THURSDAY, OCTOBER 30, 1890.

SEEBOHM'S "BIRDS OF JAPAN."

The Birds of the Japanese Empire. By Henry Seebohm. Pp. i.-xxiv., 1-386. (London: R. W. Porter, 1890.)

MR. SEEBOHM'S work on the ornithology of Japan is sure to be welcome to naturalists, as it is always useful to have the avifauna of any country or group of islands monographed and historically brought up to date. In his latest work Mr. Seebohm has incorporated all the results obtained by recent explorers in Japan, and we have now a very fair idea of the birds of this portion of Eastern Asia. The map which accompanies the volume also helps to a better understanding of the relations of Japanese ornithology with those of the adjacent countries. Mr. Seebohm has further made use of the present work to amplify and expound his recently-published "Classification of Birds," so that the work contains his latest views on this important subject. In his original work he gave two schemes of arrangement, giving a preference to the second or "alternative" one. He appears now to have changed his mind, and to have reverted to his original idea ("Classif. B.," p. vii.), with this important modification, that he now places his Coraceiiformes after his Pico-Passeres, ending with Mimogypes (American Turkey Vultures), which lead from the Ground Hornbills (*Bucorax*), and are followed by the Sub-class Falconiformes. There is no doubt that this is a great gain in idea, and we are glad to see that Mr. Seebohm is modifying his first notion, that it is absolutely advisable to reduce the orders of birds to a small number of Sub-Classes. We are of opinion that a still further increase in the number of Orders will have to take place before the scheme works to the satisfaction of ornithologists.

The exigencies of arranging the Passerine Birds in the present work, or at least the bulk of the Palæarctic genera, have obliged Mr. Seebohm to declare himself on the subject of their classification, and this is his declaration:—"With some slight modifications, I have adopted that defined by Mr. Oates ('Fauna of British India: Birds,' i., p. 8), which seems to me to be a distinct advance upon previous arrangements." Mr. Seebohm is under a misapprehension here, unless we allow that his "slight modifications" are intended to entirely subvert Mr. Oates's arrangement by turning it topsy-turvy—a new method of appreciation. The latter gentleman begins with the *Corvidæ*, Mr. Seebohm with the *Turdinæ*, not one of Mr. Oates's families being allowed full rank, but all of them relegated to the position of Sub-families in the family *Passeridæ!* The *Crateropodinæ* (a bad substitute for the *Timeliidæ* (*inæ*) follow the *Turdidæ* in Seebohm's arrangement, whereas in Oates's classification they come after the *Paridæ*, which are by him considered to be a sub-family of the *Corvidæ*. Oates's *Sylviidæ* are separated from his Timaline birds by whole families of *Certhiidæ*, *Sittidæ*, and *Regulidæ*, while in the Seebohmian arrangement the *Sylviinæ* follow the *Crateropodinæ*, and are in turn followed by the *Parinæ*, which contains Gold-crests (= Fam. *Regulidæ* of Oates), Tits (= Sub-fam. *Parinæ* of Oates), Wrens and Creepers (= Fam. *Certhiidæ* of Oates), as well as the Nuthatches (= Fam. *Sittidæ* of Oates). The *Laniidæ* and *Sturnidæ* are the only families which are similarly located by both authors, and in our humble opinion both of them are wrong. If Mr. Seebohm should ever honour us by following any classification of ours in the way in which he has followed that of Mr. Oates, *with slight modifications*, we can only beg to be protected from our friends!

The present work commences with a useful table of the literature relating to the avifauna of Japan, to which may be added a paper by Salvadori and Giglioli, "Uccelli raccolti durante il Viaggio della Corvetta *Vettor Pisani*, &c.," where there are some useful notes on the Scoters (*Œdemia*) and other birds. It seems to us a great pity that, having looked up all his books with so much assiduity, Mr. Seebohm did not think it worth while to publish a full list of references to Japanese birds, which would have been most useful, and is even necessary in a work of this kind. The chapter on the "Geographical Distribution of Japanese Birds" is very interesting, and the subject is worked out with all Mr. Seebohm's accustomed energy and speculativeness, aided by full statistics.

In the third portion of the work, the "Classification and Identification of Japanese Birds," the reader will find a great deal more than the mere title denotes, for, as we have hinted before, the author has seized the opportunity of amplifying all his previous work on the classification of Birds, so that this portion of the book is of the highest interest to ornithologists of every country. We find, however, that some of the woodcuts are not explained in the text, and are apparently added as make-weights to the diagnostic characters of the orders, but the reason for so doing does not seem very clear.

Apart from the omission of the name of the Natural History Museum (Preface, p. iii.) from the list of four-fold obligations which are considered to be due to other Museums of Europe and America, a very uncomplimentary allusion to the work of the present writer occurs on p. 113, under the heading of *Motacilla japonica*. We have no intention of following Mr. Seebohm in his reasoning with regard to this species. He devotes nearly a page to show into what confusion (partly through his own fault, as he admits) these black-backed Wagtails of Japan had fallen, and then he claims to have fixed, in 1884, that Swinhoe's name of *japonica*, bestowed in 1863, must be restricted to the larger form which we re-named *M. grandis*, "a useless synonym," as Mr. Seebohm is kind enough to call it. Nevertheless, we can assure Mr. Seebohm that if Swinhoe intended to give his name of *japonica* to one of the black-backed Wagtails of Japan, it was to the *small* one and not to the *large* one, that he meant it to apply, as a specimen in the British Museum labelled in his own handwriting shows! Swinhoe's name, therefore, is a synonym of *M. lugens*, and neither Mr. Seebohm nor any one else can "fix" the name of *japonica* for the large species. So far from being a "useless synonym," the name of *M. grandis* is the only one which can properly be applied to the latter, and even if Mr. Seebohm's argument had been correct, his manner of criticism is needlessly disagreeable.

In a work like the present, which is nothing if not exhaustive, it is surprising that we can find no reference to *Garrulus lidthi* and *Accentor fervidus*. The only evi-

dence to hand at present is that the former bird inhabits the mountains of the interior of Japan, whilst the *Accentor* may be only *A. rubidus*, but it is at least well to say so. Then again the recent work of Mr. Ogilvie-Grant on *Platalea* and *Turnix* was worth a little consideration. The nomenclature proposed for the latter genus is not adopted, and in spite of the large series of measurements given by Mr. Grant to show that the Eastern race of the common Spoonbill has a longer bill than the Western race, Mr. Seebohm states that he has been "unable to find the slightest evidence of the truth of this statement," a mode of criticism more forcible than exact. We might also ask the author why he persists in calling the Woodcock, *Scolopax rusticola* instead of *S. rusticula*, and the Wild Duck, *Anas boschas* instead of *A. boscas?* Also why does he misspell Linnæus's name throughout the work? Mr. Seebohm has, however, his own ideas as to the fitness of things, and he is in many respects too ultra-conservative for us to hope that our criticism will move him. Otherwise we might ask what is the use of *Eurhinorhynchus* having its spoon-shaped bill, if it is to be merged in the genus *Tringa?* Again, to merge so many species under the genus *Picus*, and again under *Fringilla*, which most of us consider to belong to recognizable genera, tends to fog and confuse the ideas of geographical distribution, and by no means simplifies the study, as Mr. Seebohm would have us believe.

We may add that the work is illustrated by figures from the author's work on the *Charadoiidæ*, but a large number of new cuts are added, which increase the utility of the diagnoses in the classificatory part of the work.

R. BOWDLER SHARPE.

JEANS'S "WATERWAYS AND WATER TRANSPORT."

Waterways and Water Transport. By J. Stephen Jeans, M.R.I., F.S.S. (London and New York: E. and F. N. Spon, 1890.)

THIS volume is intended to give a description of the waterways of the world and water transport, and more particularly means of transport by artificial waterways. Under the heading of "The Transportation Problem," the author deals with the vast improvements made during recent years in roads, both ordinary and rail, and with the great advancement of trade caused by better means of transport during the last hundred years. He shows that, although canals may be considered as belonging to a bygone day, they are now coming again into prominence as a cheap means of transport, and that probably they will in many cases be made the nucleus of a new and better system, under which the great inland towns of Lancashire, Staffordshire, and Yorkshire may practically become maritime places. Chapters ii., iii., and iv. deal with the English river and canal system, and the waterways of Scotland and Ireland, giving an historical account, and showing how most of them in many ways have grown and improved. Readers of this volume will be surprised no doubt at the network of canals in this country: one is accustomed to think of railways as the only means of transport, and to forget the really large traffic carried by canals in many counties. The author tells us of the many continuous lines of water communication between different commercial centres of importance in England, and points out how often it happens that the through routes are rendered useless for really large boats, owing to the locks being shorter or narrower on one section than on another—thus allowing the smallest lock to be the gauge of the boat—down to the very low maximum of twenty-four tons on the canal system between the Derbyshire district and London.

On projected canals the author has much of course to say. The Manchester Ship Canal, which has attracted so much attention, no doubt has been the cause of many similar projects. The Forth and Clyde Canal is designed to enable vessels of considerable tonnage to pass from sea to sea, the present waterway being too contracted to be of much use. The Sheffield and Goole Canal is projected to form an improvement on the present navigation, to enable barges carrying 700 tons, and small sea-going steamers carrying 300 to 400 tons, to come to Sheffield for cargoes, and to serve the South Yorkshire collieries. The proposed waterways from Birmingham to the sea are now being considered in that district. In short, the present tendency seems to be to bring the ship to the manufactory, and thus save the railway charges to the coast for the carriage of the manufactured article.

The book is divided into three sections, the first of which concludes with a good detailed description of the waterways of different countries. Holland, the land of dykes and ditches, appears to have a splendid system of water communication, and the United States has received ample notice at the hands of the author. The waterways of British India are described, and the question of canals *versus* railways in that country is discussed. The author says that "Sir Arthur Cotton has even advocated the summary and indefinite suspension of nearly all railway schemes and works, in order that the attention of the Government might be concentrated upon canals, mainly for irrigation, but also adapted for purposes of navigation." This is all very well from the canal point of view, but it would be interesting to calculate the capacity of canals capable of contending with the present traffic on the railways, excluding any military questions from the subject; and in case of the famine railways, *i.e.* railways built to distribute food as a primary reason for their existence, and where quickness of delivery becomes the all-important consideration, the comparison becomes absurd. Much important work has, however, been done in India by an extensive system of artificial waterways serving the dual purpose of irrigation and navigation, and by careful superintendence the country is greatly improved and enriched by their use.

Section II. of the volume treats of the important subject of ship canals. The greatest artificial waterway constructed up to the present time has been the Suez Canal, and this monument of engineering skill is very properly dealt with first in this section. It is interesting to note that some of the earliest canals recorded were constructed between Suez and the Nile, and these were for some reason allowed to fall into decay. The author gives an excellent account of the construction of the Suez Canal; the political and monetary difficulties encountered by M. de Lesseps in the early days of the company are explained; and the ultimate completion and enormous growth of traffic through the canal are well described. On p. 208, we

are told that "vessels of nearly 200 feet in *width* propel themselves through the canal." This must be a misprint.

Of the Panama Canal we find a good descriptive account. The many early surveys made to locate the best course for such a project are described, and it is interesting to note that as early as the year 1588 the proposal to construct such a canal is recorded. The floating of the original company, the commencement of the works, and the ultimate complete failure of these works, are well described by the author. Everything appears to have happened to seriously hamper the work on every side: political strife on the isthmus delayed the work; an act of incendiarism destroyed a number of buildings erected for the purpose of the canal; and the heavy mortality among the *employés* obtained an unenviable notoriety, and rendered the supply of good men uncertain. Bad as these events proved, the real reason for the ultimate failure of this undertaking must ever be ascribed to the insufficient data obtained of the country and of its geological formation by the company's engineers; the original estimates have proved to be understated and entirely wrong, and the many engineering difficulties must have been practically overlooked.

The Report of the Special Commission appointed in 1889 to inquire into the affairs of the company was published in May, and describes in detail the position of the undertaking. It is estimated that some 30 millions will be required to finish it, so that its ultimate construction does not appear very probable.

The projected Nicaraguan Canal, a purely American project, is also described. The author says:—"The distance from ocean to ocean by the route that has recently received the approval of the United States Government, and is now in course of apparent realization, is 169·8 miles. Of actual canal there will be 40·3 miles, the remaining 129·5 miles being free navigation through Lake Nicaragua, the Rio San Juan, and the valley of the Rio San Francisco."

Chapter xxiii. brings us home again, and deals with the Manchester Ship Canal, a monument of engineering now fast reaching completion. From the excellent description given of these works the reader will obtain a good idea of the undertaking generally.

Chapter xxiv. commences Section III., and deals with the transport problem with special reference to railways and canals. The question of railways *versus* canals is here discussed, and the steady decline of canal navigation from the date of the commencement of railway competition is pointed out. The author says that at that time, "one by one, canals dropped out of the race, and were bought up by the railway companies, either with a view to getting rid of competition, and so securing absolute control over the traffic, or in order to make way for new railway lines." Curiously enough, the *Engineer* of the 3rd inst., in a leading article on this subject, illustrates the above quotation by a reference to the Sheffield Canal, which has been allowed by the present owners—the Manchester, Sheffield, and Lincolnshire Railway Company—to silt up and become nearly useless.

The railways in this and other countries are getting to be considered gross monopolies, and the improvements in the canal navigations are being looked upon as a means of relief. The Manchester Ship Canal is the firstfruits of this feeling on the part of traders and manufacturers, and other ship canals are being talked of.

On the comparative cost of water and land transport the author has much to say. In discussing the relative cost of carriage in the States and in this country, we must not forget that the capital charges per mile on open lines in this country cannot fairly be compared with those in the States, for the reason that the land was in the first instance bought from landowners anxious to obtain the largest sum; the average station buildings and fixed plant are of a far more expensive description; and the kind of traffic carried is of a different type.

The railways in the United States appear to be able to carry goods at a remarkably low rate, no doubt severe competition for the traffic being the reason; at the same time, excluding capital charges and the like, the amount of coal burnt per ton mile in this country is far below that used by the American locomotives.

If traffic is to be moved from town to town at the cheapest rate, it is necessary that it shall be moved in large masses, or trains. It is on this account that the American traffic can be transported by railway cheaper than in this country: were it possible in England to obtain a steady through traffic in any large volume, the weight of trains hauled would certainly increase, and the rates would probably drop in proportion. Canals, when properly managed and with proper appliances, ought to carry heavy traffic with the same regularity as the railways; but as long as they are controlled by the railway companies, they are, in the nature of things, bound to decay and become a secondary means of transport.

The author explains in chapter xxviii. various mechanical means of haulage in vogue at the present time, and then goes on to deal with locks, planes, sluice-gates, and the like. The volume concludes with a chapter on the acquisition by the State of the waterways. The subject is handled in a masterly manner. In this book we have a large amount of information put together in a readable form, and no doubt it will prove very useful to those interested in a very important subject. N. J. L.

SANITY AND INSANITY.

Sanity and Insanity. By Charles Mercier, M.B., Lecturer on Insanity at the Westminster Hospital Medical School, and at the Medical School for Women. The Contemporary Science Series. (London: Walter Scott, 1890.)

TO bring the facts of any department of knowledge before the non-scientific in an easily assimilable form, without offence to the good taste of some one or other section of the community, is by no means so simple a matter as the prolific literature of this class in late years might seem to indicate. It is not every author or lecturer, however able as a man of science, who can thus cater satisfactorily for an omnivorous, but captious and critical public. Every mechanics' institute and popular lecture-room exemplifies this truth—the enthusiasm of the aspirant to public honours in this field is often inversely proportional to his qualifications and actual attainments. The first requisite condition is that the author be

thoroughly and profoundly acquainted with his subject, so that in a popular *résumé* facts should assume their due perspective—that mole-hills be not amplified into a *bizarre* prominence, or that the great mountain tracts encircling the subordinate features of the territory lose not in the distant haze their outlines—in other words, that principles be clearly enunciated, and inductions marshalled in harmonious sequence. The next pre-requisite qualification is a keen realization of the obstacles which beset his own path of observation ; those knotty points, those complex junctions of thought which cause so much delay in the history of all intellectual effort. The most learned authorities are often the most laboured and tedious exponents of their craft ; but we have only to glance at the essays and popular lectures of Clifford, Tyndall, Huxley, or Haeckel, to learn what a degree of excellence is thus attainable by a profound thinker and a cultured mind. It is on account of the rarity of this style of writing that we hail with pleasure the appearance of Dr. Mercier's book, which is an excellent example of the perspicuity with which a cultured mind can delineate an obscure and difficult subject. Dr. Mercier's numerous contributions to psychological literature which have appeared from time to time in *Brain*, *Mind*, the *Journal of Mental Science*, and his book on the "Nervous System and the Mind," are a sufficient pledge of his capacity for a graceful handling of the subject of insanity. After a preliminary sketch of the mechanism of the nervous system, and the modern view of its mental correlate, given in simple but pleasing outline, the author devotes his fourth chapter to a discussion on the "Nature of Insanity," which he defines as a disorder in the *process* of adjustment of the organism to its environment—a disorder not subject to correction. The faulty adaptation of organism to environment is fully considered, and all qualifications in any such definition of insanity are lucidly expressed.

In this chapter above all others the author exhibits his analytic abilities and discriminative capacities to greatest advantage, and the conception of the nature of insanity so framed is to our minds a mental synthesis which has remained unchallenged since first enunciated by Dr. Mercier in 1882. In this connection he makes the trite remark that such process of adjustment is simplified by a simplification of the environment, and hence the major utility of asylum treatment. Undoubtedly, the moral factor will long remain the most important in the treatment of insanity ; and here Dr. Mercier would seem at one with Dr. Clifford Allbutt, who with becoming pungency ridiculed the idea of "curing insanity out of the bottle."

The following six chapters are devoted to etiological inquiries, and the causes of insanity are grouped under the headings of heredity, direct and indirect strain, neurotic instability, the laws of inheritance. Reversion and its limitations by the "massive pressure of race heredity" are ably discussed, as is also prepotence in its relations to insanity. The potency of the *moral factor* in the production of insanity, always tinctured with more or less mystery to the laity, is largely developed by the author, and reduced to its simple elementary terms ; in fact, the work before us is calculated very largely to remove the repellent aspects of insanity which so long have been created by ignorance and a false appreciation of its nature.

With respect to the community of origin of the religious and sexual instincts, we cannot find ourselves in accord with Dr. Mercier's views ; throughout his argument we believe he places undue emphasis on the significance of the sacrificial element. Cogent as are the arguments so frequently used to indicate such lineal relationship, we think equally strong reasons may be advanced to show that the development is along parallel lines of contiguity, rather than the sublimation of the religious out of the sexual element. The concluding five chapters deal with the various forms of insanity ; and the vagaries of the insane mind are graphically registered in these short but concise and interesting delineations. We congratulate Dr. Mercier on the production of a work which deserves a widespread popularity. W. B. L.

OUR BOOK SHELF.

A Guide to the Literature of Sugar : a Book of Reference for Chemists, Botanists, Librarians, Manufacturers, and Planters, with a Comprehensive Subject-Index. By H. Ling Roth. (London : Kegan Paul, Trench, Trübner, and Co., Limited, 1890.)

ALTHOUGH published in 1890, it is right to say that this compilation only brings our knowledge down to the beginning of the year 1885. It is intended to have a supplement ready soon, and to bring the work up to date. In the meantime we can speak highly of the evident care and labour bestowed on this volume by the compiler. The arrangement is based on that of Mr. Daydon Jackson's "Vegetable Technology." There is a catalogue of authors, a list of anonymous publications, a list of periodicals, a list of Parliamentary publications, and a chronological table. The first part of the latter is taken from Dr. Falconer's "Sketch of Sugar in Early Times" (1796). The comprehensive subject-index forms a very valuable part of the work. It is arranged in sections as follows :—Bibliography and History, Statistics and General Economy, Illustrations, Geographical Distribution, Chemistry, Origin of Vegetable Sugars (the various plants yielding sugars), Beet Sugar, Cane Sugar, Parasites, and Distillation. It will be easily seen that this guide to the literature of sugar covers practically the whole field in regard to vegetable sugars. It is a work that will prove of much interest to numerous readers having to do with the cultivation and manufacture of sugar, whether derived from the sugar-cane, beet, sorghum, palm, maple, or maize. We only hope the compiler will be encouraged to bring out the promised supplement. During the last five years considerable activity has been displayed in the United States in regard to the production of sugar from sorghum ; and there is, besides, the very important fact that the sugar-cane has recently been shown to produce mature seed, and possibly capable of improvement by seminal selection. The literature in regard to this point alone is well worthy of being carefully traced. D. M.

Practical Plane and Solid Geometry. By I. H. Morris. (London : Longmans, Green, and Co., 1890.)

STUDENTS will find this work to be a most instructive course, arranged in such a way that no external aid will be required. Section I. begins at the very beginning of the subject, and in it there are many problems dealing with lines, areas, use of scales, plans and elevations of solids, sections, &c. Section II. treats of descriptive geometry ; and various problems on the projections of lines, oblique surfaces, and solids are given, and thoroughly worked out. The concluding chapter of this section is devoted

to graphic arithmetic, in which there are both questions and examples on multiplication, division, addition, subtraction, fractions, involution, &c.

Throughout the book the figures are placed on the right-hand pages, and the text opposite them on the left—a very good arrangement. The diagrams and figures are neat and clear, especially the complicated figures required in the drawing of sections of some solids. The exercises have been selected from the papers of the Science and Art Department, College of Preceptors, Oxford and Cambridge Locals, and various Military Colleges. They are carefully graduated, and, when necessary, hints have been added to facilitate their solution.

Madagascar; or, Robert Drury's Journal. Edited by Captain P. Oliver. (London: Fisher Unwin, 1890.)

THIS book may be divided into three parts: Captain Oliver's introduction and notes, Robert Drury's journal, and a description of the island by the Abbé Rochon. In the first part Captain Oliver tries to prove that the journal is more or less fictitious. At the beginning of the introduction he gives the names of—as he himself says—the best authorities in France, all of whom believe the journal to be true; also a letter which leads him to say that the book was credited in the middle of the eighteenth century. After having quoted these authorities in favour of the truthfulness of the journal, Captain Oliver proceeds to give his own ideas on the subject, which are that the book was written by Defoe from Drury's story, and a great deal of the matter taken out of French books—namely, François Cauche, 1658, and Hacourt, 1661. He then goes on to say that the original journal had a French map, and he regards that also as evidence against Drury. Drury acknowledges himself to have almost forgotten the language and manners of his own country, and, as he was but fourteen years of age when he left, we may take it for granted that he did not know how to draw a map. What then could be more natural, when he had his journal edited, than to take the best map then published, which happened to be a French one, and give it with his journal?

After reading the introduction, one almost thinks that the book is fictitious; but when half-way through the journal, in which every little action is described so minutely, one comes to the conclusion that it is true—at least, that it has not been proved untrue. The journal itself is interesting, but very monotonous.

The description of the island by the Abbé Rochon is very interesting, as it tells all about the first attempts of the French to colonize Madagascar. H. C. L.

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.*]

Large Meteors.

THE "ball of fire" seen by Mr. C. Randolph at Milverton, Somerset, on October 16, at 12h. 5m., and the "brilliant meteor" observed at Edinburgh, on October 17, at about 15h. (see NATURE of October 23, pp. 615 and 620), were probably members of the October meteor shower, which has a maximum on about October 18–20, and a radiant point at 92° + 16° in the extreme north-eastern limits of Orion.

There was also a fine meteor on October 19 at midnight. I was engaged in telescopic observation at the time, and was intently watching a new nebula I had just discovered about 2° N. of the star α Camelopardi, when I became aware of several brilliant flashes which lit up both sky and landscape in a startling manner. Quickly withdrawing my eye from the telescope, I turned towards the direction from whence the flashes proceeded, and saw the end point of a magnificent fire-ball which had fallen in the vapours on the western horizon. It left a bright streak just east of β Aquarii, or from 326° – 8° to 319° – 10°, but this soon died away.

This meteor must have been a grand object to observers in the Bristol Channel and in the western counties of England. The city clocks were striking the hour of twelve when it appeared, and from the direction of its flight it evidently belonged to the well-known Orionid meteor shower.

The new nebula I have referred to is situated at 71° + 68°, and is a fairly conspicuous object in my 10-inch reflector with a power of 60. I watched it for more than an hour for traces of motion, but detected none, so I assume it was not a comet. Since October 19 we have had clouded skies, and I have had no opportunity to re-observe the object.

Bristol, October 24. W. F. DENNING.

Extraordinary Flight of Leaves.

THE pastoral farm of Dalgonar is situated near the source of the Skarr Water, in the parish of Penpont, Dumfriesshire. The ridge of hills on the farm as per Ordnance Survey is 1580 feet above sea-level. There are only five trees on the farm—two ash and three larch. An extraordinary occurrence presented itself to the eyes of Mr. Wright, my informant, at the end of October 1889, on this farm, which has been narrated to me in a letter received from him, as follows:—

"I was struck by a strange appearance in the atmosphere, which I at first mistook for a flock of birds, but as I saw them falling to the earth my curiosity was quickened. Fixing my eyes on one of the larger of them, and running about 100 yards up the hill until directly underneath, I awaited its arrival, when I found it to be *an oak leaf*. Looking upwards the air was thick with them, and as they descended in an almost vertical direction, oscillating, and glittering in the sunshine, the spectacle was as beautiful as rare. The wind was from the north, blowing a very gentle breeze, and there were occasional showers of rain.

"On examination of the hills after the leaves had fallen, it was found that they covered a tract of about a mile wide and two miles long. The leaves were wholly those of the oak. No oak trees grow in clumps together nearer than eight miles. The aged shepherd, who has been on the farm since 1826, never witnessed a similar occurrence." JAMES SHAW.

Tynron School, Dumfriesshire, October 21.

On the Soaring of Birds.

IN answer to my criticism (NATURE, September 4, p. 457), Mr. Blix refers (October 16, p. 593) to an article in the *Skand. Arch. f. Physiologie*, in which he has given "an account of the weighty reasons" leading him "to suppose that soaring birds are able to undertake successive alterations of direction with very little loss of *vis viva*." To bring forward reasons, however, tending to show that birds *can* do certain things is no answer to an objection with regard to *how* they do them.

Mr. Blix has thought it superfluous to point out "that the manœuvre of the bird is the same, and the loss of energy thereby equally the same, whether the bird turns in a calm or in a uniform wind," from which it is to be inferred that he had thoroughly grasped the truth of this himself. Why did he, then, propound a theory founded upon what is directly contrary to his own conviction?

It is not easy to see what has led Mr. Blix to suppose that I hold any other opinion, since my letter was written with the intention of pointing out this fact to him.

19 Well Walk, Hampstead, October 23. C. O. BARTRUM.

MANNERS AND CUSTOMS OF THE TORRES STRAITS ISLANDERS.[1]

IT is not my intention this evening to attempt a special study of any particular institution or series of customs, nor even to discuss the ethnological affinities of the natives inhabiting the islands of Torres Straits.

[1] Friday Evening Lecture delivered at the Royal Institution, by Prof. Alfred C. Haddon, on May 23, 1890.

The comparative study of institutions and customs has led to brilliant suggestions, and has especially thrown light upon obscure facts in our own culture, and given a new significance to observances which, because they are of every-day occurrence, are passed by without comment. This field of inquiry is one which has only recently been systematically tilled, but it promises a rich harvest of unexpected results.

The detailed study of a single tribe or natural assemblage of people has great interest, as it puts one in touch with such varied subjects as the physical, mental, and moral characters of the people; and the tracing out of their affinities requires wide study and careful comparisons. A patient research of this kind always opens up questions of wider import than the initial inquiry.

Neither of these methods will occupy us to-night, as I wish to present before you as vivid a conception as I can of some of the manners and customs of a people small in number but rich in interest. We will consider, therefore, neither a composite image of savages in general, nor of rude customs, but the particular habits of a disappearing people, who thirty years ago were naked, unknown savages, who to-day are British subjects, and who in a very few years will have lost the last remnants of their individuality, and possibly ere long will practically cease to exist—at all events as a distinct people. The dissolving views which I shall exhibit this evening are a fit emblem of the facts which they illustrate.

My anthropological inquiries in Torres Straits may not inaptly be compared with the methods of the palæontologist, especially in his study of the more recent fossils. Amongst such fossils we find some representatives of existing forms, others slightly different from those we are accustomed to, others again which are quite dissimilar, and often of these only disconnected fragments may remain, and it takes great patience and careful piecing together to restore the latter into any semblance of their former selves; nor should surprise be felt if mistakes are occasionally made in the attempt.

A similar experience occurs to those who study an isolated people which is rapidly becoming modified and is dying out at the same time. Some facts collected from legend and myth precisely resemble the present habits of the natives; others have only lately fallen into desuetude. Lastly, some customs are so dissimilar from anything in our own country, that it is difficult to thoroughly understand them under favourable circumstances; but when these customs are no longer practiced, and but imperfectly remembered, when they have to be described through the unsatisfactory medium of Jargon English, and when one bears in mind the great difference in the mental conceptions of narrator and listener, what wonder is there that disconnected narratives are recorded, or that errors creep in?

Happy is that traveller who has the opportunity of studying existing habits. It was my lot to recover recently lost or fast dying-out customs; our archæologists grapple with the problems of the past; it is the object of all to assist towards a complete History of Man.

Torres Straits, as you are aware, separate New Guinea, the largest island in the world, from Australia, the smallest continent. Although the Straits are eighty miles wide in their narrowest part, yet, owing to the presence of islands and of numerous and often extensive coral reefs, there is only one channel suitable for ocean-going steamers, and that averages a mile in width, and in places is much less.

The islands in Torres Straits may be divided into three geological groups by the lines of longitude 142° 48′ E. and 143° 30′ E.

The islands to the west are composed of old igneous rocks, and are surrounded by fringing reefs. These islands may in fact be regarded as disconnected portions of Northern Queensland. They are fertile, but there is no particularly luxuriant vegetation; doubtless irrigation and cultivation would greatly improve their productiveness.

The central group of islands is composed of low coral islets formed by wind and wave action; the soil is poor, and supports only a scrubby vegetation. Coco-palms grow on some of the islands, and there are occasional mangrove swamps.

The eastern islands, Uga, Erub, and the Murray Islands, are of volcanic origin, and are also fringed with coral reefs. In these the soil is rich and vegetation luxuriant, Uga and a great part of Mer being simply large gardens of coco-palms, bananas, and yams.

It is interesting to find that the inhabitants of the volcanic islands form one tribe, which I term the Eastern Tribe; the Western Tribe occupying all the remaining islands. The customs of the two tribes are different and their languages distinct, so much so that there are only a few words in common, and these are mainly trade words. Four subdivisions of the Western Tribe can be distinguished, the members of each of which inhabit certain intermarrying groups of islands.

Independently of the above-mentioned subdivisions, the islanders were divided into clans, each clan having some animal for its *augŭd* or "totem." For example, in the Western Tribe there were the dugong, turtle, dog, cassowary, snake, shark clans, and so forth. There was supposed to be some relation between the clans and their respective *augŭd*, "all same [*i.e.* similar to] family," as it was expressed to me. A dog-man, for instance, was credited with understanding the habits and feelings of dogs, or a cassowary-man prided himself on having thin shanks like a cassowary, which would enable him to run quickly through the grass. With the exception of the first two clans, no one was allowed to kill or eat the totem of his own clan; if he did, his other clansmen would probably kill him for sacrilege. On a dugong expedition, no dugong-man might keep the first dugong he captured, but he might partake of the rest; the same restriction applied also to the turtle and the turtle clan. If only one dugong or turtle was caught on the first day, the dugong- or turtle-man had to relinquish it; supposing only one was caught on the succeeding day, the account was, so to speak, "carried forward," and there was no *sabi* (*tabu*) on it. The dugong and turtle were too important articles of food for the clan members to be entirely deprived from partaking of their *augŭd*.

The women, or at all events some of them, used to have a representation of their *augŭd* cut on the small of the back. I made inquiries on this point on most of the islands in the Straits, but could only find four old women who had them; these I sketched, and two of them I also photographed.

[Various photographs illustrating the appearance of the natives were then thrown on the screen.]

I have alluded to the fact that different customs characterize the Eastern and Western Tribes; as an example of this I may mention that in the latter tribe the girls proposed marriage to the men, while in the Eastern Tribe the more usual course was adopted.

It might be some time before a lad had an offer; but should he be a fine dancer, with goodly calves, and dance with sprightliness and energy at the festive dances, he would not lack admirers.

Should there still be a reticence on the part of his female acquaintances, the young man might win the heart of a girl by robbing a man of his head. Our adventurous youth could join in some foray; it mattered not to him what was the equity of the quarrel, or whether there was any enmity at all between his people and the attacked. So long as he killed someone—man, woman, or child—and brought the head back, it was not of much consequence to him whose head it was. Possibly a man killed would redound to his greater glory, but any skull was

better than none, and its possession was recognized as an order of merit. How much more distinction would a man gain when he could boast of a whole trophy of skulls!

The girl's heart being won by prowess, dancing skill, or fine appearance, she would plait a string armlet, *tiapururu;* this she intrusted to a mutual friend, preferably the chosen one's sister. On the first suitable opportunity the sister said to her brother, "Brother, I have some good news for you. A woman likes you." On hearing her name, and after some conversation, if he was willing to go on with the affair, he told his sister to ask the girl to keep some appointment with him in the bush.

When the message was delivered, the enamoured damsel informed her parents that she was going into the bush to get some wood or food, or made some such excuse.

In due course the couple met, sat down and talked, the proposal being made with perfect decorum.

The following conversation is given in the actual words used by my informant, Maino, the chief of Tud.

Opening the conversation, the man said, "You like me proper?"

"Yes," she replied, "I like you proper with my heart inside. Eye along my heart see you—you my man."

Unwilling to give himself away rashly, he asked, "How you like me?"

"I like your fine leg—you got fine body—your skin good—I like you altogether," replied the girl.

After matters had proceeded satisfactorily, the girl, anxious to clench the matter, asked when they were to be married. The man said, "To-morrow, if you like."

They both went home and told their respective relatives. Then the girl's people fought the man's folk, "For girl more big [*i.e.* of more consequence] than boy;" but the fighting was not of a serious character, it being part of the programme of a marriage.

"Swapping" sisters was the usual method of getting a wife. If a man had no sisters he might remain unmarried, unless he was rich enough to pay for a wife with a shell armlet (*waiwi*) or a canoe, or something of equal value. If a youth was "hard up," an uncle might take compassion on him and give one of his own daughters in exchange for a wife for his nephew.

This exchange of girls—a sister for a sister, or female cousin for another man's sister—was an economical method of getting a wife, as one was a set-off against the other. The usual feasting occurred, but the presents were dispensed with, or at all events the purchase-money was saved, and probably there would be no fighting.

When a young man of the Eastern Tribe arrived at an understanding with a girl, he put his *gelar* ("law," *i.e.* *tabu*) on her, and made arrangements to fetch her away. She kept awake on the appointed night, listening for the preconcerted signal, and they quietly stole away to his parents' house, and the next morning he sent a messenger to say where the girl was. The girl's friends armed themselves with bows and arrows, sharks' teeth fastened on to sticks, and other weapons, and proceeded to the other village; but the fight was not a serious affair. On the same day the girl would be painted red by her future mother-in-law, and clothed with a large number of leaf petticoats; and numerous ornaments would be suspended on her back, these made a clanking sound whenever the girl moved. For some months she remained in the house, and under the constant supervision of her future mother-in-law, the young man residing elsewhere. After say three months, negotiations would commence between the two families, and the girl's relations would come to *taaugwat* (or scrape hands), and presents would be exchanged, and some alteration made in the decking of the girl. After a further probation period of a few months, some friend, in the secret, would engage the young man in conversation, and the bride would steal up behind him with some food she had previously cooked, and, while still behind his back, would thrust it by his side. He, looking round, exclaimed, "Why, that's my woman!" and then hung down his head in shame. Being informed that all was duly performed according to old usage, the couple ate food together, this being the ratification of the contract.

It appears that in the Eastern Tribe marriage was regarded as a state of *tabu*, the man isolating one woman as his exclusive property, for he had powers of life and death over his wife. For several reasons I suspect that the Eastern Tribe has arrived at a slightly higher stage in the evolution of the family than the Western, as the man has a more independent position, and does not live more or less with his wife's people after marriage, as is the custom among the Western Tribe. In both tribes a wife had to be paid for; a canoe, dugong-harpoon, shell-armlet, or articles of equal exchange value, being the usual price.

Manhood is with us a gradual development of youth; with nearly all savages it is a state of privilege, the full advantages of which can be gained only by the observance of special ceremonies.

The growth of hair on the face warned the father that his boy was growing up, and he consulted with other fathers who had sons of about the same age.

"Good thing," he might have remarked; "boy no stop along woman now: he got hair, time we make him man now;" and arrangements would be duly made.

The following information, respecting the former initiation ceremonies, was gained at Tud (usually known as Warrior Island), the natives of which island were probably the most warlike of all the Western Islanders:—

The lads were handed over to their uncles, or to some old man, by their fathers, who then ceased to have any intercourse with them. They were conducted to the *Taiiokwod*, or open space sacred to the men, where no woman or child ever ventured, and which henceforth had for them many deep-rooted associations. The uncles washed the youths with water and then rubbed charcoal into the skin; this being daily repeated till the probation period was over. The lads were covered with mats doubled up like a tent with closed ends, and there they sat the livelong day in groups, without moving, playing, or even speaking. Four large mats stretched across the *Taiiokwod*, the mats belonging respectively to the *Sam* (cassowary), *Umai* (dog), *Kodal* (crocodile), and *Baidam* (shark) clans. For each mat there was a fireplace, the fire being tended by the young men of their respective clans. The old men sat on their appropriate mats, in the centre were the drums, and the dance-masks were placed along one side. Opposite the centre was a small mat, on which sat the chief of the island; for, contrary to the general custom of the tribe, this island had a recognized chief, the result, probably, of their belligerent habits. By the side of where the chief used to sit, a large ovoid stone was pointed out to me; it had a dire significance, for long ago four boys, tired of the irksomeness of the discipline, broke bounds, and meeting their mothers in the bush, asked for food. They were recaptured, and were all killed by the old men with that stone, which was then placed in its present position, as a warning to other youths. The boys of the cassowary and dog clans sat at the end beyond the shark fireplace, and the crocodile and shark boys were placed at the opposite end of the clearing.

Their instructors watched the lads, and communicated to them the traditions of the tribe, rules of conduct were laid down, information in all branches of native lore taught, and thus, generation after generation, the things of the fathers were transmitted to the sons.

The following are some of the rules which I was informed were imparted to the youths by the "old men":—

"You no steal."

"If you see food belong another man, you no take it, or you dead."

"You no take thing belong another man without leave; if you see a fish-spear and take it, s'pose you break it and you no got spear, how you pay man?"

"S'pose you see a dugong-harpoon in a canoe and take it, and man he no savvy, then you lose it or break it, how you pay him? You no got dugong-harpoon."

"You no play with boy and girl now; you a man now, and no boy."

"You no play with small play-canoe, or with toy-spear; that all finish now."

"You no like girl first; if you do, girl laugh at you and call you a woman." [That is, the young man must not propose marriage to a girl, but must wait for her to ask first.]

"You no marry the sister of your mate, or by and by you will be ashamed; mates all same as brothers." [But "mates" may marry two sisters.]

"You no marry your cousin; she all same as sister."

"If anyone asks for food, or water, or anything, you give something; if you have a little, you give a little; if you have plenty, give half."

"Look after your mother and father; never mind if you and your wife go without."

"Don't speak bad word to mother."

"Give half of all your fish to your parents; don't be mean."

"Father and mother all along same as food in belly; when they die you feel hungry and empty."

"Mind your uncles, too, and cousins."

"If woman walk along, you no follow; by and by man look, he call you bad name."

"If a canoe is going to another place, you go in canoe; no stop behind to steal woman."

"If your brother is going out to fight, you help him; don't let him go first, but go together."

Who will say, after this, that the Torres Straits Islanders were degraded savages?

At length the month of isolation expired, and for the last time the uncle washed the lad; he then rubbed him with scented leaves, and polished him up with oil. Then he was decorated with armlets and leglets, breast-ornaments, and possibly a belt, his ears ornamented, and a shell-skewer passed through his nose; bright-coloured leaves would be inserted in his armlets, and his hair rolled into the approved string-like ringlets. So they "make him flash—flash like hell—that boy."

The afternoon of the eventful day was occupied in this congenial task, and at nightfall all the lads who were being initiated were marshalled by their uncles behind a large mat, which was held vertically. In this wise they marched to the village until they arrived at an open space where a mat was spread on the ground before a circle of friends and relatives. When the approaching party reached this mat the lads seated themselves upon it, and then the screening mat was lowered. Suddenly, for the first time for a month, the fathers and female relatives saw the boys, and great were the crying and shouting and exclamations of delight at the brave show. With tears the mothers cried out, "My boy! my boy!" and they and other elderly female relatives rushed up to them and fondled and caressed them, and the mothers surreptitiously put dainty morsels by their boys.

Sitting with legs crossed under them and down-turned faces, the boys neither moved nor exhibited the least emotion, for now they were men.

Less precise is my information respecting the corresponding rites of the Eastern Tribe. So far as I could gather, there were in Mer, the largest of the Murray Islands, two important ceremonies, which we may term the initiation and recognition ceremonies. For the first the lads were assembled near a sacred round house, or *pelak*, in which the awe-inspiring masks were kept. The ceremony was conducted by three *zogole*, or sacred men, and their *tămileb*, or attendants. The latter arranged themselves in a double row, from the *pelak* to the place where the boys were assembled, and, holding long sticks, performed certain movements. Slowly the dread apparition advanced; the chief *zogole* came first, wearing a huge mask with human features and a beard of jaw-bones; the second *zogole* steadied this mask with a rope; the third *zogole* wore a long mask, shaped like a shark. Then for the first time the names of these masks were revealed to the lads—BOMAI and MALU. These were the sacred names which it was not lawful to communicate to the outsider, death to both being the penalty. Their collective name of *Agud* was, however, known to all.

I can only allude to the customary food-offering presented to the *zogole*, and the course of instruction instilled into the youths, one item of which was the narration of the legend of Malu, and must pass on to the recognition ceremony. This function took place in the afternoon on the sand beach outside the village of Las. A great concourse of people was assembled—men, women, and children—the newly initiated lads occupying the front row.

First four men of the dog-clan played about in pairs. (I may here parenthetically remark that it took me a fortnight's work to glean what little information I have respecting these two ceremonies. On one occasion I induced a number of men to rehearse some of the dances for me on the actual spot where they were originally performed, in order that I might gain a clear comprehension of them. One of my photographic "studies" I now throw on the screen.) The dog-men were followed by pigeon-men, who danced and beat their chests; later, whirling along the strand, came a body of dancers, circling from left to right as they advanced, an outer ring with sticks, an inner ring brandishing stone clubs, and possibly some drum players in the centre. Lastly, the three *zogole* appeared, completely covered with white feathers, and each carrying five wands. Although seen by the women, their identity was supposed to be unknown.

This was the final function, and was followed by the ever-recurring feast. Thenceforth the lads took standing as men.

Strangely enough, at neither Tud nor Mer could I discover that the bull-roarer was employed at these ceremonies. The widespread use and sacred character of this simple instrument has been emphasized by Mr. Lang in one of his charming essays. Knowing its universal distribution in Australia, I was not surprised to find that in Muralug, or Prince of Wales Island, which lies close to Cape York, its use was associated with the initiation of the lads. It was only by speaking in a low voice to the chief of the island and his son Georgie, whose photograph you have already seen, and by assuming more knowledge than I actually possessed, that I could induce them to admit of its being employed. Cautiously looking round to see that no one was near, its name, *wanès*, was whispered to me. After much persuasion, a model of one was made for me, on the express understanding that I should not show it to any woman on the island; and I did not. It is now in the British Museum. All that I could gather was that it was whirled in the bush and then shown to the lads. Death was the penalty to both if a man exhibited it to a woman, or to anyone who had not been initiated.

Great was my surprise when, shortly afterwards, I saw the Saibai boys who were staying at the mission station on Mer, playing with bull-roarers identical with the one with which I had been so secretly intrusted. The most sacred emblem in one island was a toy in another. In case some of you may not be acquainted with this most interesting implement, I have brought one of these bull-roarers.

From these important initiation ceremonies we may

pass to others which had a less sacred significance. All the native ceremonies were associated with processions, or with movements of a less regular character, the performers of which were invariably specially dressed for the occasion—usually there was a special costume for a particular rite, one distinguishing feature of which was the wearing of masks or head-dresses. It is convenient to describe these functions as dances; and a series can be traced extending from the most sacred initiation and funeral dances on the one hand, through the seasonal dances to the war and ordinary festive dances on the other.

Profanation of the initiation or of the funeral ceremonies was punished with immediate death. In some instances, at all events, dance-masks could only be worn at the appropriate festival; even the casual putting on of one was supposed to cause slow but certain death. It was my good fortune to witness a seasonal dance at Thursday Island. This was anticipatory of the fishing season during the north-west monsoon.

The men were clothed with a petticoat made of the shredded sprouting leaves of the coco-palm, and adorned with various armlets and leglets; but the striking part of the costume was the mask, of which the lower portion represented a conventional crocodile's head, surmounted by a human face; above this was a representation of a saw-fish, some five feet in length, and overtopping all was a long red triangular erection decked with feathers. The ceremony was called the *Waiitutu kap*, or "saw-fish dance." The actual dance consisted of two men at a time coming out from behind a screen and going through their simple evolutions to the monotonous accompaniment of the drum and a lugubrious chant.

More varied was the costume of the secular dance. All their bravery was donned. The effective head-dress of egret's feathers, or the cassowary coronet, framed the face, a shell skewer pierced the nose, breast ornaments, coco-palm leaf petticoats, armlets, leglets, ornaments or implements carried in the hand, all went to make up a picture of savage finery. Here, too, the women were occasionally allowed to participate, though of course both sexes never danced together. When women were allowed to be present at the more important dances, they were merely spectators.

The large canoes of the Torres Straits Islander of former times must have been very imposing objects when painted with red, white, and black, and decorated with white shells, black feathers, and flying streamers; and not less so when actively paddled by a noisy, gesticulating, naked crew, adorned with cassowary coronets, shell ornaments, and other native finery; or swiftly sailing, scudding before the wind with mat sails erect.

The body of a canoe is a simple dug-out, on to the sides of which gunwale boards are lashed. There is a central platform supported on a double outrigger. The thwart poles of the outriggers are usually six feet apart, and extend to some ten feet beyond the stem of the canoe; a doubly-pointed float is attached to the ends of the thwart poles on each side. Receptacles are built into each side of the platform for the storage of bows and arrows, fishing gear, water-bottles, and other belongings.

The sails are two in number, and are oblong erections of matting placed in the bows, some twelve feet in height, and each about five feet wide. The mats are skewered on to two long bamboos, which support the sails along their length; a bamboo stay also serves to keep the sail upright.

The longest canoe I measured was nearly sixty-eight feet in length. A stone lashed on to a rope is kept in the bow for an anchor. When sailing, a man stands in the stern holding the steering board.

The canoes are made at the mouth of the Fly River, in New Guinea, and are fitted with but a single outrigger, as theirs is only river navigation. I was informed that it was at Saibai that the canoes were re-fitted, this time with two outriggers, and an attempt at decoration was made, but the latter having a purely commercial significance was rather scant. The ultimate purchasers ornamented their canoes according to their fancy, as they usually prided themselves on having fine canoes.

I was much puzzled when I first went to Torres Straits by occasionally seeing a canoe with a single outrigger. I afterwards found it belonged to a native of Ware (one of the New Hebrides) residing at Mabuiag, and that he had re-outrigged a native canoe according to the fashion of his own people. When I was staying at Mabuiag some natives of that island were fitting up a canoe in imitation of this one. Here a foreign custom is being copied; how far it will spread among the Western Tribe it is impossible to say; but, strangely enough, the Eastern Tribe has entirely adopted an introduced fashion, and I did not see a solitary canoe with a double outrigger. It would be tedious to enter into a comparison between these various canoes. In the Eastern Islands the platform baskets are absent, and European sails are in universal use—mainsail, foresail, and jib. Among the Western Tribe, European sails have not yet quite supplanted the original mat sails. Throughout the Straits the canoes are not decorated in the old style. It was in Mabuiag alone that I found two canoes which were more or less decorated. Utilitarian ideas are now two widely spread for the æsthetic faculty to be indulged in.

I have dwelt at some length on this subject, as it is important to record all transitions. As an example of how rapidly and completely some changes occasionally come about, I may mention that at Mer, one of the Eastern Islands, some, at all events, of the young men did not appear to know that there had been a change in the rig of their canoes.

But, after all, the most interesting feature in connection with the canoes is the method by which they are purchased. I have previously mentioned that they were made on the mainland of New Guinea on the banks of the Fly River. Supposing a native of Muralug (Prince of Wales Island, the island which is nearest to Cape York) wants a canoe. He sends word, say, to a relation of his in Moa, for the inhabitants of these two islands often intermarry. The latter sends a message to the next island of Badu. A Badu man passes on the word to Mabuiag (these two also were intermarrying islands); the Mabuiag native informs a friend in Saibai, who in turn delivers the message at Mowat, on the mainland of New Guinea, or Daudai, as the islanders call it, thence the word passes along the coast till it reaches the canoe makers. As soon as the canoe is ready it retraverses the route of the order, being handed on from place to place, and island to island, until it at length reaches its destination. Should, however, there be a new canoe for sale on any of the intermediate stations, this might be sold, and thus obviate the tedious delay of waiting for one to be made to order. Another trade route is through Nagir and Tud to Mowat. The Murray Islanders send to Erub, and the natives of the latter island trade directly with Parem and the mouth of the Fly River. The most remarkable feature in these transactions is that payment is usually extended over three years; in fact, that canoes are purchased on the three years' hire system. This method of purchase, though but recently adopted by ourselves, has for an unknown period been practised by the naked islanders. The mere fact of its existence demonstrates a high level of commercial morality, for if the debts were often repudiated, the whole system would long ago have collapsed.

This commercial morality corroborates to a considerable extent the ethical standard said to be imparted to the youths during initiation. Nor would I like to say that they acted less up to their standard than we up to ours:

I doubt whether we would be much the gainers by a comparison. In making this statement it must be distinctly understood that I am only comparing their lives with their own ideals, and not judging them by the ethical standards of other races. It is true they were treacherous, often murdered strangers, and were head-hunters; that their ideas of sexual morality differed from ours, but these "crimes" were not prohibited by public conscience, and there was therefore no wrong in their committing them.

Our higher civilization has swept over these poor people like a flood, and denuded them of more than their barbarous customs; the old morality has largely gone too.[1]

FRENCH POLICE PHOTOGRAPHY.

M. ALPHONSE BERTILLON, who has so completely demonstrated the futility of the photograph as a means of judicial identification on any extended scale (see my description of M. Bertillon's system of police anthropometry in the *Fortnightly Review* for March last), when a mere mass of photographs is accumulated with no scientific scheme to aid them, has himself, nevertheless, done more than anyone else to develop and demonstrate the proper subordinate use of the photograph as an agent of the law. M. Bertillon's studies on the subject are not only most valuable to the members of the public administration, but are intensely interesting and instructive to the general reader, and the general scientific student especially, as will be readily acknowledged on a perusal of the young French official's latest publication.[2] He has not only offered me the privilege of making such extracts as I please from this work, but has kindly furnished me with some of the diagrams in the text. This new volume has already attracted considerable attention in France, and will doubtless be received with as much interest in England as have M. Bertillon's previous studies in the domain of anthropology, so that an account of the work in the columns of NATURE seems most opportune.

M. Bertillon begins by describing the sharp distinction between ordinary photography and judicial photography. Artistic and commercial photographs are subordinate to considerations of taste and fashion—not by any means for the purpose of recognizing the subjects of the photographs when met with in after time. The judicial photograph, on the other hand, takes no heed of artistic pose, but must conform to rules which enable the skilled eye to recognize the subject under the most unfavourable circumstances. It relates to various classes of subjects, some known and to be recognized hereafter, such as dangerous criminals; and some unknown and to be, if possible, identified by distant witnesses at the present time, such as suspected persons under arrest, corpses at the Morgue, the wandering insane, lost children, subjects of paralytic shocks, and innumerable human mysteries constantly falling into the hands of the police. The police are thus obliged to be constantly circulating photographs of their own manufacture, and it is of the utmost importance that such photographs should be taken upon the most scientific lines for accomplishing the object in view. Above all, in collecting vast numbers of judicial photographs for future reference—the photographic archives, "cantly" known in English as the "Rogues' Gallery" (though by no means confined to rogues in the eyes of the law)—it is important that the portraits should be taken with uniformity, the questions of full face or profile, full length or bust, &c., being decided beforehand, a fixed scale being adopted. Otherwise two photographs will be often of little use for purposes of comparison.

There is but one object to be attained, and that is easily analyzed—to produce the most perfect likeness, or rather to produce the likeness easiest to recognize, the one most easily identified with the original. The problem in this shape depends on a new factor: Under what circumstances and aspects did those who will be called upon to give an opinion on our photograph know our subject? and leads to this further question: What is the object sought by the judicial inquiry?

If it is a question of taking a sort of print of the individual which, together with his description and judicial record, will enable him to be identified after the lapse of many years, then above all things it is necessary to have recourse to the most lasting features of the human body, and to consult the natural sciences, more especially anthropology. If, on the other hand, it is a question of identification with the past—that is, that our photograph is destined to be compared with others that have been preserved in jails or police offices—the solution is very simple, and consists, above all other considerations, in reproducing the pose, the light, the size, and scale of reduction used in the archives to which our portrait is to be sent.

In regard to the important subject of light M. Bertillon speaks as follows:—"Absolute similarity is unfortunately unattainable. The aspect of the studio, the hour of sitting, the state, more or less cloudy, of the sky, will always betray themselves by the difference in the direction, and the greater or less intensity, of the shadows. We ought first of all to reject, as too complicated, all artistic or fantastic lights. For the full face the light should come principally from the left, a little in front. The pose chair and the apparatus being fixed to the floor at an unchangeable distance, we have for the profile but the direct front or back light to choose from. The light from behind gives more accentuation to the full face, and a more artistic tone. But the interior folds of the ear are necessarily in the shade, and the silhouette does not stand out so clearly as with a front light. The necessity of our profiles being taken with a front light, together with the early hour at which they are taken (so as not to interfere with the magistrates, whose work commences at 12), forces us to take the right profile to the exclusion of the left. In fact, the photograph studios generally facing north, and the sun being south-east between 10 and 11 o'clock, the left profile can only be lighted by a counter light to the camera. In a judicial studio, therefore, thus lighted from the north, the apparatus would be placed on the east side and the pose chair on the west, the work being done in the morning. By a curious coincidence, and no doubt from analogous causes, the greater number of ethnographic photographs of profile, especially those which compose the superb collection of Prince Roland Bonaparte, are taken from the right side."

The author next discusses the scale to be employed, advocating the necessity of including the shoulders, to show on occasion the crook-backed carpenter, or stiff Briton or Prussian (presumably contrasted with the supple Frenchman), preferring a reduction of 1 in 7 and a distance of 2·56 metres, various technical details being given for the benefit of the artist.

In his second chapter, M. Bertillon takes up the question of the use of the judicial photograph after it is obtained—firstly, as regards identification of two photographs; secondly, identification of a photograph with a person in custody; thirdly, with a person at liberty; lastly (the operation most familiar to the public), identification with a recollection in some one's mind. Of course, it is for this latter object that police portraits are strewn broadcast for the eve of the community at large.

[1] Further information as to customs and legends of the Torres Straits Islanders will be found in the Journal of the Anthropological Institute, vol. xix. 1890, and in *Folk-lore*, vol. i. 1890.

[2] "La Photographie Judiciaire, avec un appendice sur la classification et l'identification anthropométriques." Par Alphonse Bertillon, Chef du Service d'Identification de la Préfecture de Police. (Paris: Gauthier-Villars et fils, 1890.)

But the chief exercise of this function in the ranks of the police themselves is the search among their store of portraits for a person of whom they receive a description, the crucial points in this description being set out, and specially the dangers to be avoided. Thus certain colours of hair and complexion make photographs almost unrecognizable, and peculiarities of gesture and movement are so characteristic of some persons as to make mere immobile portraits little suggestive even to familiar acquaintances. As regards comparison between two photographs, the author calls attention to the points which should prevent two apparently dissimilar commercial photographs from being pronounced different subjects; and, on the other hand, the striking family likenesses which should make one careful in declaring two similar portraits the same person. M. Bertillon gives the clue to the physiological data which should govern judgment on these occasions. He illustrates a clever contrivance (but lately borrowed from their French brethren by the English police) by which a newly-taken portrait of a person in custody and an old portrait are compared on equal terms by a covering up of all but the unchangeable portions of the face—hair, beard, and moustaches being obliterated. M. Bertillon makes his most daring speculations, however, in relation to identification of a person at large from a photograph in hand. He says, even as the word "chime" is not conveyed to the brain without a sensation not only of sight of the bells but the sound as well of its ring, so identification should come from certain clue characters of personal appearance, suggesting the absolute identity. It is of no use to sit down and study in detail a photograph which probably tallies in few points with the same person as he is likely to be encountered abroad; but the unchangeable individual data must be seized upon by the trained mind versed in the language of anthropology, so that an encounter with the desired object will never fail to tell the secret. Thus, in the frequent necessity of stopping persons on embarkation at a sea-port, the profile is, of course, the thing to be kept before the inspecting eye; but even this must be understood in relation to the disguise of bearing, expression, &c., all of which must be considered—not the mere photograph taken under far different circumstances. M. Bertillon concludes this interesting section as follows:—"The officer charged with so difficult a mission as the search for, and arrest of, a criminal by the aid of a photograph, should be able to repeat and write from memory the description of the face of the man he is in search of. It is the best means of proving to his chiefs that he has at heart the task confided to him. The reader will see later the special terminology which a knowledge of the subject necessitates. More than one of our readers will be surprised to see that police science borrows some of its methods from natural history and mathematics. We think that this descriptive study of the human frame will interest the portrait photographer as much as it will the judicial inquirer. Are not both scrutinizers of the human physiognomy, though truly from a different point of view?"

The author's third chapter is devoted to other applications of photography to judicial purposes. Here he refers to the notorious pocket cameras, which he puts aside as rarely of much use for police purposes, it being at a critical moment more of an object to capture a malefactor than to photograph him. Still, he admits an occasional value for this kind of photography, and gives a startling example of the scene of a most dramatic murder in the suburbs of Paris at the instant of its discovery, before anything of the surroundings had been disturbed. This, M. Bertillon contends, would naturally be most valuable in the hands of the prosecution. Numerous other uses of photography are mentioned, such as cases of mine accidents, traces in the snow before it melts, and other matters of future judicial investigation. Many objects connected with crime may become the subject of photography, such as weapons and portions of dress; and photo-chromography comes in opportunely to spread abroad not only the form but the colour of the articles considered important in tracing a criminal, so that evidence as to such articles may be forthcoming.

In his appendix, M. Bertillon gives an interesting summary analysis of the human figure, based on the studies of Quételet; but as this is only indirectly connected with the subject in hand, I will only refer to the two features on the importance of which in judicial investigation the author lays the greatest emphasis—namely, the nose and the ear. That important and delicate subject over which so much concern is evinced in the social circle and the domain of literature—the human nose—M. Bertillon considers equally worthy of prominence in anatomical study and police practice. He offers a scheme whereby noses may be studied with profit to the judicial mind, discarding the considerations which chiefly appeal to the ordinary eye in comparisons—colour, size, and general shape—and confining the classification to the line profile pure and simple, apart from all other elements. M. Bertillon makes fifteen classes, into which all noses, even the most eccentric probosces, may be sorted: firstly, three grand divisions—the *elevated*, the *horizontal*, and the *drooping*, according to the nature of the base-line; each of these to be again divided by the bridge line into *concave*, *straight*, *convex* (or curved), and, lastly, *undulating* (wavy, broken, or irregular in outline). The detective or judicial functionary, when called upon to say whether a face under his surveillance corresponds with a photograph in question, will find great help in a thorough nasal analysis, for two noses are never exactly alike.

Yet more important is the ear, which, M. Bertillon insists, should always be shown in the portrait. His remarks on this feature are so valuable that I will conclude my summary of his unique little volume by an abstract from this portion, illustrated by the accompanying diagrams, the use of which has been so kindly allowed me by the author:—

"We will close our examination of the profile by studying the ear, which, thanks to the projections and depressions with which it abounds, is the most important factor in the problem of identification. It is all but impossible to find two ears identically similar in all their parts, and the variations in the conformation which this organ presents appear to remain without modification from birth until death. We believe that the registration at birth of certain peculiarities in the ear would render any substitution of persons, even when adults, impossible. From birth unchangeable in its form, uninfluenced by surroundings or education, this organ remains throughout life like the untangible legacy of heredity and interuterine life. Nevertheless, on account of its immobility itself, which prevents its taking any part in the play of features, no part of the face less attracts the attention of the profane. Our eye is as little accustomed to notice it as our tongue is to describe it. In fact, the denominations of the principal parts of which it is composed have been but very summarily described in most of the anatomical treatises.

"It will be sufficient for us to confine ourselves to the prominences which border the depressions, to give a good idea of the latter, and it will enable us to shorten our description by one-half. The prominences are five in number.

"(1) The border of the ear, or helix, a semicircular projection commencing at A (Fig. 1) in the middle of the ear, above the auditory passage, reaching to the periphery, and bordering two-thirds of the upper ear.

"(2) Where it ceases, the lobe commences soft and rounded, terminating at the base the circumference of the ear.

"(3) Then the tragus—small, flat, triangular, cartilaginous prominence—placed outside in front of the auditory

passage. Its shape presents but few individual variations.

"(4) Opposite, separated by the auditory passage, is the antitragus, less prominent than the tragus, but of far greater descriptive value.

"(5) Finally, above it the fold of the anthelix, which, after rising about 1 centimetre, bifurcates in two branches, the upper and the horizontal, the latter rejoining the helix above its original starting-point.

"The above order of enumeration enables us to draw the different contours of the ear without raising our pencil, starting from point A, and finishing at point M; this course of the pencil is shown on Fig. 1 by the alphabetical order of the capital letters, which separate each of the subdivisions, of which we are about to describe the most characteristic morphologic variations.

"The border may be divided into four parts—the starting-point, A B; the anti-superior part, B C; the posterior, C D; and the final, D E. Each of these parts may vary independently—that is to say, may be small, medium, or large. It also happens pretty frequently that the beginning and ending portions (A B or D E) are altogether missing; at other times the portion C D is more fully developed than the superior or upper part, or less so. The irregularities of contour that result therefrom are very characteristic. Lastly, the final part, D E, may

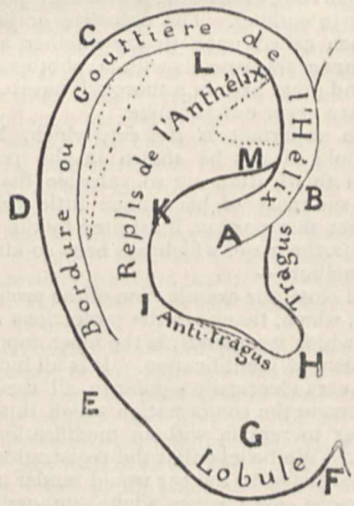

FIG. 1.

be very much developed and continue round the lobe to the cheek.

"The *lobe* should be considered—

"(*a*) The outline of its free edge, E F, which may terminate in a descending point, and attached to the cheek, or squared, or in rounded ellipsoid.

(*b*) "Its degree of adherence to the cheek, F H, which we called 'fused,' or it may be joined by a membranous fold, which only becomes visible when the ear is stretched from the cheek. Finally, it may be entirely separated from the cheek.

"(*c*) Of the shape of the anti-exterior surface, G, which may be traversed by the prolongation of the helix, level or mammilated.

"(*d*) Of its dimensions in height, which may be small, medium, or large.

"The *antitragus* presents a general line of direction, the inclination of which may vary from horizontal (the head being in its normal position) to obliquity of 45°. In relation to this line, represented in the drawing by the dotted line H I, the antitragus can profile in line with an upper concavity, or rectilinearly, or slightly sinuous, or projecting. Finally, the antitragus (especially its free extremity) may be inverted outwards or straight. Putting aside all questions of shape, the antitragus may vary also with reference to its indefinite dimensions.

"The parts I K and K L of the fold of the *anthelix* may each separately be small, medium, or large. When the anthelix, and specially the upper branch, K L, is little accentuated, the ear stands out from the head, and takes a shape which resembles the ear of the mammifer. The horizontal portion, K M, of the anthelix has a bearing sometimes truly horizontal, sometimes oblique, sometimes intermediate.

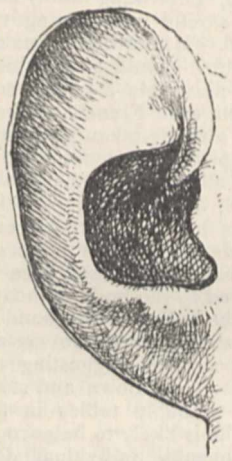

FIG. 2.—Ear showing all the characteristics at a minimum.

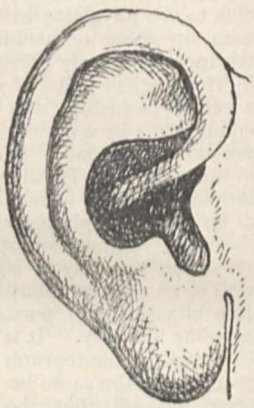

FIG. 3.—Ear showing all the characteristics at a maximum.

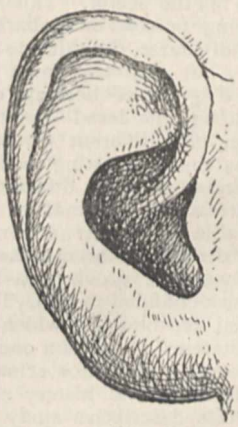

FIG. 4.

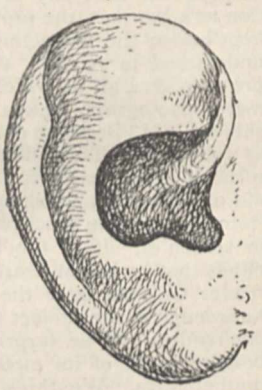

FIG. 5.

FIGS. 4 and 5.—Ears showing the corresponding peculiarities alternately at a minimum and at a maximum.

"The whole ear, including the lobe, may equally deflect from the head; hence the shape called "peduncular" by some authors. In other cases the deflection is most noticeable in the posterior part, or upper, or even in the lower part of the ear. We must also notice the presence of a prominence in a certain number of ears, between the points C and D. This protuberance is called 'the tubercle of Darwin,' after the celebrated English naturalist, who saw in it a survival of the pointed ear of certain monkeys (Fig. 5)."

It is to be hoped that M. Bertillon's work will be seen in English, for I have given but a fragment of the choice, fresh matter in the little volume.

EDMUND R. SPEARMAN.

THE CINQUEMANI "CHRONOLOGE."

THIS is a very singular and interesting contrivance. It is a clock with only one toothed wheel, yet it shows the hours, minutes, days of the week, &c., and strikes the hours and quarters at each quarter of an hour. Moreover, there is an arrangement for repeating the hours and quarters at will. The single toothed wheel spoken of is the escape-wheel, and this propels a pair of pallets and pendulum in the ordinary way. The rest of the work is done in the fall of a small leaden ball, a long chain of these balls being intermittingly elevated, and one of them discharged over a revolving drum each quarter of an hour. We will follow one of these balls through the course of its multifarious duties. It first enters a sling in a tape wound over the escape-wheel axle, and we notice that it is the weight of this and three other balls (which have been previously deposited in preceding slings) which is keeping the escape-wheel going. As the wheel turns round, the balls descend, and after a quarter of an hour the lowest will have arrived at a funnel-shaped opening, where it will get liberated from its sling, and fall. It first strikes a lever which enables the drum to move on and discharge another ball into a sling upon the escape-wheel tape. Then rushing down a tube it enters a zigzag. It is within this zigzag that the striking of the quarters is performed, for at each of its angles a bell is placed, against which the ball strikes sharply as it passes them. After leaving this zigzag, the ball is projected down another, where it strikes the hours. As the number of blows to be struck is regulated by a similar contrivance at each zigzag, we will confine our attention to that for the hours. The channel down which the ball passes is vertical to the face of the zigzag. Now the front or zigzag side of this channel is a moving tape, which carries a little trap. As the tape is always moving, the position of the trap depends upon the time, and the position of the trap also determines the stage of the zigzag upon which the ball will be projected. Thus, when the trap is opposite the sixth stage of the zigzag, the ball will encounter six corners upon its way down, and consequently six blows will be sounded. When the trap is at the top, twelve blows are sounded; and when the trap is at the bottom, no blows are sounded. When the ball leaves the zigzag, it enters a sling at the lowest part of the chain first spoken of, and is intermittingly carried up again to begin its work over again. For repeating the hours and quarters at will, there is a separate reservoir of smaller balls; and by pulling a handle one of these can be discharged above the first zigzag, and when it has done its work it disappears through a hole, which the regular balls cannot penetrate, back to its own reservoir. It may be mentioned that, in lieu of bells, the hour zigzag has a single vertical sonorous tube for each set of corners. The time, days of the week, &c., are shown by means of tapes carrying pointers suspended over the escape-wheel and another axle. The inventor, the Rev. Canon Cinquemani, maintains that the simplicity and precision, by reason of the constant force on the escapement of his "chronologe" (which he has patented), render it peculiarly advantageous for missionary and other distant stations, where the assistance of professional clockmakers is not readily procurable. H. D. G.

THE NEW AUSTRALIAN MAMMAL.

IN vol. xxxviii. of NATURE (p. 588), Dr. E. C. Stirling, of Adelaide University, described as a "new Australian mammal" a small mole-like animal which had been obtained in Central Australia near the telegraph line between Adelaide and Port Darwin. The same description, with some additions, was afterwards published in the Transactions and Proceedings of the Royal Society of South Australia, vol. x. p. 21. But no decision was arrived at as to the exact affinities of this animal—not even whether it is a Marsupial or a Monotreme—nor has any name been given to it. On behalf of the zoologists of this country, who have waited patiently two years for further information, I now venture to urge Dr. Stirling to send one of his specimens of this extraordinary creature (in a letter subsequently addressed to me he speaks of having received two additional examples) to London, and allow us to endeavour to decide what it really is. I need not point out the extraordinary interest of this discovery. If a Monotreme, as seems probable, it will be the third known form of this very peculiar type of mammal-life; if a Marsupial, it is quite different from all known members of that group; and if it turns out to be a Placental Mammal, it will revolutionize our canons of zoological geography. On behalf of the Zoological Society of London, I think I may promise that the specimen, if forwarded, shall be submitted for examination to our very best authorities on the subject, and shall be fully described and illustrated in our scientific publications. Such a grand discovery should certainly not be concealed from the world's knowledge any longer.

P. L. SCLATER.

RICHARD BURTON.

WE have already announced the not unexpected death, at the age of 69, of Sir Richard Burton, one of the most versatile geniuses and extensive explorers of any time, and one who, so far as Africa is concerned, deserves to be ranked with Stanley and Livingstone. He was born on March 19, 1821, at Barham House, Herts, of old families on both sides, and with a heritage of fighting and wandering propensities. It is curious now to think that Burton was sent to Oxford with a view to taking orders. He soon destroyed all prospects of any such career by getting himself rusticated. He succeeded in obtaining an appointment in an Indian regiment, and, while yet little more than a boy, his restless wanderings began. For half a century Burton lived a life of the fiercest intensity—equal to the lives of three ordinary men. Before his famous journey to Mecca he had published more than one book on his travels in India and neighbouring countries. Before attempting the hazardous enterprise to the holy city of the Moslems, in 1852, he took every precaution to delude his fellow-pilgrims into the belief that he was one of the faithful. His extraordinary gift of picking up languages made this easy; and whether his disguise was or was not penetrated, he succeeded in getting inside, and, better still, outside Mecca, to tell an expectant world of mysteries practically unrevealed before. This journey would certainly have made his name famous; but he meant to do even greater things. At that time it was as dangerous to attempt to enter fanatical Harrar as it was for a Christian to join the Haj. But Burton did it, and lived to tell the world the story of it; though he and Speke had a narrow escape when, the following year (1855), they attempted to reach the Nile through the Somali country.

A preliminary trip to Zanzibar produced a learned and interesting book on that island and its people. We say preliminary, because by this time, 1856, Burton had something much more important in view. Livingstone, it should be remembered, had been at work in Africa for many years; in 1856 he returned to England to tell the full story of his crossing of the continent. Through Livingstone, through Krapf and Rebmann, and others, rumours had been for a long time coming out of great lakes in the interior. Before D'Anville, in the end of last century, made a clean sweep of all the crowded features on the map of Central Africa which had accumulated since the end of the sixteenth century, there were lakes in plenty, scattered over the centre of the continent, and great rivers and mountain ranges, some of them an inheritance from the days of Ptolemy. But no one knew how these features ever came there. The hydrography they in-

dicated was impossible; and there was no evidence that any white traveller had ever seen them. The probability is that these lakes and rivers were put down from the reports of natives who had communications with the interior. Much of the existing geography of Africa rests on no better foundation; but then we know better how to sift native reports now than our predecessors did 200 years ago. At all events, as some of us who were at school then may remember, the map of Africa, in 1856, had the word "Unexplored" spread all over its centre. As has been said, Krapf and Rebmann, the missionaries, who had seen Kilimanjaro, and thought they got a glimpse of Mount Kenia afar off, had heard of great lakes in the heart of Africa. It was to seek these lakes that Burton, accompanied by Captain Speke, set out from Zanzibar in June 1857. The expedition was under the auspices of the Government and of the Royal Geographical Society. Before leaving Zanzibar Burton wrote home that he was about to set out in search of "the Great Lake." His eyes were gladdened by the sight of the waters of Tanganyika, at Ujiji, on February 14, 1858. It is scarcely possible for us to realize what this meant at the time. The route, now so well known, from Zanzibar to Ujiji had never before been trodden by the feet of white men. The difficulties which beset this pioneer expedition were disheartening. Before it set out, there was no Tanganyika, no Victoria Nyanza, no Albert Nyanza, no Bangweolo on the map, and only the lower 200 miles of the Congo. Burton's discovery of Lake Tanganyika may be regarded as the centre from which all succeeding discoveries in Central Africa have radiated. It is the great central lake round which all others are grouped. Indeed Burton's companion, Speke, as we know, made a run to the north on the homeward route, and discovered that other great lake, the Victoria Nyanza, which he rightly surmised to be the source of the White Nile. Of the unhappy relations between Burton and Speke this is not the place to write, even if we had any inclination to revive a bitter controversy that ought to be allowed to lie in the grave where it was placed many years ago. That Burton's bitterness against Speke blinded him to the importance of his companion's discovery all will admit. That Burton was of a rough type, given, like other great and successful men, to carrying out his purposes at any cost to themselves and others, there can be no doubt. The big things in the world have generally been accomplished by such men.

Burton's discovery gained him the medal of the Royal Geographical Society, but hardly anything else. After a run to America, he, in 1861, with his newly-married wife, went as Consul to the White Man's Grave—Fernando Po. From here he explored the Cameroons, the Gorilla country, and Dahomey. A few years later a Consulate in Brazil gave him the opportunity of exploring the highlands of that country. After a short stay at Damascus, Burton was appointed Consul at Trieste in 1872, and there he was allowed to vegetate till his death, with no greater reward for all his valuable services to science than a K.C.M.G., given him four years ago. Visits to Iceland, to Midian, and to the Gold Coast, produced several volumes to add to the many he had already published; probably no traveller has ever been so prolific in books. It says little for the intelligence and enterprise of a Government that could find no better use for the services of a man of such power as Richard Burton than to give him the charge of a third-rate Consulate. Of Burton's versatile scholarship and its published results we need not speak in detail. He was one of the few survivors of the old type of adventurer of which our country has been so prolific—men who have been the makers of our Empire and the founders of modern knowledge. Science is bound to remember him as one of her pioneers into the great unknown. K.

PROFESSOR HEINRICH WILL.

THE sad announcement of the death of this well-known chemist from heart disease, on the 15th of this month, is made in the *Chemiker Zeitung* of the 22nd inst. Dr. Will was for thirty years Professor of Chemistry and Director of the Laboratories at the University of Giessen. He was born on December 8 in the memorable year 1812, at Weinheim, where his father held an important official position. After completing his studies at the High School of his native town, he devoted himself for a time to pharmacy. But in 1834 he entered the University of Heidelberg, and in the same year undertook the position of assistant in the laboratory under Prof. Geiger, and after that eminent chemist's decease, in 1836, under the celebrated Prof. L. Gmelin. In 1837, at the request of Prof. von Liebig, he removed to Giessen, where he occupied the position of assistant until his graduation as Doctor in 1839. He then habilitated himself at the University as Privat-docent of Chemistry, his dissertation consisting of a description of his "Investigation of the Constitution of the Ethereal Oil of Black Mustard." In 1842, Dr. Will undertook the direction of the newly-founded Filialslaboratorium, and in 1846 he received a call to the then recently inaugurated laboratory of the College of Chemistry in London. He, however, declined the offer, and was shortly afterwards appointed extraordinary Professor in the University of Giessen. After Prof. von Liebig's departure for Munich, in 1852, Dr. Will became ordinary Professor of Chemistry and Director of the Chemical Laboratories of the University. During the session 1869-70, Prof. Will occupied the distinguished post of Rector of the University, and his inaugural address was a memorable one, treating of the relations between matter and force considered from the chemical standpoint. After forty years' unceasing labour as a teacher and an investigator he retired, at his own request, in October 1882.

As an original investigator Prof. Will was characterized by his precision and the acuteness of his observation. He was also a most excellent teacher, understanding as few others of his time the art of explaining to students that which was so clear to himself. What, however, most struck those who had the good fortune to listen to his lectures, was the deep earnestness which he threw into his subject, and the manner in which he used to carry his students along with him through the most intricate branches of chemistry. His powerfully energetic character was even more apparent if possible in the laboratory, as he passed from student to student, speaking the right word of help and encouragement to each, and inculcating habits of work and thought which raised many of those students to positions of honour and usefulness in the chemical world. His especial fitness for the leadership of a laboratory is very manifest from a perusal of his text-book, "Anleitung zur chemischen Analyse," which appeared in its twelfth edition in 1883, and has been translated into several languages. A. E. T.

NOTES.

THE Queen has been pleased to command that the Government institution now known as the Normal School of Science and Royal School of Mines shall in future be called the Royal College of Science, London.

THE President of the Institution of Electrical Engineers and Mrs. John Hopkinson will give a *conversazione* in the galleries of the Royal Institute of Painters in Water Colours on Wednesday evening, November 19.

THE death of Robert M'Cormick, F.R.C.S., R.N., Deputy Inspector-General of Hospitals and Fleets, is announced. He was one of the oldest and most eminent officers of the medical

profession in the Royal Navy. He accompanied Sir E. Parry in H.M.S. *Hecla* in his attempt to reach the North Pole, and in 1839 joined the *Erebus*, which, in company with the *Terror*, was employed in the expedition for magnetic observation and discovery in the South Polar regions. During this voyage, which lasted four years, he discharged, in addition to his medical work, the duties of geologist and zoologist. In 1847 he called the attention of the Admiralty to the fate of Sir John Franklin, and laid before the Board plans of search for the missing vessels. His plans were accepted in 1852, and in the course of his subsequent exploration he settled various geographical questions. In 1857 he received the Arctic medal. Among his writings are: "Geology of Tasmania, New Zealand, Antarctic Continent, and Isles of the South," "Voyages of Discovery in the Arctic and Antarctic Seas," and "Round the World, with an Open Boat Expedition, in the *Forlorn Hope*, in Search of Franklin."

WE have to record the death of Mr. E. C. Nicholson, F.C.S., who was well known as a manufacturing chemist. He died on the 23rd inst., at the age of sixty-three.

A SCIENTIFIC and commercial expedition to the West Coast of Africa, under the auspices of the British Government, is about to leave London. Commander V. Lovett Cameron has been appointed chief of the staff, the whole expedition being under the superintendence of Mr. James Bennett, of the firm of E. C. Bennett and Co.

STUDENTS of Egyptian archæology will be glad to learn that the Catalogue of the Gizeh Museum will be published in January.

THERE have been some unpleasant rumours lately about the destruction of the Pyramids for building material. The Cairo correspondent of the *Times* says there is no truth in these reports. The real facts are that the loose stones accumulated at the base are being removed, which will lay bare the lowest courses and display the Pyramids to greater advantage. The work is being conducted under the superintendence of the Museum authorities.

THE botanical explorer, Mr. C. C. Pringle, was engaged, during the early part of this year, in investigating the high land between Mexico and Tarupico; he has made large collections, including, as he believes, many new species.

DR. R. VON WETTSTEIN returned in July from his botanical expedition to Tuzla, Zwornik, Vlasenica, and Srebrenica in Eastern Bosnia. He has obtained interesting results, which will be published in the *Oesterreichische botanische Zeitschrift*.

ON October 16, Prof. Wallace delivered the inaugural address to the class of agriculture and rural economy at the Heriot-Watt College, Edinburgh. He chose as his subject dairy practice. The address has now been published.

THE October number of the *Auk*, which completes the seventh volume of that publication, is a somewhat bulky part, and besides the usual excellent papers on North American ornithology, it contains some essays by European naturalists. Dr. A. B. Meyer describes a new species of Humming Bird (*Eriocnemis aurea*) from Colombia. Mr. Eagle Clark gives an account of a collection of birds made by Dr. Gillespie at Fort Churchill, Hudson's Bay, and presented to the Edinburgh Museum in 1845. Mr. J. A. Allen describes a new *Icterus* from Andros Island in the Bahamas, as *Icterus northropi*. Mr. D. G. Elliot also publishes the first portion of his description of a collection of birds obtained by Mr. C. F. Adams at Sandakan in North-Eastern Borneo. This paper contains many errors, and the author is evidently not acquainted with the recent literature on the subject. *Copsychus adamsi*, sp. n., is certainly *C. niger* of Wardlaw Ramsay (P.Z.S., 1886, p. 123). Mr. Seebohm, not Mr. Sharpe, is the author of the fifth volume of the "Catalogue of Birds," and he will probably be interested in the occurrence of *Geocichla interpres* in Borneo, which is here recorded for the first time. *Pitta venusta* of Mr. Elliot's paper will assuredly prove to be *Pitta nosheri*, already recorded from Sandakan, by Mr. Bowdler Sharpe, in the Proceedings of the Zoological Society for 1881, a paper which seems to have escaped Mr. Elliot's notice. He will also find Mr. Alfred Everett's "List of the Birds of Borneo" of great use to him in his future studies.

THE authorities of the Government Central Museum, Madras, are having an index collection made on the same principle as that adopted in the British Museum (Natural History). This is noted in the Administration Report of the Museum for the year 1889–90. The index collection, in its complete state, should teach the most important points in the structure of the principal types of animal and plant life, and the terms used in describing them. The series exhibited during the past year illustrated, by means of specimens with descriptive labels, arranged in wall and table cases, the outer covering or integument of mammals and its modification into hair, nails, claws, hoofs, horns, antlers, &c. Other series are in course of preparation, illustrating the dentition and osteology of mammals, the external characters and osteology of birds, the structure and forms of shells, mimicry, &c. The exhibition of these series, the Superintendent hopes, will be of use both to those who are engaged in teaching, and to students in Madras, and bring the Museum more into touch with the Educational Department than it has been hitherto.

SOUNDINGS have lately been carried on in the Straits of Dover, in connection with the proposal for the construction of a bridge across the English Channel. According to a telegram sent through Reuter's Agency from Paris, the result of the surveys made shows that the route which has been investigated is a little shorter than was expected, that it presents every guarantee as regards solidity and stability, and that the depths are not quite so great as was anticipated. M. Renaud, a hydrographic engineer, who was designated for the work by the French Minister of Marine, is of opinion that if the Bridge Company went a little further north a perfectly straight route could be obtained with a better foundation and less depth of water. This route would be four kilometres shorter, and would therefore considerably decrease the cost of construction. It also appears to be less exposed to the wind, which would prove a great advantage, especially during the progress of the works.

THE U.S. National Museum has issued its Thirty-eighth Bulletin. The work consists of a valuable contribution, by Prof. J. B. Smith, towards a monograph of the insects of the Lepidopterous family Noctuidæ, of Temperate North America.

SOME time ago a memorial on the decimal system was presented to the London School Board by the Decimal Association. The Board have now informed the Association that, on the recommendation of the School Management Committee, they have asked the Education Department to modify Schedule I of the new Code, so that decimal fractions shall be taught in the fourth standard at latest, and the metric system of measurement and weight be included in the teaching of the fourth and upper standards. The School Management Committee of the Board have also decided that models illustrating the metric system shall be added to the Board's requisition list in the event of the Education Department accepting the proposal of the Board.

MESSRS. J. B. BAILLIÈRE ET FILS are issuing, in weekly parts, a work on the various races of mankind ("Les Races Humaines"), by Dr. R. Verneau. It will complete the work entitled "Merveilles de la Nature," for which Brehm wrote the

"Vie des Animaux." The first part of the new work has been sent to us. The author arranges his facts clearly, and there are some good illustrations.

MR. FISHER UNWIN has published an interesting volume on "Teneriffe," by George W. Strettell. It is an expansion of a paper read by the author before the Congress at Brighton last August. Mr. Strettell records his personal experiences, and in describing Teneriffe as a health resort, avoids, with equal care, extravagant laudation on the one hand, and undue depreciation on the other.

THE new volume of the "Minerva Library" consists of reprints of Darwin's "Structure and Distribution of Coral Reefs"; his "Volcanic Islands"; and his "Geological Observations on South America." Prof. J. W. Judd contributes a critical introduction to each work.

A CORRESPONDENT inquires as to the titles of any works in the nature of scientific guide-books to Switzerland and the neighbouring countries, and to the usual tourist resorts for health, &c.—which deal with their chief features of botany, zoology, geology, ethnology, &c. The books should not exceed the size or cost of ordinary guide-books, and may be French or English. We shall be glad to print any titles that may be sent to us.

A SOMEWHAT severe shock of earthquake occurred at Hechingen on October 14, at 2.30 a.m. At Nexö, on the Island of Bornholm, a slight rumbling of earthquake was noticeable for almost an hour on October 8, the same day on which several shocks were felt in Norway.

THE formation of icebergs was watched, this last summer, by Mr. H. B. Loomis and Prof. Muir, while staying seven weeks near the Muir Glacier (*Amer. Journ. of Science*). The falling of blocks from the terminal wall was very irregular: at times, about every five minutes; while at other times the observer might wait an hour without seeing one fall. One day, in twelve hours, 129 thundering reports from the falling bergs were heard at camp, about a mile off. In heavy rain, especially, it seemed as if a thunderstorm or cannonade were going on. Sometimes a block, breaking off, bursts into fragments, and falls like a cataract. Again, an enormous block will sink unbroken into the water, then rise, perhaps 250 feet, even with the top of the glacier, the water pouring off it; then topple on its side with a heavy thundering roar, scattering spray in all directions, and wallow about among other icebergs like a huge monster.

A PAMPHLET on "The Law of Storms," considered with special reference to the North Atlantic, has been sent to us by the author, Mr. Everett Hayden. It is an abstract of a paper read by him before the National Geographic Society in November last. Hurricanes are most frequent in the summer months in each hemisphere. Originating in the tropics they move westward, then poleward, and finally eastward in higher latitudes, gradually receding from the equator. Between hurricanes north and south of the line the essential difference is that in the northern hemisphere the rotation of the cyclonic whirl is against the hands of a watch and in the southern with them. The author goes on to say that the noted hurricane regions are the West Indies, coast of China and Japan, Bay of Bengal (especially in May and October at the time of the change of the monsoons), and the South Indian Ocean (about Mauritius). In the brief statements and descriptions regarding hurricanes and storms, including some of the latest hurricanes that have occurred in the last two or three years, the most recent, most important, and best established facts, which every navigator ought to know, have been written concisely and intelligibly. Accompanying these descriptions are charts which illustrate clearly the wind currents and barometric depressions. To explain the great cloud bank, and the storm wave or general elevation of the sea caused by the spirally in-blowing winds and low barometer, the author has given a very neat little sketch in cross-section, and a second sketch is added to convey a clear mental conception of the actual motions of the particles of air as they flow inwards from below, their whirl upwards and flow outwards at the top.

IN a paper on moles, lately read before the Bristol Naturalists' Society, and now printed in its Proceedings, Mr. C. I. Trusted calls attention to the fact that there are said to be no moles in Ireland. He has never seen a mole-hill in that country, and an acquaintance of his at Belfast—"a good and observant naturalist"—says, "It *is* a fact that moles do not exist in Ireland." Yet, as Mr. Trusted points out, there are in many parts of Ireland wide districts which seem to be well suited to the mole's habits.

THE Department of Public Instruction, in New South Wales, have printed in their technical education series a valuable paper on wattles and wattle-barks, by J. H. Maiden. In an introductory note the Minister for Public Instruction says that experiments in wattle-culture in Victoria and South Australia have resulted in a practical success. He knows of no sound reason why similar enterprise should not be equally profitable in New South Wales, which has, in many parts, soil and climate well adapted for this industry.

SOME persons digging peat near the village of Fochterloo, Friesland, lately came across a sunken forest of trees with enormous trunks. The trees are lying on a sandy soil, in the direction from north-west to south-east; it is not yet decided to what species they belong. The exteriors resemble oak, but the insides are brittle, and burn like tinder.

WE have received the third edition, just published, of a general list of observatories, astronomers, astronomical societies, and astronomical reviews, prepared by Mr. A. Lancaster, librarian of the Royal Observatory of Brussels. Under the heading of each observatory will be found its latitude and longitude, the names of all those who compose its staff, and its yearly publications. Under astronomical societies the information given relates to the following: date of foundation, object, memoirs published, and names of the president, secretary, and treasurer. The next part is headed, "Institutions diverses," and includes—among other institutions—the Bureau of Longitudes of France at Paris, Bureau of the *Nautical Almanac* at London, Bureau of the *Nautical Almanac* at Washington, Solar Physics Committee, &c. The staff employed or members in each of these institutions is given, together with the yearly publications. The fourth section deals with astronomical reviews and journals, and the information that is brought together mentions the name of the editor, the price, the frequency of publication, and the date of first appearance. The fifth and sixth sections consist of alphabetical lists, with addresses, of astronomers and instrument makers. With the help of the good general alphabetical table that is added at the end, the book will be sure to be found very handy and useful for reference.

R. FRIEDLÄNDER AND SON, Berlin N.W., 11 Carlstrasse, have issued part xxiii. of their "Catalogues of Books." It contains titles of a large number of important works dealing with every branch of astronomical science, hence it will be of great use to those in search of rare books, and also to the general bibliographer.

WE have received the sixth fascicule of the "Works of the Aral-Caspian Expedition," which contains the geological diary of Prof. Barbot de Marny during the Expedition. This diary, which unhappily remained unpublished for thirteen years after the Professor's death, is rich in accurate observations, which

have lost none of their value, notwithstanding subsequent exploration; and the whole gives a vivid description of the explored region, from the Caspian Sea, over the Ust-Urt plateau, to the mouth of the Amu-daria and to Samarkand. Of the many short notes scattered in the diary we may select one in which it is mentioned that Barbot de Marny has had the opportunity of finally ascertaining that the so-called *bugry* of the Caspian shore are simply due to denudation. The layers of clay and sand of which they consist are mostly horizontal, and, when they are not so, the stratification has no relation whatever to the exterior shape of these elongated low ridges. The next contribution to the same fascicule is by M. Andrusoff. It is full of geological data, and its conclusions are very interesting, the author never failing to discriminate between what is already proved and what still belongs to the domain of hypothesis. His remarks about the Caspian Sea and its present fauna being remains of a Miocene sea, and the enumeration of the geological problems in connection with that fact which remain yet unsettled, will be read by geologists with interest, the more so as the substance of this paper has been given in German in the *Jahrbuch der k.k. Geologischen Reichsanstalt*, vol. xxxviii.

THE following are the arrangements for Tuesday evening lectures at the Royal Victoria Hall during November:—November 4, Mr. Arnold Mitchell, "Old Buildings and the Story they tell"; November 11, Mr. A. H. Gilkes, "Columbus"; November 18, Mr. A. P. Laurie, "Air and Water," with experiments; November 25, Mr. Hilliard Atteridge, "The New Divisions of Africa." The oxyhydrogen lantern will be used with all these lectures.

IN our note on the Rev. J. A. Galbraith, on October 23, the ast three lines should have been printed as follows:—"In 1854 he was chosen Erasmus Smith Professor of Experimental Philosophy. Along with Dr. Haughton, Prof. Galbraith was the author of various excellent scientific manuals."

IN a communication to the current number of the *Comptes rendus*, M. Moissan announces the result of his redetermination of the atomic weight of fluorine. The method adopted consisted in converting a known weight of sodium, calcium, or barium fluoride, prepared in a manner specially devised by M. Moissan in order to exclude impurities, into sulphate by repeated ignition with pure sulphuric acid in a small platinum retort. The process for obtaining pure sodium fluoride was as follows. An already fairly pure specimen of sodium chloride was freed from the last traces of potassium by a large number of fractional crystallizations. This was then converted into bicarbonate, of soda by saturating its aqueous solution successively with ammonium and carbon dioxide. The precipitated bicarbonate, after repeated washing, was converted into the normal carbonate by boiling its solution in water, and the crystals which separated on evaporation were freed from traces of chloride by repeated partial crystallization. The carbonate was next converted into fluoride by treatment with redistilled hydrofluoric acid originally prepared by distillation of hydrogen potassium fluoride, HF . KF. The sodium fluoride thus obtained, after ignition at a red heat, was probably the purest specimen which has ever been obtained. As the result of five ignitions with sulphuric acid, the values obtained for the atomic weight of fluorine ranged from 19·04 to 19·08, when Na = 23·05 (Stas), S = 32·07 (Stas), and O = 16. The calcium and barium fluorides employed in the second and third series of determinations were obtained in microscopic crystals by precipitating potassium fluoride with calcium or barium chloride in dilute solutions of particular strengths. The values obtained in the case of four experiments with calcium fluoride varied from 19·02 to 19·08, and as the result of five determinations with barium fluoride, 19·05–19·09. As barium fluoride is not so regularly decomposed by sulphuric acid as sodium and calcium fluorides, M. Moissan considers that the nearest approximation to the truth is afforded by taking the mean of the experiments with the the two latter fluorides. This value is 19·05. Hence the atomic weight of fluorine may be considered, as has previously been supposed, to be practically represented by the whole number 19.

THE additions to the Zoological Society's Gardens during the past week include a Diana Monkey (*Cercopithecus diana* ♀) from West Africa, presented by Mr. Howard V. Henry; a Spotted Ichneumon (*Herpestes nepalensis*) from Nepal, presented by Mr. J. Percy Leith, F.Z.S.; a Polecat (*Mustela putorius*), British, presented by Mr. F. D. Lea Smith; two Laughing Kingfishers (*Dacelo gigantea*) from Australia, presented by Mr. W. B. Phillips; two Pomatorhine Skuas (*Stercorarius pomatorhinus*), British, presented by Mr. T. E. Gunn; a Cashmere Monkey (*Macacus pelops* ♀) from Cashmere, deposited; two Common Squirrels (*Sciurus vulgaris*), two Reed Buntings (*Emberiza schæniclus*), two Redpolls (*Linota rufescens*), British, purchased; an Angora Goat (*Capra hircus* ♀ var.), received in exchange; two Vinaceous Turtle Doves (*Turtur vinaceus*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m. on October 30 = 0h. 36m. 39s.

Name.	Mag.	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ′
(1) G.C. 105	—	—	0 34 23	+41 5
(2) G.C. 117	—	—	0 36 43	+40 16
(3) δ Piscium	4	Yellowish-red.	0 42 58	+ 6 59
(4) η Ceti	3	Yellowish-white.	1 2 31	−10 49
(5) θ Ceti	3	Whitish-yellow.	1 18 30	− 8 45
(6) α Andromedæ... ...	1	White.	0 2 42	+28 20
(7) 3 Schj.	8	Deep red.	0 14 5	+44 6
(8) R Vulpeculæ	Var.	Yellowish-red.	20 59 30	+23 23

Remarks.

(1) The spectrum of this bright nebula has not yet been recorded. The G.C. description is: "Very bright; very large; much extended in the direction 165°; very gradually very much brighter in the middle."

(2) This is the companion to the Great Nebula in Andromeda, which is described by Herschel as "exceptionally bright; large; round; pretty suddenly much brighter in the middle to a nucleus." With reference to the spectrum, Dr. Huggins notes: "This small but very bright companion of the Great Nebula of Andromeda presents a spectrum exactly similar to that of 31 M (the Great Nebula). The spectrum appears to end abruptly in the orange, and throughout its length is not uniform, but is evidently crossed either by lines of absorption or by bright lines." Referring to the Great Nebula, the same observer wrote: "The spectrum could be traced from about D to F. The light appeared to cease very abruptly in the orange; . . . no indications of the bright lines." A comparison of the two descriptions would lead one to suppose that the spectrum of the companion is the more discontinuous of the two, and, if this be the case, measurements of the positions of the brightnesses in the spectrum may teach us a good deal about the nebulæ which have so-called "continuous" spectra. After such a definite statement by Dr. Huggins as to the existence of irregularities, it is highly desirable that further observations and measurements should be made. Carbon comparisons (spirit-lamp flame) are suggested.

(3) A star of Group II., with bands 2, 3, 5, 7, 8 so narrow that Duner describes them as "little more than lines." Narrow bands are common to both the early and late species of the

group, but in the former case the bright carbon flutings are strongly developed, whilst in the latter they are barely visible. Another characteristic of the later species is the addition of absorption-lines to the narrow bands. The observations of Mr. W. J. Lockyer and myself show that δ Piscium represents a late stage of the group, there being little or no carbon radiation.

(4, 5) Stars of the solar type. The usual differential observations are required.

(6) A star of Group IV. Observations of the relative thicknesses of the hydrogen and additional lines should be made, and the characters and positions of the latter noted. It appears that in some of these stars the added lines are similar to those seen in α Cygni, whilst others are solar.

(7) In this star of Group VI. the blue zone is very pale, the carbon band λ 564 is very wide and dark, and band 4 is suspected (Dunér).

(8) There will be a maximum of this variable on October 31. The period is about 138 days, and the range from 7·5–8·5 to 2·5–13·0. According to Dunér, the spectrum is one of Group I., but excessively weak. More details may possibly be obtained if the spectrum be observed at maximum. A. FOWLER.

SPECTROSCOPIC OBSERVATIONS (SAWERTHAL'S COMET 1881 I., AND β LYRÆ).—Dr. Nicolaus von Konkoly, the Director of the Astro-physical Observatory in O'Gyalla (Hungary) has issued the volumes containing his observations made during 1888-89. He notes, with respect to Sawerthal's comet (1881 I.):—

"I have observed the spectrum with a Merz universal spectroscope having one prism in position. This gave a dispersion of 8° (H to D), which was more than sufficient for my purpose. I was obliged to use this instrument, because the deviation it gave suited the focussing arrangement of the Kartaler refractor. The telescope of the spectroscope magnified seven times.

"The continuous spectrum was not very bright, and faded away slowly at each end. I thought that I could distinguish the D line (dark). It was so weak, however, that I could not fix its position with the micrometer. The continuous spectrum extended from 673 μ to 435 μ. Besides this I was able to recognize five hydrocarbon bands which I have located five times. From these measurements I have deduced the following mean values: I. 561·46 μ, II. 546·25 μ, III. 515·88 μ, IV. 513·26 μ, V. 472·56 μ.

"The lines were not sharply defined on either side, and were much widened near the continuous spectrum. The measurements given above are of the middle of the maximum light-intensity of the bands, which could be easily distinguished."

β Lyræ was spectroscopically observed on January 1, 1889, and it is recorded:—"The C line was bright and could be easily seen, and a dark band was visible at a slight distance from it. D_3 was distinguished in a similar manner. Near it, in the green, some fine lines could be perceived. F was suspected, but it was almost invisible."

Dr. Konkoly gives an extended account of his observations of Jupiter from 1885 to 1889, and accompanies it with a series of fourteen drawings of the planet. Several drawings of Sawerthal's comet are also given.

SPECTROSCOPY AT PARIS OBSERVATORY.—M. Deslandres has charge of the spectroscopic section just created at Paris Observatory, and in the current number of *Comptes rendus* (October 20) he gives an account of the instruments to be used with the great equatorial (1·20 metres aperture). Those who have tried to obtain photographs of star spectra by means of a slit spectroscope on a large telescope, know how difficult it is to adjust a star on the slit, and, when there, to keep it in position for a sufficiently long time. To enable this to be done during a long exposure, M. Deslandres has arranged a total reflecting prism near the dark slide, so that the red end of the spectrum may be seen whilst the blue end is being photographed. In this way he has obtained many photographs of stellar spectra in juxtaposition with comparison spectra. To adjust the instrument for observing, the spectrum of a star, a small mirror, having a hole in the centre about the same diameter as the length of the slit, has been fixed in front of the slit at an inclination of 45°. The image of a star is thus reflected to the side of the instrument, and after another reflection reaches a small telescope fixed at the spectroscope. This telescope, therefore, gives the image of a star in the plane of the slit, and constitutes a veritable finder for use with the spectroscope.

ON THE LATER PHYSIOGRAPHICAL GEOLOGY OF THE ROCKY MOUNTAIN REGION IN CANADA, WITH SPECIAL REFERENCE TO CHANGES IN ELEVATION AND TO THE HISTORY OF THE GLACIAL PERIOD.[1]

DR. G. M. DAWSON has been engaged continuously for seventeen years in geological exploration of the Western Territories of Canada, including the country from Lake Superior to the Pacific; and in the paper above named he summarizes the history of the successive deposits and earth-movements which have built up the mountain ranges of the West, and the relations of these to the geology of the great plains to the eastward. He devotes special attention to the Glacial age, and concludes that the drift phenomena of the plains belong to a period of submergence, and that in the extreme period of glaciation there were great glaciers on the Cordillera on the west, and the Laurentian axis on the east, with a vast internal sea between. He is thus entirely opposed, as far as North America is concerned, to the idea of a Polar ice-cap or a great continental glacier flowing down the interior plateau of the continent, and he resolves the phenomena of the ice age into the operation of huge mountain glaciers and floating ice.

The leading points of the memoir may be summarized, with the aid of a few extracts, in such a manner as to convey a general view of the history of the great Cordilleran belt, which stretches along the west coast of America from Behring Straits to Cape Horn, and more especially to indicate that of its more northern portion.

The general structure of the country may be defined as follows:—

"At the present day, the western border region of the continent is formed by a series of more or less nearly parallel mountain-systems, with an average breadth in British Columbia of about 400 miles. The trend of these systems is north-west and south-east, or similar to that of the corresponding portion of the Pacific shore-line, the position of which, in fact, depends upon that of these orographic features. This generally mountainous zone of country is often referred to as the Rocky Mountain region, but is more appropriately named the Cordillera belt, the Rocky Mountains proper constituting only its north-eastern marginal range. In traversing it from east to west, in the southern part of the province of British Columbia, four distinct mountain-systems are crossed: (1) the Rocky Mountains proper, (2) mountains which may be classed together as the Gold Ranges, (3) the Coast Ranges, (4) an irregular mountain-system which in its unsubmerged parts constitutes Vancouver Island and the Queen Charlotte Islands, and which may be designated the Vancouver system. Between the second and third of these mountain-systems is a region without important mountain ranges, which is referred to as the Interior Plateau of British Columbia.

"To simplify our conception of the main features of this part of the Cordillera for our present purpose, we may, however, regard it broadly as being outlined on the north-east and south-west sides by the Rocky Mountains proper and by the Coast Mountains, as dominant ranges. This view is justified by the remarkable constancy of these two ranges and their relative importance. The intervening region may then be described as comprising the Interior Plateau together with the various ranges which have been grouped together under the name of the Gold Ranges, as well as other detached mountains and irregular mountainous tracts."

The geological history of British Columbia begins, like that of many other parts of the world, with that primitive crumpling of the earth's crust which produced the Laurentian gneisses. These exist principally in the Gold Ranges, and are in this region neither greatly extended nor of great elevation. In the Palæozoic age there were sea-bottoms receiving sediment, but apparently little mountain-making.

"Omitting, then, from consideration the imperfectly-known progress of events in the earlier stages of the geological history of the region, we may endeavour to picture to ourselves its condition in the Triassic or first stage in the Mesozoic division of geological time. The central region of the continent was at this time occupied by a very extensive, though shallow, mediterranean sea, which was either entirely cut off from the ocean

[1] By Dr. G. M. Dawson, F.G.S., Assistant Director of the Geological Survey of Canada. Transactions of the Royal Society of Canada, 1890. 73 pages quarto, with 4 maps.

or had only occasional and brief connection with it, and in which red beds with occasional layers of gypsum and salt were being deposited.[1] Rocks which represent a portion of the bed of this inland sea enter into the composition of the Rocky Mountain Range near the forty-ninth parallel, but are not known to occur to the north of that parallel for a distance of more than thirty or forty miles. To the west, they are not found in the Selkirk or Purcell Mountains. We appear, in fact, to discover in this vicinity the northern end of the inland Triassic sea. To the west of the Gold Ranges (under which term it will be remembered that the Selkirk, Purcell, and other mountains are grouped), deposits, also referable to the Triassic period, and more particularly to its upper part, are again found. These occur both on the mainland of what is now British Columbia and on Vancouver Island and the Queen Charlotte Islands. They contain truly marine fossils, and consist largely of materials of volcanic origin, which give evidence of contemporaneous volcanic activity on a great scale. To the north, in the Peace River country, and to the east of the present position of the Rocky Mountains, rocks holding the same marine forms are found, and they have quite recently again been discovered by Mr. McConnell in a similar position, still further north, on the Liard River.

"It would thus appear that in Triassic times the eastern border of the Pacific washed the western slopes of the Gold Ranges, and that where this mountain-system became interrupted, in its northern part, the sea was continued across its line, and covered a large tract of country to the east of the present position of the Cordillera belt.

"Precisely how far to the east the shore of this northern expansion of the Pacific was situated has not yet been determined. The region between it and the northern end of the inland sea previously referred to must have been a land area, which separated the open ocean of the north from the Mediterranean on the south. The Rocky Mountains proper had not yet been formed, nor is there any evidence of mountain ranges in the region of the Coast and Vancouver systems of to-day, though the volcanic action there in progress may have produced insular volcanic peaks. The deposits of the inland Triassic sea, including as they do beds of salt and gypsum, appear to prove the existence of a very dry climate in the area occupied by it; and as the land barrier separating it from the moisture-bearing westerly winds of the Pacific cannot have been wide, it must have been high. It is thus probable that the mountains of the Gold system formed at this time a lofty sierra, which was continued to the south of the forty-ninth parallel by the Cabinet, Cour D'Alaine, Bitter Root, and other mountains at least as far as the Wahsatch Range in Utah.

"The Triassic period was closed by one of those epochs of folding and dislocation of strata which are found to be recurrent in geological time, and which are generally attributed to the secular contraction of the earth's crust. The evidence of this time of change has been examined in greatest detail in the vicinity of the present coast-line, where it resulted apparently in outlining the Vancouver and Coast Ranges, and was accompanied by the production or extravasation of great masses of granitic rocks.[2] It is highly probable that some corrugation along the line of the Rocky Mountains occurred at the same period, as, in the next succeeding Earlier Cretaceous strata, without further evidence of disturbance, conglomerates are found to be composed of fragments of many varieties of the older rocks, which could scarcely otherwise have been rendered subject to denudation. Though much remains to be discovered respecting this post-Triassic epoch of disturbance, it was evidently an important one, and its results were wide-spread in the Cordillera region. It is quite possible that it was accompanied by, or resulted in producing, a general elevation of this entire region above the sea-level, as no rocks distinctly referable to the Jurassic or next succeeding period have yet been distinctly recognized either in British Columbia or in its bordering regions.[3] It must be borne in mind, however, that a portion of the red beds of the inland sea, described as Triassic, may extend upward into the Jurassic period, and that the marine Triassic fossils of the western and northern sea are referable to the later stages of the Triassic, or 'Alpine Trios' of the Cordillera region, comparable with the St. Cassian and Hallstadt beds of the Alps in Europe; while the beds of the Cretaceous next found are, according to European analogies, near the base of that formation."

"The next distinct record of the physical conditions of the region under discussion is afforded by the Earlier Cretaceous rocks. These, on the evidence of contained molluscan fossils, are regarded as about equivalent to the Gault of England, though the associated remains of plants are such as to admit their assignment to a somewhat older date. At this time, the immediately post-Triassic elevation had been followed by a subsidence of the land, resulting in the re-occupation by the open sea of the great area which had been similarly characterized in the Triassic. As in Triassic times, we find that this Earlier Cretaceous extension of the Pacific, to the north of the fifty-fourth parallel, spread eastward in a more or less connected manner completely across the present position of the Cordillera belt, while the Gold Ranges, and probably also other insular areas, continued to exist as dry land. In this case, as in that of the Triassic, it has not yet been found possible to outline exactly the eastern limit of the sea, in consequence of the want of sections cutting down to the base of the Cretaceous in the area of the Great Plains. There are, however, reasons for believing that it did not extend far beyond the line of the present foothills of the Rocky Mountains.

"In one important particular, the conditions in this Earlier Cretaceous period differed from those of the Triassic. There was at this time no isolated inland sea, and waters in connection with the main ocean stretched southward to the east of the Gold Ranges as far as the forty-ninth parallel and beyond it to a further distance which is as yet undetermined. This extension of the open sea thus actually overlapped, to a considerable extent, the area formerly occupied by the Triassic mediterranean."

This was followed, however, in Middle and Later Cretaceous times, by a great depression in which the marine beds of the Neobrava and Pierre Groups were deposited. This submergence was succeeded by some measure of elevation or folding, leading to the existence of vast swampy and lacustrine flats, in which the lacustrine and peat deposits of the Laramie formation of the great plains were formed. These deposits may be regarded as closing the Cretaceous era, or as transitional between it and the Eocene.

"This state of affairs was brought to a close by another of the recurrent epochs of folding and dislocation of the earth's crust, which was one of the greatest of those of which we find the results in the region under discussion, as well as the last of an important character to which this region was subjected. Under the influence of enormous pressure acting from the Pacific side, the nearly horizontal strata, which bordered the Gold Ranges on the north-east, were folded together and thrown up into a dominant ridge of Alps, which finally outlined the Cordilleran belt on this side. A similar folding and upthrust affected also the western marginal mountains which have been referred to as the Vancouver Range, but the action was there probably less violent and certainly affected a narrower zone. A portion of the crumpling to which the rocks of the Coast Ranges have been subjected was doubtless also produced at or about the same time, and certain granitic extrusions which cut the earlier Cretaceous rocks on its eastern flanks, as well as much of the flexure of these Cretaceous rocks, are also attributed to this period of disturbance.

"There is really no means of ascertaining what effect this disturbance produced in the region of the Gold Ranges, but it is more than probable that the whole width of the Cordillera then suffered changes and deformation of such a character that little if any trace of its surface contour of an older date can be found to-day.[1] It does not, however, necessarily follow that the

[1] Cf. "Note on the Triassic of the Rocky Mountains and British Columbia," Transactions of the Royal Society of Canada, vol. i., Section iv., p. 143.

[2] Cf. "Report of Progress, Geological Survey of Canada," 1878–79, pp. 46 B, 48 B; "Report of Progress, Geological Survey of Canada," 1886, p. 15 B.

[3] Certain rocks, from which fossils supposed at the time to be Jurassic were described, have since been found to belong to the Earlier Cretaceous. Cf. "Report of Progress, Geological Survey of Canada," 1876–77, p. 150; "Mesozoic Fossils," vol. i. p. 258.

[1] In respect to this great epoch of orographic movement, as evidenced particularly in the more southern part of the Cordillera, which has now been somewhat closely studied, Mr. S. F. Emmons may be quoted as follows:—"It is unquestionably one of the most important events in the orographic history of the entire Cordilleran system. With the exception of the great unconformity between the Archæan and all overlying sediments, which is a phenomenon *sui generis* and altogether exceptional, no movement has left such definite evidence as that which follows the deposition of the coal-bearing rocks to which the name Laramie has by universal consent been applied."—*Bulletin Geol. Soc. Amer.*, vol. i. p. 285.

general altitude of the Cordillera belt was at this time materially changed. The greater part of the accumulated pressure appears to have been relieved by folding along the lines of its two bordering ranges, and it seems to be not improbable, as a general proposition, that changes in elevation affecting wide areas are due to other causes than those producing mountain ranges.[1] We are warranted in assuming, however, that a certain movement in elevation was coincident, or nearly so, with that of the great disturbances above outlined, as no strata representative of the Eocene period proper have yet been found anywhere in the western part of Canada. The entire area of the Great Plains was thus sufficiently elevated to become dry land, as occurred at the same time in the Western States to the south of the international boundary."

The Eocene period thus witnessed the formation of the great interior table-land, which accordingly has present no aqueous formations of this age. In Miocene times, however, there were large interior lakes, with deposits rich in remains of plants and insects, and on the plains fluviatile gravels with mammalian bones.

The Pliocene period inaugurated another great continental elevation, which continued for a long period, and in which the fiords and cañons of the Cordillera were cut down by fluviatile action to the sea-level of the period. Many local illustrations are given in this memoir of the curious results in regard to denudation which this period of rest and elevation produced.

This leads to the glacial history of the region, the key to which is believed to be found in the unequal elevation whereby, while the great plains to the east remained under water, the Cordilleran Ranges became covered with a great glacier discharging north toward the Yukon Valley and the Arctic Sea, and south to Puget Sound, while glacial streams ran westward to the Pacific. At this time the Rocky Mountains produced but few and small glaciers on their eastern sides; but across the wide sea which covered the plains the Laurentian Mountains supported another *névé* discharging ice in all directions.

This was followed by what is usually called the inter-glacial period, when, as is believed, the plains were slightly elevated and the mountains depressed; and this was succeeded by the second glacial period, in which the mountain glaciers were comparatively small, and the depression of the plains was so great that water-borne boulders were deposited at elevations of 5000 feet or more on the foot-hills of the Rocky Mountains. It is to be noted here that the present eastward slope of the western plains had not yet been impressed on them. The series of events thus indicated is illustrated by the following table, which, however, the author regards as somewhat provisional:—

SCHEME OF CORRELATION OF THE PHENOMENA OF THE GLACIAL PERIOD IN THE CORDILLERAN REGION AND THE REGION OF THE GREAT PLAINS.

Cordilleran Region.	*Region of the Great Plains.*
Cordilleran zone at a high elevation. Period of most severe glaciation and maximum development of the great Cordilleran glacier.	Correlative subsidence and submergence of the Great Plains, with possible contemporaneous increased elevation of the Laurentian axis and maximum development of ice upon it. Deposition of the lower boulder-clay of the plains.
Gradual subsidence of the Cordilleran region and decay of the great glacier, with deposition of the boulder-clay of the Interior Plateau and the Yukon Basin, of the Lower boulder-clay of the littoral, and also at a later stage (and with greater submergence) of the inter-glacial silts of the same region.	Correlative elevation of the western part of the Great Plains, which was probably more or less irregular, and led to the production of extensive lakes in which inter-glacial deposits, including peat, were formed.
Re-elevation of the Cordilleran region to a level probably as high as or somewhat higher than the present. Maximum of second period of glaciation.	Correlative subsidence of the plains, which (at least in the western part of the region) exceeded the first subsidence, and extended submergence to the base of the Rocky Mountains near the forty-ninth parallel. Formation of second boulder-clay, and (at a later stage) dispersion of large erratics.
Partial subsidence of the Cordillera region to a level about 2500 feet lower than the present. Long stage of stability. Glaciers of the second period considerably reduced. Upper boulder-clay of the coast probably formed at this time, though perhaps in part during the last.	Correlative elevation of the plains, or at least of their western portion, resulting in a condition of equilibrium as between the plains and the Cordillera, their *relative* levels becoming nearly as at present. Probable formation of the Missouri Côteau along a shoreline during this period of rest.
Renewed elevation of the Cordillera region with one well-marked pause, during which the littoral stood about 200 feet lower than at present. Glaciers much reduced and diminishing, in consequence of general amelioration of climate toward the close of the Glacial period.	Simultaneous elevation of the Great Plains to about their present level, with final exclusion of waters in connection with the sea. Lake Agassiz formed and eventually drained toward the close of this period. This simultaneous movement in elevation of both great areas may probably be connected with the more general northern elevation of land at the close of the Glacial period.

Among the evidences given of the partial submergences and differential elevations stated in this table, reference is made to the "White Silt formation" so extensively distributed in many parts of British Columbia, and indicating water action up to levels of about 2700 feet, to the high-level terraces; the peculiar distribution of boulders from the Laurentian highlands on the eastern slopes of the Rocky Mountains; the absence of glacial abrasion on the plains; the chemical character of the boulder-clay, leading to the inference that it was formed under water; the wide distribution and characters of the inter-glacial beds, the character and position of the Missouri Côteau, and a variety of other local facts. The objection that marine shells are not found in the Pleistocene strata is treated thus:—

"From what has already been said with respect to the Cordillera region, and more particularly in connection with the meaning which the White Silt formation appears to have in that region, it seems probable that the water by which the northern part of the Great Plains is supposed to have been flooded was in connection with that of the sea.[1] In discussing the results of my earlier investigations of the superficial deposits of this part of the plains, in reference to a theory of their submergence, I have stated that after a certain stage the waters entering from the north and south must have formed an open strait between the Arctic Ocean and the ocean to the south.[2] This was written, however, under an assumed limitation implying an equal subsidence of the continent; and at the time no satisfactory information was available respecting the position of the margin of the glacial deposits in the corresponding western part of the United States, such as has since been supplied by the work of Chamberlin, Salisbury, Todd, Wright, McGee, Upham, and others. The result of these new facts appears to show that, instead of opening broadly southward as well as to the north, any body of water covering the northern part of the Great Plains could have had only a tortuous and comparatively narrow communication with the sea to the eastward, round the front of the great confluent Laurentide glacier, and that even this communication was probably formed only at the time during which the plains stood at the lowest level indicated by the spread of the drift deposits. If such conditions may be assumed as probably

[1] Cf. Le Conte, *American Journal of Science*, III. vol. xxxii. p. 178.

[1] It must still, however, be admitted as possible, that a great lake was in some manner produced, in the region of the plains, with a height somewhat exceeding that of the sea.

[2] "Geology and Resources of the Forty-ninth Parallel," p. 255.

representing the facts at the time, they go far toward explaining one of the greatest difficulties against the acceptance of the hypothesis that the waters by which the plains were flooded were in communication with those of the sea. The difficulty alluded to is the complete absence, so far as yet ascertained, of the remains of marine organisms from the glacial deposits. While prolonged weathering and the action of sub-aërial waters might result in the removal of calcareous organic remains from certain parts of these deposits, the condition of much of the boulder-clay, together with the occasional actual occurrences in it of fragments of Cretaceous or Laramie shells, is such as to show that any contemporaneous mollusks might have been preserved. If, however, the body of water in question, though communicating with the sea to the northward, was almost throughout closed to the south and in receipt of large quantities of fluvial water, it may well have been in great part brackish, if not almost entirely fresh. Adding to this the conception of its frigid temperature due to the great abundance of ice with which it must have been laden, and the vast amount of fine sediment which must have been carried into it by sub-glacier streams, it will be apparent that the conditions were singularly inimical to the existence of life of any kind, whether that characteristic of salt or fresh water. Somewhat similar conditions, though on a much smaller scale and without the adjunct of glacial waters or glaciers, occur in the southern extremity of Hudson Bay, where, as Mr. A. P. Low informs me, marine life is almost entirely absent, the water being nearly fresh and clouded with mud derived from the large entering rivers and from the action of the waves upon the shallow earthy shores."

Finally the climatal conditions deducible from the geological facts coincide with these facts in enforcing the probability that the great ice age of North America depended mainly on the existence of high mountains, surrounded by submerged areas, traversed by ice-laden currents, and that we are to imagine, not a continent covered with ice, but a submerged continent, with snow-clad mountains rising at its margins, and forming the gathering grounds of great local glaciers—the *Cordilleran*, the *Laurentide*, and probably the *Appalachian* glaciers. These were the favouring conditions, but the author does not venture to deny the co-operation of other and cosmical causes. He concludes as follows:—

"When the study of the superficial deposits of different parts of Europe and America was for the first time seriously begun, it was endeavoured to explain the phenomena entirely by diluvial action, and when the evidence of ice-action became insuperable, icebergs and floating ice only were at first admitted as factors. Since that time the pendulum of opinion appears to have swung to the opposite extreme, and the energies of the majority of investigators have been extended in endeavouring to account for the varied facts of what has become definitely known as the Glacial period, almost exclusively by the action of great confluent glaciers. From this extreme point, the pendulum may now be supposed to have returned so far, as to leave the hypothetical North Polar ice-cap almost without an advocate, but at what position it may eventually come to rest time alone can decide. I am aware that some of those who have accepted what I may perhaps be pardoned for characterizing as extreme views as to glacier action, have more or less completely, and to their own satisfaction at least, solved all difficulties opposed to the action of land ice, such as those presented by the facts met with over the Great Plains, by the application to these of their single universal menstruum. For myself I need only say that I have endeavoured to approach the subject of the glaciation of the north-western part of the continent, here reviewed, untrammelled by *a priori* theories, and with some personal familiarity in the field with nearly all parts of the region dealt with."

The above is only a hurried and imperfect summary. The paper itself, as containing the matured conclusions of long and thorough investigation by an able and earnest explorer, should be carefully read by all interested in the structure of the Great Cordilleran backbone of the American continent.

THE SCIENTIFIC INVESTIGATIONS OF THE FISHERY BOARD FOR SCOTLAND.[1]

THE results of the scientific investigations for 1889 are given in full detail with numerous tables and two charts. It was found that, during the year, no increase but rather a decrease, mainly in the migratory round fishes, occurred in the closed waters, and likewise in the open waters adjacent, the results of 1887 having been proved exceptional. The results of concurrent investigations carried on on board the *Garland* into the food of fishes, their spawning, and the distribution of the young, show that great and important differences—which must be taken into consideration both from a scientific and legislative point of view—prevail among the various food-fishes (Section A).

Dr. Wemyss Fulton, in his paper on the distribution of immature sea-fish and their capture by various modes of fishing, gives the results of the investigations into this important subject. The fundamental question as to what an immature fish is, has been determined for the first time by the examination and measurement of 13,000 fishes. The maximum size (as given in detailed tables) varies very much accordlng to the species; any law regulating the legal sale of fish on the principle of size is therefore not based on scientific data. The distribution differs in the same way, but territorial waters serve as nurseries for the young fish. Tables given show the distribution of immature fishes at distances from the shore up to 22 miles and in various depths of water. Details are also given as to the proportion of immature food-fishes captured by the various modes of fishing. Dealing practically with the wasteful destruction of immature food-fishes, Dr. Fulton points out the difficulty of deciding among the different species, and shows how difficult it will be to save immature fish from capture and destruction by the beam-trawl, as that engine is now employed. The recommendations briefly are: that an inquiry should be made as to the retention of vitality by the various kinds of immature fish brought up in the trawl in order to ascertain the chances of survival if replaced in the sea; the protection of nurseries whose areas are capable of definition; the preservation of flat-fish under a certain size; and the establishment of hatcheries for sea-fish. A simple method is explained by which fishermen and trawlers might add to the fish-supply by fertilizing the ova of ripe fish when captured.

Regarding this Report, it should be noted that the importance of this question is not a thing which has dawned upon the Scottish Fishery Board since the conduct of scientific investigations was placed under new management (that of Dr. Fulton). In this paper, as in many others—indeed, everywhere in this year's Report—the willingness to ignore all that was done during the years that Prof. Ewart was convener of the Scientific Committee is very evident. In the Report of 1887 it is stated that "We have organized a series of extensive and systematic inquiries into the conditions of the reproductive organs of various kinds of fishes throughout the entire year, with particulars as to their size, &c., *which will help to clear up the hitherto obscure problems as to the minimum size of sexually mature individuals, &c.*" We have certain information that the original discoveries which led to this Report on immature fish were made by one who has done more than his share to redeem the work of the Fishery Board. And it is only fair that the credit which is Mr. T. Scott's due, and which is denied him there should be acknowledged here.

Dr. Fullarton furnishes a Report, with chart, on the cockle-beds of Barra (in the Hebrides), which furnishes the chief cockle-fishing in Scotland. It is desirable—and the wish of the fishermen themselves—that means should be taken to prevent the taking of undersized cockles, and to insure the working of the beds in rotation.

Dr. Fullarton also gives a paper on oyster-culture fauna in France and Holland. It is most desirable that scientific and practical measures should be taken to revive the Scotch oyster-fishing, which has gradually declined, and these should be planned on known and tried lines. The same must be said of the cultivation of mussels, and this should be urged even more strongly, as their scarcity or abundance are of the utmost importance to the line-fishermen. Lobsters also call for practical legislation and artificial cultivation. The Fishery Board are constructing a lobster inclosure at Brodwick, Arran, and hope that means will be provided for their carrying on operations at the recently established hatchery at Dunbar.

Section B contains the biological investigations. The food of fishes was dealt with in an elaborate Report by Mr. Ramsay Smith, based upon the examination of many thousand food-fishes which prove to live chiefly upon Crustacea, Annelids, Echinoderms, Mollusks, and upon one another. There are great differences, however, as to the proportion of the organisms selected as food by different fishes, and the proportions of the

[1] "Eighth Annual Report of the Fishery Board for Scotland." Part III. Scientific Investigations.

dietary vary to some extent at different places and at different seasons. These observations will ultimately demonstrate what organisms are valuable as fish-foods and what are not; the proportion in which the various vertebrates compose the dietary of fishes; and the possibility of introducing a valuable food-fish, such as the English sole, in places where it is absent or scarce. They will also show in what way the organisms forming the food of fishes may be protected and improved.

In a Report on the spawning and spawning-places of food-fishes, Dr. Fulton describes the results of the observations made during the year, many thousands of fishes having been examined on board the *Garland* all along the coast, and the duration of their spawning period in most instances determined. The duration of the spawning period varies much in different fish, and in some cases fully-grown adults appear not to spawn every year. The majority of the food-fishes congregate at the spawning time in immense shoals on the east coast at grounds lying from about eight to above twenty miles from shore in what may be termed the extra-territorial spawning zone. The young fishes are not, as a rule, found at the place of spawning, the floating pelagic eggs being carried by the currents chiefly shorewards. Dr. Fulton gives reasons for the belief that the selection of a particular offshore ground for spawning depends upon the set of the surface currents at the spawning season, these carrying the floating eggs during their development to the zones where food for the young fishes is abundant and shelter most readily secured.

Prof. W. C. McIntosh has made an elaborate study of the pelagic fauna of St. Andrews Bay, of which the second part, dealing with the distribution of the invertebrate organisms which form the food of many larval and other fishes, is now given.

Prof. McIntosh has also, in another paper, described the ova of the food-fishes and the larval and post-larval stages obtained in the *Garland's* tow-nets at various parts of the coast. These include the ova or larvæ of plaice, lemon-sole, flounders, dabs, cod, haddocks, ling, whiting, &c., and they constitute an indispensable part of the general study of the reproduction of the food-fishes.

Mr. Thomas Scott, in his valuable additions to the fauna of the Firth of Forth, gives a list of 80 species of organisms, not previously recognized as belonging to that locality. Some of these are for the first time recorded from the east of Scotland; some are new to Britain, and a few new to science. This paper is illustrated by two plates.

Mr. Scott, in his Report on the invertebrate fauna of inland waters, gives the result of the first investigations into the invertebrate organisms present in Scottish lochs and inland waters ever carried on in this country.

Dr. Fullarton's paper on the development of the clam is one which would hardly have found acceptance in any scientific journal. Had text and plates been submitted to the judgment of a skilled investigator, there would have been little or nothing of either for publication, as both display gross inaccuracy. There are many very remarkable statements in this paper, and the author naïvely describes as normal, phenomena whose pathological nature the merest tyro ought to be able to recognize.

Dr. John Beard, in his paper (illustrated by three plates) on the development of the common skate, gives the result of the study of this subject, on which very little has been written, though the skate is one of the most common elasmobranch fishes of our seas. The development of the embryo as it lies within its "purse" at the bottom of the seas occupies probably nine or ten months, being more rapid in summer than in winter. The eggs may be deposited throughout the year, but chiefly in March and April. Dr. Beard furnishes minute descriptions of the egg-cases or "purses" of the various species of skates and rays, and of the various stages in the development of the embryo. He discusses the function of the temporary external gills, so characteristic in advanced stages of development; and, in opposition to other authorities, he gives good reason for the belief that they are purely respiratory in function, and are adapted to the special conditions under which the developing embryo is placed.

Dr. Fulton, in his paper on the proportional numbers and sizes of the sexes among sea-fishes, gives the results of his inquiries, based upon the examination of 12,666 fishes. Females are, as a rule, more numerous than males; the female is also as a rule larger, but the male is the larger among the cod, haddock, and a few other fishes.

Among the "Notes and Memoranda" will be found Mr. Scott's hybridism among fish, the account of ingenious and interesting experiments made on board the *Garland* on the artificial fertilizing of the ova of certain species of sea-fishes with the milt of other species sometimes widely separated zoologically. Dr. Fulton sends interesting notes on the reproduction and migrations of the common eel, and on the presence of anchovies in Scotch waters. Regarding the former paper, it should be remembered that a German zoologist recently obtained a conger-eel at Zanzibar with eggs ten times the size of those here described. There is nothing really remarkable in the reproductive organs of the eel obtained at Howietoun, eels with eggs as large being very often caught. It has usually been estimated that the eel produces five millions of ova. The number is here increased to upwards of ten millions, and the method by which this was counted is not given. There is a lamentable looseness in quoting literature, even that of British zoology. We are told that *Myxine* is a protandric hermaphrodite, and that this was discovered by Nansen. As a matter of fact, the discovery was made by a Scotch naturalist (Cunningham), and within a short distance of Edinburgh. If Nansen's paper had been read as well as quoted, this misstatement would not have been made.

Section C contains notes on contemporary work relating to fisheries in this and other countries. We note that no mention is made, however, of the very important "Plankton" expedition of Germany of last year, which is the more to be wondered at as interesting accounts of the expedition have been published in Germany.

It is much to be regretted that the Fishery Board Bill of last year did not become law. The conduct of scientific investigations might then have been placed in different hands, with the result, among other things, that properly-organized scientific work would have been carried on by a thoroughly competent scientific staff, and the Government grant of £2000 a year usefully and judiciously expended, instead of being, as at present, frittered away because the dominant clique of the Fishery Board do not know what to do with it. The Scientific Department of the Fishery Board needs reorganization quite as much as the Fishery Board itself. Under the control and direction of the leading Scottish biologists, some adequate return ought to be made for the nation's money. To do this, however, the work must be properly planned and directed, and moreover the working of the different investigations given only to men who really understand their subject. Government has been asked, and is asked in the present Report, to furnish increased funds. We hope and believe that the authorities will be wise enough to stay their hand till they can reorganize everything connected with the Fishery Board.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. Love, St. John's, and Mr. Coates, Queens', have been appointed Moderators, and Mr. Wallis, Corpus, and Mr. Burnside, Pembroke, Examiners for the next Mathematical Tripos, Part I.

Mr. L. Fletcher, Keeper of Minerals at the British Museum, and Mr. H. P. Gurney, of Clare College, are nominated Examiners in Mineralogy for the Natural Sciences Tripos.

Mr. H. M. Stanley was, on October 23, admitted to the honorary degree of LL.D.

The following communications were made to the Cambridge Philosophical Society at the annual general meeting on October 27:—The President, the origin and early years of the Society; Mr. C. Chree, on the vibrations of some simple systems; Dr. A. Gamgee, on the principle on which Fahrenheit constructed his thermometrical scale; Mr. H. J. Sharpe, on liquid jets.

The Harkness Scholarship for Women, tenable at either Girton College or Newnham College, Cambridge, is to be awarded triennially to the best candidate in an examination in geology and palæontology, provided that sufficient proficiency is shown. The candidates must be resident members of Girton or Newnham College, in their first or second term. The Scholarship will be of the value of about £35 a year for three years. The next award will be made in 1891. The examination will be held at Cambridge in the Michaelmas Term, and the award will be made on or before November 15, 1891. The intended range of examination is indicated by the following schedule:—General physical geography; such geological phenomena as are matters of common observation; the principal agencies which change or modify the earth's surface and the life on it; outlines

of the stratigraphy of the United Kingdom; outlines of the classification of organized beings, existing and extinct; the commoner rocks and rock-forming minerals, and the commonest and most characteristic British fossils. Candidates must send in their names, on or before October 12, 1891, to Miss A. Johnson, Llandaff House, Cambridge, from whom further information may be obtained.

SCIENTIFIC SERIALS.

American Journal of Science, October 1890.—A description of the "Bernardston Series" of metamorphic Upper Devonian rocks, by Prof. Ben. K. Emerson. With respect to this paper, Prof. J. D. Dana remarks:—"Prof. Emerson has given the region a thorough investigation, in which he has removed the doubts as to the relations of the beds, made out, as far as possible, the system of faults and flexures, studied the rocks as to their kinds and transitions, and determined the age of the series to be Upper Devonian. The paper will be accepted in America, and should be elsewhere, as putting the facts beyond doubt that gneiss, diorite, granite, and the other crystalline rocks described are not always of Archæan or pre-Cambrian make; that granite and diorite are not always of igneous origin; and these conclusions are made sure on the well-established criterion of age, that is, fossils—Crinoids, Corals, Brachiopods."—On the circular polarization of certain tartrate solutions, by J. H. Long. The author describes certain peculiarities of solutions of potassium antimony tartrate, when mixed with potassium or sodium carbonate, acetate, or phosphate in amounts insufficient to produce immediate precipitation. A decrease of specific rotation took place in the case of each of the mixtures. It is probable, therefore, that a temporarily stable antimony salt is formed with a corresponding amount of alkali tartrate. The observed rotation is due to this in conjunction with that of the potassium antimony tartrate which remained unchanged.—A rapid method for the detection of iodine, bromine, and chlorine, in presence of one another, by F. A. Gooch and F. T. Brooks.—Metacinnabarite from New Almaden, California, by W. H. Melville.—On the Keokuk Beds at Keokuk, Iowa, by C. H. Gordon.—Note on the vapour-tension of sulphuric acid, with the description of an accurate cathetometer microscope, by Dr. Chas. A. Perkins. The author finds that the vapour-tension is not greater than about 0·01 mm. at ordinary temperatures.—Experiments upon the constitution of the natural silicates, by F. W. Clarke and E. A. Schneider.—On five new American meteorites, by George F. Kunz. Descriptions and analyses are given of the group of meteorites recently discovered in Brenham Township, Kiowa County, Kansas; the Winnebago County, Iowa, meteorite; the meteoric stone from Ferguson, Haywood County, North Carolina; the meteoric iron from Bridgewater, Burke County, North Carolina; and the meteoric iron from Summit, Blount County, Alabama.—On the determination of the coefficient of cubical expansion of a solid from the observation of the temperature at which water, in a vessel made of thin solid, has the same apparent volume as it has at 0° C.; and on the coefficient of cubical expansion of a substance determined by means of a hydrometer made of this substance, by Alfred M. Mayer.

THE *American Meteorological Journal* for October contains articles:—On cyclical periodicity in meteorological phenomena, by E. D. Archibald, in which he advocates investigations as to the possible connection between weather and other physical agencies, on the following plan: (1) the collection and analysis of all previous investigations which bear traces of any value, and their distribution under the head of the particular element dealt with; (2) the arrangement of the periods in the matter of length; (3) the choice of the particular working hypothesis intended to be employed, and the working out of its supposed effects in different parts of the world; (4) the reduction and comparison of the data representing the various elements, and their comparison with the deductions from the hypothesis; (5) the investigation of the causes of apparent exceptions, and the exhibition of the final results, both in tabular and graphic form.—On accessory phenomena of cyclones, by H. Faye. The author draws attention to the theories of Redfield and Reid, and to the contradictory theories of Espy and Bache, from which he argues that only one conclusion could be drawn, viz. that there were two entirely different kinds of storms and tornadoes; and he refers to the advance made by the study of synoptic charts, both as regards the movements of cyclones and thunderstorms. The article contains an illustration of what he assumes to be a typical figure of a cyclone.—On temperatures in and near forests, by Prof. M. W. Harrington. The author shows that this subject admits of a much less satisfactory solution than that of soil temperatures discussed in an earlier paper. The observations used are from several sources over Central Europe, and refer in this part of the discussion to differences of temperature extremes. They show that the forest cuts off the mean daily maxima on the yearly average to the extent of 2° or 3°; the effect is most marked in summer and least in winter. The action of the forest on the minima of temperature is also a moderating one: the temperature does not on the average fall as low in forests as outside. With long-continued unchanging weather the peculiarities of forest climate tend to disappear.—On the Meteorological Section of the French Association for the Advancement of Science, held at Limoges in August last, by A. L. Rotch. The attendance of meteorologists was not large, but some important matters were discussed, among which may be mentioned the use of self-recording instruments on mountain stations, the subject being introduced by M. Teisserenc de Bort, and a paper on the recent seismic activity of Japan, by M. Y. Wada, of Tokio.

IN the *Journal of Botany* for October is a very interesting biographical sketch, accompanied by an excellent portrait, of the late Mr. John Ralfs, of Penzance, whose classical work, "The British Desmidieæ," one of the most valuable monographs ever published, was brought out as long ago as 1848. The value of this work may be judged from the fact that before its publication the number of species of Desmids recorded as British was four. An interesting note is given on the fertilization of the sugar-cane, by Dr. Fressanges, President of the Medical Society of Mauritius.

THE greater part of the number of the *Nuovo Giornale Botanico Italiano* for October is occupied by the completion of Signor L. Nicotra's interesting and important paper on the flora of Sicily. Going through the natural orders successively, he describes in general terms the representation of the order in the flora of the island, and points out the contrast between the flora of its north-eastern and that of its south-western portion, due to geological causes, the former having more of a European, the latter more of a North African character. Some particulars are added with regard to the flora of the small islands adjacent to Sicily. The remaining articles in the number are of special interest to Italian botanists.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, October 20.—M. Duchartre in the chair.—Study of the movement of a double cone which appears to rise, though it really descends, on an inclined plane, by M. H. Resal. A double cone placed on two guides inclined to the horizon, and nearer to one another at the lower than at the upper end, appears to ascend. The author has studied the mechanics of this movement.—Note on lightning-flashes which meet one another, by M. A. Trécul. On September 29, M. Trouvelot presented a paper on the identity in the structure of lightning and discharges from an induction machine. The author calls attention to the fact that he made similar observations ten years ago.—Observations of Brookes's comet (March 19, 1890), made with the great equatorial of Bordeaux Observatory, by MM. G. Rayet, L. Picart, and Courty. Seventy-one observations for position are given, extending from June 21 to October 12.—Remarks relative to a cause of variation of latitudes, by M. R. Radau. The movements of the sea, as well as certain meteorological phenomena (avalanches, &c.), may give rise to small deviations of the axis of our globe. It is shown that a mass of water 2000 cubic kilometres in size could produce an effect large enough to be observed.—On the established variations in the observations of the latitude of the same place, by M. A. Gaillot. Observations made at Berlin, Potsdam, and Prague, indicate that the latitude of a place is subject to a periodic variation, the maximum occurring in the summer, and the minimum in the winter, the amplitude of the oscillation about the mean value being ± 0″·25. M. Gaillot gives two hypotheses to account for this variation, and points out the means of testing each of them.

They are: (1) the axis of rotation is changed in the interior of the earth, the poles describing a circumference about the mean position, of which the radius is 0″·25 (7 or 8 metres); (2) the accepted periodic variation in observations of latitude is due to refraction phenomena.—Organization of spectroscopic researches with the great telescope of Paris Observatory, by M. Deslandres. (See Our Astronomical Column.)—Two solar prominences observed at the Haynald Observatory, Kalocsa (Hungary), by M. Jules Fényi. On August 15, at 9h. 39m., Paris mean time, a prominence reaching a height of 323″, was observed on the western edge of the sun. Its base extended from +37° 4′ to +44° 58′ heliographic latitude. Another prominence was seen on August 18, at 11h. 45m., between −41° 29′ and −55°. This attained a height of 418″, but was of a much more broken character than the preceding one.—On certain kinds of surfaces, by M. Lelieuvre.—Researches on the atomic weight of fluorine, by M. Henri Moissan. (See Notes, p. 649.)—Action of aromatic amines and of phenylhydrazine upon the β-ketonic nitriles, by M. L. Bouveault. The author establishes the generality of the reaction—

$$R{-}CO{-}C\begin{matrix}R'\\ \\ R''\end{matrix}{-}CN + R'''NH_2 = H_2O + R{-}C(=NR'''){-}C\begin{matrix}R'\\ \\ R''\end{matrix}{-}CN.$$

—On the mode of combination of sulphuric acid in plastered wines, and on a method of analysis permitting the distinction between the amount of the plastering and the acidification of the wine by sulphuric acid, by MM. L. Roos and E. Thomas. It is shown, by experimental means, that the sulphuric acid introduced by the plastering exists in the wine as K_2SO_4, and not as $KHSO_4$; hence, on precipitation of the H_2SO_4 by $BaCl_2$, the whole of the HCl will remain in combination, thus:—$K_2SO_4 + BaCl_2 = BaSO_4 + 2KCl$; and so the titrations of Cl by standard $AgNO_3$, taken (*a*) in filtrate from the $BaSO_4$ made up to a definite volume, and (*b*) in a fraction of the same filtrate evaporated to dryness, and then made up to the same fraction of the definite volume, should be exactly the same if no free H_2SO_4 be present; if free H_2SO_4 be present, a corresponding quantity of HCl will be lost to titration (*b*).—The saccharine matters in mushrooms, by M. Em. Bourquelot.—On the excretory apparatus of *Palinurus vulgaris*, *Gebia deltura*, and *Crangon vulgaris*, by M. Paul Marchal.—On the primitive conformation of the kidney of Pelecypodæ, by M. Paul Pelseneer.

STOCKHOLM.

Royal Academy of Sciences, October 8.—On the spectrum of absorption of bromium, by Prof. Hasselberg.—On the development of the Orthagoriscæ, by Prof. Smitt.—A report on entomological researches in the south of Sweden and Denmark, by Prof. Aurivillius.—Microscopical structures represented in coloured figures, which had been photographed by the firm Lumière, at Lyons, exhibited by Prof. Gyldén.—On the properties of a combination between nitrogen and hydrogen (HN_3) (discovered by Prof. Curtius, in Kiel), which in its free state, as well as in its combinations, has a most remarkable analogy with the hydrogen combinations of the haloids, and in consequence thereof has been named hydrazoic acid, reported upon by Prof. Nilson.—Studies of the crystal form of the arsenopyrite, by Dr. Weibutt.—Studies of naphthalene derivatives, by Dr. Paul Hellström.—Some observations on the anatomy of the subterranean elongations of the Gramineæ, by the same.—On the occurrence of *Dictyophyllum Nilssoni*, Brongn., in the coal-bearing strata of China, by Prof. Nathorst.—On Ribaucour's cyclic system, by Prof. Bäcklund.—Derivatives of ethylidendisulphon-acids 1, and on 1, 4 fluor-naphthalin-sulphon-acid, by Herr Mauzelius.—Contributions to the knowledge of the moss flora of Canada, by Lector N. C. Kinberg.—Contributions to the theory of infinite determinants, by Herr H. von Kock.—On the conductibility of electricity through hot, saline vapours, by Dr. S. Arrhenius.

DIARY OF SOCIETIES.

LONDON.

SUNDAY, NOVEMBER 2.

SUNDAY LECTURE SOCIETY, at 4.—The Order of Nature—its Relation to Human Life and Happiness: A. Elley Finch.

MONDAY, NOVEMBER 3.

ROYAL INSTITUTION, at 5.—General Monthly Meeting.

TUESDAY, NOVEMBER 4.

ZOOLOGICAL SOCIETY, at 8.30.—On the Indian Gaur and its Allies: W. T. Blanford, F.R.S.—Description of a New Squirrel from the Philippine Islands: Dr. A. B. Meyer.—On a Cervine Jaw from Algeria: R. Lydekker.—Note on the Skull of the East African Reed-buck (*Cervicapra bohor*): Dr. A. Günther, F.R.S.

WEDNESDAY, NOVEMBER 5.

ENTOMOLOGICAL SOCIETY, at 7.—African Micro-Lepidoptera: Right Hon. Lord Walsingham, F.R.S.—A Monograph of British Braconidæ, Part IV.: Rev. T. A. Marshall.—New Species of Moths from Southern India: Colonel Charles Swinhoe.

THURSDAY, NOVEMBER 6.

LINNEAN SOCIETY, at 8.—A Contribution to the Study of the Relative Effects of different parts of the Solar Spectrum on the Assimilation of Plants: Rev. Prof. Henslow.

CHEMICAL SOCIETY, at 8.—The Magnetic Rotation of Saline Solutions: Dr. W. H. Perkin.—Note on Normal and Iso-propylparatoluidine: E. Hori and H. F. Mosley.—The Action of Ammonia and Methylamine on the Oxylepideus: Dr. F. Klingemann and Dr. W. F. Laycock.—Condensation of Acetone Phenanthraquinone: G. H. Wadsworth.

FRIDAY, NOVEMBER 7.

GEOLOGISTS' ASSOCIATION, at 8.—*Conversazione.*

SATURDAY, NOVEMBER 8.

ROYAL BOTANIC SOCIETY, at 3.45.

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