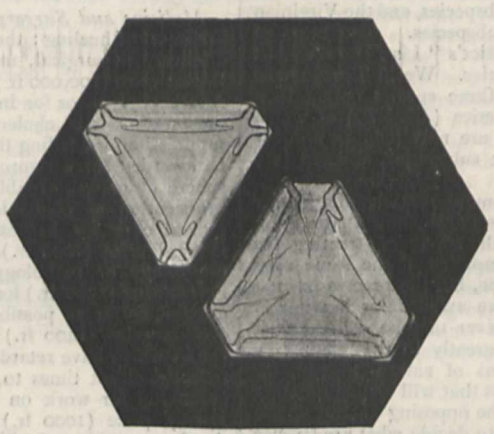


FIG. 3.—1899, February 13. Wind north, temperature 1°.

Photographs have been secured during every winter since 1884, and they now number more than 800, no two alike. Nearly every great and famous winter storm since that date has furnished its quota of from four to twenty (and in one instance thirty-four) of new forms to this collection. At the same time, observations have been made and data secured, while photographing them, of the temperature; kinds and approximate heights of clouds (when possible); the direction and rapidity of movement of various cloud strata; the direction and velocity of the surface winds; also changes in the forms of the crystals form hour to hour as the different portions of each storm passed over the district. The latter observations were made to ascertain whether there was any general law of distribution of the forms within the different portions of a storm. Differences in form of crystals deposited by local storms from those of general storms were also noted, as also

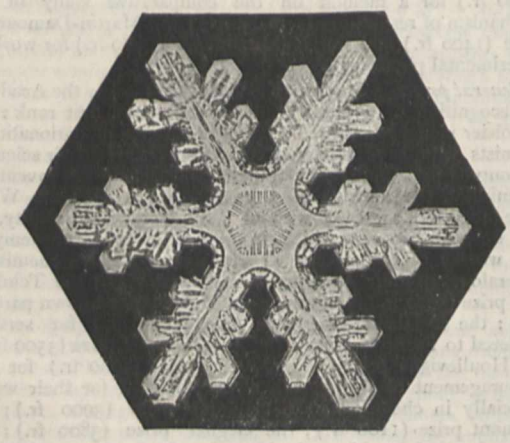


FIG. 4.—1900, December 5. Wind north-west to north, temperature 22°. Cloud, stratus.

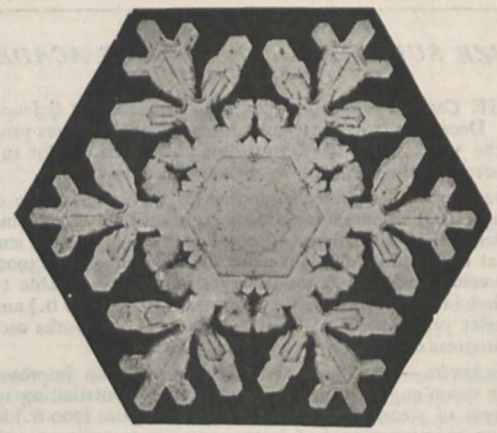


FIG. 5.—1888, March 12. Great blizzard, temperature 12°. Diameter one-quarter of an inch.

the forms originating in, and peculiar to, each of the various cloud strata. These observations, and the data secured, indicate that the temperature and the humidity of the air at the earth's surface is a much less important factor than is generally supposed in determining the form and size of

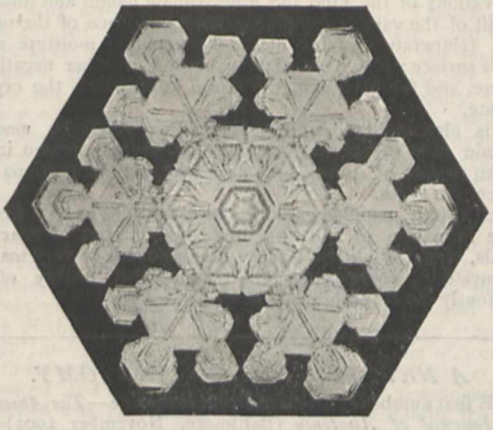


FIG. 6.—1901, February 15. Wind north-west, temperature 14°.

humidity due to these; the character of the storm, whether local or general, and the portion of the storm region from which the crystals come. To these must also be added the initial and subsequent movement of the crystals within the clouds. If, as must often be the case, the nuclear forms originating in the

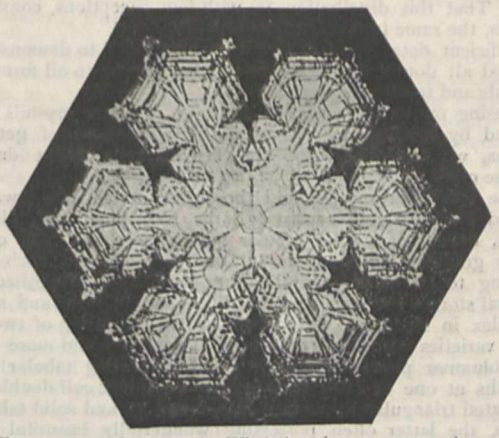


FIG. 7.—1898, January 26. Wind changing west to north-west, temperature 18°.

the crystals. We may easily conceive this to be the case, because at a given temperature, &c., at the earth's surface, the temperature and humidity of the air where the crystals form might vary greatly, one time from another, and would depend largely upon the height of the snow-producing clouds. The height of these varies greatly at different times, even when the temperature at the earth's surface remains the same. The data secured have not revealed the great mystery of the origin and cause of the differences in the forms of the nuclei; why columnar forms predominate at one time, tabular forms at another, or why both are sometimes found associated together. Much has been learned, however, of the conditions tending

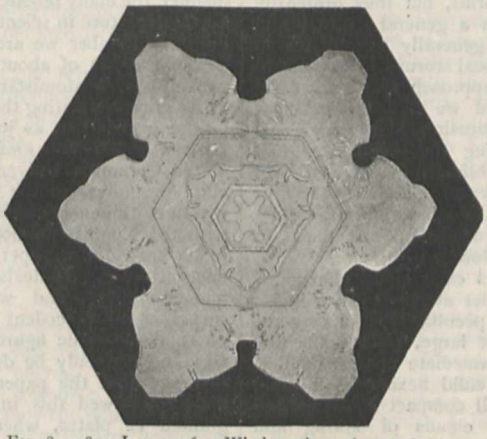


FIG. 8.—1899, January 6. Wind south-south-east, temperature 22°. Clouds, upper stratus.

lower ascending clouds are carried upward to much greater heights by the strong ascending air currents, which often occur within such storms, until they become heavy enough to fall back through them, then the crystals will in all probability be greatly modified by passing through atmospheric strata varying greatly in density, temperature, humidity, &c. That they are greatly modified by these flights in the clouds is clearly shown by the interior structure of many of the crystals outlining many of these transitory states. Thus, crystals of which the nuclear form was originally nearly perfectly hexagonal sometimes become partly triangular in outline, and *vice versâ*. No. 8 is an example of such modifications.

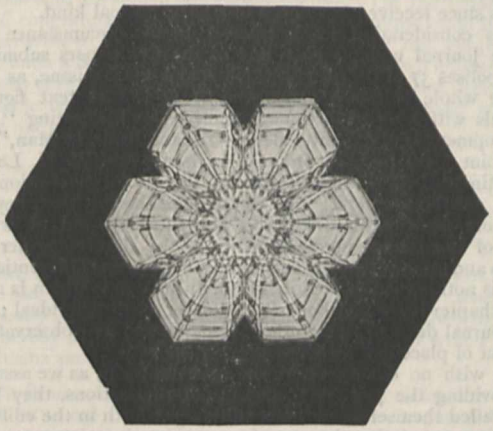


FIG. 9.—1886, February 26. Wind north-west, temperature 8°.

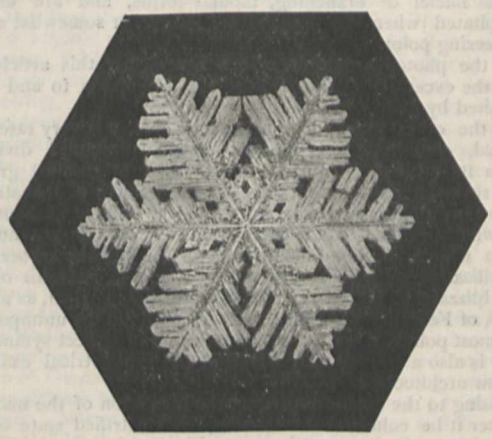


FIG. 10.—Wind west, temperature 34°.

to modify their forms after the nuclear form is once organised. These conditions are many, the chief among them being the height, number and vertical depth of the cloud strata and the resultant variation in temperature, atmospheric pressure and

Perhaps the most important facts of a general nature to be gleaned from twenty years' study are these:

(1) That the greater number of the more perfect and beautiful tabular forms occur much more frequently in, and are confined

almost wholly to, the western and north-western portions of great storms and blizzards.

(2) That there seems to be a law of general distribution of the different forms, the columnar to one, the tabular and granular to others, with many varieties associated together in other portions of such great storms.

(3) That this distribution is, with few exceptions, constant, that is, the same in nearly all storms.

Sufficient data has not as yet been collected to demonstrate beyond all doubt the fact that this law applies to all forms of crystals and to all storms alike.

Passing on to the variation in form of those crystals deposited by local storms, as compared with those of general storms, we find that these are very marked, except during intense cold.

The local storm types and those precipitated from low, detached clouds usually consist of large, frail, branching, tabular forms, devoid of a solid tabular nucleus (see No. 10), or of heavy granular varieties, similar one to the other, each according to its class. On the other hand, those deposited by general storms are usually more diversified in form and more complex in structure, the snowfall often consisting of two or more varieties associated together. The larger and more perfect columnar prisms, columnar forms possessing tabular outgrowths at one or both ends (which we might call doublets), truncated triangular forms (see Nos. 2 and 3), and solid tabular forms, the latter often possessing wonderfully beautiful and complex interior designs (as in No. 1), are common only to general storms. Branching tabular and granular forms are common to both general and local storms, but they ordinarily possess solid nuclei if deposited from a general storm (as in Nos. 4–7), whereas the nuclei are generally absent (as in No. 10) if the crystals originated in local storms. During zero weather the crystals of local storms approach much nearer in form to those of general storms, and we find solid tabular forms, branching tabular forms possessing solid hexagonal nuclei and sometimes doublets, among the snowfall. Often during the intense cold succeeding a blizzard the snowfall will consist wholly of very minute columnar and pyramidal forms, or of both columnar and minute frost-like tabular forms, falling apparently from low, detached nimbus or alto-nimbus clouds, or even from a sky free, or nearly so, of clouds.

During relatively mild temperatures each cloud stratum, if alone, there being no other clouds either above or below them, commonly precipitates each its own peculiar type of crystals. Low detached nimbus clouds deposit large, frail, branching tabular forms, similar to No. 10; intermediate clouds, smaller, branching tabular forms, possessing solid hexagonal nuclei; and the high cirro-stratus clouds, small compact columnar and tabular forms. The large cumulus clouds of spring and autumn usually shed large, heavy, pyramidal-shaped granular snow. These granular forms frequently, if not invariably, possess nuclei of branching, tabular forms, and are usually precipitated when the temperature is near or somewhat above the freezing point.

Of the photomicrographs which accompany this article all, with the exception of No. 10, are those common to and were deposited by great storms.

Of the other numbers of the series, No. 2 is very rare and unusual, containing as it does eleven triangular divisions within its outlines. Apparently the lines of greatest growth were reversed during one stage of the growth of this strange form, thus differing widely from No. 3, which has outlines somewhat similar. No. 4 possesses a very rare unique nuclear design which is very difficult to explain by any process of crystallisation of which we know. No. 5 (a souvenir of the great blizzard of March 12, 1888) is very symmetrical, as also is No. 6, of February 15, 1901. No. 7 is, in all but the unimportant outermost points, a marvel of complexity and perfect symmetry. No. 9 is also a marvellously beautiful and symmetrical example of snow architecture.

Passing to the causes governing the formation of the nucleus, whether it be columnar or tabular, the electrified state of the atmosphere, whether negative or positive, and perhaps, also, as suggested by Prof. Cleveland Abbe, the presence in greater or less amounts of various gases and vapours in the atmosphere, may all be controlling factors.

Although much has been already learned about these interesting phenomena, yet there still remains much more. Cooperation between many observers is essential to carry out this work successfully. Simultaneous observations of the forms and changes the crystals undergo from hour to hour during our great blizzards should be made by many skilled observers, stationed along a general line extending north and south. These observers must be familiar with the names and approximate heights of the various clouds. This study should include observations of the kind and approximate height and direction of drift of the various clouds, direction and force of the surface wind, temperature of the air, and amount of moisture at the earth's surface; also its electric condition, whether negative or positive, and the portion of the storm from which the crystals emanate.

It is also highly desirable that observations be made to ascertain why the perfect crystals are more common in the western portion of storms, and also why certain portions produce certain types.

Such a study, supplemented by investigations as to the causes of the formation of the two fundamental types of hoar-frost crystals, would doubtless lead to the discovery of very many of the mysteries surrounding the origin and history of the wondrously beautiful forms of snow.

A NEW JOURNAL OF ANATOMY.

THE first number of a new scientific magazine—*The American Journal of Anatomy* (Baltimore, November 1901)—has been received and merits a descriptive notice because, as it has been "founded to collect into one place, and present in a worthy manner, the many researches" of American anatomists, it marks a new departure in scientific journalism, and while its pages are but 98 in number we are informed that future issues will be in quarterly parts of about 125 pages each. The interest with which British anatomists regard their branch of science as practised in America has during the last four to five years been heightened by the association, as joint editor of our own long-established *Journal of Anatomy and Physiology*, of Prof. G. S. Huntington, of the Columbia University at Washington, who is one of the chief promoters of the new journal now under review. The reason of this enhanced interest lies in the fact that his connection with the English publication was marked by the appearance in its pages of a paper of a kind to which its readers were unaccustomed. It deals with a series of sections of an early human embryo, and while containing nothing that is new, surpasses all precedent in being illustrated by 11 plates of photomicrographic figures which do not portray a single fresh fact and can only be defined as useless. When, further, it is observed that the paper (by an English author) which immediately followed this in order of publication was similarly granted 12 plates, where 4 might well have sufficed, there is no wonder that there arose in the minds of the supporters of the journal a misgiving, lest the new association might perhaps lead to disaster. Let it be said, however, that American papers since received have been of a more normal kind.

This consideration lends interest to the circumstance that in the journal under review one of the five papers submitted monopolises 37 of the 98 pp. which make up the issue, as well as the whole of the 9 plates and 27 of the 42 text figures. It deals with a series of human embryos, as illustrating "The Development of the Limbs, Body-wall, and Back, in Man," and is a joint production by Drs. C. R. Barden and W. H. Lewis, of Baltimore. It is carefully written, and of the illustrations no praise can be too high. But we deplore the fact that, beyond the more exact determination of the actual period at which some of the important constituents of the developing nervous system and parts of the fore- and hind-limbs are first differentiated, there is nothing either recorded or delineated in it which is new. As a chapter for a text-book it would be well-nigh ideal; but in a journal devoted to records of research and new observations it is out of place and does but hamper the way.

We wish no disrespect to the authors, for if, as we assume, in providing the positively magnificent illustrations, they have but availed themselves of the condition set forth in the editorial advertisement, "that the cost of more expensive plates must be borne in part by the authors," we would rather tender them our hearty thanks. While, however, we would thus appraise their enterprise and artistic taste, we are still of opinion that, if our surmise is correct, both these and their enthusiasm have been misapplied; for if we are to proceed on these lines, the danger, at present obvious enough in all departments of anatomical

inquiry, of the science becoming buried in its own literature will be rendered unavoidable. Of the other papers which fill the remaining 61 pp. of the issue before us there are four. One by Dr. Preston Kyes, of Chicago, on "The Intralobular Framework of the Human Spleen," contains little that is new, and is chiefly noteworthy for the introduction of a method. Then follows a paper entitled "Studies on the Neuroglia," by Dr. Carl Huber, of Michigan, which embodies a useful *résumé* of the conflicting results of the observations of previous investigators. The author has adopted the comparative method of inquiry, and has done good service in relation to technique; and among his chief results is the conclusion that certain of the neuroglia fibres are not simply processes of the cells, or, as von Kölliker believed, of a differentiated cell-plate, but that they are to be regarded as intercellular.

The fourth paper is welcome, as dealing, in an up-to-date manner, with the modern topic of "The Normal Histology of the Human Hæmolymph Glands." Its author, Dr. A. S. Warthin, also of Michigan, gives it as his opinion that our conceptions of lymphoidal tissues are greatly broadened by the study of these glands. He distinguishes between "spleenolymph" and "marrowlymph" glands, on a basis of structural and functional differentiation. He defines the latter as retroperitoneal, and in many observed cases most prominent when associated with pathological conditions. He admits the existence of transitional types of gland, and suggests that the ordinary lymphatic gland is the most highly developed, and that the spleen stands in similar relationship to it through the spleenolymph gland as does the lymphoid marrow through the marrowlymph gland. He further regards the red marrow as "the most primitive type of lymphoid structure."

The fifth and last paper is by Prof. C. S. Minot, of Harvard Medical School, who needs no introduction to English anatomists. It is "On the Morphology of the Pineal Region, based upon its Development in Acanthias," and is a very careful study, mainly of the paraphysis and velum. Six "fundamental morphological divisions" are recognised "in the median line of the diencephalic roof," and for some of these new terms are proposed. It is pointed out, on a delimitation of that which the author terms the "paraphysial arch," as distinct from the "post velar," that the posterior commissure belongs morphologically to the mid-brain. The paraphysis is regarded as in all probability a true gland, akin to the infundibular gland and the glandular epiphysis of birds; and it is suggested that these are severally comparable to ductless glands, and that they "supply some substances which are useful to the nervous system."

The journal is well supported, and its get-up is deserving of the highest praise. Its collaborators include the names of more than sixty persons, most of whom are either leaders in human and comparative anatomy in the United States or otherwise well known, and its editorial board is composed of eight of their number who are sufficiently representative. On the whole, we would congratulate our friends upon their venture; and if they will only see to it that, whenever possible, they rest content to work upon a basis of the bare record of facts hitherto unobserved, whereby they will not burden an already overcrowded literature, we can at least assure them of our sympathy and good wishes, if not our actual support.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LORD Strathcona, the Lord Rector of the University of Aberdeen, has sent a cheque for 25,000*l.* towards the Aberdeen University building scheme, the public having subscribed 30,000*l.* and thereby more than fulfilled the condition under which Lord Strathcona promised his gift.

THE Prince of Wales has consented to visit Manchester on March 12 to open the Whitworth Hall at the Owens College. At a meeting of the Court of Governors of the College on Tuesday, the following motion was passed:—"That the time has arrived when steps should be taken to secure that there should be, as originally proposed by the Owens College, an independent University in Manchester."

THE annual meeting of the Geographical Association will be held at the College of Preceptors on Wednesday, January 15. Mr. Douglas W. Freshfield, president of the Association, will occupy the chair, and an address will be delivered by the Right Hon. James Bryce, M.P., on "The Importance of Geography in Education." Tickets may be had on application to the hon. sec., Dr. A. J. Herbertson, 9, Staverton Road, Oxford, or to the hon. treas., Mr. J. S. Masterman, St. Margaret's, Dorking.

THE system of teaching by correspondence is not one which has attained to very great favour in this country, except, perhaps, as a means of preparing for examinations, and it would be considered by most especially unsuitable for studying such preeminently practical professions as civil, mechanical and electrical engineering, mining, &c. Yet it appears from an article in a recent number of the New York *Electrical Review* that this system has a considerable vogue in America. The International Correspondence Schools, in spite of the fact that they were only inaugurated ten years ago, now number more than 350,000 students, amongst whom a large proportion are following courses in engineering, and it is not the only institution of the kind in the States. A decidedly valuable feature of the system in the case of the electrical courses is that students are supplied with sufficient apparatus to carry out most of the fundamental experiments. No doubt this method of teaching can be of great benefit to those who are actually employed in engineering works and are thus more or less conversant with the practical side of the subject, and in consequence can be of considerable help in raising the efficiency of the country, which must ultimately depend on the efficiency of its workers.

A PAPER on German Technical Schools by Prof. V. C. Alderson, Dean of the Armour Institute of Technology, published in the *Chicago Inter Ocean*, contains some points which serve to accentuate the account given in last week's notes (p. 213) of the little that is being done for higher technical education in Great Britain. Prof. Alderson describes briefly the Technical High Schools at Charlottenburg, Karlsruhe, Munich, Hanover, Darmstadt and other German cities, and compares the work carried on in them with that of the technical schools in the United States and Great Britain. He points out as a lamentable fact that the provision for engineering education in London is totally inadequate. "In this great city of 6,000,000 people barely 600 students a year are provided with engineering instruction of an advanced character. In this great metropolis, which contains more engineers of every class than any other city in the world, and where there is the greatest demand for their services, not only at home, but in foreign enterprises financed in London, the provision for their education is comparatively nothing. Any one of the German Technische Hochschulen which I have described, with far less reason for existence, has a larger equipment, is more expensive to maintain, covers a broader field of work, and is better fitted to exert a powerful influence upon the profession and the industries than the best technical school in London. Not only are the few schools now in the field inadequate for the purpose, but many fields of engineering education are entirely bare. Absolutely no provision is made for teaching marine engineering, naval architecture, railway engineering, municipal engineering, or architecture. These are departments of the utmost consequence for the continued prosperity of London, yet she allows her young men to pick up their training in the old-fashioned way, and if she needs a really capable man she must import him from Germany, Switzerland or America. London has received no greater shock recently than to wake up and find that the equipment of the new 'twopenny tube,' as the Electric Railway is called, was almost entirely American. The error which Englishmen make in this whole field of technical education is a failure to recognise the difference between the skilled workman and the professional engineer. She has been endeavouring to compete with the highly trained scientific experts of Germany and America by simply educating the hand, training artisans in the belief that she was making professional engineers. Not until England is dotted with large and flourishing schools like the Central Technical College of London, not until the English realise the necessity of training both the hand and the head, and not until she perceives the full value of high-grade engineering education will she be safe from the intrusion of German and American engineers who have had a thorough engineering training." This view from outside confirms that which can be seen when our educational structure is examined from within, and supplies a further reason for increased scientific training for leaders of industry.

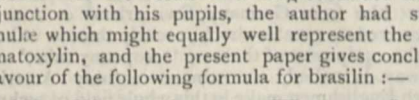
SOCIETIES AND ACADEMIES.

LONDON.

Chemical Society, December 19, 1901.—Prof. Emerson Reynolds, president, in the chair.—It was announced that the remaining meetings of the present session would be held alternately on Thursdays at 8 p.m. and Wednesdays at 5.30 p.m., commencing with an evening meeting on Thursday, January 16. The text of the address of congratulation to M. Berthelot was then read, and the secretary recorded the presentation of a plaster cast of the bronze portrait of Bunsen from the tomb at Heidelberg by Sir Henry Roscoe, and of a photograph of a bas-relief of Prof. Julius Thomsen by Mr. H. Faber.—The following papers were read :—(1) The constitution of corydaline, (2) the relations of corydaline to berberine, by Dr. J. J. Dobbie and Mr. A. Lauder. The authors have studied exhaustively the action of various oxidising agents, such as potassium permanganate and dilute nitric acid, upon corydaline, an alkaloid derived from the Tyrolean plant *Corydalis cava*, and by the identification of the ultimate oxidation products have established the fact that it is closely related to the yellow alkaloid berberine, and have therefore assigned to it a constitutional formula of the type suggested by Perkin for the latter alkaloid. The interrelations of the two alkaloids are shown in the following scheme :—

Corydaline (colourless) $C_{22}H_{27}NO_4$	by *oxidation* gives	dehydrocorydaline (yellow) $C_{22}H_{23}NO_4$.
Berberine (yellow) $C_{20}H_{17}NO_4$	by *reduction* gives	tetrahydroberberine (colourless) $C_{20}H_{21}NO_4$.

The constant difference C_2H_6 observed in the corresponding alkaloids of the scheme is accounted for by the presence of a methyl group in the α position of the pyridine ring and the occurrence of two contiguous methoxyls in place of the piperonyl group of the berberine formula of Perkin.—The magnetic rotation of some polyhydric alcohols, hexoses and disaccharoses, by Dr. W. H. Perkin, sen. The phenomena of varying specific rotation shown by solutions of sugars have been explained by the assumptions that these substances in the solid form possessed a structure which became modified gradually in their aqueous solutions, or that the solid was made up of complex molecules which underwent simplification in the presence of a solvent, or that solution was accompanied by gradual hydration. The magnetic rotations of solutions of the various sugars show that the first of these hypotheses is probably the correct one, and incidentally it was found that the observed values for dextrose agreed best with those calculated for Tollens' formula, which represents that substance as similarly constituted to ethylene oxide.—Stereoisomeric halogen derivatives of α-benzoylcamphor, by Dr. M. O. Forster and Miss F. M. G. Micklethwait. α′-Benzoyl-α-bromocamphor and α-benzoyl-α′-bromocamphor were prepared and characterised ; the former has the specific rotation $-10°$ in benzene, the latter under the same conditions $-53°$. The corresponding chloro-derivatives have respectively the rotations $-27°$ and $+26°$ in chloroform.—Brasilin and hæmatoxylin, by Prof. W. H. Perkin, jun. These closely related substances are the characteristic colouring matters respectively of Brazil wood and logwood. As the result of a long-continued investigation in conjunction with his pupils, the author had suggested two formulæ which might equally well represent the constitution of hæmatoxylin, and the present paper gives conclusive evidence in favour of the following formula for brasilin :—



hæmatoxylin being hydroxybrasilin with the —OH in the position 1.—Is argon an elementary substance? by Mr. G. Martin. The view is put forward that since argon furnishes no characteristic series of compounds it may be regarded as a mixture of elementary gases.—The action of phosphorus trithiocyanate on alcohol, by Dr. A. E. Dixon. In this reaction thiocyanic acid is formed together with isopersulphocyanic acid, but no substance of the formula $C_8H_{18}N_4S_4O_2$ as found by Lössner, could be obtained.—The influence of salts and other substances on the vapour pressure of aqueous ammonia solutions, by Dr. E. P. Perman. Alkali salts produce an increase of pressure, while the formation of complex substances with copper salts reduces it.—The action of sodium hypochlorite on benzenesulphoanilide, by Dr. J. B. Cohen and Mr. J. T. Thompson. Benzenesulphonyl-p-chloranilide is the principal product of this reaction, and has been obtained in a pure state and characterised.—The relationship between the substitution and constitution of benzeneazo-α-naphthol, by Dr. J. T. Hewitt and Mr. S. J. M. Auld. This substance is regarded as an oxyazo-compound, since on acetylation and complete decomposition it furnishes aniline, but not acetanilide, and by reduction gives rise to a hydrazo-derivative. The monobrombenzeneazo-α-naphthol behaves similarly, the substitution occurring in the naphthol nucleus.

Geological Society, December 18, 1901.—Mr. J. J. H. Teall, V.P.R.S., president, in the chair.—Prof. H. G. Seeley drew attention to a skull of *Equus fossilis* from Keswick, exhibited by Mr. J. Postlethwaite, and said that it belonged to a species of horse, but the skull appeared to be broader and flatter in front of the orbits than in the *Equus caballus* ; and it gave evidence on the upper surface of being an aged specimen, an inference which was supported by the palatal conditions. Mr. Postlethwaite said that the skull was found beneath the floor of one of the rooms of a farm-house about six miles east of Keswick. The house, which is of considerable age, was being altered and repaired, and it was in taking up one of the floors, for the purpose of relaying, that the skull was found. The surface-deposit on the farm is Glacial Drift.—Prof. W. W. Watts called attention to the exhibited set of twenty-two photographs, the first of three sets to be published as typical examples of geological photographs by the committee of the British Association on geological photographs.—Coal and petroleum-deposits in European Turkey, by Lieut.-Colonel Thomas English. In this paper an account is given of the formations which include some recently discovered coal-seams and naphtha-bearing sands of Tertiary age in the little visited stretch of country lying to the north of the Gulf of Xeros in the Mediterranean, and of the western portion of the Sea of Marmora. —On the geological and physical development of Dominica ; with notes on Martinique, St. Lucia, St. Vincent and the Grenadines," by Prof. J. W. W. Spencer. These islands form a continuation of the volcanic chain extending from Gaudeloupe, though separated one from the other by embayments in the submarine plateau, reaching to depths of more than 6000 feet, within the line connecting the shores of the islands. These submarine valleys head in cirques, like the amphitheatres which occur on the slopes descending from high plateaux. From the ends of the cirques, valley-like channels can be traced landward on the submerged plateaux, or can be found to cross them in order to join like features on the other side. The cols between the opposite valleys vary in depth from about 2000 to 3600 feet, except that between the Grenadines and the Trinidad banks, where the divide may not be more than 750 feet below the surface of the sea, and one south of St. Vincent (less than 1300 feet). Some of the submarine channels have remarkable tributaries. The drowned valleys, like those about the islands to the north, assume two very different forms—those with broad undulating outlines, such as characterise the features produced during the long Miocene-Pliocene period of erosion, when the surfaces of the land were at or near the base-level of erosion, and other types where very deep valleys and gorges incise the more rounded features of the drowned plateau, which in the early Pleistocene epoch thus appears to have stood for a limited time at an altitude of 6000 or 7000 feet, as shown within the limits of the Antillean mass (and still higher from evidence beyond). There are no coastal plains, strictly speaking ; only to a very limited extent are the islands surrounded by shelves submerged to a depth of less than 200 feet. But the Grenadine banks are extensive. One or two outlying remnants of the Antillean plateau occur south-east of Dominica, and another about sixty miles east of Martinique, all of which may be fragments of the old coastal plains. All the islands are underlaid by old Tertiary or pre-Tertiary igneous rocks —On the geological and physical development of Barbados, with notes on Trinidad, by Prof. J. W. W. Spencer. Barbados, more than 100 miles east of the main chain of islands, is a remnant of the dismembered and sunken Antillean plateau, with the embayment in it, west of the island, reaching to a depth of more than 7000 feet. But the drowned Barbados ridge extends far, both to the south and to the north of the island, and is connected by another ridge with the Martinique mass. Trinidad is part of the South American continent, being on the subcoastal shelf which extends much

farther seaward. Trinidad has more continental features than the other islands. Its surface-topography has been found to owe its origin to the erosion features of the Miocene-Pliocene period, which have been covered by only thin mantles as in Barbados, so that its life-history falls into harmony with that of the other islands. In its older beds it has the deep oceanic oozes as in Barbados. No volcanic phenomena have been added to the features of these islands.

Royal Microscopical Society, December 18, 1901.—Mr. William Carruthers, F.R.S., president, in the chair.—Messrs. R. and J. Beck exhibited a new micrometer microscope, the body of which was made to traverse across a long stage by means of a fine screw, the milled head of which was divided so as to indicate a movement of 1/100 millimetre. The body could also be placed in a horizontal position, when it could be used as a telescope to measure distant objects.—Mr. F. W. Watson Baker exhibited a number of microscopic specimens illustrating the development and structure of eyes. They were shown under twenty microscopes and were the most perfect sections which could be obtained from the best preparers in this country and abroad.—Mr. Nelson sent three notes which in his absence were read by the secretary. The first was a description of Holtzapffel's microscope. The date of it is 1830 and in it are found four original devices, (1) the clamp foot for clamping the instrument to the edge of a table, predating a similar device of Varley's in 1831; (2) the back of the mirror is flat polished brass so that monochromatic light may be reflected by it; (3) the stage is focussed by an excentric which differs from and predates the somewhat analogous devices of Pacini and Plössl; (4) the movement of the lens holder by means of a steel tape and pinion. The second note was a description of the first English achromatic objective, made by W. Tulley. It was a triplet and was made at the suggestion of Dr. C. R. Goring, who paid 90*l.* for it. The focus of the combination is 0·933 inch, initial magnifying power 10·72, N.A. ·259, and the O.I. the large amount of 24·2. Mr. Nelson then described the Chevalier-Euler achromatic objectives of 1823-24 and 1824-25. These were doublets, and in 1827 Mr. J. J. Lister put one of the Chevalier doublets as a front and a Tulley's triplet as a back lens. The focus of the combination was 0·52 inch and it was the finest microscopic objective that had up to that time been produced, and was, strictly speaking, the first really successful scientific microscopic objective. Lister's labours in perfecting objectives and the great use they had been to the leading opticians of the day were referred to. The third note was on a useful caliper gauge. It can be purchased at any watchmaker's tool shop for three or four shillings. It is convenient for measuring the thickness of cover glasses, and for low-power work the scale may be placed on the stage of a microscope and the constant of an eye-piece micrometer found by comparison with the mm. divisions.—The president gave an account of some investigations which he had made in reference to a disease that had caused great mischief in the cherry orchards in Kent. About fourteen months ago, when his attention was first directed to it, the disease was prevalent over a considerable area, a noticeable feature in connection with it being the persistence in the autumn of the dead leaves on the branches, instead of their falling off, as they would if the trees were healthy. The leaves of affected trees were pervaded by the mycelium of a fungus which destroyed them, and as the food of the tree was prepared by the leaves, the growth of the tree would, as a consequence, be arrested. The results of experiments in the cultivation of the fungus showed it to be one which belonged to the genus Gnomonia. Many of the fungi in this class passed through various stages in their life-history, for example, the mildew on wheat, which was first developed on the berberry and then spread to the wheat, appearing first as rust and afterwards as mildew from the same mycelium. The president referred to the absence in this country of any authority competent to investigate cases such as this; on the continent, however, the Governments had taken up the matter, and the experts who had inquired into it had found that to check the spread of the disease it was necessary to collect all the dead leaves and burn them. The president had consequently urged upon the fruit growers the necessity of following this recommendation, but had only been able to persuade two growers to do so; both of these, however, had found it to be thoroughly effective. Prof. A. W. Bennett in his remarks enlarged upon the absence in this country of investigations into such matters by State-paid establishments, and described what was being done in the United States, where every State had its own experimental station.

PARIS.

Acadamy of Sciences, December 30, 1901.—M. Fouqué in the chair.—M. Albert Gaudry was elected vice-president for the year 1902.—On double fertilisation in the Solanaceæ and Gentianaceæ, by M. L. Guignard. A study of *Nicotiana tabacum* and *Datura loevis* in the Solanaceæ and of *Gentiana ciliata* shows that double fertilisation is effected in both of these orders in essentially the same manner as in other cases which have been observed.—On a series of factorials, by M. Niels Nielson.—On linear differential equations which are of the same species, by M. Alfred Lœwy.—Some new theorems on entire functions, by M. Ernst Lindelöf.—On integral invariants and differential parameters, by M. Alf. Guldberg.—Internal tensions produced by two equal directly opposed forces acting on an indefinite solid, by M. Mesnager.—The critical constants and molecular complexity of some hydrocarbons, by MM. Ph. A. Guye and Ed. Mallet. The critical pressures and temperatures are given for durene, naphthalene, diphenylmethane and diphenyl. From these are calculated the critical coefficients, the constants *a* and *b* in Van der Waals' formula and the ratios of the real critical density to the theoretical. The conclusion is drawn that none of the hydrocarbons studied are associated at the critical point.—The extension of Kirchhoff's laws, by M. E. Carvallo. The results of this investigation are expressed as follows: The flux of the total current through the whole of a closed surface is zero, and the total electromotive force which rules in a closed circuit is zero.—On a new reaction between electrostatic tubes and insulators, by M. W. de Nicolaiève.—The action of high-frequency currents upon animals, by MM. H. Bordier and Lecomte. It has been shown that high-frequency currents can be applied directly to man without any sensation being produced, in spite of the large amount of energy which can be thus transmitted. It has been suggested as an explanation of the absence of sensation that the currents pass over the surface of the body without penetrating it. The experiments of the author negative this view, as such currents were found to be fatal to the rabbit, guinea-pig and rat.—Remarks on the preceding communication, by M. d'Arsonval. The facts described by MM. Bordier and Lecomte are in full accord with previous observations of the author. Stress is laid upon the conditions which must be observed in studying high-frequency currents. It is necessary to avoid all action on the sensibility, muscular contraction, and all abnormal elevation of temperature.—On the existence of rays capable of reflection in the radiation emitted by a mixture of the chlorides of radium and barium, by M. Th. Tommasina.—On the electro-capillary maxima of some organic compounds, by M. Gouy.—The heat of formation of the hydrate of chlorine, by M. de Forcrand. The number deduced from the dissociation curves of Isambert, Roozeboom and Le Chatelier is 18·16 calories; the value obtained from direct experiment is 18·57.—On the determining causes of the formation of the visual organs, by M. Antoine Pizon. The phenomenon of vision is regarded simply as a consequence of the accumulation of pigmentary granules at certain points of the body, and of the absorbing power of these granules for light rays. These views are regarded as affording an explanation of the occurrence of the eyes in the regions of greatest illumination, the position of the cephalic eyes, the extraordinary number of eyes in certain annelids, the more or less complete disappearance of the eyes in species inhabiting caves and in internal parasites.—The leaf trace in ferns, by MM. C. E. Bertrand and F. Cornaille.—On the eclogites of the Aiguilles Rouges, by M. Étienne Joukowsky.—On ergot of rye, by M. Marcel Guédras. The therapeutic action of this drug is due to sphacelinic acid and to cornutine. These active principles cannot be separated practically, since they have nearly the same solubility.

NEW SOUTH WALES.

Linnean Society, November 27, 1901.—Prof. J. T. Wilson in the chair.—The following papers were read:—Descriptions of new genera and species of Australian Lepidoptera, by Mr. Oswald B. Lower. Sixty-seven species referable to six families, namely, Arctiadæ 2, Noctuidæ 39, Thyrididæ 1, Pyralidæ 23, Tortricidæ 1, Plutellidæ 1.—The deterioration of raw and refined sugar crystals in bulk, by Mr. R. Greig Smith. The deterioration of bulk crystals is in many cases caused by *Bac. levaniformans*,

which was separated from many samples of inverting sugar. The conditions necessary for the degradation are a moist state of the sugar and a warm temperature. The formation of gum levan is in abeyance, probably on account of the infinitesimal amount of nitrogenous food. The bacillus is widely distributed, having been found in beet crystals from France and Germany and in cane sugar from Java, Egypt and Australia.—The acid fermentation of raw sugar crystals, by Mr. R. Greig Smith. *Bac. levaniformans* may set up an acid fermentation whereupon the sugar smells strongly of acetic and butyric acids.—Notes on the botany of the interior of New South Wales, part v., by Mr. R. H. Cambage. The conspicuous vegetation of the country around the Lachlan River, extending from Parkes to Marsden, is dealt with.—Studies in Australian entomology, No. xi. Description of a new ground-beetle from Victoria, by Mr. Thomas G. Sloane. The insect here described is a species of Morphnos, easily distinguished from the only other member of the genus, *M. flindersi*.—On the skeleton of the snout and os carunculæ of the mammary fœtus of monotremes, by Prof. J. T. Wilson.—The protoconchs of some Port Jackson gasteropods, by Mr. H. Leighton Kesteven.—Studies on Australian Mollusca, part v., by Mr. C. Hedley. Several land shells hitherto unfigured, collected by the Chevert Expedition, are herein illustrated.

ST. LOUIS.

Academy of Science, December 2, 1901.—Mr. J. Arthur Harris presented in abstract a paper on normal and teratological thorns of *Gleditschia triacanthos*, L.—Prof. A. S. Chessin, of Washington University, delivered an address on the harmony of tone and colour. The speaker said that although the idea is not new that colours, like tones, are subject to laws of harmony, he did not know that any systematic theory concerning this had thus far been presented, and the object of the paper was to establish such a theory. A colour scale was constructed, and the properties of the intervals corresponding to those appearing in the musical scale were discussed, and the conclusion was reached that within the limit of an octave the laws of harmony in tone and colour are identical.—A paper by Prof. A. S. Chessin, on the true potential of the force of gravity, was presented and read by title, the author remarking that this was the first of a series of detailed papers bearing upon the general subject, the broad conclusions concerning which he had presented in synopsis at a recent meeting of the Academy.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 9.

MATHEMATICAL SOCIETY, at 5.30.—Non-uniform Convergence, and the Integration of Series: the President.—Network: S. Roberts, F.R.S.—On Quartic Curves with a Triple Point: A. B. Basset, F.R.S.—On the Integrals of the Differential Equation

$$\frac{du}{\sqrt{f(u)}}+\frac{dv}{\sqrt{f(v)}}=0,$$

where $f(x)\equiv ax^4+4bx^3+6cx^2+4dx+e$, Considered Geometrically: Prof. W. Snow Burnside.—On the Fundamental Theorem of Differential Equations: W. H. Young.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Discussion of the Technical Reports on the Institution Visit to Germany, 1901, by the Committees on Traction, Light and Power; Manufacturing, and Telegraphs and Telephones.

FRIDAY, JANUARY 10.

ROYAL ASTRONOMICAL SOCIETY, at 5.—The Attraction of the Himalaya Mountains upon the Plumb-line in India: Major S. G. Burrard.—The Period and Light Curve of the Variable Star 6685 Y Lyræ: A. Stanley Williams.—Note on a Further Attempt to observe the Corona without an Eclipse: Rev. C. D. P. Davies.—The Double Star Σ 1639 Comæ Berenicis: Thomas Lewis.

MALACOLOGICAL SOCIETY, at 8.

MONDAY, JANUARY 13.

SOCIETY OF ARTS, at 8.—The Purification and Sterilisation of Water: Dr. Samuel Rideal.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—From Shanghai to Bhamo: Dr. R. Logan Jack.

TUESDAY, JANUARY 14.

ROYAL INSTITUTION, at 3.—The Cell: Prof. A. Macfadyen.

ZOOLOGICAL SOCIETY, at 8.30.—Observations on some Mimetic Insects and Spiders from Borneo and Singapore: R. Shelford.—On Variation in the Number and Arrangement of the Male Genital Apertures in *Nephrops norvegicus*: F. H. A. Marshall.—On some Remarkable Digestive Adaptations in Diprotodont Marsupials: Dr. Einar Lönnberg.

INSTITUTION OF CIVIL ENGINEERS, at 8.—American Workshop Methods in Steel Construction: H. B. Molesworth.

WEDNESDAY, JANUARY 15.

SOCIETY OF ARTS, at 8.—Elliptographs: Frank J. Gray.

ENTOMOLOGICAL SOCIETY, at 8.—Annual Meeting.

ROYAL METEOROLOGICAL SOCIETY, at 7.45.—Annual General Meeting.—Address on The Element of Chance in relation to various Meteorological Problems: W. H. Dines, President.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Annual Meeting.—Address by the President.

GEOGRAPHICAL ASSOCIATION, at 3.—Annual Meeting.—Address on The Importance of Geography in Education: Right Hon. James Bryce, M.P.

THURSDAY, JANUARY 16.

LINNEAN SOCIETY, at 8.—On the Use of Linnean Specific Names: H. and J. Groves.—Exhibitions: Branches of Cherry affected by the Gnomonia Disease, with Remarks on its Effects and Climatic Causes: A. O. Walker.—Photographs and Specimens of Heads of Wild Sheep, to Illustrate a recent Suggestion as to the Use of Large Horns in Feral Species: J. E. Harting.

CHEMICAL SOCIETY, at 8.—Myricetin, Part II.: A. G. Perkin.—The Colouring Matters of Green Ebony: A. G. Perkin and S. H. C. Briggs.—An Investigation of the Radioactive Emanation produced by Thorium Compounds, I.: E. Rutherford and F. Soddy.

FRIDAY, JANUARY 17.

ROYAL INSTITUTION, at 9.—Interference of Sound: Lord Rayleigh.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Theory of Heat-Engines: Captain H. Riall Sankey.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Modern Machine Methods: H. F. L. Orcutt.

EPIDEMIOLOGICAL SOCIETY, at 8.30.

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