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THE GEOLOGIST AS GEOGRAPHER.

North America. (The Regions of the World Series.) By Prof. Israel C. Russell. Pp. viii + 435; 7 coloured maps and 39 other illustrations. (London, Edinburgh, and Glasgow: Henry Frowde, 1904.) Price 7*s.* 6*d.* net.

THE geologist might well rest content with the usefulness of his science even if its only harvest were the revolution which it has wrought in man's conception of his mundane surroundings as expressed in the new geography. It may be that here and there the geographer still lingers who is satisfied to bound his ideas at the surface of things and to lose hold of reality in his dream of eternal seas and everlasting hills. It is true that the old geography still persists in children's school-books as ancestral customs still linger in children's games, and that the delineation of county boundaries and the names of obscure villages are still drilled painfully into the youthful mind as essentials of earthly knowledge. But the antique trammels have at least been loosened; and not in the Americas only is it that a new world has been discovered by the geographer.

We could not wish for a better exemplification of new spirit than may be found in the lucid description of a great continent which lies before us. Prof. Russell quotes with approbation the saying that "geography is the geology of to-day," and throughout his book we are made to feel that in its every aspect the present condition of the land is the evanescent expression of all preceding time. It is not without cause that "prehistoric" time is relegated, in his chart on p. 309, to the period preceding the Archæan, and that from the beginning of geological evidence he regards all time as historic.

To the geologist the sea is only land inconveniently covered by water, and we are therefore prepared to find that Prof. Russell's idea of the North American continent is not bounded by the coast-line, but includes the submerged "continental shelf." The first chapter of his book deals with this shelf, its structure, its river valleys, its marine life and its geological history, with that of the land margin by which it is bounded.

Then, in chapter ii., the topography of the land is described under the broad headings of (1) coastal plains and plateaus; (2) Atlantic mountains; (3) continental basin; (4) Pacific mountains; (5) Antillean mountains. This part of the book is vitalised by the author's wide personal knowledge of the continent, gained in the service of the U.S. Geological Survey, and by his keen sympathy in wild nature. With vivid touches of description, sure and true, and free from the cloying sentiment by which such attempts are too often overclouded, he brings before us the feeling aroused in him by the varied scenes of the wide continent. There are many passages which we should have liked to reproduce, but, lacking space, we must content ourselves by referring, as examples, to the bird's-eye view of the prairie plains (p. 97); to the expression of their straining monotony (p. 103); to the sketches of the fantastic Bad Lands (p. 111), of the glorious summits of the Californian Sierra (p. 151), and of the dense forests around Puget Sound (p. 240).

The third chapter deals with the climate of the continent, and, like every other part of the book, goes back to first principles in the course of the exposition, so that the untrained reader may gather much general as well as special knowledge by a studious perusal of it. We imagine that if the writer had been a Canadian his southern boundary for the "boreal zone," as shown on the map, plate iii., would have been somewhat differently arranged, and that it would not have included Vancouver Island and the coast of British Columbia, nor have divided Manitoba from the greater part of North Dakota. The description of the agriculture of this zone is contained in the following sentences:—

"On account of the low mean annual temperature [of the northern portion of the zone], and especially because of the shortness of the growing season, agriculture is of small importance. Along its southern border, more especially in south-eastern Canada and Newfoundland, such small fruits as currants, huckleberries, raspberries, blackberries, cranberries, &c., grow wild and yield abundant returns when cultivated. In favoured localities white potatoes, turnips, beet, and certain varieties of the apple, as well as the more hardy cereals, are cultivated with moderate success" (p. 202).

As practically the whole of Canada, except small portions of the south of Ontario and Quebec, is relegated to this zone, the above statement is decidedly inadequate. We notice also that in the margin of the map referred to there is a letterpress indication to symbols which are not visible on the map.

The plant life of the continent is described in chapter iv., wherein the characteristic features of the great forests, the cactus plains, the treeless prairies, the sage-brush lands, and the Arctic tundra are in turn presented. In this part we recognise that the author shares the repugnance felt by every good American to the term "desert" as applied to the arid lands of the western States. So, in the map which forms the frontispiece to the volume, all the sage-brush and cactus country is swept into the "grassland" division, to which term, however, the qualification, "partly with Scrub, &c.," is added in the index. Yet, even allowing for the potential irrigation of limited oases in the future, there are vast stretches that must remain, as at present, worthy only of the name of desert, and such herbage as they have is desert-herbage. In concluding his account of the plant life, the author refers briefly to the slow migration of forests under geological changes of climate by which nature, like a careful husbandman, secures a rotation of crops.

"The suggestion in this connection furnished by geologists is that we are living in a spring-time following the great winter, known as the Glacial epoch, and that the tropical, temperate, and subarctic forests are migrating northward in an orderly march, and each in turn ascending higher and higher on the more lofty mountains" (p. 257).

The discussion of the animal life occupies another chapter (v.), and here we are given a succinct account of the life-regions and life-zones, with lively descriptions of the best known representative mammals, in which again it is shown that America is or was blessed by the abundance of large herbivores and the rarity of dangerous carnivores. And how ill she deserved the blessing is also shown.

As for the birds, why!—"when one attempts to write an account of the birds of North America, the heavens seem darkened with such a multitude of varied and beautiful forms and the air filled with such a discordant clamour mingled with the sweetest of music that failure to convey an adequate idea of the countless numbers and diversity of the feathered throng within the compass of a few pages must be recognised from the start"!—wherein, somehow, we feel that The Eagle, for once, has flapped his wings.

Chapter vi., describing the geology of the continent, is the longest in the book. It claims, and defends the claim, that North America should be regarded as "the most typical" of all the continents by reason of its comparatively steady growth from one main nucleus and the resultant simplicity of its general structure. An outline of its evolution from the earliest recorded time is presented, with the inevitable incidental exposition of the fundamental principles of geology; the relation of the past to the present is clearly brought out; and the mineral resources of the continent, but more especially of the United States, are somewhat fully reviewed.

Then follows a chapter (vii.) on the aborigines, in which the author guardedly agrees with Powell "that the primordial occupancy of the continent antedates present geographical conditions, and points to a remote time which can be discovered only on geological and biological investigation" (p. 357), and he states the lines of evidence which have led to this provisional conclusion. The sad history of the outcome of the European invasion upon the original inhabitants, whether Eskimo or Indian, is briefly retold, and it is acknowledged that the Canadian Government has been less unsuccessful than that of the United States in its dealings with the natives; but the whole record is pitiful.

It is mentioned in the preface that much curtailment was found necessary in the treatment of the economic phases of geography, and in a foot-note, reference (p. 408) is made to the omission, through exigencies of space, of chapters that had been written on the geography of fisheries, forestry, mining, commerce, agriculture, &c. As it stands, the book is so full of information that he will be indeed a hardy reader who can assimilate all that is provided and still desire more. The volume concludes with a short chapter (viii.) on political geography, and in the foot-note already referred to it is explained that space has been found for this part "for the reason that it presents a view of political adjustments not usually taken and in a way perhaps pessimistical, which may awaken opposition." The different kinds of political boundaries to be found on the continent are then considered, and a lament is raised that so many of the boundaries should be arbitrary where the conditions were so favourable for an ideal subdivision of territory. Here once more the wings of The Eagle are spread. The essential conditions of an ideal nation are defined (p. 421)—conditions that naturally find their fulfilment in the United States. Then (p. 423):—

"In North America, perhaps, several such eligible sites for a definite number of people might be chosen, but in no case without the drawing of unnatural boundaries. The continent, as is shown by its geology and geography, is a unit, and the most typical of comparable size of any on the earth. These same conditions point to a single political unit. Arguing from geographical relations simply, and not considering the racial differences and local self-interests, the one boundary in North America should be the shore boundary, except at the 30-mile-wide Isthmus of Panama."

In illustration of this chapter, a coloured map is given, showing in vividly contrasting pink and blue the areas respectively under "two radically different principles of government—the monarchical and the republican," or "the countries self-governed" and "those still acknowledging allegiance to hereditary rulers."

But surely there is a touch of unscientific prejudice in the insistence upon this distinction. Is not the Government of Canada to all intents, except in name, as purely democratic as that of the States—nay, is it not even more democratic when we take count of the political state of the negroes, the Indians, and the Chinese immigrants south of the border? And shall San Domingo and the Central American "republics" bear the colour of Freedom on the map which is denied to the Dominion?

Throughout the book we find that the author is at his best when describing those portions of the continent which lie within the States, but this is pardonable, or even commendable, since he is thus the better able to give the acceptable tinge of personal experience to his descriptions. Nevertheless, it is probable that Canadian geographers will feel that the background of the picture is sometimes a little out of perspective. Certainly they will object that the name of their charming mountain-resort Banff should be spelt *Bamf* (p. 126). G. W. L.

TWO METHODS OF DEFENDING FREE TRADE.

The Return to Protection. By William Smart, M.A., D.Phil., LL.D., Adam Smith Professor of Political Economy in the University of Glasgow. Pp. x+284. (London: Macmillan and Co., Ltd., 1904.) Price 5*s.* net.

Free Trade. By the Right Hon. Lord Avebury, P.C. Pp. x+164. (London: Macmillan and Co., Ltd., 1904.) Price 5*s.* net.

NOW that everyone has made up his mind as to the advisability or not of an alteration of our fiscal policy, and the question is relegated to the

political arena to be settled by political methods, it seems unnecessary to recapitulate arguments which should be familiar, and we may be content to refer readers to Lord Avebury's "Free Trade," where they will find two chapters of the "Essays and Addresses" recently reviewed in NATURE expanded and brought up to date. In it are many illuminating, if familiar, statistics and telling arguments for use by the convinced free trader; but it is not likely that a tariff reformer will be influenced by these, for it is quite obvious that his case is neither understood nor met. It is no use to repeat that we have progressed wonderfully since 1846, when the whole argument of the reformer is that the continuance of this progress is threatened. It is quite time that free traders realised that a picture of the distress prevalent in the 'thirties does not carry conviction to those who say that free trade has been good, but there are now changed conditions and a better way. This position is not essentially absurd, and Lord Avebury's arguments, loose and inconclusive as they are in many cases, will not affect it.

On the other hand, no tariff reformer can afford to neglect Prof. Smart's argument. It would not have been surprising if, after fifty years' almost unquestioned acceptance in Great Britain of the principle of free trade, those to whom it had become axiomatic had been found unprepared to meet a sudden attack from new quarters, and with quite unusual weapons. It would be idle to deny that the attack has been sharp, that the defenders have learnt much, and that economic science has benefited by the examination, revision, and modification of its doctrines. No one can now speak on the subject of foreign trade or tariffs without a careful analysis of the possible effects of the sudden changes artificially introduced by the policy of foreign nations or of combined capitalists. Prof. Smart is one of those found ready to meet the attack, and tariff reformers will find it difficult to move him or the readers of his book except by the hard blows of rigid and convincing logic.

For future readers there is a delightful note in the preface that the book "was written during the universal discussion which accompanied and followed Mr. Chamberlain's propagandism of Preferential Tariffs, and Mr. Balfour's advocacy of Retaliation." It may be hoped that the implied prophecy will be fulfilled, and that the book may occupy a permanent place as the best statement of the case for free trade in 1904. Perhaps because Prof. Smart was "a Free Trade manufacturer in this country, and a Protected manufacturer in the United States," before he became a teacher, his writings are always marked by a simple practicalness as well as by lucid reasoning. There is an almost complete absence of the use of technical terms, but without them it is found possible to disrobe arguments in favour of this or that modification of freedom of trade of their speciousness, and to show exactly in what circumstances they are true. Prof. Smart finds the most deeply rooted reason of the very general (foreign) approval of protection in the idea that "the continued existence of a nation, as a nation, depends on its finding employment for its own people." No proof has ever been offered either from theory or statistics that protection regularises the demand for labour, whether permanently by stereotyping an existing division of labour, or temporarily by diminishing the amplitude of the fluctuations related to the periodic ebb and flow of commercial credit. It is true that when an industry is well established, capital invested and labour specialised, much temporary loss may ensue if a sudden artificial diversion of the channels of trade is made, and it often appears that this might be met by protection; and it is certain that a sudden removal of protective barriers, already existing, would be disastrous. Backed by such reasoning, there is always a strong minority in favour of protection, just as there used to be strenuous opposition to the introduction of machinery, while the uncombined majority of consumers is often mute. This line of argument at best supplies a case for specific and temporary protection, and is completely dealt with by Prof. Smart when he shows that as a matter of history it has not proved possible to restrict protection to any point that economic science might assign.

"When a Government once adopts the protectionist faith, it is driven by force of circumstances, not to select and categorise, but to tax everything; and when it tries to let in some things free, or at a reduced rate, is met with a storm of opposition from hundreds of vested interests."

Without assenting to or denying the plea that protection can be advantageous in some cases, it is shown that practically vested interests are established, and that science gives way to political exigencies, a condition in which the pushful and unscrupulous succeed better than the deserving.

The treatment of the possibility and use of retaliation is marked by similar appreciation of the reasons alleged in its favour, and practical examination of its difficulties in detail. In the absence of any specific proposals, it is always open to a retaliator to say that the plans analysed are not the ones in question, but most of the possible cases are considered, and the special difficulties in England's way are shown.

"So far as I can see, the only part of Retaliation for which we are prepared is the threat of it. So great is the power of the British Lion's roar that it even seems enough to show that he is opening his mouth ominously. Suppose the other beasts of the forest do not fall down and creep to his feet, what then? Would it not be better to change his mind? It will scarcely be dignified to pretend that he was only going to yawn."

Prof. Smart admits the possibility of dumping, but considers that its extent is much exaggerated, that in the nature of things it is temporary, and that there is no practical remedy. The reader is left with the impression that a remedy would not be refused on any pedantic grounds if a strong case were made out. The absence of pedantry, and the broadness of view which marks the whole book should make it at the same time of great service to the hot-headed free trader, and a not disagreeable corrective to the tariff reformer who is not too sure of his ground. A. L. B.

PLACE-NAMES OF SCOTLAND.

Place-names of Scotland. By James B. Johnston, B.D. Second edition. Pp. cxi+308. (Edinburgh: David Douglas, 1903.) Price 6*s.* net.

THE author of this work aims to do for Scotland what Dr. Joyce in his "Irish Names and Places" has already done for Ireland. It is a laudable attempt and one that is full of interest. Not only do we get here an alphabetical list of a large number of the place-names of Scotland, with explanations of their origin, but introductory chapters dealing at some length with the different sources from which have sprung the characteristic names of North Britain. Thus Mr. Johnston gives an account of the Celtic, Norse, English, Roman, Norman, modern, and ecclesiastical names, aiming to make his treatment of the subject no mere dilettante trifling, but a work based on historic evidence. He has in many cases ransacked old books and documents to get the older forms of the words as a guide to their original meaning, and this is really the most valuable part of the task he has undertaken. Had he consistently followed out his own principles enunciated in the introduction, his work would have been of a much higher order and free from the defects which too obviously encumber it. As it is, many of his derivations are quite as fantastic as the "mouth-esk-burgh" for Musselburgh, which by the laws of phonetics he solemnly rejects.

The real reason for the inequalities which even a second edition of the book, after twelve years' interval, has failed to remove is the author's inadequate acquaintance with the Gaelic language. As he admits himself, the Celtic names constitute the largest and most complicated portion of his task.

"The Celt's warm, emotional heart loved to seek out the poetry and colour in the world around, and many of his place-names show that 'stern nature was his daily companion, and friend.' Indeed, the majority of Celtic names give either the simplest possible description of the site named, or describe some prominent feature, or else the colouring or appearance of it as it strikes the eye."

In view of this, it is obvious that a thorough knowledge of the original language spoken in the country, as well as of the topography, is essential to the writer who would adequately discuss the meaning of the place-names; without it there must necessarily be much juggling with words.

If Mr. Johnston really knew the Celtic laws of aspiration and eclipsis, he would never say that the Gael loves to speak of the "Shawms of David," nor would he, when deriving Nairn from G. an earrann, find it necessary to suppose that Auchenairn must be Auchencairn through loss of c. Clachnaharry is clach na h'aire, "stone of watching," and yet he cannot think what Altnaharra is unless allt-na-charraigh, "stream with the pillar or rock," or from marbhaidh, "of the slaughter."

Allt, which is a streamlet passing through a ravine, he interprets sometimes as a glen or river. Kil, so common in the place-names of Scotland, becomes at one time cill, church, at another caol, narrow, again cul, back, and yet again coille, a wood, in the most arbitrary fashion. Auchter suffers in the same way, being uachdar or achadh just as suits his fancy. Take the three words ending in ellan. Killellan, we are told, is "church of St. Fillan," Inellan, en eilean, "bird-island," Balmaclellan, "village of John Maclellan." On the same principle Balmaghie becomes in this book "village of Macghie," whereas it more probably means "wind-swept town," like Tonderghie, not far away from it, which means "back to the wind." Another form of the word, Balmuchie, ludicrously appears as "the house or farm of swine." Banavie, he says, is probably not the "Vicus Bannavern" of St. Patrick's birth; why *probably* in a matter so entirely certain by every form of evidence?

Mr. Johnston says "every 'ness' is Norse, this being the Icel. nes, Dan. Naes, a nose," and he admits that it may be traced in names like Stromness and Deerness. Yet when he comes to Alness he has recourse to the extraordinary derivation G. ath'n-innis, "ford of the island" (the Black Isle). It would indeed take as violent a stretch of imagination to suppose that the Cromarty Firth was fordable at Alness as to imagine that Rogart means "red enclosure," "from the Old Red Sandstone here." As a matter of fact there is no Old Red Sandstone there, only granite. But these derivations are no less ingenious and far-fetched than that for Belleville, near Kingussie, which in a footnote Mr. Johnston says is in G. bail-a-bhile (*sic*), "village at the brae-top." Who with any claim to Celtic literary knowledge does not know that Belleville is the name which James Macpherson of Ossianic fame gave to the house which he built in the eighteenth century, thus superseding the former name of the place, which was called Raitts? No Highlander would translate allt grad as "*ugly* burn," or write achadh *tuas* for "field above" as the derivation of Auchtose. Ptolemy in his ancient map did not apply the name Varar, as here alleged, to the Moray Firth, but to the estuary of the Farrar, now the Beauly.

Many of the most beautiful ancient names in the country, such as the names of farms, little hills, lochs and rivulets, as well as hundreds of names beginning with prefixes such as tigh, allt'tobar, Ceann, Cnoc, &c., are left wholly untouched. One wonders on what principle the author selects some of the names he inserts and omits others. There are not more than about 500 names worthy of note in his own county of Stirling, he says. Why! there are almost as many in many a parish.

Yet for all its defects Mr. Johnston has written a book which is a good foundation for a better, and will have a fascination for a great many people, and it is quite true, as he says, that the historian, the philologist, the antiquarian, and the anthropologist will, each and all, find in it sidelights both helpful and interesting.

AN IMPRESSIONIST TEXT-BOOK OF PAPER MAKING.

Chapters on Papermaking. Vol. i. By Clayton Beadle. Pp. 151. (London: H. H. Grattan, 1904.)

THERE is a "mission" for science in relation to industry which is to re-infuse into its reiterated routine operations that measure or kind of interest which we know as "intelligent." Our factory workers are not the craftsmen of the past centuries; division of labour makes this difficult, and in many cases impossible. But though shut out from the "joy" of the craftsman, and far removed from that higher order of appreciation which makes the craft of the Oriental a part of his religion, our workers can cultivate an intelligent interest in their work. The book before us is directed to this particular aim, and is especially justified in regard to the art of papermaking, not only because modern papermaking is in all essential respects based on the ancient craft, but the various operations are interdependent on such obvious lines that whatever particular section of the work a man may be engaged in, he can easily acquire and keep an intelligent grasp of the whole.

The book may be described as a series of studies of special points, largely and evidently such special points as have from time to time challenged the interest of the author in the course of his occupation as chemist to one of our oldest and most important paper mills. There is no essentially logical sequence in these studies, but we agree with the author that there is no occasion to multiply routine text-books. It is obvious, therefore, that there is no call to read the chapters in any particular order. The subjects treated may be briefly summarised as follows:—Raw fibrous materials and cellulose; bleaching and general view of the chemistry of the operations; the whole question of the function of water in relation to the manufacturing operations, as well as the physical and chemical points involved in the relation of water to the celluloses; paper in relation to the entire range of its applications, and the destructive agencies which it is required to resist and survive.

In dealing with these subjects the author follows the original method, that is, he develops his theme largely by original observations and investigations, trusting to the particular perspective of his own experience to give the subject-matter its cohesion. The result is quite satisfactory. There is room for contributions of this kind.

As a particular illustration of the author's methods, we may mention the statistical discussion on pp. 90–93 of the total contribution of basic matters in working up a rag pulp, both engine sized (resin) and tub sized (gelatin and soap), in relation to the sulphate of alumina required to be used. This subject might be very much extended to involve many of the most interesting developments of modern chemical science, *e.g.* the ionisation of salts and the peculiar functions of the organic colloids in relation to electrolytes in solution. There is no doubt that the reactions in the beater will not be understood until studied in relation to these questions.

In a discussion of the theory of the bleaching process, the author returns to some questions arising in the study of one of the systems of electrolytic bleaching, which was based upon the circulation continuously of the electrolysed ($MgCl_2$) solution between the electrolyser and the potcher. There is no doubt that this condition gives an unexpected maximum of bleaching efficiency, possibly because energy may be carried in some particular forms not necessarily expressed in the simple oxidising actions of the solution, as, *e.g.*, on HI or As_2O_3. In this connection it is to be noted that Brunck advances a similar hypothesis in relation to ozone and its oxidising reactions (*Zeitsch. angew. Chem.*, 1903, p. 894).

Further, according to the specification of recent patents (Schuckert), the addition of certain organic compounds, more particularly resin (soda resinate), to a solution of an alkali chloride to be electrolysed enables a very much higher concentration of "bleaching chlorine" to be economically worked. Certainly there are points here which should attract investigators to a re-examination of the phenomena.

On the general question of bleaching actions, the author is somewhat discursive, and there are one or two inaccuracies and omissions in small but not less essential points. Thus, on p. 90, the reaction of sodium sulphite as an "antichlor" is stated to add to the alkalinity of the pulp. The normal sulphites in oxidising to the normal sulphates do not affect the balance of alkalinity. In cases where potassium iodide is decomposed by a paper, *i.e.* by a constituent of the paper, with liberation of iodine, the methods of Wurster should certainly have been imported into the investigation. The investigations of Russell should have been noticed, and the subject connected with the general question of autoxidation.

We mention such points to show that the methods of the author are suggestive rather than exhaustive, and paper mill chemists especially will find these lectures full of matter to set them thinking, observing, and in turn investigating a number of phenomena which they might otherwise neglect or pass over.

We apply in conclusion the text which opened this brief review:—There is the human side even to the highly competitive production of modern times, and authors who contribute to this aspect of industry, and notably to the pleasure of the worker, are deserving of the particular encouragement of a large circulation.

THE DEVELOPMENT OF THE HUMAN BRAIN.

Die Entwicklung des menschlichen Gehirns wahrend der ersten Monate. Untersuchungsergebnisse von Wilhelm His. Pp. iv+176. (Leipzig: S. Herzel, 1904.) Price 12 marks.

THIS work, as its title indicates, deals with the development of the human brain during the first four months. Half of the book, on the development of the cerebral hemispheres and the origin of the intramedullary tracts, is original matter, and continues the work already commenced in 1890 by the author's paper on the organisation of the medulla. The re-

maining half of the book deals with the early histogenesis of the nervous system, and is practically a recapitulation of the author's previous results, all, however, carefully re-studied in the light of additional material, and copiously illustrated with original photographs.

Apart from its scientific value, for which, indeed, the author's name is a sufficient guarantee, the book is a striking testimony to the debt neurology owes the late Prof. His, for not only is the entire work, comprising practically all that is known of the development of the human brain, based on the author's own observations, but most of the facts here described owe their first explanation to Prof. His.

In the introduction, the author briefly describes his methods, chief of which is his "graphic reconstruction," originally described by him in 1880, the only difference being that photographs of serial sections are now used instead of drawings. Following this is a tabular statement of the embryos used, and a discussion of the difficulties of age estimation, and the introduction closes with an earnest appeal for systematic measurements of all prematurely born embryos at gynæcological institutions.

The first portion of the book deals with the development up to the close of the first month, and commences with an account of the author's myelospongium, which, in opposition to Koelliker, he believed to be a syncytial network formed by the union of outgrowths from the spongioblast cells.

The author originally held that connective tissue cells took part in the formation of the definitive neuroglia, and especially that this was the mode of origin of Deiter's cells; in the present work, however, he agrees with the majority of neurologists that the original neural plate is alone concerned in the formation of the supporting tissue.

The author's "Keimzellen," as he showed in 1891, form both nerve cells and glia cells, and, as Schaper maintained in 1897, they are merely undifferentiated cells of the myelospongium in active multiplication, not, as the author originally supposed, a special form of cell to be distinguished from all other cell-elements in the neural plate.

The author gives a brief criticism of recent papers in opposition to the neurone conception, on behalf of which, it will be remembered, Prof. His was one of the first advocates; in particular he deals with Bethe's paper of 1903, in which the nerve is made to arise from a linear syncytial cell series which also later forms Schwann's sheath; His shows that Bethe is really dealing with the mesenchymatous sheath, which in the lower vertebrates, *i.e.* chick, appears very early; in man, as His's photographs clearly show, there is no possibility of confusing the growing end of the non-medullated nerve bundle with the surrounding tissue, and especially is this the case with Meynert's "fremdartiger" strands, as these grow into regions of the myelospongium practically free from cells. This portion of the book closes with a full description of the neural tube of an embryo at the end of the fourth week, "Embryo N" already described in previous papers.

The second portion of the book deals with the development of the cerebral hemispheres, and commences with a description of the author's well-known models; this is followed by a detailed account of the histogenetic differentiation of the hemispheres up to the close of the first month, and is illustrated by numerous exceedingly clear photomicrographs. A few pages follow on the blood vessels of the fore-brain. The last twenty-five pages deal with the origin of the intramedullary tracts.

The whole book is written expressly for the professed neurologist, and abounds in tabular statements, references to individual embryos, and so forth; but there is much, especially in the earlier parts of the book, which is also of interest to the student of general morphology, and it is on behalf of such students that we could wish the numerous excellent photographs of brain sections had been provided with reference letters.

No bibliography accompanies the book, a want duly apologised for in the preface. It should also be noted that, as indicated above, the whole development of the brain is not dealt with; in the author's words,

"Ich theile mit, was mir mehr oder minder abgeschlossen vorliegt. Die Zwischenkapitel hoffe Ich, falls mir Leben und Arbeitskraft bleiben, in absehbarer Zeit zu können."

All zoologists will regret that this hope is not destined to be fulfilled. G. C. C.

THE TURBELLARIA AS PARASITES AND PARASITE-CARRIERS.

Die Turbellarien als Parasiten und Wirte. By L. von Graff. Pp. vi+65. (Graz: Leuschner und Lubensky's Universitäts-Buchhandlung, 1903.) Price 14.50 marks.

PROF. VON GRAFF'S latest work dealing with the Turbellaria is no less interesting than any of its predecessors, and students of parasitology must stand greatly indebted to him for putting together in such an accessible and stimulating form a full summary of all that is at present known of parasitism amongst the Turbellaria. The first half of the work is devoted to an account of the anatomy of six species of parasitic rhabdocœls. Although all of these have been previously described by von Graff himself, or by other writers, the ampler accounts here given clear up many doubtful points and supply precise information not hitherto available on various anatomical features. This part of the work is illustrated with three plates of great excellence.

The second part is devoted to considerations of a more general character. It includes a list of all known Turbellaria which have adopted a parasitic or commensal habit Amongst them von Graff distinguishes four principal grades of parasitism, namely, (1) occasional commensalism; (2) ectoparasitism; (3) occupation of some chamber in the body of the host which communicates with the exterior; and (4) endoparasitism. The author points out that the effects of parasitism of the second and third grades do not pro-

duce any very marked results on the parasite. The development of organs of adhesion is not greater than in the free-living species. Eyes may or may not be present, and the size of the pharynx varies with the species. The character shared by the largest number of representatives of these groups appears to be the loss of cilia, especially on the dorsal surface. There is hardly an indication of that increase in size of the genital glands so conspicuous in endoparasitic forms where the eyes and adhesive organs are frequently absent, the pharynx and nervous system much reduced, whilst the body, on the other hand, is invariably completely ciliated. As might be expected, the number of families represented in grades (2) and (3) is greater than the number of those which contain endoparasites; the majority of the latter belong to the Vorticidæ. The hosts most affected by parasitic Turbellaria are holothurians, crustacea, and mollusca. Other echinoderms, worms, tunicates, and vertebrates are also preyed upon to a lesser extent.

Von Graff makes some interesting comments on the classification of the platyhelminthes. The species of the genus Temnocephala usually regarded as transitional forms between the Turbellaria and monogenetic trematodes might, he points out, be referred with equal justice to the vorticid genus Derostoma. Again, Fecampia, when sexually ripe, agrees in characters of systematic importance with the cestodes. In fact, "the more thorough our knowledge of the platyhelminthes becomes, the more difficult it is to define the classes of the phylum. But just as so-called bad species are of value to the student of evolution, so these 'bad classes' of the flat-worms supply him with arguments which are the more convincing in that they rest on the sure ground of ascertained morphological facts."

The work concludes with a useful list of the very numerous parasites with which the Turbellaria themselves may be infected. These range from symbiotic algæ and bacteria to trematodes and nematodes. It is curious that the first recorded orthonectid, found by Keferstein in *Leptoplana tremellaris* thirty-five years ago, has not yet been adequately described. It differs considerably from the other orthonectids noticed since then.

F. F. LAIDLAW.

OUR BOOK SHELF.

Applications of the Kinetic Theory to Gases, Vapours, and Solutions. By W. P. Boynton, Ph.D. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1904.) Price 7*s.* net.

THERE are probably few mathematicians who can follow the long and difficult investigations by which it has been attempted to dispense with the second law, and to represent thermodynamical properties of matter as the changes which must necessarily take place in a molecular system for which the principles of dynamics and the laws of probability are assumed to hold good. Such attempts have been found practically in every case to involve some *further* assumption, whenever a kinetic theory has been applied to the consideration of irreversible phenomena, and Mr. Burbury has unearthed this inevitable assumption when it has escaped the attention of writers of several recent papers. It is probably as impossible to build up an irreversible thermodynamical system out of reversible dynamical elements without any assumption as it is to build up a Euclidean geometry without some axiom of parallels.

But apart from such considerations as this, a kinetic theory is of considerable use to the ordinary physicist in furnishing him with a mechanical representation of the properties of matter in its various states. Dr. Boynton has taken as his standard the requirements of a reader who is familiar with the elements of the calculus, and he has produced a book which will be of great value to students both of physics and of chemistry.

It is perhaps unfortunate that those English physicists who are most competent to write books like the present one are usually too much tied down by other duties to undertake such work, especially as the task is in most instances an unprofitable one to the author. It is therefore satisfactory to find that Dr. Boynton's book is written so much on the lines of an English text-book that it seems well suited for introduction into this country. The features which we particularly like are, firstly, that the author is careful to give his readers no excuse for believing he has proved a result when he has only given an elementary investigation of it, and secondly, that instead of introducing irrelevant philosophical digressions or views of his own, he has kept strictly to an exposition of commonly accepted theories.

It is much to be wished that the same could be said of all the books which find their way into our class-rooms from the other side of the water. It is because they do not generally come up to the present standard of excellence that the difficulty of writing English text-books that are worth writing is to be regretted.

G. H. B.

Handbuch der Physik. By Dr. A. Winkelmann. Second Edition. First part of vol. iv., Electricity and Magnetism. 140 figures. Price 12 marks. First part of vol. vi., Optics. 170 figures. Price 14 marks. (Leipzig: Barth, 1904.)

EVERY student of physics will share the satisfaction of the editor of this treatise that a second edition was called for so soon; for he has found it to be an indispensable storehouse of expert knowledge in all branches of the subject, and the need for another edition enables it to be brought once more abreast of the rapidly advancing tide of knowledge.

The book is of the nature of an encyclopædia, for each section is written by an expert in the section; twenty-two of the leading physicists of Germany collaborate in this way with Dr. Winkelmann, the editor, in its production. Of the two parts before us, that on electricity and magnetism is contributed by Drs. Graetz and Auerbach, while the part on optics is the work of Drs. Czapski, von Rohr, and Eppenstein.

References are brought up to the middle of 1902. Thus amongst electrical instruments the Dolezalek electrometer finds a place; the large amount of recent work on the properties of dielectrics is very amply discussed, including the double-refracting properties for electric waves. Great stress is laid on the important advances made in the construction and standardisation of standard cells.

The optical portion is wholly occupied with geometric optics and applications to optical instruments. The fact that the writers are connected with the firm of Zeiss is a sufficient guarantee of the quality of their contributions. The only regret that one feels in glancing through the book is that the tremendous

amount of material to be dealt with makes compression a *sine qua non*. It is only a taste we get; but the voluminous references to original sources forming the extensive footnotes point the way to a fuller feast. It is as a reference book that the chief value of the volume will be found; it is not intended for consecutive reading.

Each paragraph is a highly condensed account of a particular part of the subject. Thus von Rohr concentrates into a few pages the principal facts treated at more adequate length in his treatise on photographic objectives.

Again, von Seidel's method for dealing with the aberrations of lenses is limited to what seems very scanty treatment when the importance of the method is taken into consideration. But for fuller information the author is obliged to refer to a forthcoming work by A. König and himself—there is only room for outlines in a work like the present.

The work throughout is produced with the thoroughness which is characteristic of German publications. We look forward to the completion of the entire book.

Laboratory Exercises in Physical Chemistry. By Frederick H. Getman. Pp. viii+241. (New York: Wiley and Sons; London: Chapman and Hall, Ltd., 1904.) Price 8*s*. 6*d*. net.

THE title of this book might lead one to expect that what is really a distinct want had at length been met. Beyond the title, however, there is little in it that merits favourable comment; both in conception and in execution it is most inadequate. One finds, for example, that viscosity and surface-tension are accorded fourteen pages, of which four are purely theoretical and wholly out of place, whilst solubility is disposed of in four and a half pages. Again, we discover molecular volume in the chapter on thermometry, and polarimetry in the chapter entitled "The Spectroscope"! Not only is the author hopelessly deficient in the general sense of proportion and arrangement, but in matters of detail he is equally at fault. He actually (p. 30) introduces the temperature correction of the barometer into the calculation of a vapour density by Victor Meyer's method—the only method given—and does not even succeed in doing it correctly. He defines the unit of resistance as the international ohm (p. 153), and then gives his data in terms of the Siemens mercury unit (p. 172), which is never defined or even mentioned. Turning to his practical instructions we encounter the same thoughtlessness and omission of important details. The student who carried out a series of conductivity measurements at different dilutions according to the instructions on p. 177, for example, would obtain truly wonderful results, for no mention is made of the necessity of having two pipettes so adjusted that one withdraws exactly the same volume as the other delivers. What, again, is a student to make of the instruction on p. 178—"About 20 c.c. of a N/32 solution of pure sodium hydroxide is titrated with the dry acid of which the basicity is sought"? These instances suffice.

In closing the volume one can only express the hope that there may speedily be forthcoming a book which shall be in fact what this is in pretension.

Les Animaux domestiques. By J. Anglais. Pp. 103; illustrated. (Paris: Schleicher Frères et Cie., 1904.)

THE object of this volume may be best described by paraphrasing the first portion of the introduction, where Dr. Anglais states that it has been his aim, with the aid of a number of ingeniously planned coloured plates, to describe the essential characteristics, both external and internal, of a certain limited number of types of our most familiar domesticated animals. It is addressed to all who desire to make themselves acquainted with the leading features and characteristics of such animals, without the drudgery of long and profound practical study, and to acquire a general idea of their physiology and the history and object of their subjugation by man. As many details as possible of the peculiarities of the external form and of the internal anatomy are displayed in the illustrations and described in the text, so that it is hoped the work will serve in the case of some readers as an epitome of comparative anatomy and morphology, while for others it may form a starting point for more detailed study. The animals selected for illustration are the horse, the cow, the sheep, the pig, the dog, the cock, and the goose, each being illustrated and described on the same plan.

The illustrations of each species are five in number, and are printed on both sides of the cards, which are cut out to the shape of the animal, and so arranged as to fold over one another. The first shows the external form, the second the skeleton, the third the vascular system, the fourth the muscles, and the fifth the nervous system and viscera.

So far as anatomy can be learnt by means of diagrams, the work appears to deserve all that is claimed for it, and it will probably prove of considerable assistance to artists. Whether all the subjects selected for illustration would meet with commendation at the hands of breeders may, perhaps, be open to question. R. 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.*]

Traction of Carriages.

IN tentative answer to your correspondent, p. 270, I suggest the following:—

The best angle of traction on a rough or irregular surface is at an upward inclination to its general slope. This upward slanting pull can be applied to a two-wheeled vehicle, and to the fore-wheels of any vehicle, but not to the hind wheels—especially if they are far away.

Consider, further, the summit of a hill, and let a waggon be so elongated that its hind wheels are still ascending while the horse is descending: his pull is exerted at a very bad angle on this part of the load, and in extreme cases the hill might almost act as a detent.

I should like to take the opportunity of saying that whether the traditional heavy draught of a long-bodied carriage is well founded or not, I am convinced that the ordinary hanson cab is badly balanced, and that a horse would be better with some load on his back, except when descending a hill. The comfort of a wheelbarrow over a balanced cart is considerable.

Though it may be easy to overdo the loading, nothing can be worse than a constant upward pressure on the chest of a horse: a pressure which at present automatically increases on an up grade, thus tending to deprive the animal of part of his own weight, on the existence of which the efficacy of every locomotive depends.

OLIVER LODGE.

Lobster Hatching.

PERHAPS your readers interested in economic marine biology may care to know, as a small contribution to the record of times and seasons, that the berried-lobsters kept at the Port Erin Biological Station started hatching out their young on July 15. So far the loss after hatching has been under 1 per cent. We find the best food for the young lobsters to be finely teased up fresh liver of the common shore crabs. W. A. HERDMAN.

Biological Station, Port Erin, Isle of Man, July 22.

THE PRESENT STATE OF AGRICULTURAL EDUCATION IN ENGLAND.

WE have just received from the Essex Education Committee a little illustrated pamphlet which tells us what is being done in that county for the education of the agricultural community. It represents a different system from any prevailing elsewhere, hence it may be worth while to examine it not only on its own account, but from the more general point of view of the organisation of rural education, so great is the diversity of procedure in the various counties.

The centre of the Essex system is a set of laboratories, chemical and botanical, in Chelmsford; here samples of manure, foods, soils, seeds, &c., are tested for the local farmers; here also various investigations in connection with the field experiments or with special problems arising in the agriculture of the county are carried out. The laboratories form primarily an investigating and advisory centre; at the same time a considerable amount of direct instruction is given there, mainly in the form of short courses for adult students. There is a winter school of agriculture giving a nine weeks' course, shorter courses still in horticulture and dairying, Saturday classes for the instruction of elementary schoolmasters, and a series of occasional lectures on market-days for farmers. From this centre also emanate the lecture courses given in the winter up and down the county.

Of course, this does not exhaust all the work being done in this direction by the Essex County Council; at Dunmow there is an intermediate school with a strong agricultural side, and at one end of the scale there are scholarships to be won at Cambridge, at the other classes in such manual operations as ploughing, shepherding, farriery, &c. On the whole, then, the Essex farmer is not badly served; he has a scientific organisation working out the local problems which he can consult for technical advice, and a recognised system of education by short courses is being developed for him, though as yet it is in a somewhat imperfect state.

But it is noteworthy that neither the Board of Agriculture, which has charge of all higher education in agriculture, nor the Board of Education can even advise, much less control; the whole scheme is managed by a committee "which, with the single exception of the Chairman, consists entirely of Essex farmers." All honour to such a committee for the open-minded way it has attacked the problem, but in the end so restricted an administration cannot make for efficiency.

The county unit for educational purposes is valuable, always provided the central authority is active to coordinate, to give continuity of policy, to prevent, on the one hand, overlapping agencies, and on the other to see that the whole field is covered. It would be easy to point out the weak spots in the Essex programme, the scanty provision for secondary and the neglect of primary instruction of a rural character, but the county authority is working hard according to its lights and to its resources. Turn to the neighbouring counties, and the need of some central stimulus is seen; Herts does about as little as it can, a few lectures and some courses on cottage gardening represent its method of shelving its duties, while in Suffolk we are informed that part at least of the technical instruction money goes in 5*l.* doles to village flower shows! These counties and many others like them have but slender funds to devote to technical education, so slender that it does not seem to be worth anyone's while, inside the county or out, to see that they are rationally spent. The only authority which has any power is the Local Government Board, the auditor of which has to see that the expenditure is on something that can be made to square with a definition of technical education!

The time has come when either the Board of Education or the Board of Agriculture (and it is also a pressing matter that one or other of these bodies is made wholly responsible for agricultural education) should step in and tell the county councils what they ought to do and how they must set about it. By this time experiments enough have been made, for it is well known what sort of work will succeed and what schemes are feasible; in one county or other every sort and grade of rural education has had a trial, and some survive to do excellent work of their kind. Only a central authority knows what has answered elsewhere and can be made to answer again; at present we see county after county embarking on schemes foredoomed to failure, schemes which each committee thinks to be new inventions instead of the obvious mistakes into which every beginner falls unless he has the forethought to get up his subject. The free experimenting of the last ten years has done its work; it is time now to apply the successful results. And unless the central authority does intervene in earnest, it is not too much to say that the purely rural counties will never get any agricultural education at all; they are poor and unenterprising, they are isolated and bitterly averse to cooperating with neighbouring counties as feeble as themselves (even east and west Sussex cannot join forces to support the same agricultural school), lastly, they are angry at being called upon to meet the unexpectedly heavy demands for elementary education, and will divert as much of the "whisky money" to that end as they can. It is not that the country is without agricultural education; we have now many organisations as good as anything in America or Germany, which have equally won the confidence of the farmers for whom they were designed. Among others, we need only instance the Kent and Surrey joint scheme which makes a centre of the Wye College, or the Cheshire School at Holmes Chapel, but whole tracts of the country that are even more in need of similar work are absolutely blank, and are likely to remain so unless a central authority can step in with some power and a determination to shake the self-complacency of the backward county councils.

From another point of view the lack of a central authority with a wide general outlook is even more disastrous—there is no provision for the furthering of research. Now it is not only a truism that any scientific teaching that is to be of value must be based on research, but anyone who has had experience in that line has learnt that you can only secure the sympathy and cooperation of farmers by instituting investigations in which they are interested. A course of lectures on agricultural chemistry would go unheeded, little more attention would be paid to a course on manures; but offer them the results of some first-hand experience in the shape of experiments dealing with a problem of local importance, and they will come to hear and remain to discuss. How does the American Department of Agriculture seek to commend itself to its farmers? Almost wholly by research. Principal Reichel's article, again, in the reports of the Mosely Commission, tells us how the great Canadian agricultural college at Guelph only took root when it got hold of the farmers by experiments followed by discussion. Yet the Local Government Board, which passes many curious things masquerading as education, draws the line at research, and even the Board of Agriculture, which has some money

to spend on furthering higher agricultural education, has decided that research is outside its purview.

Yet if there is one field of work of proved public utility which wants the fostering of a central authority it is agricultural research. To begin with, when it is only possible to raise one crop in a year the progress of an agricultural investigation is necessarily slow, and requires to be continued without any external pressure to produce a result quickly. Again, the problems of the nutrition of plant or animal are so complex that the investigator, eliminating variables to obtain a crucial test on some particular point, appears altogether unpractical to the farmer. Now that the main principles of the action of manures and their adaptation to particular crops and soils are known, original investigation, which is really breaking new ground, will not appeal either by its methods or even by its results to the ordinary man. It will be done for the benefit of the teacher and the expert, and will get translated into practice by modifying the instruction or advice which they give to the actual working farmer. But research of this kind will never obtain the support of the county councils, except so far as it is undertaken out of pure keenness by individuals on the staff of the various teaching institutions; the county councils require demonstrations of the application of known principles to local conditions and experiments for the enlightenment of the current generation of farmers. Even with such trials it is difficult to secure the necessary continuity of policy; Somerset has just discontinued its experimental farm after a very few years' trial, and there is a local movement directed against another county experimental farm which is very ominous in view of the pressure on educational funds brought about by the new Bill. For permanent investigations, "travaux à longue haleine," we have in this country only Rothamsted and the Royal Agricultural Society's station at Woburn; Rothamsted has but 2500*l.* a year (each American State gets at least 4000*l.* a year for its experiment station!), and is asking for further funds to enable it to do more than continue to exist, yet it does not appear to have convinced the Board of Agriculture that research is part of education or is worthy of assistance. As to the Woburn farm, who can say what will happen through the financial straits into which the society has been driven by its show at Park Royal? But in any case compare these two solitary agencies with the great organisation possessed by the United States, of which we get a personal impression in Prof. Armstrong's paper in the Mosely Commission reports. Yet it cannot be argued that we need such work any less than America, for even if in England itself "agriculture only stands for shillings where commerce stands for pounds," the proportion is very different when we look at the Empire as a whole. Teachers and investigators are being constantly called for; how are the experts to be trained, the teachers to be inspired, if there is no adequate provision for research at home? Up and down our dependencies men may be found doing expert work in agriculture, men whose knowledge, both of agriculture and of science, has been acquired by working as assistants in commercial analytical laboratories; these men are doing excellent work, but they cannot wholly escape from the defects of their training.

Nobody familiar with the facts can fail to recognise the enormous advance that has been made within the last twelve years, before which time agricultural education did not exist for the ordinary farmer; now it is good "in parts," and the time is ripe for a strong central administration to take the work in hand, level up all round, and put research, which should be the mainspring of the whole, on a sound independent footing.

TWO BOOKS ON LOCAL NATURAL HISTORY.[1]

MR. TREGARTHEN'S brightly written and exquisitely illustrated book is absolutely redolent of the breezy uplands and the surf-beaten beetling cliffs of the western duchy, and is evidently the work of a sportsman-naturalist of the old-fashioned and best type. It is true that the author deals with his subject more from the sporting than from the natural history aspect—and to a great extent with the methods of sport belonging to a bygone day—but perhaps it is none the worse for this, being entirely free from all traces of that "faddism" which tends to taint the work of many of the self-styled field-naturalists of to-day. Whether he is describing fox-hunting in the olden time, the habits and wiles of foxes and their cubs, dilating on the fascinations of digging out badgers from their subterranean retreats, or narrating the perils attendant on a midnight descent through a tortuous adit to the rocky cave where dwell the seals, he is equally delightful and fresh. All the photographs of animal life, to say nothing of those which portray the striking coast scenery of the Land's End district, are admirably well chosen and well executed, the one of fox cubs herewith reproduced being only a sample of the general excellence of style.

Although ostensibly devoted to sport, the work contains here and there some interesting observations with regard to the fauna of the county. We are told, for instance (p. 165), that hares are almost non-existent in this part of the country, their scarcity being due apparently not to excessive persecution, but to the unsuitableness of the climatic or other physical conditions. Some years ago, upwards of 150 of these animals were turned out in various parts with the result that within a comparatively short period nearly all had disappeared. It is satisfactory, however, to learn that the badger (why will the author call it one of the most ancient of animals?) is as abundant as the hare is scarce, the author stating that it generally shares a burrow with the fox. Seals, too, thanks to their wariness and the almost inaccessible caves they select for their abode, show no signs of decrease on the northern coast.

To the naturalist, the description of the seal-caves and their living denizens is, indeed, the cream of the whole book, and many readers would, we feel sure, long for an opportunity of beholding the scene described, were it not for the attendant dangers and difficulties. The particular visit described was made by night at low-water, when the entrance to the cave was barred by exposed boulders, thus rendering it impossible for the seals to escape. "We advanced to the edge of the water," writes the narrator when describing the visit, "with a torch in each hand, holding them well up, and forward at full arm's-length. It was the sight of a lifetime. Five huge beasts, two grey, the rest a dirty yellow, mottled with black spots, lay swaying on the sand, prepared to make a rush—they can shuffle down a slope at a great pace—if we entered the pool; and these were not all, for in dark recesses beyond I saw indistinct forms move, and once I thought I caught the gleam of liquid eyes."

The numerous species of sea and shore birds frequenting the Land's End claim the author's attention in the concluding chapter, where reference is also made to several of the rarer birds of the land. Both

[1] "Wild Life at the Land's End; Observations of the Habits and Haunt of the Fox, Badger, Otter, Seal, Hare, and of their Pursuers in Cornwall." By J. C. Tregarthen. Pp. xii+236; illustrated. (London: John Murray, 1904.) Price 10*s.* 6*d.* net.

"In the King's County." By E. K. Robinson. Pp. viii+352. (London Isbister and Co., 1904.) Price 6*s.*

magpies and green woodpeckers are stated to be more common at the present day than was formerly the case, while it is only of late years that the pushing starling has taken to breed in the district. With a bare reference to the account of the author's last sight of a pair of Cornish choughs—possibly the last of their kind—we must take leave of a charming volume.

In any work devoted to outdoor life in Norfolk the element of sport is certain to loom large, next to which birds will probably claim a considerable share of the author's attention, and Mr. Robinson's volume is no exception to this rule. Such subjects as "a royal shoot" and "beside the covert" are, indeed, intercalated with chapters on "panics in bird-land," "the hawk's harvest," and the "birds of autumn," and throughout the portions devoted to the wild life of the county there will be found scattered many observations

FIG. 1.—Fox cubs. From Tregarthen's "Wild Life at the Land's End." *From a Photograph by C. Reid.*

which cannot fail to be of interest to the field-naturalist and lover of the country. A feature of the work is the candid and straightforward manner in which the utility or harmfulness of the mammals and birds generally classed by keepers as "vermin" are discussed, no special pleading being used to afford any of these creatures exemption from destruction when, in the author's opinion, it is well merited. Among the mammals which, according to Mr. Robinson, rightly occupy a place in the "keeper's museum" are the stoat and the hedgehog, the indictment against the latter, from the keeper's point of view, being even heavier than the one in Bell's "British Quadrupeds."

To residents in Norfolk the book should prove specially welcome, but it is also one which can be taken up to while away an idle hour by every reader interested in sport and country life. R. L.

RELATION OF RAINFALL TO RUN OFF.

IN NATURE of January 7 (vol. lxix. p. 226) notice was directed to the attention paid by the Geological Department of the United States to the water resources of the country, and to the series of reports that had been issued relating to the supply available for domestic and business purposes, for power and for irrigation. We have recently received a further series of reports relating to the progress of the stream measurements for the year 1902 carried out on the northern and southern Atlantic coasts, Mississippi River, Great Lakes, Pacific coast and Hudson Bay drainage districts; the hydrography of California and the storage reservoir there; and an account of the irrigation of India.

With the exception of the last, these volumes consist almost entirely of statistical records of the flow of streams, and although of great value to American hydrologists, do not call for any special notice.

Paper No. 80 of the series of hydrographic investigations on the relation of rainfall to run off, compiled by Mr. George W. Rafter, contains information which is of value to those interested generally in the question of water supply.

The author of the paper commences by saying that, as the result of many years' study of the problem indicated by the title of the paper, he has come to the conclusion that no general formula is likely to be found expressing accurately the relation of rainfall to the run off of streams, for these vary so widely in their behaviour that every stream is a law unto itself.

Mr. Rafter directs attention to the desirability of the adoption of uniformity or standardisation of the units of measurement, and warns engineers to be very slow to add to the number of standards of measure

for flowing water already in use. In the United States, as in this country, the cubic foot is taken as the unit of volume and the second as the unit of time when measuring flowing water in streams, while here the gallon is generally adopted as the unit when dealing with supplies for domestic purposes. In the United States the million gallons in twenty-four hours appears to be recognised as a standard for city water supply, and an acre in area covered one inch or a foot deep in a month or a year is used for irrigation purposes. The unit of inches of rainfall per acre on the catchment area and the resulting run off in gallons for town supplies, or in cubic feet for drainage, is a measure of very general adoption. In India many irrigation engineers have adopted the term "cusecs" as representing cubic feet per second.

With regard to the proportion of rainfall that finds its way into a stream, the author deprecates the use of averages, and expresses the opinion that safe deductions can only be obtained from using the minimum rainfall and taking into account the longest period such minimums may be expected to occupy. The records of the United States show that this minimum period may be expected frequently to last more than three years.

In this country the general rule is to take the average of the longest period over which the rainfall records of the district extend, from this to deduct one-fifth to allow for the mean annual rainfall of the three consecutive driest years, and from the product further to deduct from eleven to fifteen inches for loss by evaporation, soakage, &c., according to the character of the ground, the remainder giving the quantity available for storing. If compensation water has to be provided, a further deduction of one-third of the available supply has to be made. Fourteen inches is commonly taken as the figure representing evaporation, &c., in this country. For example, with an average annual rainfall of thirty inches, ten inches would be available for run off or storage, or, where compensation water has to be given, 6.67 inches would be available for storage. Taking an inch of rainfall as 3630 cubic feet per acre, 10 inches would give 36,300 cubic feet or 226,300 gallons to the acre of gathering ground.

As a general statement, Mr. Rafter's investigations have led him to the conclusion that the minimum rainfall varies from half to one-fourth the maximum.

The late Mr. Symons's proportion for this country was that the rainfall for the wettest year was half as much more than the mean, and for the driest year one-third less, or, taking the average of three wettest years, one-fifth less than this average.

Mr. Rafter considers that averages derived from a shorter period than thirty-five years are not to be relied on within 2 per cent. The same conclusion was arrived at by Mr. H. R. Binnie in his paper on the average annual rainfall reported in the minutes of proceedings of the Institution of Civil Engineers, 1892. This figure was derived from an examination of rainfall statistics from 153 stations situated all over the world. While short periods like five years' average gave an error of 32 per cent., and thirty years 5.8 per cent., the error for thirty-five year periods was only 2½ per cent., and fifty years came no closer.

Although the annual quantity of rainfall varies very much in different localities and in different countries, the same law universally applies as to the relation of the wettest and driest years to the average fall if taken over a sufficiently long period.

As pointed out by the author of the report, caution is necessary in taking the average of the rainfall as a guide; for storage purposes, where the water has to be collected in a reservoir a minimum fall derived from an average of years may be a trustworthy guide, but where provision has to be made for carrying off the water in artificial channels for drainage purposes, or where the water has to be pumped, as in low-lying districts, the data to be ascertained is the maximum rainfall that has to be dealt with in a short period. Thus, while the rainfall of the year, or even of the winter months, may not have been excessive, yet floods may have ensued due to heavy rain falling for a few days on ground already saturated. In the Fen districts on the east coast of England, which depend entirely on artificial drainage, the rule is to allow for a discharge equal to a continuous fall of a quarter of an inch of rain during twenty-four hours. The mean daily fall of the rain which caused the twenty-one floods in the Witham district since 1852 was an average of 0.26 inch spread over seventeen days; the average annual fall of the district for the wet period was 32.39 inches, and over a period of seventy years 22.93 inches. The greatest fall during this period averaged 0.41 inch spread over fourteen days, in November, 1885, and also in October, 1883, when there was considerable flooding.[1]

The figures given in this paper show that in the eastern States of America with a maximum rainfall of from 20 to 60 inches half the rainfall runs off, and that with a minimum fall from a fourth to a sixth. In the western States, with a fall of about 12 inches, the run off varies from half an inch to an inch.

The total run off of a stream depends very largely on the run off of the storage period. Usually about 0.75 to 0.85 of the total rainfall of this period runs off in the stream, while for the summer, or growing period, not more than about 0.1 of the rainfall appears, this small quantity being due to evaporation and absorption by vegetation. The total run off for the year depends very largely on whether or not the rainfall from December to May is large or small. Whether any given stream is low during the summer months or has then a well sustained flow will depend very largely on the rainfall of the month of May. When the May rainfall is heavy enough to produce full ground water, the flow is likely to be well sustained.

The extent of afforestation seems to have a considerable effect on the run off of streams, catchments with dense forests showing a larger run off for the same rainfall than those which are deforested.

THE ARAPAHO SUN DANCE.[2]

THE scientific value of the anthropological series of the *Publications* of the Field Columbian Museum, Chicago, has been sustained by the important memoir on the Arapaho sun dance by Dr. G. A. Dorsey, the energetic curator of the Department of Anthropology. Although only very recently published, the work bears the date of June, 1903, which will cause superfluous trouble to bibliographers. Dr. Dorsey witnessed the sun dance in 1901 and 1902, and he has taken great pains to give a clear and minute account of this eight-day ceremony. The description is illustrated with a great wealth of illustrations, there being no fewer than 135 plates, many of which contain two figures; it is probably safe to say that no ceremony has hitherto been so amply illustrated. It is also a matter of congratulation that the description is so detailed, as the significance of a ceremony can only be adequately realised when all the details of the events

1 "The Fens of South Lincolnshire" (Simpkin, Marshall and Co., Ltd.) "The Drainage of Fens and Lowlands" (Spon, Ltd.).

2 "The Arapaho Sun Dance; the Ceremony of the Offerings'-lodge. By G. A. Dorsey. Field Columbian Museum, Anthropological Series. Vol. iv. (Chicago, U.S.A., June, 1903.)

are carefully recorded. We can heartily congratulate the author and the museum authorities on the publication of this authoritative memoir. More information would, however, be welcome as to the precise part taken by the several social groups of the Arapaho in this national festival, as this is usually an important element in social ritual. Apparently the ceremony may take place at any time, but it is generally during the winter. It is performed in compliance with a vow.

Many ceremonies are performed in connection with a Rabbit-tipi (or tent), which is erected on the first day, and the men who perform the rites are known as Rabbit-men; the origin of the name is due to a myth. On the second day a sweat-lodge is built, not only as a means of bodily purification, but because they want to be cleansed from former sins, evil desires, and to be protected from all kinds of plagues. Next, a bison should be caught and killed; now they have to content

FIG. 1.—The straight-pipe being smoked by the Sun Dance priests and dancers.

themselves with any old buffalo robe that is available, and this skin has to be painted. On the fourth day the centre-pole for the Offerings'-lodge is cut down by two women, and brought into the camp and erected in its midst with great ceremony; as this new lodge is being completed, final rites are held within the Rabbit-tipi. In this very large lodge is the altar, and here dancing takes place, which is at the present day of a simple character. Near midnight of the second and fourth days a remarkable symbolic ceremony takes place between the grandfather and wife of the Lodge-Maker. The former personifies the sun and the latter the moon, and the ceremony brings strength to the people and increase to the tribe. The sixth day is known as "Medicine Day"; the dancers have now fasted for about forty hours, and it is supposed that by this time their minds are in a proper condition to be susceptible to the influence of the sun, and they are exhorted to be of a reverent frame of mind. The rising sun is greeted with a dance. During this most important day of the series new chiefs are inaugurated and names changed. There is a considerable amount of evidence that in former times unbridled license prevailed throughout the camp on this night, which was taken advantage of by all, as it was considered one of the rites of the ceremony; in more recent years this has been entirely given up, but the occasion is utilised for courting. The seventh day commences and ends with sun dances, and then takes place the ceremony with the symbolic sun-wheel. The dancing is particularly fatiguing, and finally, in the ceremony witnessed by Dr. Dorsey, a great shout was sent up by all, for the ceremony had come to a happy termination without anyone falling by the way and without a mishap. This impressive exhibition of endurance and faith is termed "gambling against the Sun." It expresses on the part of each dancer his earnest prayer and effort to conquer, to survive, and to complete his three days' fast without falling, in spite of the opposition of the intense heat of the sun; to survive means to win benefit. Then follow the bathing and purification of the dancers.

On the last day of the sun dance ceremony there takes place the final dancing out to meet the sun; the method of advancing by degrees outside the lodge is a form of asking the Man-Above and the Grandfather to listen to their prayers; it also typifies the going after something which is good. A shaking of blankets which takes place may be regarded as a purification rite whereby sickness and sorrow are shaken off. The smoking of the straight-pipe (Fig. 1) at this time, on the part of all, which forms the final performance in the ceremony, is to the effect that all might follow a straight road, that all might be protected, and that the families of those who have fasted and taken part in the ceremony might be guarded from harm, inasmuch as they have performed the ceremony according to the orders of the Man-Above.

Before dispersal, parents, often accompanied by their children, enter the Offerings'-lodge, and after praying, tie on to the centre-pole the clothes discarded by their children during the year. One of these prayers is as follows:—"White Man-Above, my Father, here are the clothes of my child. I am going to deposit them. They are no longer good for my child. By doing this I ask you to watch over him from day to day and keep him from temptation. May he grow up to be a man, to understand your teachings which we have just gone through! I hope you will hear our prayer for my child."

A. C. HADDON.

THE UNGULATE MOLAR.[1]

IN the course of his attempt to solve the puzzle of the homologies of the cusps in the more complicated types of ungulate molars, the author of this bulky memoir takes the opportunity of directing attention to certain points with regard to mammalian dentition in general, and also comments on the exceeding intricacy and difficulty of several of the problems presented thereby. The solution of one difficulty, he observes, not unfrequently gives rise to a whole crop of fresh problems, and, paradoxical as it may seem, every increase in our knowledge serves only to reveal the depth of our ignorance.

With the enormous amount of variation displayed

[1] "Recherches de Morphologie phylogénétique sur les Molaires supérieures des Ongulés." By F. Ameghino. *An. Mus. Buenos Aires*, ser. 2, vol. iii. Pp. 541, figures.

by the molars of the numerous types of ungulates peculiar to the Tertiary formations of South America, Dr. Ameghino has almost a superfluity of material upon which to work. So vast, indeed, is his subject, that it would be impossible, within the limits of our space, to follow him in his survey from one type to another, or, indeed, to discuss his general conclusions, and I shall therefore confine myself to directing the attention of my readers to certain points of special interest in the author's work.

In the first place, it may be noted that Dr. Ameghino reiterates his opinion as to the falsity of the tritubercular theory of molar development, tritubercular molars, instead of being the primitive type, having been derived, on his view, from those with four or six cusps. Whether this opinion is in any way biased by the author's contention that the earlier Patagonian mammals are of Cretaceous age may be worth consideration.

Of greater importance is the support given by Dr. Ameghino to the view that the molar formula of the placental and marsupial carnivores is numerically identical, that is to say, that there are three true molars in both (when the full series is developed) instead of three in the one and four in the other. He consequently regards the replacing marsupial premolar as the third instead of the fourth, and the tooth behind it as a persistent milk-molar. The numerical identity

FIG. 1.—Right upper molar of horse. *p*, antero-internal pillar; *hy*, postero-internal pillar.

FIG. 2.—Left upper molar of Nilgai to show accessory pillar between the two main inner crescents.

of the marsupial and placental series was urged long ago by Prof. Gaudry, and this view was more fully developed a few years since by the present writer, when evidence in favour of the above-mentioned homology of the marsupial replacing tooth and the one behind it was likewise adduced. Although it has subsequently received the assent of Dr. Wortman, this view has not, however, yet been accepted by zoologists generally. It may be added that it is a question on which only those with a considerable amount of palæontological knowledge are competent to form an opinion.

Another point of great interest referred to in Dr. Ameghino's memoir is the alleged occurrence in Nesodon and certain other Patagonian Tertiary mammals of three distinct dentitions. Since the existence of this remarkable phenomenon is stated to have been accepted by Dr. Scott, it may apparently be taken as fully authentic. The "pre-lacteal" cheek-dentition, according to the figure given, consists of three very small teeth, differing somewhat in form from their successors of the milk-series. Dr. Ameghino, whose view is almost certainly in this instance influenced by his opinion as to the age of the Patagonian mammals, regards the "pre-lacteal" dentition as a direct inheritance from reptilian ancestors. In view, however, of the specialised characters of Nesodon and its allies, and the absence of a functional "pre-lacteal" series in any other mammals, it would seem much more probable that it is a superadded feature.

The last point to which we have space to allude relates to the homology of two of the cusps in the equine molar. To render this point clear, two figures have been introduced into this notice.

Since the date of publication of the first part of Gaudry's "Enchainements," the antero-pillar of the equine molar (*p* in Fig. 1) has been almost universally regarded as one of the primitive constituents of the tooth, corresponding to the inner extremity of the anterior transverse ridge (protocone) of the rhinoceros or anchitherium molar. From comparison with a large number of extinct forms, Dr. Ameghino comes, however, to the conclusion that this antero-internal pillar (which is detached in Hipparion but joined to the body of the tooth in Equus) is really a superadded element, derived from the cingulum, and corresponding to the "accessory pillar" of the molars of many ruminants (Fig. 2). Consequently, the protocone will be represented by a part of the anterior inner crescent of the horse's molar. Apparently Dr. Ameghino has made out a very strong, if not a conclusive, case for the new interpretation; I may add that the same opinion was independently arrived at and published by Dr. Forsyth-Major so long ago as 1873, but has been generally neglected in favour of the Gaudrian theory.

Without in any way endorsing all his views, it may be confidently stated that in this memoir Dr. Ameghino has made a very important contribution to mammalian odontology. R. L.

DR. ISAAC ROBERTS, F.R.S.

THERE is one class of scientific amateurs which seems to be the peculiar product of English society. Dealing with astronomy alone, and confining our attention to those who have passed away, we have such men as Lassell, Barclay, De La Rue, &c., all of whom, after amassing a considerable fortune in commercial pursuits, have devoted the evening of their lives to furthering the interests of their favourite science. The latest example of this earnest attachment to this particular branch of science was Dr. Isaac Roberts, whose death we record with profound regret. It is possible that he may be nearly the last of a distinguished series, for it is not unlikely that, as science tends to specialise in particular directions, such instances will become less and less frequent. The wealthy amateur, it may be, will continue to provide the means for others, but the requirements for the production of valuable work tend to become more and more severe, and the actual prosecution will soon be reserved to those who have been able to give up their whole life to special study. But Dr. Roberts was fortunate in finding a subject at which he could work with effect personally, and his own exertions were rewarded with valuable results.

For some years Dr. Roberts seems to have wavered between geology and astronomy as a congenial pursuit in his leisure hours. But possibly it was the application of some form of mechanical inquiry that attracted him in either direction. Among his early papers are the results of investigations affecting the circulation of underground water and the filtering and hygroscopic properties of Triassic sandstone. In studying the movements of underground waters, of which the observations were carried on with great regularity, he employed mechanical contrivances which he designed himself. Similarly, in practical questions such as the determination of the pressure of grain on the walls of lofty warehouses, when stored to great height, the mechanical side of the question seems to

have had the greatest attraction for him. Finally, when he settled down to the continuous study of astronomy and procured a powerful reflector suitable for his purpose, he introduced many small conveniences to assist the work, which no doubt contributed in a large measure to his ultimate success; for at the time he began his work astronomers had not recognised with the keenness they do now the necessity of controlled driving clocks to equatorials, and other happy suggestions for lightening the labour or the irksomeness of prolonged exposure in photographic work. This was the direction in which Dr. Roberts chose to work, and in which he earned a well merited reputation. It may be said of his early photographs that they were a revelation, and they are still worthy of profound study, though others working with more powerful instruments, and guided, it may be, by his early experience, have equalled and possibly surpassed them in the amount of detail shown. Two handsome volumes containing photographs of nebulæ and star clusters, which Dr. Roberts published at his own expense and widely distributed, speak to his industry and liberality, and his mechanical genius found another outlet by constructing a machine for the ready copying or transference of the positions of the stars photographed, to copper plates, from which they could be readily printed. How far this device has been used is uncertain: probably mechanical photographic processes have supplanted it.

Another feature in Dr. Roberts's methods which was eminently practical and worthy of imitation was the care he displayed in selecting a site for his observatory. His desire was to secure a good observing atmosphere and the greatest freedom from clouds, and many and minute were his inquiries, both at home and abroad, before he settled on Crowborough Hill, where his observatory was finally situated. Even shortly before his death he visited Las Palmas for the purpose of making some observations which required good observing conditions, and it will be to the regret of many friends that his activity and his energy are lost to us while he was still eager and capable of pursuing his favourite study.

The deceased astronomer, who had been elected a fellow of the Royal Society and many other learned bodies, was in his seventy-fifth year. He was twice married, on the second occasion to Miss Dorothea Klumpke, whose name and reputation are known throughout Europe, and to whom the deepest sympathy will be tendered.

NOTES.

WE regret to have to record the death, at the age of eighty-two, of Sir John Simon, K.C.B., F.R.S., which took place on Saturday last.

THE death is announced of Prof. Trasbot, formerly director of the Alfort School, at the age of seventy-two years. He had been a member of the Paris Academy of Medicine since 1886, and was the author of many works relating to pathology, epidemic diseases, and sanitary administration.

THE death is announced also of Dr. J. Bell Hatcher, curator of vertebrate zoology at the Carnegie Museum, Pittsburg, at the age of forty-six years.

THE Berlin correspondent of the *Lancet* states that Prof. Koch will vacate his position as chief of the Royal Institution for Infectious Diseases on October 1, in order that he may have more time for scientific research. He will, however, continue to be connected with the institution, and, by special order of the Government, will have on the premises a laboratory furnished at the public expense, and the clinical material of the institution will be placed at his disposal. We learn also from the same source that Prof. Koch is to succeed Prof. Virchow in the membership of the Royal Academy, Berlin, and that his successor as chief of the Institution for Infectious Diseases will be Prof. Gaffky, now of the University of Giessen. Prof. Gaffky's acceptance of Prof. Koch's chair in the University of Berlin was announced in our issue of July 14.

IT is announced in *Science* that Mr. H. C. Russell, Government Astronomer of New South Wales, is to retire at the end of the present year, after forty-six years' service.

THE seventy-second annual meeting of the British Medical Association was opened at Oxford on Tuesday last, when the president, Dr. Collier, delivered his address. In the evening a reception was held in the Sheldonian Theatre, and the Middlemore prize for the best original work on ophthalmology brought out during the past three years was awarded to Mr. J. Herbert Parsons.

THE Lord Provost of Glasgow opened on Thursday last the health exhibition which has been organised in connection with the twenty-ninth autumn congress of the Sanitary Institute now in session at Glasgow. The exhibition is divided into colonial, municipal, and educational sections, and among the exhibits are a model hospital and a model one-house dwelling.

THE congress of the Royal Institute of Public Health at Folkestone was opened on Thursday last and closed on Tuesday.

AN intercolonial agricultural conference was opened in Pretoria on Monday last, and the delegates will discuss, among other subjects, the formation of a Central South African Agricultural Union, African coast fever, the native question, irrigation, and fruit and cotton growing.

THE sixth centenary of the birth of Petrarch opened at Arezzo on July 20. The Count of Turin represented the King of Italy, and Signor Orlendo, Minister for Public Instruction, represented the Italian Government. An artistic tablet was unveiled at the house in the Via dell' Orto in which Petrarch was born, and later there was a memorial ceremony in the Politeama Aretino. The festivities lasted until July 25.

THE new hall of the Royal Horticultural Society in Vincent Square, Westminster, was opened by His Majesty the King on Friday last. The building, which includes a library, offices, council chambers, and a lecture room, in addition to the large hall in which the society will hold its fortnightly exhibitions, has been built to celebrate the centenary of the society. In the address which Sir Trevor Lawrence read to the King and Queen the work of the Royal Horticultural Society was reviewed, and in regard to the efforts of the collectors sent out by the society in the nineteenth century, it was said, in the words of Mr. Andrew Murray, that "the results have affected the appearance of all England. Nowhere can a day's ride now be taken where the landscape is not beautified by some of the introductions of the Royal Horticultural Society." Perhaps nothing indicates more clearly the way in which the society has promoted the science and art of horticulture than the fact that whereas there were one thousand three hundred fellows in 1887, there are now eight thousand, one hundred and fifty. Baron Sir Henry Schroeder presented the report of the building and appeal committees, in which it was stated that twenty-six thousand pounds had been subscribed towards the cost of the hall, which will amount in the end to forty

thousand pounds. His Majesty received congratulatory addresses on behalf of the society. Dr. Maxwell Masters presented those from the Société Royale d'Agriculture et de Botanique de Gande and from the Horticultural Society of Prussia; Mr. Edwin Mawley that from the National Rose Society. His Majesty then declared the hall open. It is, we understand, the intention of the society to provide scientific instruction as well as practical training in connection with the gardens at Wisley.

ARRANGEMENTS have been made which will make it unnecessary to close the Museum of Practical Geology, Jermyn Street, for a month in autumn as heretofore; the museum will therefore remain open to students and visitors daily.

THE International Astronomical Congress will begin its meetings at Lund, Sweden, on September 5.

THE tenth International Congress of Navigation is to be held at Milan from September 24 to 30, 1905. Applications for the local organising committee's letter of invitation to the congress, and for the programme of the arrangements made, should be addressed to the general secretary of the congress, Signor E. Sanjust di Teulada, 3 Via Sala, Milan, or to Prof. L. F. Vernon Harcourt, 6 Queen Anne's Gate, Westminster.

AN interesting exhibition of about 700 incandescent electric lamps, including the first experimental lamps made by Mr. Edison, is about to take place at the St. Louis Exposition. The collection is stated to be complete and unique, and to include a specimen of every kind of filament lamp ever made in Europe or America.

ACCORDING to the Indian correspondent of the *Lancet*, Mr. Tata left a will by which his heirs and trustees are required to carry out his intentions with reference to the research institute in which he took so great an interest.

THE Paris Academy of Sciences has awarded the Lecomte prize of fifty thousand francs for the most interesting work in physical science to Prof. Blondlot for his researches on the *n*-rays.

A GOLD medal has been awarded to Commander Peary by the Société de Géographie, Paris, in recognition of his work in the North Polar regions.

THE Elliott-Cresson medal is to be conferred on Dr. Hans Goldschmidt, of Essen (Ruhr), Germany, by the Franklin Institute, Philadelphia.

AFTER an absence of a year and eight months the Scottish National Antarctic Expedition has returned to Scotland, leaving, however, Mr. R. C. Mossman, the meteorologist, in the South Orkney Islands to continue his research work. At the meeting held to welcome home the expedition, Sir John Murray, as president of the Royal Scottish Geographical Society, read the following message of congratulation which had been telegraphed to Mr. Bruce, the leader, by Lord Knollys:—"I am commanded by the King to congratulate you and the officers and crew of the *Scotia* on your and their safe return and on the completion of your addition to scientific knowledge and discovery in the south-eastern part of Weddell Sea.—KNOLLYS." A number of other congratulatory messages were also read, the gold medal of the Royal Scottish Geographical Society was conferred on Mr. Bruce, and a gold watch-seal presented to Captain Robertson.

ACCORDING to the *Electrical Review*, the United States Naval Wireless Telegraph Commission will shortly recommend the establishment of wireless telegraph stations at various strategical points on the sea coast. These stations will transmit all Government messages, including weather bureau information, and it is probable that commercial telegrams will also be accepted. The Treasury proposes to provide revenue cutters with wireless telegraph apparatus. It is also stated that a contract has been signed between the United States Government and the De Forrest Wireless Telegraph Co., by the terms of which it will ultimately be possible to send wireless messages between New York and Japan. The Government, which will defray the cost of the various equipments, will have the use of the various installations for naval and other purposes, and the company will be bound to maintain them in good working order with the right to transmit commercial messages.

WE have received from the secretary a programme of the proceedings of the sixth International Zoological Congress to be held at Berne from August 14 to 19. Up to the present 250 persons have joined the congress, and a number of countries and scientific societies will be represented, while no less than seventy communications have been announced to be read at the various sections. These sections are six in number, and in them the study of geographical distribution is assigned an important position. The proceedings will commence by a meeting in the great market-hall on the evening of Sunday, August 14.

MR. J. G. MILLAIS is to be congratulated on his good fortune in having been able to add an entirely new mammal to the British fauna in the form of a vole (*Microtus orcadensis*), of which the description appears in the July number of the *Zoologist*. In a postscript by Mr. O. Thomas it is stated that the new species is totally distinct from all other known forms, differing from the common short-tailed field-mouse (*M. agrestis*) not only in external characters, but in the number of folds in the second molar, and being apparently equally distinct from the Continental field-mouse (*M. arvalis*) and the eastern *M. ratticeps* and their immediate relatives. It forms, in fact, a small zoological and geographical puzzle. In the same number Mr. R. J. Howard describes an instance of the long-eared owl nesting on the ground.

A NOTE in the *Scientific American* directs attention to a communication which was recently addressed to the French National Society of Agriculture by M. Bignon on the efficacy of artificial clouds in preventing late frosts. M. Bignon has for many years successfully protected his vineyard by the method he describes. The vineyard is divided into five parts, separated from east to west by walks of from 12 to 15 feet wide, and is encircled by an avenue of equal width. These walks facilitate the placing of the fires, which are built in small basins sunk into the earth some 50 feet apart, and filled with 15 or 20 pounds of resinous matter and some pieces of pine and other vegetable débris. During 1903 (in one week of which the frosts were very heavy) the method saved, it is reported, 25 per cent. of the harvest, or some 125 to 150 barrels of wine. It is stated that any substance can be burnt which gives a thick and abundant smoke, such as green herbs, moss, damp straw, tufts of grass, &c., but best results have been obtained by the heavy oils which are the residues of gas.

M. ÉLISÉE RECLUS is preparing for the Belgian Society of Astronomy, Meteorology and Physical Geography a monograph descriptive of the volcanoes of the world and maps showing their distribution. One map, in colours, will

be on a scale of 1 : 40,000,000, and this will be supplemented by others on a scale of 1 : 2,000,000. On the proposed maps all the areas the surface of which is formed of eruptive rocks will be shown, and the location of the various forms of volcanic phenomena will be marked. Volcanoes that are believed to have been extinct since the historic period, those that have been active since the beginning of human history, and those which have more recently been centres of eruption will all have their distinctive signs.

IN the opinion of the town sanitary committee of St. Petersburg the town medical officers should be sent abroad periodically in order to become acquainted with the progress of the sanitary and medical departments of the large towns of western Europe, and so be able properly to organise medical and sanitary supervision.

DR. R. FULTON, writing to us from Dunedin, New Zealand, suggests that polyandry among birds is connected with the parasitic habit of depositing the eggs in the nests of other species. After referring to the well known fact that the common cuckoo is very markedly polyandrous, Dr. Fulton proceeds to point out that the same feature exists, or is in course of being developed, among many other wholly or partially parasitic species, such as the American cow-birds and cuckoos, parasitism gradually creeping in *pari passu* with the development of parasitism. If our correspondent's theory is well founded, it would certainly seem worth the attention of ornithologists. The writer further states that, contrary to the usual opinion, there are numbers of instances known where cuckoos (species not stated) have supervised the forced adoption of their offspring by other species, have assisted in their feeding, and have finally reclaimed and taken them away from their foster-parents. In support of this statement he cites Campbell's "Australian Birds."

WE have been favoured with a copy of a circular letter from Hofrath Dr. Franz Steindachner, director of the Royal Museum of Natural History, Vienna, in which attention is directed, in the first place, to the importance of Pará, at the mouth of the Amazons, as a zoological station, and, secondly, to the great value of the biological work which has been carried on there during the last few years by Dr. Emil Goeldi and his able staff of assistants at the "Museum Goeldi." Dr. Goeldi's "Album de Aves Amazonicas," which has been specially noticed in our columns, and Dr. Huber's "Arboretum" are, in Dr. Steindachner's opinion, works of the highest scientific value.

IN the *Quarterly Review* for July, Prof. Ray Lankester in an article on sleeping sickness reviews our knowledge of the trypanosomata. He directs attention to the recent researches of Schaudinn, which seem to prove that two blood-parasites, the first a malaria-like one, the Halteridium of birds, the other a spirillum-like form or Spirochæte, are simply phases of trypanosomes. Similarly the parasitic bodies known as the Leishmann-Donovan bodies (NATURE, vol. lxix. p. 495), are stated by Rogers to give rise to trypanosome forms. Incidentally Prof. Lankester takes the opportunity to indict the British Government for its supineness with regard to scientific research.

PARTS i. and ii. of vol. lxxvii. of the *Zeitschrift für wissenschaftliche Zoologie* contain two long papers devoted to annelid morphology, the one, by Mr. A. Luther, on the "Eumesostomine" rhabdocœlous turbellarians, and the other, by Mr. E. Mattiesen, on the embryology of the freshwater planarian, or dendrocœlous, turbellarians. Both are of far too technical a nature for detailed notice in our columns, but it may be pointed out that, according to modern principles of nomenclature, the title "Eumestominæ" for the subfamily typified by the genus Mesostoma is a misnomer, the proper term being "Mesostominæ."

THE *Entomologist* for July opens with a coloured plate illustrative of three new species of butterflies described in the first article by Mr. W. Dannatt. Various writers record the capture during the present season in different parts of the country of no less than eight examples of the rare striped hawk-moth (*Deilephila livornica*).

THE July number of *Nature Notes* contains an account of the annual meeting and conversazione of the Selborne Society held in May last in Burlington Gardens, when a large number of prizes were awarded for work connected with field natural history. The society continues to display its wonted activity in endeavouring to protect such natural and artificial features of the country as appear in danger.

NO. 12 of the *Publications de Circonstance* of the International Council for the Exploration of the Sea contains a useful catalogue of the fishes of northern Europe with their names in the different languages of this region. In part xiii*a*. of the same is commenced a detailed account of the present condition of the Swedish and Danish sea-fisheries, illustrated with maps and diagrams.

THE *Proceedings* of the Philadelphia Academy for April contain three papers dealing with descriptive zoology, namely, one by Mr. A. Gulick on the fossil land-shells of Bermuda, a second by Mr. J. A. G. Rehn on the bats of the genus Macrotus, and a third by Mr. H. C. Oberholser on the birds of the genus Dendrocincla. More general interest attaches to a communication by Mr. A. E. Brown on post-Glacial Nearctic centres of dispersal for reptiles, of which only the first page is included in the section before us.

THE third part of Mr. G. M. Allen's list of the fauna of New England (in course of publication by the Boston Natural History Society) is devoted to the Mammalia, of which eighty-eight species and subspecies are recognised. Old-fashioned naturalists will be somewhat surprised to see well known species figuring under such unfamiliar titles as *Paralces americanus* and *Odocoileus virginianus borealis*.

THE *Proceedings* of the Royal Physical Society of Edinburgh for June contain an abstract of the address of the retiring president, Prof. J. C. Ewart, which was devoted to the "making of the elephant," based on recent discoveries in Egypt. In addition to Mr. W. E. Clarke's account of the Færöe mouse, already noticed in our columns, the contents of this number include a paper by Drs. Hepburn and Waterston on the anatomy of the porpoise, and one on colour variation in the viper by Dr. G. Leighton.

IN *Science* (July 1) Prof. Long, in an interesting paper, gives an able summary of the relation of modern chemistry to modern medicine. He deals briefly with the action of enzymes, with oxidation in the tissues, with toxins and Ehrlich's side-chain theory, and with the application of physical and mathematical chemistry in the exact study of problems which at one time were assumed to be essentially biological. He finally discusses what should be the proper course of chemistry for the medical student, and concludes that the young man commencing the study of medicine must bring with him a knowledge both of inorganic and organic chemistry sufficiently broad to enable him to grasp the new problems which medicine now presents.

THE papers in the July number of the *Journal of Anatomy and Physiology* (xviii., part iv.) are almost all purely anatomical in character. Prof. Arthur Robinson's third Hunterian lecture on the early stages in the development of mammalian ova and an obituary notice of the late Prof. His are the only exceptions.

TO commemorate the centenary of the birth of M. J. Schleiden, botanist and naturalist, a short account of his life and works has been prepared by Dr. Mobius, and is published by Engelmann, of Leipzig. Endowed with a controversial temperament and possessed of a ready wit, Schleiden's life was characterised by strenuous activity, but he practically sacrificed his scientific career at an early age in order to plunge into political matters. He is best known for his "Grundzuge der Botanik," which may be described as the first *scientific* text-book of botany. A collection of lectures entitled "Die Pflanze und ihr Leben" was even more successful, as it passed through six German editions, and was translated into English, French, and Dutch.

IN addition to the general botanical surveys of a county or a division of a county, there is considerable scope for the investigation of ecological problems on a less extensive scale. In the account of the botanical survey of a pasture which appears in the *Naturalist* (April), Mr. R. C. Gaut describes the characteristic plants which were found, and discusses the causes which enabled the crested dogtail grass to dominate a wet field, while hard by it was replaced by tussock, Yorkshire fog, or foxtail grasses.

IN the *West Indian Bulletin* (vol. v. part i.) Mr. Buttenshaw takes up the subject of West Indian starches, their origin and characters. The majority of them are obtained from roots and tubers, and the order Scitamineæ provides a number of plants which store up starch. The writer mentions that the bread-fruit yields a starch suitable for laundry work, and that farinaceous foods can be prepared from the yam-bean, *Pachyrhizus tuberosus*, and "cho-cho" root, *Sechium edule*. In the same number will be found a report on the fruit industry of Jamaica by Mr. W. E. Smith, and a list of the birds of St. Vincent prepared by Mr. A. H. Clarke.

A THIRD report of the special chloroform committee of the British Medical Association has been published (*Brit. Med. Journ.*, July 23, p. 161). Prof. Sherrington and Miss Sowton have continued the perfusion experiments on the isolated mammalian heart (see NATURE, vol. lxviii. p. 351), and find that equal quantities of chloroform dissolved in physiological saline solution, in serum, and in blood respectively exert on the heart very different degrees of depression, chloroform in the salt solution depressing the heart much more powerfully than when administered in blood in the same percentage strength. Mr. Vernon Harcourt gives the results of further tests with his inhaler, and Messrs. Byles and Harcourt and Sir Victor Horsley discuss the estimation of chloroform dissolved in blood.

WE have received a copy of the twenty-sixth annual report of the Deutsche Seewarte, for the year 1903. This report marks an important epoch in the history of the Seewarte, owing to the retirement of Geheimrath Dr. G. v. Neumayer, with the title of "Excellenz," after twenty-seven years of eminent service as director of the institution. Under his able guidance the Seewarte has become one of the best organised of the European services, especially in the domain of maritime meteorology and international weather telegraphy. Dr. Neumayer's successor is Rear-Admiral A. Herz, who has the aid of a very efficient staff of assistants. We observe from the report that, like the work of our own Meteorological Office, the useful operations of the Seewarte are constantly increasing. In the department of ocean meteorology, 1169 log-books of various classes were received in the year 1903 against 939 in the previous year, which gave the very substantial increase of 72,563 sets of observations in the year 1903. In the department of weather telegraphy and storm signals great activity has been shown in perfecting the system of 7h. a.m. reports, and in extending it over the whole of Europe. Experiments have also been made with the view of improving the system of signals for giving warning of storms at night, by means of white and red lanterns. Space prevents us from specially mentioning the work of several other departments, but we have frequently had occasion to refer to the valuable publications issued by them from time to time.

IN view of the arrangements in progress for continuous temperature observations at the observatory on Monte Rosa, Dr. Emilio Oddone contributes to the *Atti dei Lincei*, xiii. (1), 8, a short note on the values of the mean temperature for the different months of the year, estimated for the Monte Rosa station from other observations. Three different methods have been adopted. The first is based on observations at lower levels combined with corrections based on the temperature gradient; the second is based on temperature observations made in balloon ascents, and the third on 800 temperature observations made in various Alpine ascents, and reduced to the altitude and latitude of the Monte Rosa station. In this way materials have been collected from which it will be possible to infer, in the light of future observations, to what extent the mean temperature of a mountain station can be predicted from observations made elsewhere.

WE have received the "Year-book" of the Austrian Central Institute for Meteorology and Terrestrial Magnetism for 1902. A more valuable series of observations and carefully prepared results could not be imagined; the volume contains daily observations or results for 409 stations, including Jerusalem and two other foreign places. The rainfall observations of 2560 stations are separately dealt with by the hydrographic department, and the Philosophical Society of Brünn has also a separate system of some 200 temperature stations, while the observations for Hungary are published by the Hungarian Meteorological Office. The distribution, as regards altitude above sea-level, of the 409 stations contained in the "Year-book" in question is worthy of note:—from 0–500 metres, 252 stations; 500–1000 metres, 111 stations; 1000–1500 metres, 33 stations; 1500–2000 metres, and 2000–2500 metres, 6 stations each; 1 station (Sonnblick Observatory), 3100 metres. We have here all the necessary materials for determining the value of observations on mountain stations for the purpose of weather forecasting, and for discussing other interesting questions as to the effect of altitude on the behaviour of various meteorological elements. A report of an international expert conference as to the usefulness (or otherwise) of the practice of gun firing for the dispersion of hail-clouds ("weather-shooting") is published separately as an appendix to this volume. The director of the Austrian Meteorological Service is Dr. J. M. Pernter.

ALTHOUGH many attempts have been made to prepare mixed anhydrides of organic acids and nitrous or nitric acid, they have always hitherto been fruitless. In the June number of the *Gazzetta*, however, L. Francesconi and U. Cialdea describe the method by which they have succeeded in preparing the mixed anhydrides of nitrous acid and acetic, propionic, and benzoic acids. These

anhydrides, which have the general formula R.CO.O.NO, are obtained by the interaction, at the temperature of a mixture of ice and salt, of nitrosyl chloride with the silver salts of the acids named. They form yellowish oils which may be distilled in a current of carbon dioxide at temperatures not exceeding 70°. On being heated, the vaporised anhydrides explode with violence, so that especial methods had to be devised for their analysis. By water the anhydrides are decomposed into nitrous anhydride and the corresponding organic acid.

IN the same number of the *Gazzetta* L. Francesconi and N. Sciacca establish the remarkable result that, at the temperature of liquid air, nitric oxide cannot be made to combine with a larger proportion of oxygen than that corresponding with the production of nitrous anhydride. Only at temperatures above −110° does nitrous anhydride combine with oxygen to form the peroxide N_2O_4. At −150° nitric oxide readily reduces the peroxide to nitrous anhydride, whilst the latter is stable, under the ordinary atmospheric pressure, at all temperatures below −21°. The pure anhydride is, at −185°, a dark blue solid which on being melted forms a dark blue liquid.

TO part iii. of vol. i. of *Records* of the Albany Museum Dr. R. Broom contributes four short papers on reptilian and amphibian remains from the Karoo series. Special interest attaches to an anomodont hind foot on account of the mammalian affinities exhibited by the tarsus. A new genus of labyrinthodont (Cyclotosaurus) and one of an endothiodont anomodont (Chelyoposaurus) are described.

THE *Annual Report and Transactions* of the Manchester Microscopical Society for 1903 has just been issued, and is of an encouraging nature. The society has now 181 members as compared with 170 at the end of 1902, and the financial statement is of a satisfactory character. The address which was delivered in December by Prof. S. J. Hickson, F.R.S., as president, on "Variations" is printed in the volume.

IN the *Physikalische Zeitschrift* (No. 14) W. Seitz describes a method of measuring the intensity of the β rays given off by radio-active bodies, in which the converse principle to that adopted by Strutt and by Paschen is made use of. Instead of measuring the positive charge which accumulates on a radio-active body in a vacuum, the magnitude of the negative charge produced by the impact of the rays themselves on an insulated metallic disc suspended in an exhausted glass vessel is determined. The apparatus used lends itself particularly well to the study of the absorption of the rays caused by the interposition of thin sheets of various materials. It is shown that the law found by Lenard to govern the absorption of the kathode rays roughly applies also to the β radiations, namely, that for unit surface the same absorption is caused by equal "masses" of the different materials, these masses being measured by the product of thickness and density. But the law is only approximately true, and, in the case of the elements, there is an increase in the absorption, for equal masses per unit of area, with an increase in the atomic weight.

AMONG papers in the *Verhandlungen der k.k. geologischen Reichsanstalt* for 1904, we note a study by Father R. Handmann of the Congeria-fauna of Leobersdorf, near Vienna (p. 48). The author sustains the view of Dr. Brusina, that this fauna is a northern offshoot from a Croatian centre of development. Dr. O. Ampferer (p. 73) describes in detail the relics of great landslips from the mass of the Tschirgant above the valley of the Inn. These probably occurred in late Glacial times. Travellers by road in this district will know how to this day the hillsides are in a state of unrest and instability. Herr C. von John (p. 104) furnishes a paper of interest to chemists and engineers on the different deductions that may be arrived at as to the heating power of coals, according to the condition and treatment of the sulphur present. This element may exist in organic combination, or in iron pyrites, or in a sulphate, and the mode of calculation adopted may seriously affect the statement of the oxygen present.

IN the *Journal* of the Royal Microscopical Society for June, Dr. A. E. Wright discusses the following four methods of measuring the magnification of a microscope and its elements:—(1) use of a focusing lens placed above the ocular for bringing the emergent rays to a focus in the plane of a suitable measuring scale; (2) separate measurements of the magnifying powers of objective and ocular; (3) measurements depending on Helmholtz's formula; and (4) methods involving the production of a fiduciary phenomenon by means of a diffraction grating.

THE Royal Engineers' *Journal* for June contains the description of a new form of slide rule invented by Major F. J. Anderson. The advantages claimed for it appear, so far as can be judged from the description, to consist in the fact that it can be used with a duodecimal instead of a decimal scale of notation, and that the numbering of the lines is made absolute, there being separate and parallel scales on the upper limb for numbers from 1 to $\sqrt{10}$, $\sqrt{10}$ to 10, and so forth, and on the lower limb for the square roots of these numbers. Those interested in slide rules will doubtless compare the present instrument with the circular slide rule and the form proposed some time ago, in which the graduations formed a spiral line on the surface of a cylindrical ruler.

IN the *Parents' Review* for July, Prof. J. Arthur Thomson gives a suggestive paper on "Nature and Nurture," in which he discusses some of the problems of inheritance and shows that much may be done to mould the young in spite of the factors of inheritance. Dr. Leslie Mackenzie discusses normal growth in the school ages, dealing with such subjects as work, play, sleep, and diet; Dr. Clouston gives some useful hints on nervous diseases and symptoms of the school age, and Mr. George Smith discusses developmental exercise at school. If parents and others in charge of the young would study such articles as these and put into practice what they teach, the race would grow up healthier and happier.

THE last three numbers of the *Bulletin* of the St. Petersburg Society of Naturalists (2, 3, 4, for 1904) contain a number of interesting communications:—"On the Respiration and the Biology of Enzymes," by I. Warschawsky, S. Kostytschew, N. Maximoff, and M. Lestsch; "On the Tertiary Formations of Crimea and Western Caucasus," by V. Bogatscheff and J. Mikhailovsky, both giving extensive lists of the fossils they have found; "On the Geology of Samara," by W. Lehmann; "On the Peat-bogs of Novgorod," by W. Sukatcheff; "On the Lichens in the Sayans," by A. Elenkin; "On the Volcanic Rocks of the Trialet Mountains in the Caucasus," by B. Kolenko; "On the Fossils Found in the Bolshezemelsk Tundra (North-eastern Russia)," by W. Chitrowo; "On the Survival of the Heart in Mammals," by Th. Thur; "On the Morphology of the Phagocyte Organs of Insects," by O. Dawydoff; "On the Influence of Quinine on the Respiration of Germinating Seeds," by J. Smirnoff; "On the Morphology of the Rust-fungi," by W. Tranzschel; and several smaller notes. All of them are summed up in French or in German.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN AUGUST :—

Aug. 7. Juno in opposition to the Sun (Juno, mag. 8·7).
10. 7h. Saturn in opposition to the Sun.
10–12. Epoch of the August meteors (Perseids, Radiant 45°+57°).
14. 11h. 20m. Minimum of Algol (β Persei).
15. Venus. Illuminated portion of disc=0·983, of Mars=0·986.
17. Saturn. Outer major axis of outer ring=43″·43. Outer minor axis of outer ring=11″·37.
19. 16h. Mercury at greatest elongation (27° 24′ E.).
23. 11h. 6m. to 12h. 33m. Transit of Jupiter's Sat. III. (Ganymede).
24. 8h. Moon in conjunction with Saturn (Saturn 4° 4′ S.).
30. 8h. Moon in conjunction with Jupiter (Jupiter 2° 7′ N.).
,, 14h. 44m. to 16h. 8m. Transit of Jupiter's Sat. III. (Ganymede).
,, 14h. 51m. to 16h. 13m. Moon occults ξ′ Ceti (Mag. 4·5).

THE CENTENARY OF DOPPLER.—We have received from Dr. Karl Haas a copy of the address that he read on the occasion of the celebration of the centenary of the birth of Christian Doppler. It is strange to reflect that Doppler, in 1842, years before Kirchhoff and Bunsen had demonstrated the possibilities of the spectroscope, first announced the principle bearing his name which has since become so famous and so fruitful of application. He himself was not happy in his original suggestion, for he sought to employ the "principle" as a means of explaining the colour of double stars, and it may be that some of the controversy that at one time raged round this question originated in its faulty application, rather than in the generic principle underlying the suggestion. So far as acoustical waves were concerned the matter could be, and was, settled by experiment, and Dr. Haas not only referred to the various tests that had been made to prove the validity of the "principle," but exhibited some of the apparatus that had been employed, and repeated the experiments. Dr. Haas briefly referred to Doppler's strenuous life and work in other departments of natural science, showing that the enunciation of the principle was not a matter of accident, but that it was led up to by philosophical study, and put before the audience the grounds on which Doppler was entitled to their respect. But the valuable work that had been accomplished in the realm of spectroscopy naturally made him linger on this part of the subject, and he gave a useful summary of what has been effected by those who saw how the principle could be applied in special directions; as, for example, Sir William Huggins in the measurement of the motion of stars in the line of sight, Sir Norman Lockyer in the matter of sun-spots and prominences, Dr. Langley and others in the determination of the time of rotation of sun and planets, Prof. Keeler in the spectroscopic observations of the ring of Saturn, and by Dr. Vogel in the department of spectroscopic binaries. M. Belopolsky's scheme for showing experimentally the validity of the principle when applied to light waves was mentioned, while in the department of theoretical physics one was reminded how the application of the same principle was rendering most efficient service. If the centenary served no other purpose, it at least had the effect of tracing the connection between the original thought and its manifold applications.

SATURN'S NINTH SATELLITE (PHŒBE).—The next volume of the "Harvard Annals" is to contain a discussion of Prof. W. H. Pickering's recent observatons of the satellite Phœbe from the photographs obtained at Arequipa.

Meanwhile, in order that other workers may be able to observe this satellite, Prof. E. C. Pickering publishes the following position angles and distances from Saturn on the dates named :—

1904	Position angle	Distance
July 14	... 77°·4	17′·8
July 24	... 79°·8	14′·3
August 3 ...	... 84°·0	10′·5

(*Circular* No. 67, Kiel Centralstelle.)

PRINCIPAL PLANES OF THE STARS.—In the first of a series of papers entitled "Contributions to Stellar Statistics" (published by the Carnegie Institution), Prof. Newcomb discusses "the position of the galactic and other planes toward which the stars tend to crowd."

After demonstrating *in extenso* the formation of the general equation determining the planes, he considers several special cases, and arrives at the following important results, giving the positions of the poles of the respective planes determined :—

	R.A.	Dec.
Galactic plane (omitting branch) ...	192°·8 ...	+27°·2
,, ,, (including ,,) ...	191°·1 ..	+26°·8
Gould's belt (as determined from 36 stars, of small proper motion, near it)	179°·6 ...	+26°·4
Plane of all stars to magnitude 2·5.	181°·2 ...	+17°·4
,, ,, ,, 3·5.	180°·0 ...	+21°·5
Plane of fifth-type (Wolf-Rayet) stars	190°·9 ...	+26°·7

A determination of the mean latitude of 42 points in the main stream of the galaxy shows that this stream is not, on the whole, a great circle, for the mean latitude obtained is −1°·74, showing a small but well marked displacement of our system from the central plane towards Coma Berenices, where the north galactic pole is situated.

Gould's values for the poles of his belt were R.A.=171°·2, dec.=+30°; the value given in the above table reduces his value for the inclination of the belt to the galactic plane by nearly one half.

The above position of the plane containing the Wolf-Rayet stars was determined from the positions of seventy-one such stars (excluding those found in the Magellanic Clouds) communicated by Prof. Pickering, and deviates by only 15′ from the position obtained for the galaxy.

Prof. Newcomb has also investigated the law of "star-richness" of the galactic regions, and among other interesting results records the following numbers as the richness per square degree as determined from the Bonn and Cordoba Durchmusterungs :—

	Bonn DM.	Cordoba DM.
Near galactic pole	8·6 ...	29·9
In rifts of the galaxy ...	19·8 ...	45·7
In the galaxy generally ...	24·6 ...	94·1

This result shows that, neglecting the agglomerations, the galactic density is more than double the other in the northern hemisphere, whilst in the southern it is not more than 50 per cent. greater. The general result indicates that, even neglecting the condensation of the Milky Way, the richness increases considerably from the galactic poles towards the equator.

THE PERSIMMON CREEK METEORITE.—No. 1380, vol. xxvii., of the *Proceedings* of the U.S. National Museum contains an illustrated description of the physical and chemical characteristics of the meteorite found at Persimmon Creek, North Carolina, in the spring of 1893. The weight of the main mass of this meteorite was 9 lb. 6 oz., but a fragment weighing 1 lb. 13 oz. had been previously detached. The date of the fall is unknown, but the general appearance when found indicated that it had lain in the soil for a considerable period, whilst the inspection of a polished surface afforded evidence of its meteoritic origin, and showed that it was composed of a more or less continuous matrix of iron containing troilite, schreibersite, and carbon. Separate analyses of the various constituents were made, and the results are given in the paper.

ENHANCED LINES OF TITANIUM, IRON, AND NICKEL.—In No. 5, vol. xix., of the *Astrophysical Journal*, Mr. Herbert M. Reese, of Yerkes Observatory, gives a list of wave-lengths in the Ti, Fe, and Ni spark and arc spectra respectively, indicating a fair number of new enhanced lines.

The majority of these, however, are only very slightly enhanced, and will require further confirmatory evidence before being finally accepted.

FURTHER EPHEMERIS FOR COMET 1904 *a*.—A supplement to No. 3961 of the *Astronomische Nachrichten* contains a continuation of the ephemeris published by Prof. Nijland in No. 3951 of that journal. This ephemeris gives the positions of the comet for every alternate day from July 18

to October 30, but, as the comet will be only 0·3 of its original magnitude on July 30, and is still decreasing, it is scarcely worth while reproducing it here.

The R.A. is varying but little, and on August 1 will be 12h. 16m. 40s., whilst the declination is slowly decreasing, and on the same date will be +47° 34′·6.

A MODIFIED FORM OF THE NEWTONIAN REFLECTOR.—In the *Monthly Notices* for May, 1895, the Rev. Chas. Davies described a modified form of Newtonian reflector in which the rays from celestial objects fell on a large plane mirror fixed at the open end of a horizontal tube, and were thereby reflected on to an ordinary parabolic mirror fixed at the other end, afterwards being brought to a focus through an aperture in the centre of the plane mirror to which was affixed the observing eye-piece. A movement of the plane mirror about the optical axis, and of the horizontal tube in azimuth, allowed any point in the sky to be reached.

By fixing the telescope in a fork at the upper end of a polar axis, M. E. Schaer, of Geneva, now proposes to modify this instrument so that, whilst retaining its original advantages, such as the unchanging position of the eye-piece, it may be used like an ordinary equatorial and cœlostat, and by the simple rotation of the polar axis by clockwork the object may be kept stationary in the centre of the field. In this arrangement the mirrors are so placed that they suffer very little from flexure caused by changes of position. Using a model instrument constructed on these lines M. Schaer found that the practical results were excellent (*Astronomische Nachrichten*, No. 3958).

SEISMOLOGICAL NOTES.

THE sixteenth number of the *Publications* of the Earthquake Investigation Committee in Foreign Languages (Tokyo) consists of 117 quarto pages of print and 9 full-page illustrations. The subject is on Milne horizontal pendulum seismograms obtained at Tokyo, the author of which is A. Imamura, assistant professor of seismology at the Imperial University of Tokyo.

While discussing amplitudes, it is pointed out that these quantities may be increased or decreased according to the relationship existing between the periods of earth movements and the period given to the pendulum, an objection, as has frequently been pointed out, to pendular apparatus in general. Out of a list of 298 records (July 24, 1899, to December 24, 1902), the more important are considered in relation to corresponding records obtained from other types of instruments in Japan, and from similar types of instruments in various parts of the world, the registers from which are issued biannually by the British Association. The more important results relate to the speeds with which different phases of earthquake motion have been propagated over paths of great length. By means of more than forty diagrams, each referring to a particular earthquake, speeds along arcual paths for several of the more important phases of motion are represented by straight lines, that is to say, the speeds are constant. For certain disturbances the evidence leads us to this conclusion, but this is not the case for all. For example, in Fig. 4, a diagram similar to publications by the British Association (Report, 1902, p. 66), we notice in connection with the preliminary tremors that the longer the wave path the greater are the divergencies among the observations which give the time interval to traverse the same. The time taken to travel 25° has apparently varied between 3·5 and 4 minutes, that is to say, the observations agree within 30 seconds. For 80°, however, the divergence is 5 minutes, while on still longer paths the intervals are still greater. When we look at these variations as shown on squared paper, we should certainly hesitate before representing their mean position by a straight line. If, however, it is a straight line, and we know the recording instruments to be similar, then one inference is that minute tremors which may be recorded at a station near to an origin may have failed to reach or to make themselves evident at stations which are very remote.

But why should earthquake vibrations fall in line with the vibrations of elastic bodies? If our world has a fluid or gaseous nucleus, Arrhenius, Fisher, and other physicists and geologists see in the same an explanation for many phenomena. Convection currents might explain slight changes in latitude (Fisher), and they certainly suggest variability of velocity along the same path.

Although we do not agree with all Mr. Imamura's conclusions, seismologists are indebted to him for a piece of valuable research.

In vol. ii., No. 6, of the reports of the Tokio Physico-mathematical Society Mr. K. Honda gives an account of the daily periodic changes in the level in an artesian well the depth of which is 380 m. with a water head within 3·2 m. of the surface of the ground. What he found was that there were two maxima and minima every twenty-four hours, the range of motion varying between 3 cm. and 1 cm. (For somewhat similar experiments made in a shallow well close to the bore-hole here considered, see Reports Brit. Assoc., 1895, p. 104.)

Near to the days of full and new moon the movements are marked and regular; the phases of maxima and minima agree with those of the tides in Tokyo Bay. The well sinks with a high barometer and rises with a low barometer. Rain does not affect the level. By experiment it was found that variation of pressure of 1 mm. of mercury produced a change in the level of the water of 13·5 mm. An equal natural pressure acting on the water head causing it to sink, and on the surrounding ground causing it to rise, only results in a level change of 4·35 mm. From this it is concluded that the earth's crust only transmits 68 per cent. of pressure on its surface to a depth of 380 m. Another conclusion is that the daily fluctuation of 1 to 3 cm. is more likely to be a tidal than a barometrical effect. The distance to the sea is 3 km. In a deep well in Yokohama 0·6 km. from the sea, the tidal effect results in a change of level of 16 cm. This extremely interesting paper concludes with references to the frequency of earthquakes in relationship to fluctuation in barometric and tidal loads. In No. 9 of the same reports Mr. Honda gives a continuation of similar researches carried on at three other deep wells, at the end of which he shows that earthquakes with a submarine origin are most frequent when tidal pressure is at maximum, a minimum, and when the rate of pressure is changing most rapidly. No. 8 of the *Journal* is from the pen of Dr. F. Omori, who shows, chiefly from the consideration of after shocks, that earthquake frequency is affected by changes in atmospheric pressure.

Consul G. Pára, of Uskub, gives (*Kaiserliche Akad. d. Wissenschaften in Wien*, April 21, No. 10) a few statistics relating to the destruction caused by the earthquake which on April 4 disturbed the Balkans. This is followed by further details of a more geological character by Prof. R. Hoernes. The phenomena described are of an ordinary character.

Under the title of "L'Eruzione dell' Etna in 1892," (vol. i.), in a large quarto volume, the director of the observatory in Catania, Prof. A. Ricco, and S. Arcidiacono give a detailed account of the phenomena which accompanied the eruption of Etna in 1892. As an assistance to the better understanding of the historical sequence in events, this is prefaced by accounts of the eruptions of 1883 and 1896, all of which took place on the line of a radial fracture at points from 1000 to 1500 m. lower than the main central crater. It is essentially a volume of observations of value to the vulcanologist, to be followed at a later date by deductions.

In the *Bollettino dell' Accad. Gioenia, Catania*, fas. lxxix., December, 1903, S. Arcidiacono gives a short account of earthquakes which recently disturbed Etna, and which were of local origin. From a tabular statement of these it appears that from 1898 seismic activity was fairly uniform and not pronounced, but after the eruption of 1902 it became three-fold.

The first paper in the *Bollettino della Società Sismologica Italiana* (vol. ix., No. 9, 1903–4), by M. Tito Alippi, relates to the possible relationship of *bonniti* and *bombiti* (mist poeffers, barisal guns, &c.) to seismic movements. From a list of seismic disturbances recorded in a district where *bonniti* were frequent, it does not appear that the two phenomena are connected. The multiplication of the seismograph was, however, only 12. Had it possessed ten times this sensibility it might have responded to minute

tremors propagated in the soil, and quickly afterwards to movements produced by air waves acting on the building, and then to the instrument. A second paper, by the late Dr. M. Contarini, is on the choice of earthquake recorders. Although the paper is short it contains good advice. We are told first to select our instrument according to the object we may have in view. If we wish to record earthquakes of local origin, a type of instrument may be used different to that which will record disturbances with their origins as distant as the antipodes. Again, an instrument which may record the times of arrival of certain phases of motion may not be able to analyse the same; in fact, for earthquakes of distant origin it is doubtful whether an instrument yet exists that gives a true record of the movements of the soil.

At the end of the number the Italian catalogue of shocks of local and of distant origin is brought up to the end of September, 1902.

In an interesting article of twenty-eight pages, M. Paul Choffat gives in *Communicações du Servia Geologique du Portugal* (Tome v., pp. 279–306) an account of "Les tremblements de terre de 1903 en Portugal," to which he adds notes relating to earthquakes which took place in previous years. From the conclusions we learn that there are two chief centres from which disturbances felt in Portugal originate, one of which is suboceanic off the mouth of the Tagus, from which the great Lisbon earthquake of 1755 radiated, and the other is in Andalusia, the shocks from which are comparatively feeble. There are also several local centres.

AGRICULTURAL NOTES.

THE officials in charge of the County Technical Laboratories at Chelmsford are engaged in an investigation that will commend itself to Londoners; they are trying to gain some information as to the natural causes bringing about variation in the composition of milk. Two reports dealing respectively with the winter and summer months of the past year have been issued. From the latter we learn that in Essex milk is poorest in the months of July and August. This is the common experience of dairy farmers. It is when the pastures begin to dry up that the quality of milk suffers most. In the Essex experiments four cows were kept under observation from May until September, and two others for a shorter period. The yield of milk fell off at the rapid rate of 10 per cent. per month; with this decline there was an increase in the proportion of fat, but no regular increase in the case of solids not fat. In the month of July the percentage of non-fatty solids decreased in the milk of every animal. The milk of four of the cows, and the mixed milk of the six animals, never fell below the standard in solids not fat, but two of the cows often failed in this respect. The mixed milk and the milk of one of the cows never contained less than the standard quantity of fat, but the milk of two of the cows frequently, and the milk of two others occasionally, contained less than the required 3 per cent. of fat.

In connection with the investigations on nutrition, which form an important part of the work of the Storrs Agricultural Experiment Station, Conn., analyses have recently been made of the flesh of many kinds of fowl. The analyses were published in the annual report of the station for 1902–3, and some account of them is also given in a recently issued bulletin on "Poultry as Food." The bulletin contains a table showing the composition of the digestible nutrients in the flesh of poultry; comparisons are made between young and mature birds, and also between poultry and other common articles of diet. The meat of light-fleshed birds is shown to be usually richer in albuminoids and poorer in fat than the meat of dark-fleshed; and among light-fleshed fowls chickens supply a more nitrogenous food than mature birds; on the other hand, in dark-fleshed fowls the flesh of the young appears to contain more fat and less albuminoids than the flesh of older birds. The following figures show that the breast, or breast and wings of poultry, usually contain more albuminoids and less fat than the legs or dark meat. The analyses were of raw meat. Cooking may materially alter the proportion of fat.

	Digestible nutrients	
	Albuminoids	Fat
	Per cent.	Per cent.
Chicken, light meat	21·2	7·0
,, dark ,, ...	20·2	7·8
Turkey, light meat	25·0	10·7
,, dark ,, ...	19·4	23·8
Duck, breast	21·6	2·2
,, other parts	16·9	24·8

An important paper containing a summary of Koch's investigation of Rhodesian red-water, or, as he prefers to call it, African coast fever, appears in the May number of the *Agricultural Journal* of the Cape of Good Hope. This disease of cattle, introduced from the coast, has recently worked havoc in Rhodesia, the mortality among the herds of certain districts having risen to 90 per cent. Like Texas fever, with which it was at first confounded, coast fever is due to the presence of a tick-conveyed parasite in the blood. An animal which has recovered becomes immune, and, according to Koch, a proportion of the progeny contract the disease in a mild form as calves and also become immune, so that an immune race will gradually form in the same way as a partially immune population is to be found in many of the most deadly malaria districts. In the absence of ticks, coast fever cannot spread. Unlike Texas fever, injection of the blood of a diseased animal will not produce the disease. But Koch has shown that repeated injections result in a mild fever which is sufficient to confer partial, and in his opinion a high degree of immunity. On this fact is based the treatment which he recommends for the disease, the injection of 5 c.c. of defibrinated blood from a sick or "salted" animal about seven times at intervals of a fortnight. This treatment he believes will in four or five months confer immunity. Inoculation is absolutely safe, for of 3115 "clean" animals treated not one died, and the treatment is so rapid that an operator can deal with 300 to 500 per day. Of the efficacy of the treatment it is clear that Koch has a high opinion, though he is careful to point out that his experimental evidence is not yet complete. Of 1688 animals that had been exposed to infection and were inoculated, 174 died. As in many of these cases inoculation must have been too late to benefit, Koch argues that the number dying because inoculation failed to protect must have been very small. In view of the very high death rate in unprotected herds it would appear that the proposed treatment is of high promise.

But Koch's views on the value of inoculation do not seem to be shared by all the experts who are now engaged in the study of African coast fever, and the Government entomologist, Mr. Lounsbury, who has made a careful study of the tick conveying the disease, appears to favour the use of arsenical dips, which, by destroying the tick, would put an end to the ravages of coast fever. Lounsbury speaks of these dips as an "effectual remedy," while Koch characterises their use as a "temporary" measure. Mr. Lounsbury publishes an interesting account of the experiments by which he proved that the infection was carried by the common brown cattle tick of South Africa (*Rhipicephalus appendiculatus*). He failed in ten experiments to convey it through the blue tick, which Koch says is partly responsible for transmission. In a preliminary experiment Lounsbury proved that brown ticks taken from sick cattle in Rhodesia produced coast fever in Cape Colony. Brown ticks were then collected in a region in the colony in which coast fever was unknown. From these ticks progeny were raised, the majority of which were fed throughout life on healthy cattle without causing any disturbance in health; others were taken to Rhodesia and placed on a sick cow; they were then taken back to Cape Colony and put, at intervals of a few days, on three cattle. "The results were most decisive. The three animals sickened each in turn about a fortnight after the infestation," and all died. This experiment was repeated, and it was found that a single tick could produce the disease. Lounsbury notes that one of the cattle which died in his experiments had previously been inoculated ten times from an animal pronounced by Koch to be suitable as a "bleeder."

While in South Africa Koch has studied horse-sickness, and in a recent report on his work he speaks of "encouraging results which . . . impress me with the conviction that a practical method of protective inoculation against Horse-sickness is within our reach." A serum has been prepared which has slight curative but high protective properties. Unfortunately, the immunity conferred by the serum lasts only for some fifteen days, so that a horse cannot be "salted" by inoculation, and to be safe from an attack the animal must have already had horse-sickness in some form. The "practical method" which Koch proposes consists in producing horse-sickness by an injection of virus, and then arresting its progress by injections of the protective serum before it becomes dangerous. The method has been practised successfully on more than a dozen animals. As the result of his experiments Koch recommends the following treatment:—Seven injections of virus at intervals of twelve days, the doses increasing from 0.01 c.c. to 5 c.c. Four days after each of the first three injections of virus, doses of 100 c.c., 50 c.c., and 50 c.c. of protective serum to be given. The injections of both virus and serum are made subcutaneously in the neck.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Frank Smart studentship in botany has been awarded to Mr. A. M. Smith, of Emmanuel College.

Mr. E. R. Burdon, of Sidney Sussex College, has been appointed assistant curator of the botanical museum.

Science announces the resignation of Prof. G. Trumbull Ladd as head of the department of mental philosophy and metaphysics of Yale University.

LORD STRATHCONA has given 4000*l.* to the scientific department of the Manitoba University. A block of land sufficient to yield a large annual income is also to be placed at the university's disposal.

THE chair of chemistry in University College, Sheffield, has been accepted by Dr. W. P. Wynne, F.R.S., at present professor of chemistry in the School of Pharmacy of the Pharmaceutical Society of Great Britain.

DR. C. SCHUCHERT, of the U.S. National Museum, has been appointed professor of historical geology in the Sheffield Scientific School of Yale University, and curator of the geological collections in succession to the late Prof. Beecher.

THE "Year-book" for the session 1904–5 of the Armour Institute of Technology, Chicago, a copy of which has reached us, contains full particulars of the course in fire protection engineering instituted last year. The course is arranged to furnish instruction in modern methods of fire prevention and extinction. Since fire insurance interests are closely connected with the work of the course, a portion of the time of senior students is devoted to the study of modern practice of fire underwriting. Prof. Taylor, who is in charge of this department of the institute, has rightly given great prominence in his syllabus to the scientific principles upon which successful work in fire extinction depends.

THE consultative committee to the Board of Education has submitted a number of suggestions to the board for a system of school certificates. The committee is of opinion that, with the object of diminishing the multiplicity of examinations affecting secondary schools, and of providing a test of adequate general education which may be widely accepted, a general system of school certificates is desirable. The committee does not think it is desirable that examinations for such certificates should be conducted by means of papers set for the whole country from a single central organisation. It suggests that such examinations should be controlled by a recognised examining body, which should be either a university or a combination of universities, or an examination board representative of a university or universities, and of the local authorities which are prepared to cooperate with them. It proposes that recognition of these examining bodies should mean recognition by the Board of Education, acting on the advice of the consultative committee. The establishment is suggested of a central board for England consisting of representatives from the Board of Education and from the different examining bodies, the duty of which should be to coordinate and control the standards of these examinations, to secure the interchangeability of certificates, and to consider and, as far as possible, to adjust the relations of the examining bodies and their spheres of external action. There can be little doubt that some such plan as the consultative committee proposes would enable schoolmasters to utilise in the better education of their boys much of the time now absorbed by the preparation for numerous special examinations.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, July 11.—M. Mascart in the chair.—Thermochemical investigation of the solution and polymerisation of cyanogen: M. **Berthelot.** Potassium cyanide has considerable thermal effect on a solution of cyanogen whether in water or alcohol.—Note on the heat of transformation of black crystalline sulphide of antimony into the orange coloured precipitate: M. **Berthelot.**—Condensation of glycol bromoacetate with acetoacetic and acetone dicarboxylic esters: A. **Haller** and F. **March.**—Origin in food of the arsenic normally found in man: Armand **Gautier** and P. **Clausmann.** Practically all food materials, particularly fish, contain traces of arsenic, the total arsenic received by an average man in a year being 7·66 mg.—The relation between external work and total expenditure of energy in a muscle in dynamic contraction, when the muscle is doing negative work, against the fall of a load, by gradually elongating as the load falls: A. **Chauveau.** It is concluded that the expenditure of energy is greater in negative work than in fixed contraction, but less than in positive work under the same conditions of load, stimulus, &c., and that in negative work the expenditure of energy increases more rapidly, when the work is increased by increase of load, than by increase of movement.—Note on a new method of observing *n*-rays: R. **Blondlot.**—Analysis of the ashes contained in the urns of Materpa (Thebes, eighteenth dynasty): MM. **Lortet** and **Hugoumenq.**—Regulation of watches at sea by wireless telegraphy: J. A. **Normand.**—The academy appointed MM. Mascart, Troost, Moissan, Guyon, and Lacroix to assist at the inauguration of the Pasteur monument in Paris.—Two problems on isothermic surfaces: L. **Raffy.**—Explosion waves: E. **Jonguet.**—Kathode rays and magnetofriction; reply to Villard: H. **Pellat.**—Note on the refractive indices of solutions: Edmond **Van Aubel.**—The relation between the pressure of a gas in a vacuous tube and the length of the spark produced: Gaston **Séguy.** As the pressure decreases in geometric progression the length of the spark increases in arithmetic progression.—The densities of sulphurous anhydride and of oxygen: Adrien **Jaquerod** and Alexandre **Pintza.** Morley's method of weighing the gas by the loss in weight of the generating apparatus was used with concordant results in the case of sulphurous anhydride.—The heat of combustion of organic sulphur compounds, and a note on that of compounds containing halogens: P. **Lemoult.** Results of experiments are compared with those obtained by calculation according to the position of the sulphur.—Reactions of the esters of 2 : 3-butanonic acid. (1) Action of phenyl hydrazine: L. **Bouveault** and A. **Wahl.** The phenyl hydrazone obtained in the cold is proved to be that in the 2-position by the formation of the paranitrophenyl hydrazone of methyl phenyl acetopyrazolone previously obtained by Bülow.—Researches in the pyrane series: E. **Blaise** and H. **Gault.**—On some phenolic ethers of the pseudo allyl chain $R—C(CH_3)=CH_2$: MM. **Behal** and **Tiffeneau.** These bodies are obtained by the magnesium methiodide reaction on the corresponding esters, using one or two molecules in excess of the magnesium methiodide, and are intermediate between the corresponding allyl and isoallyl compounds in boiling point, density, and refractive index.—Action of traces of some salts, and of caustic alkalis on diphenyl carbonic ester: R. **Fosse.**—Mechanism of the action of the cytoplasm in seeds during germination, and the synthetic realisation of this mechanism *in vitro*: Maurice **Nicloux.** The development of acid in oily seeds, when

germinating, is proved to be due to the hydrolytic action of the cytoplasm on the oil. The name *lipaséidine* is proposed for the active substance in the cytoplasm. The action requires some acid to start it, but CO_2 is proved by experiment *in vitro* to be sufficient, and CO_2 is produced in germination.—A new trypanosome in birds: M. **Thiroux.**—Some phenomena during ovogenesis among the cirripedes, particularly in *Scalpellum velutinum*: A. **Gruvel.**—On the structure of the heart in gasteropods and lamellibranchs: F. **Marceau.**—On the development of black rot (*Guignardia Bidwellii*): P. **Viala** and P. **Pacottet.** For rapid development black rot requires a warm temperature and a moist atmosphere, but at low temperatures growth proceeds slowly. It is, moreover, highly resistant towards acids and toxic substances generally.—Garéwaite, a new fibrous basic rock of the North Urals: L. **Duparc** and F. **Pearce.**—Stationary waves observed in the neighbourhood of the human body: Augustin **Charpentier.**—Localisation of iodine in the African turtle: MM. **Doyon** and **Chenu.**—Action of salts of the alkaline earths on living substance: N. C. **Paulesco.**—Influence of sterilisation on food-stuffs: A. **Charrin.**—On the contractility of protoplasm, i., action of chlorhydrate of amyleine on ciliary movement: L. **Launoy.**—On the supposed chlorophyll of silk: Jules **Villard.**

July 18.—M. Mascart in the chair.—Experiments on the slow oxidation of cyanogen and cyanides by free oxygen: M. **Berthelot.** The absorption of oxygen from air by the following solutions is examined:—potassium cyanide, hydrocyanic acid, and cyanogen in water and in alcohol, alcohol alone, and alcoholic potash, also by these solutions in the presence of mercury. Absorption of oxygen is observed in every case, but becomes more rapid when the tube is heated or exposed to light. When mercury is present, the absorption of oxygen causes solution of some mercury, particularly with the cyanides.—The natural immunity of cynocephales towards trypanosomiases, and the activity of their serum towards trypanosomes: A. **Laveran.**—Hypsometric tables of Cretaceous strata in the north of France: J. **Gosselet.**—Pamphlets presented to the academy:—Considerations on the principles of arithmetic: L. **Gros.**—Researches on the quantity of citric acid in wines: Lucien **Robin.**—A work on tables of corrections of the times of the moon's rising and setting: S. **Abdullah.**—A supplement to the general problems of flight: M. **Averly.**—The secretary read several telegrams concerning the earthquakes of July 12 and 13.—Steered balloons. Longitudinal stability: Ch. **Renard.**—On the anomalous propagation of light in the neighbourhood of a focal line, and on the interference of vibrations the amplitudes of which are different functions of the distance: G. **Sagnac.**—On the disappearance of some of the silicon lines in the spectra of certain stars: A. **de Gramont.**—Variation of the index of refraction of an electrolyte under the action of the current: H. **Bordier.** Chlorides of copper and of zinc were used. It was found that, when the current is constant, the reduction of index of refraction decreases with increase in the concentration of the electrolyte, whilst, when the concentration is constant, the decrease of refractive index plotted in a curve against the strength of the current forms a straight line.—The influence of the density of the current in electrolysis with alternating current: André **Brochet** and Joseph **Petit.** Nickel electrodes in a solution of potassium cyanide were used, and the relation between the amount of nickel dissolved and the density of the current investigated for different frequencies, when the time and total current were constant.—On the fundamental law of the phenomena of osmosis: E. **Ariès.**—On the constitution of dissolved salts: Albert **Colson.** The formula

$$HSO_4Zn—O—Zn—SO_4H$$

is assigned to zinc sulphate from considerations of the basic sulphates obtained by alkalis, and of the freezing point of solutions of zinc sulphate.—On some crystalline iodates of copper: A. **Granger** and A. **de Schulten.**—Dextrolactic acid and lævolactic acid are not alike in their reactions: E. **Jungfleisch.** *l*-Lactic is much more easily racemised than *d*-lactic, so much so that in separating *d*- and *l*- from *in*-lactic by the quinine salts, *d*-lactic is easily obtained, but the supposed *l*-lactic is mainly *d*+*l*.—Orthophosphoric anilide and its homologues; the non-existence of the compound $C_6H_5NH—P{\equiv}(NC_6H_5)_2$: P. **Lemoult.**—Condensation of acetylene ketones with alcohols and phenols: Ch. **Moureu** and M. **Brachin.**—Action of oxalacetic ester on benzaldehyde in the presence of primary amines: L. J. **Simon** and A. **Conduché.**—The heat of neutralisation and acidity of monomethylarsenious acid: A. **Astruc** and E. **Baud.**—On a frequent source of error in the analysis of coal: Just **Alix** and Isidore **Bay.**—On some points in the anatomy of the cirripedes: A. **Gruvel.**—Antimeridian plants: Édouard **de Janczewski.**—Carpellised stamens of the wallflower: C. **Gerber.**—Bravais's law considered as a law of observation: G. **Friedel.**—A new theory of ouralitisation: L. **Duparc** and Th. **Hornung.**—On the terraces of the Carpathian rivers in Roumania: E. **de Martonne.**—Researches on the genital poisons of different animals: Gustave **Loisel.** The extract of an ovary is always more poisonous than that of a testis, and varies in different animals, that of the frog being most poisonous towards a rabbit. The toxic effect is nervous, producing tetanus and dyspnœa.—The influence of lactation on the resistance of the organism to morbid agencies: MM. **Charrin** and **Vitry.** A female in lactation is less resistant than the normal to alkaloids and bacteria.—The mechanical cleansing of the blood: Ch. **Répin.** To remove poisonous substances from the blood a method is used by which the plasma is removed, being replaced by artificial serum, but the corpuscles, being separated centrifugally, are immediately returned to the blood stream.—Researches on arsenic in some food-stuffs: V. **Bordas.**—A new contribution to the bacterial purification of spring and river waters by means of fine sand, which is not submerged: P. **Miquel** and H. **Mouchet.**—On the duration of the experiments in the treatment of arterial hypertension by d'Arsonvalisation: A. **Moutier.**—On a new type of piezometer: M. **Buchanan.**—The Hirondelle deep in the archipelago of the Azores: M. **Thoulet.**

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