THURSDAY, MAY 27, 1880

MATHEMATICAL JOURNALS

American Journal of Mathematics, Pure and Applied. Published under the auspices of the Johns Hopkins University. Vols. i., ii. (Baltimore: John Murphy and Co.)

THE *American Journal of Mathematics* has now completed its second volume, and has obtained an established place among the leading mathematical journals. Thanks to the Johns Hopkins University at Baltimore, America possesses, what has never been attempted in England, a *quarto* journal entirely devoted to mathematics.

Perhaps in no branch of science is the literature of the subject so exclusively confined to periodical publications as in mathematics. The books that are written are merely text-books and, in this country, generally have reference to certain special examinations. Of course there are exceptions which will immediately occur to mathematicians, such as Salmon's treatises and Todhunter's histories, and the exceptions are more numerous in Germany; but, even when all the books published in all languages which are above the rank of school-books are included, they bear an extremely insignificant proportion to the amount of original mathematical literature contained in periodical publications; in fact it would be impossible to form any idea of the present state and extent of mathematical science from any study of the books upon the subject. The same is to some extent true of all branches of science; but the want of treatises is greatest in mathematics on account of the smallness of the audience addressed and the impossibility of expressing even the results in a manner intelligible to the non-mathematical reader.

As a consequence of the scarcity of treatises there are many extensive branches of mathematics (such as, for example, the Partition of Numbers) which exist only in the periodicals; and the contents of the latter are therefore less transitory, so to speak, than in other sciences, *i.e.*, the papers are less liable to be superseded by subsequent writings and to become only of historical interest.

A journal devoted to a special subject always promotes activity in that subject, as one paper gives rise to another; but, besides this, it collects in one place many researches which would otherwise be widely scattered in the publications of different societies; and this latter advantage is much more apparent when, as in the case of the *American Journal*, its extent is sufficient to enable it to receive elaborate memoirs. Thus M. Lucas' "Théorie des Fonctions simplement périodiques" occupies 90 pages, and Mr. McClintock's "Essay on the Calculus of Enlargement" 61 pages. There is no reason to suppose that the majority of the papers contained in the *American Journal* would not have been written and printed, if the latter had not existed, but it is a real gain to the mathematician to have them all united in a single periodical.

The great increase in the number of mathematical journals in the last few years is very remarkable. The following is, we believe, a complete list of all the journals now in existence which are exclusively devoted to mathematics, with place of publication and date of foundation. An asterisk denotes that the journal to which it is prefixed admits problems for solution:—

AMERICA

*Analyst ... ... [Des Moines, 1874], 8vo.
American Journal... ... [Baltimore, 1878], 4to.

ENGLAND

Quarterly Journal... ... [Cambridge, 1839], 8vo.
Messenger ... ... [Cambridge, 1862], 8vo.

FRANCE

Journal (Liouville) ... [Paris, 1836], 4to.
*Nouvelles Annales ... [Paris, 1842], 8vo.
Bulletin ... ... [Paris, 1870], 8vo.

GERMANY

Journal (Crelle) ... ... [Berlin, 1826], 4to.
Archiv (Grunert) ... ... [Greifswald, 1841], 8vo.
Zeitschrift (Schlömilch).. [Leipzig, 1856], 8vo.
Annalen (Clebsch)... ... [Leipzig, 1869], 8vo.
Fortschritte ... ... [Berlin, 1871], 8vo.
Repertorium ... ... [Leipzig, 1877], 8vo.

ITALY

Annali (Tortolini) ... [Rome, 1850], 4to.
Giornale (Battaglini) ... [Naples, 1863], 8vo.
Bulletino (Boncompagni). [Rome, 1868], 4to.

BELGIUM

*Nouvelle Corréspondance. [Mons, 1874], 8vo.

HOLLAND

Nieuw Archief ... ... [Amsterdam, 1878], 8vo.

DENMARK

*Tidsskrift ... ... [Copenhagen, 1859], 8vo.

To these may be added the *Reprint [London, 1864] from the *Educational Times*, consisting almost entirely of problems and solutions; and also, although not strictly journals, the *Proceedings* of the London Mathematical Society [London, 1865] and the *Bulletin* of the French Mathematical Society [Paris, 1872]. The object of two of the journals, the *Fortschritte* and the *Repertorium*, is to give *résumés* of papers published elsewhere. It may be observed that all the journals included in the above list are strictly mathematical, although in the titles of some of them mathematics is coupled with physics or astronomy. A few minor periodicals, appearing at long intervals, have been omitted.

Thus of the nineteen journals included in the above list no less than seven have been founded in the last ten years, while four were founded in the preceding decade, 1860-70, so that only eight date from farther back than 1860. The oldest and by far the most celebrated journal is *Crelle*, which has now reached its eighty-ninth volume; many of the most important mathematical discoveries of the present century are contained in its pages.

The publication of problems and solutions in a mathematical journal is always to be regretted, as it is impossible not to feel that the space might be better occupied, and that the presence of mere exercises in a periodical which should be devoted to the advance of the science is undesirable. Their insertion in several cases is doubtless due to a wish to increase the number of readers by including a class who would take but little interest in, or be unable to follow, original mathematical researches; but the "problem for solution" may even be defended on scientific grounds, as it is a well-known historical fact that not a few of the greatest mathematicians were first led

to take a strong interest in mathematics by being tempted in their younger days to attack such questions. It may be remarked also that the mathematical problem has itself undergone great improvement since the days of the *Ladies' Diary*, when the problems usually appeared by the side of the enigmas, charades, &c. These problems were generally merely made-up exercises or puzzles—such as are to be found now only in examination papers—in which the data were wholly fictitious or even ridiculous; the modern problem, especially in pure mathematics, is often a theorem, or a particular case of a theorem, of very considerable intrinsic interest. It is right to mention that the *Nouvelles Annales* is really intended mainly for purposes of instruction, and that apparently a Continental student derives from this publication very much the same kind of practice and skill in the treatment of problems which at Cambridge he would obtain from his private tutor.

The history of mathematical journalism in all countries seems very similar: first, there is the Annual or other periodical, containing at the end puzzles, problems for solution, &c., the best solutions and the names of those who sent in correct solutions being given in the following number; at length these are supplemented by short articles on particular subjects—frequently suggested by the problems—by the leading contributors. The next step is the mathematical journal, consisting of two parts, the one containing original papers, and the other—quite distinct—containing a limited number of problems and solutions. Finally we have the strictly scientific journal, differing in no essential respect from the *Transactions* of a society; and, it is scarcely necessary to remark that, on account of the length of many of the formulæ, a quarto journal is preferable to one of octavo size.

From an interesting account of American mathematical periodicals by Mr. David S. Hart, which was published in the *Analyst* for September, 1875, it appears that the first mathematical journal published in America was the *Mathematical Correspondent*, which was issued at New York on May 1, 1804, and of which eight quarterly numbers only were published. The next periodical was the *Analyst, or Mathematical Museum*, of which the first number was published in 1808; five numbers only appeared. In January, 1825, the first number was issued of the *Mathematical Diary*, which continued till March, 1832; for the first two years it was published quarterly, and for the remaining five years annually, thirteen numbers in all being issued; this journal, Mr. Hart remarks, "contained besides solutions of problems many important and valuable essays on the various branches of exact science, and was the best mathematical serial that had as yet appeared." The next periodical was the *Mathematical Miscellany*, which lasted from 1836 to 1839; it had a junior and senior department, the former for young students and the latter for mathematicians; eight numbers were issued. In 1842 the first number appeared of the *Cambridge Miscellany of Mathematics, Physics, and Astronomy*, edited by Professors Benjamin Peirce and Joseph Lovering, but only four quarterly numbers were issued.

In October, 1858, Mr. J. D. Runkle published the first number of the *Mathematical Monthly*, which is by far the best known of the journals which appeared previously to those now in existence; it contained papers not exceeding eight pages in length, notes and queries, and five problems in each number intended for students, with solutions in a subsequent number. This journal, which seemed to be filling a want, unfortunately had to be discontinued in 1861 in consequence of the war. No further attempt was made to establish a mathematical journal till January, 1874, when Dr. J. E. Hendricks established the *Analyst*, which for the first year was issued monthly and has since appeared bi-monthly. This journal, in spite of many serious disadvantages due to difficulties of printing, &c., has done good service to mathematics in America. It is not to be compared to the *American Journal* as regards the importance of its papers, and a considerable portion of each number is devoted to problems; but the editor may fairly claim to have done for the encouragement of the science not less than have the editors of the *Journal*, to which the *Analyst* may now be regarded as a valuable supplement.

Soon after the foundation of the Johns Hopkins University, the *American Journal* was issued (in 1878) under its auspices, with Prof. Sylvester as chief editor and Mr. W. E. Story as acting editor, assisted by Professors Benjamin Peirce, Simon Newcomb, and H. A. Rowland. The contents of the journal have been worthy of the reputation of the editors, and as regards printing, &c., there is nothing to be desired. Among the papers may be noticed, besides the numerous and important investigations of Prof. Sylvester himself, those by Mr. G. W. Hill on the lunar theory, by Mr. G. B. Halstead on the bibliography of hyperspace and non-Euclidean geometry, and by Mr. Story on the elastic potential of a crystal. There are also contributions from Prof. Newcomb, Prof. W. W. Johnson, Mr. C. S. Peirce, &c., and from European mathematicians, Professors Cayley, Clifford, Lipschitz, &c.

It will be generally admitted that Prof. Sylvester's researches are amongst the most valuable contained in the *Journal;* one of the most elaborate of these, which occupies 60 pages, relates to an application of the new atomic theory to the graphical representation of the invariants and covariants of binary quantics. Most of the others also have reference to invariants or covariants or cognate branches of the modern higher algebra, and the great amount of space devoted to this important subject is very noticeable. There is a paper by Prof. Cayley on the calculation of the minimum numerical generating function of the binary seventhic, and Prof. Sylvester is now publishing his valuable tables of the generating functions and groundforms for binary quantics and systems of binary quantics, which he has calculated with the assistance of his pupil, Mr. F. Franklin.

There are other well-known American mathematicians, Asaph Hall, Artemas Martin, E. B. Seitz, C. H. Kummell, &c., who do not as yet appear to have contributed to the *Journal*, although their names are familiar to readers of the *Analyst*, and when these are added to the already considerable number of American authors of papers in the *Journal*, it is clear that the mathematicians in America are sufficiently numerous to support permanently such a journal as that over which Prof. Sylvester presides. The *American Journal* has started well, and there is no reason to suppose that it has not as great a

future before it as awaited *Crelle's Journal* half a century ago.

The only method of "endowing the research" of the pure mathematician is to give him a journal, and this the Johns Hopkins University has done for America. Two years ago it seemed a question whether it was worth while to apply to the Cambridge Commissioners to endow mathematics in a similar manner in England. On the whole it seemed better not to make such an application, as the obvious difficulties in the way of the editorship, &c., of a subsidised journal would be considerable, and the existing journals, which support themselves, seem to fairly meet the demand. But for the foundation of the London Mathematical Society in 1865 the want of a large mathematical journal would have become pressing; as it is, the *Proceedings* of this Society may now be regarded as taking the place of a leading English journal. The journal, however, has two important advantages over the publications of a society: (1) the printing of the papers is unaccompanied by the formalities of reading, being reported on by referees, &c.; (2) the journal is much the more procurable, especially if separate numbers be required; it also affords more rapid publication.

J. W. L. GLAISHER

OUR BOOK SHELF

Six Life Studies of Famous Women. By M. Betham Edwards. (London: Griffith and Farran, 1880.)

THIS is a readable and instructive collection of studies, containing, among others, notices of two women notable in their different ways in the history of science—Caroline Herschel and Alexandrine Tinné, the famous African explorer. The studies are marked by care and neatness, and are on the whole fair estimates of the work and life of the subjects. They are accompanied by six well-executed steel portraits.

LETTERS TO THE EDITOR

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

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

Lord Rosse's Telescope.

IN an article in the *Times* newspaper there occurs the passage—"With regard to the mighty mirror of the Parsonstown reflector M. Struve has spoken in no very complimentary terms. It was said of Sir W. Herschel's four-feet reflector that it 'bunched a star into a cocked hat;' but even this is scarcely less satisfactory than M. Struve's remark that at Parsonstown 'they showed me something which they said was Saturn, and I believed them.'" This revival of the statement attributed by Mr. Proctor in *Fraser's Magazine* for December, 1869, to "a distinguishing (*sic*) astronomer," has called forth the appended letter from the Imperial Astronomer of Russia. It is satisfactory to receive direct from M. Struve a statement of his experience of the performance of the six-foot instrument. ROSSE

25, Chesham Place, S.W., May 26, 1880.

"MY DEAR LORD ROSSE.—Yesterday evening a friend conveyed to me a note, inserted in the *Times* of April 3, under the title 'Three Giant Telescopes,' in which I am told of having expressed myself in a very uncourteous manner on the optical qualities of the great reflector constructed by your late father. I beg leave to say that those expressions are altogether invented by the anonymous author of the note, or, at least, quite a voluntary and thoroughly wrong interpretation of what I may have said. I am sorry my name is abused in such a manner by people who probably have a design of their own in depreciating the performances of the instrument, the construction of which marked in itself a high progress in optics and mechanics, and which in its space-penetrating power has not had any rival until now, though certainly with regard to definition (particulary when the mirror is considerably out of horizontal position) there are other instruments superior to it. "OTTO STRUVE

"Pulkova, April 14"

Brain Dynamics

IN his clearly-written letter on this subject Mr. Tolver Preston seems to think that the reconciliation which he offers between Free Will and Necessity is a novel one. In this, however, he is mistaken, as the supposed reconciliation was very distinctly stated by the late Prof. Clifford in his lecture at St. George's Hall on "Body and Mind." But of more importance than the novelty of the reconciliation is the question as to its validity, and it is on this question that I shall make a few remarks.

The suggested reconciliation is as follows:—No upholder of Free Will can desire to maintain that a man may act, or desire and will to act, otherwise than in conformity with his character; for to maintain this would be to maintain that a man may act at random, without reference to any fixed principles of action, and that the Will is free only in the sense of being erratic. But if it is admitted that by freedom of the Will is meant freedom to choose within the lines laid down by previous character, and freedom, therefore, to shape future character by present volitions, it follows that upholders of the Free Will doctrine ought not to quarrel with those who uphold the doctrine of Necessity as due to "brain dynamics"; for the latter doctrine supplies the very basis which the former doctrine requires. It shows *why* the Will always acts in accordance with previous character; it shows that the Will can never be free in the sense of being lawless, or not determined by adequate causes; and it shows that the Will must be free in the sense of being able to choose between motives supplied by the structure of preformed character. Thus, it is represented, believers in Free Will ought to welcome modern physiology with all its "materialistic" deductions from "brain dynamics" to mental changes. For, unless these persons desire to land themselves in that quagmire of hopeless nonsense—the conclusion that volitions are uncaused—they have no alternative but to conclude that volitions are determined by motives, which are themselves determined by previous character. But if once volitions are thus conceded to enter the stream of causation, the more rigid the causation, the better for such freedom as remains, seeing that the latter, if always strictly determined, can never be lawless or erratic. Now of all things rigid, that which is least open to any suspicion of laxity is physical causation. Consequently, if the Determinism of Psychology admits of being resolved into the Neurility of Physiology, believers in the Freedom of the Will ought to rest peacefully satisfied that while they are free to act within the limits prescribed by their own characters, they have the sure and certain guarantee of physical causation that their volitions can never break out into activity at random. Or, as Mr. Tolver Preston puts it: "Solely in virtue of the fact that there is strict Causal Sequence in nature are the actions brought into strict conformity with individual brain structures (or with character). If the principles of dynamics were not rigid, or if the laws of nature were liable to alteration, a man's actions might sometimes be in harmony with his brain structure [character], sometimes in discord with it; or any number of persons, though possessing totally different brain-structures [characters], might act identically. The questionable expediency of the proceedings of those who are disposed to grumble at what they term the 'iron' laws of nature becomes apparent here."

Such, I think, is a full statement of the suggested reconciliation. I shall now proceed to show that as a reconciliation it is utterly futile.

There is nothing to be said against the reasoning as far as it goes; but it is curious, if not unsatisfactory, that both Prof. Clifford and Mr. Preston should have performed their little play without letting us know that the Prince of Denmark has been omitted. His name in this case is Responsibility. No doubt it is perfectly true that the suggested reconciliation shows to all believers in Free Will that their belief ought only to include freedom "as freedom to act in accordance with" character;

that "such freedom actually exists;" and that "the very condition for its existence is seen to be the prevalence of that strict causal sequence in nature demanded by the Necessitarians." But although the suggested reconciliation shows all this, it fails to extend to the upholders of Free Will the relief which they most require, for the procuring of which their doctrine was conceived, and for the continuance of which their doctrine is continued, notwithstanding the manifest and manifold absurdities which it involves. That the supposed reconciliation here fails, seems almost too obvious to require showing. The more certainly it can be proved that every volition is the result of definite causes, and therefore that the character—even in that part of it which is formed by all previous volitions—is also the result of definite causes, the less possibility is there of justifying the sense of Responsibility.

Unless it can be shown that a man is responsible for the character of his character it is nonsense to speak of him as responsible for his actions, when these are determined by his volitions, which, in turn, are determined by his character. Can it, then, be shown that a man is responsible for the character of his character? Obviously not, either upon Clifford's view or any other. It is futile to speak of a man as "the architect of his own character"; for, according to the hypothesis before us, he is nothing of the kind: his character has been built up stage by stage, first by hereditary transmission, next by numberless unintentional influences acting both from within and from without, and lastly by numberless acts of volition, every one of which was strictly determined by causes, and therefore was what it was by way of inevitable necessity. It follows, therefore, that the supposed reconciliation between Free Will and Necessity tends rather to emphasise than to diminish the difficulty; it shows more clearly than ever that the sense of Responsibility, and the correlative sense of Praise or Blame, are alike incapable of any logical justification. No doubt the sense of Responsibility, the love of Praise, and the dread of Blame act as powerful motives to volition; but this fact clearly does not justify either the feeling of responsibility in him who acts, or the feeling of approval or disapproval in him who observes.

But it is of importance also to see that it is quite as impossible to justify these feelings by the doctrine of Free Will as it is by the doctrine of Necessity. For if volitions are uncaused, or but partly and irregularly caused, it is clear that neither moral responsibility, nor praise, nor blame can attach to the unfortunate man whose actions are not guided even by the hand of Providence, but occur by way of inexplicable caprice.

What, then, it cannot but be asked, is the psychological explanation of these deeply-rooted feelings of Responsibility, Praise, and Blame, which can never be eradicated by any evidence of their irrationality? To me it appears the only answer is that these feelings have been gradually formed as instincts, which, while undoubtedly of much benefit to the race, are destitute of any rational justification. GEORGE J. ROMANES

The Inevitable Test for Aurora

IN NATURE, vol. xxii. p. 33, is an implication, if not also a declaration, that the limits of height in the atmosphere, at which the *Aurora Borealis* both can, and cannot, appear, have been ascertained by those world-respected scientists, Messrs. Warren De La Rue and Hugo W. Müller, F.R.S.S. both. The skill of their experiments, the sufficiency of their exhausting apparatus, and the power of their unequalled chloride of silver battery are beyond all question; and they did, without doubt, ascertain in a very complete manner at what particular degrees of rarefaction of certain glass vessels, their electric discharges therein, took such and such appearances.

But what proof do they give that those appearances were aurora?

They mention carmine-coloured discharges in the denser air, salmon-coloured in more rarefied, and pale milky white in the highest rarefaction of all. But those colours, as judged of merely by the eye, are little proof in themselves of the presence of one and one only out of a number, of different things, elements, or manifestations somewhat similarly coloured. So that although I would not presume to be too confident of the sufficiency of the test I am about to set before those eminent men, still, as I was obliged to have the honour of presenting it to that admirable electric philosopher, M. Gaston de Planté, of Paris, three years ago, when he described with his equally wondrous collection of "secondary" galvanic-battery pots and currents of terrific intensity, the *aurora-like* effects it produced—impartial justice demands the same test to be presented now to our best physicists on the west of the British Channel.

Now the test is simply this: did the F.R.S.S. gentlemen see in their electric lights the late M. Angström's one citron line of aurora?—that line being so invaluable an indication of aurora's presence, though hitherto uninterpreted (see Rand Capron's laborious book of Auroræ [1]); and without which strange linear hieroglyph written from Creation most legibly on its forehead, no aurora has ever yet been seen by mortal man properly equipped for the occasion. And, inasmuch as the learned F.R.S.S. speak of so many variations of red—as carmine, rose, and salmon colours of various kinds—while I had the opportunity of calling attention in NATURE in 1872 to the remarkable fact that *maugre* all the violent variations of auroral red to the eye on that occasion, there was only one and the same red line in the spectroscope through every one of them—did the London scientists see that unique red auroral line manifesting itself through all their various artificial reddish tints; or, had each tint a line or lines peculiar to itself; or was there no red line whatever to be seen, though they looked for it never so earnestly; or is that crucial part of their experiment described elsewhere than in NATURE, vol. xxii. p. 33? PIAZZI SMYTH

15, Royal Terrace, Edinburgh, May 17

Variability of 60 Cancri

I FOUND the above to be a red star in 1874, and the Rev. Mr. Webb, in the same year, made independently a similar observation. It appeared to me of 8 magnitude, as it did also to Mr. Webb. It is numbered 212 in my *Red Star Catalogue*, where, considering Argeländer's previous estimate of about 6 mag., I remarked that it might be variable. This appears now certain, as on April 27 of the present year, and again on May 17, I found the star to be 5 mag. and red-orange in colour. Dr. Copeland, of Dunecht, replying to a letter on the subject, informs me that on referring to various authorities, he finds estimates of the star's magnitude from 5 by Lalande to 7 by Bessel, and in W. B. it is marked 8. As I have seen it in both extremes, the recorded differences cannot be ascribed to inaccuracies in different observers, and I must regard the star as a remarkable variable well worth special notice. It is now passing away from us, but I saw it so late as May 17 in very bright twilight, and its proximity to *Alpha* gives facilities for estimations of colour and magnitude.

Millbrook, Tuam, May 21 JOHN BIRMINGHAM

Notes of the Cuckoo

I REMARK that all the cuckoos here intone in a minor key, except one, who alone does not flatten the 3rd of the tonic. The key is in all cases precisely D of concert pitch, as proved by a tuning-fork, and the first note is F on the fifth line. In quality of voice *the Major* is not equal to the others, while he affects a certain jerkiness of style that in no small degree deteriorates his performance. It also wants the plaintive effect of the minor key. I confess I am not very learned in these matters, and a major cuckoo may not be so rare a bird on the earth after all; but I do not recollect ever having noticed one before. All the other cuckoos that I have remarked were *minors*, and, whatever may be the reason of the distinction, I cannot, at least, regard it as connected with difference of sex.

Some years ago I wrote to NATURE concerning a cuckoo who used to surprise me with a third note interposed between the mediant and the key-note. JOHN BIRMINGHAM

Millbrook, Tuam, May 21

Fall of Dust

EXTRACT from a letter to Sir B. C. Brodie, dated May 1:—

Campagne, Montfeld, Mustapha Supérieur, Alger

I WRITE to-day just to enclose you some curious red dust which fell all over Algiers last Saturday (April 24), the air quite still, and sky of a curious orange colour, everything looking as though seen through a yellow glass. The next morning this powder was swept up in large quantities in our court, all the flat roofs being also covered, and the flowers quite spoiled. It fell again the two following days, but rain followed and turned it

1 "Auroræ and their Spectra," by J. Rand Capron, F.R.A.S. (London: E. and F. Spon, 46, Charing Cross, 1879.)

into mud, which stained our whitewashed walls a reddish brown. I see that it fell in Sicily on March 29 and 30. . . . It is quite a different colour from the dust the sirocco occasionally brings us.

Monkeys in the West Indies

YOU have recently had communications in NATURE (vol. xxi. p. 131 and 371) from two gentlemen residing in the Island of Dominica, in the West Indies, Messrs. Edmund Watt and John Imray, on the incorrectness of Prof. Mivart's statement, in his paper on "Tails," regarding the non-existence of monkeys in these islands.

These gentlemen are quite as much in error as Prof. Mivart in asserting that the only islands where monkeys are to be found are St. Christopher and Nevis, and Mr. Imray especially, who says, "It certainly appears remarkable that no species of monkey should exist in the wild state in any of these islands along the whole range from Grenada to Jamaica," with the exception of the two already named.

Not only are there monkeys in the Island of Grenada, but they exist in large numbers, and enjoy all the wildness that the deep forests of the mountains secure to them.

Riding across the country over the mountain ridges, these animals are frequently to be seen skipping amongst the branches of the surrounding trees, and they have often been shot by sportsmen who have ventured into the "high woods."

Exciting *rencontres* have been met with by those who have gone in pursuit of the monkeys. When one is shot at it sets up a "*houp, houp*," that, like the whistle of Roderick Dhu,—

> ". . . garrisons the glen,
> As if the yawning hill to heaven
> A subterraneous host had given,"

and from all sides you are pelted with nuts and seeds and boughs gathered from the trees by the offended tribe. Should you succeed in maiming or killing one of them, the survivors assume so threatening an attitude that, being as a rule singlehanded, you are quite content to retire from the scene of the contest, consoling yourself with the reflection that discretion is the better part of valour.

It is even difficult to secure the skin of one of these animals, for if there are numbers present, when one is shot the others bear away their injured brother beyond your reach.

It can therefore be readily understood how difficult it is to obtain one alive. Not long ago, however, I thought I had secured a prize. One of these "natives" was brought into the town for sale. He was such a handsome fellow, and looked so interesting, that I determined to purchase him. What I was particularly struck with was his being so tame, as he allowed me, without moving a muscle, to place my hand upon his head and about his face. Having been called away for an instant, I missed my opportunity, as he was taken by another gentleman who had come up in my absence. That same evening I saw him again, and on a closer examination I discovered the cause of his docility. He was blind! That was the reason he had been caught so easily.

It is not at all to be wondered at that neither Rochefort, Du Tertse, nor La Bat, the three earliest writers on these islands quoted by Mr. Imray, mention the existence of monkeys in Grenada. They had no opportunities of knowing it. La Bat alone travelled about the island a little, but this was only on our western coast, and the Caribs, who might have informed them on this subject and on many others, had been most carefully exterminated by their countrymen. D. G. G.

Grenada, April 27

IN a letter that appeared in NATURE, vol. xxi. p. 371, on "Monkeys in the West Indies," I observed that it seemed remarkable "that no species of monkey should exist in the wild state in any of the West India Islands along the whole range from Grenada to Jamaica," &c. Since writing the above I have discovered that monkeys are abundant in Grenada in the wild state, and that they are very destructive to the growing crops. Mr. Watt (now at Cape Coast Castle), who took exception to Prof. Mivart's statement in regard to the existence of monkeys in the West Indies, called my attention also to this fact.

Have these Grenada apes been introduced, or are they indigenous? is the question, if indeed it be a question. The historic evidence points, I think, conclusively to their introduction, though I have not been able to ascertain the when and the how, as in the case of St. Kitts. The two old French authors quoted in my former letter—Rochefort, 1665, and Du Tertse, 1667—enumerate the mammalia at that time existing in the Antilles as known to them, and Du Tertse was well acquainted with Grenada; but no species of ape is amongst the number.

A letter from Mr. Sclater in NATURE, vol. xx. p. 153, proved that the St. Kitts Monkeys were referable to the green monkey (*Cercopithecus callitrichus*, Geoffr.) of Western Africa. Can Mr. Sclater or any of your readers give similar information regarding the species of the Grenada ape?

I have been informed that apes are also to be found wild in Montserrat.

Sir Robert Schomburgk, in his "History of Barbados," says, with reference to the Quadrumana: "The most interesting [of the mammalia] is the Barbados monkey, now nearly extinct, although formerly so frequent that the Legislature set a price upon its head. I have much to regret, on account of natural history, that my endeavours to procure a specimen for the purpose of determining the species have entirely failed. From the outer appearance of a living specimen I consider it to be *Cepus* [*Cebus?*] *capucinus*, Geoffr., the Say, or Weeper, or a very closely-allied species. It is not likely that it was introduced, as the first settlers found it in large numbers on their arrival."

Prof. St. George Mivart, who stands in the foremost rank as an authority on all such matters, in an article on "The Geography of Living Creatures," in the *Contemporary Review* for February last, makes the following remarks:—"The West Indian Islands, again, are admirably suited for such creatures as apes, yet none are indigenous to that region, though they rapidly increase when they have been introduced." He says in a note: "Trinidad is really a detached part of the continent of South America."

As all the historic facts go to prove that no species of the Quadrumana existed in the Lesser Antilles when first settled, it certainly does appear much more probable that the apes stated to have been found in Barbados by the first settlers had been introduced from Trinidad or the South American continent than that they existed as native to the island. JOHN IMRAY

Dominica, April 24

The Recent Volcanic Eruption in Dominica

I AM indebted to Mr. Thomas Raine, of the Colonial Bank, Barbados, for the following analysis of the volcanic dust which fell in Roseau—the capital of that island—and the surrounding country during the eruption from the crater of the "Boiling Lake" on January 11 in the present year. The analysis was made in the Analytical Laboratory, Barbados, on January 19, by Mr. George Hughes, formerly senior assistant to Dr. A. Voelker, F.R.S., the sample of volcanic dust having been collected during the eruption and forwarded immediately afterwards to Barbados. Mr. Hughes thinks that the dust "has not been exposed directly to the action of fire to any extent, or the percentage of oxide of iron would have been higher and the pyrites less—oxide of iron being one of the products from the combustion of pyrites."

Aluminia	·64
Moisture	3·26
Oxide of iron	·45
Sulphate of iron	14·46
Sulphate of lime	1·42
Carbonate of lime	·39
Magnesia	·32
Alkaline salts, loss in analysis, &c.	·47
Insoluble siliceous matters	78·59
	100·00

EDMUND WATT

Government House, Cape Coast, West Africa, April 23

Cup Stones, Cup-Marked Stones, or Cups and Rings

THE interesting paper on "A Scottish Crannog" in NATURE, vol. xxii. p. 13, is illustrated on p. 16 by an engraving (Fig. 3) which exactly represents the "Cups and Rings" that have long excited the curiosity of anthropologists on Rombald's Moor, near Ilkley, West Yorkshire. These markings, which I have examined within the past week, are on detached flattish rocks of millstone grit, immediately to the south-west of the village of Ilkley, and near to what are known as the Panorama Rocks.

On one piece of rock there are at least thirteen of the markings visible, and the rings or grooves round the central depression vary in numbers from one to six. Mr. Joseph Lund, of Overdale, Ilkley, who most politely guided me to the stones in question, also showed me, in his own garden, a large block of grit, bearing some of these markings, *from each of which is a district channel cut to the edge of the rock*. There have been many theories as to the significance of these markings. Has their use been yet ascertained?

R. MORTON MIDDLETON, Jun.

West Hartlepool, May 15

A Double Egg

THE other day on opening an egg, certainly a fine one, I found inside another perfect egg, so far as shell and the white part are concerned, but with only a faint streak of yellow for yolk. Double yolks are common, but I never saw, or read of, a perfectly formed shell inside an ordinary one before. If you think it worth notice, I send it for that purpose. T. ALLWOOD

Stafford, May 14

COMPARATIVE ANATOMY OF MAN[1]

II.

WITH regard to the cranial characters of the Americans the same difference of statement is met with as in respect to their external appearance. Morton's assertion of the general sameness in the skulls from all parts of the continent has been contested by others. But the controversies relating to this subject have nearly all turned upon one character alone, that is, the relative breadth of the cranium compared to its length, to the neglect of many others probably of equal importance. The prevalence of artificial cranial deformity, spoken of in a previous lecture, causes some difficulty by limiting the number of crania possessing their natural form at our disposal; but still there is sufficient evidence to show great variation in the cephalic index of American skulls. Although such extreme dolichocephaly as is met with among the Eskimo is very rare among true Americans, the larger number of crania of Indians, excepting those inhabiting the west coast of North America, and the region west of the Andes in South America (Peru and Bolivia), as well as Patagonia, in all of which regions brachycephaly prevails, are either mesaticephalic or moderately dolichocephalic. But the two forms are curiously intermixed, or at all events found in different tribes inhabiting contiguous regions, much, in fact, as they are in Europe. As the inhabitants of the two extreme ends of the continent, the Eskimo and the Fuegians, are both dolichocephalic (though in the case of the latter the evidence of cranial form is not yet so complete as might be wished), and as certain skulls, apparently of great antiquity, which have been discovered in Patagonia and Brazil are of the same form, it has been conjectured that the primitive inhabitants of the continent were a race with long and narrow heads, and that the brachycephalic race are later intruders.

The characters of the skeleton of the face exhibit, as is so often the case, greater uniformity than those of the cranium proper. The frontal region is almost universally low and retreating, and the supraciliary ridges generally well developed in the males. This and the form of the nose distinguish them from the majority of Asiatic Mongols. Nasal bones, compressed laterally, hollowed near their upper end, and forming a salient projection forwards at the lower end, giving the characteristic high bridge to the nose of the living face, are found in the great majority of American skulls from all parts of the continent. The tendency to a narrow form of nasal aperture (so very marked in the Eskimo) prevails throughout the American continent, the average index of 123 specimens being 47·2, which is almost as low as that of Europeans, while a really platyrhine nose, such as is the rule among negroes and Australians, is rarely, if ever, met with. The form of the orbit is also characteristic, being almost invariably large, round, and high, having an average index in 129 examples of 91·5. In the artificially-flattened heads this index is greatly increased, as the depression of the forehead drags the superior margin of the orbit upwards, often so much as to cause the vertical height to exceed the horizontal diameter. The malar bones are always full, and project laterally, and the nasi-malar angle, though somewhat diminished by the saliency of the nose, approaches to that characteristic of the Mongolian races. In the projection of the jaws forwards the skeleton of the face holds an intermediate position between the orthognathous white and the prognathous black races, in a great many cases inclining towards the latter. The lower jaw is large and the chin fairly prominent; the teeth are of moderate size and vertically implanted. Morton found the average cranial capacity of 155 ancient Peruvian skulls to be as low as 75 cubic inches, less than that of almost any other known race. It has been thought that some error may have crept into his method of measurement, but his estimate is probably not far wrong, as the average of 47 male skulls in the College collection is 1,345 cubic centimetres, or 82 inches, and of 50 females, 1,194 c.c., or 73 inches, giving a mean for both sexes of 77 cubic inches. On the other hand the barbarous tribes of Indians of both North and South America gave, in Morton's hands, an average capacity (for both sexes) of 84 cubic inches, and the Chinooks, from the mouth of the Columbia River, have remarkably capacious skulls, the average of 7 males in the College being 1,589 c.c. (97 inches), larger than those of any other race, but these may be rather exceptional specimens. It is, however, perfectly certain that the crania of the comparatively civilised Peruvians were much smaller than those of either the Indians of the North-West, or the Patagonians, or even Fuegians; but, as Morton remarks, the former, living under a thoroughly organised paternal despotism, seem neither to have thought nor acted except at the dictation of a master, while the brain of the savage was always in a state of activity to provide against the necessities and dangers of his daily life. But it must be recollected that the stature of the Peruvians was much less than that of the hunting tribes, and it is also possible that the difference may depend partly upon some general law connecting the size of the brain with the prevailing temperature, as inhabitants of cold regions have usually a larger brain capacity than those who dwell within the tropics.

The general characters of the American cranium are thus rather negative than positive, but on comparing it with the cranium of other races, it will be seen that it has no affinity whatever with that of any of the negroid people, Australians, Melanesians, or true negroes. From these it differs in every essential character, but with the Mongolian cranium it presents many affinities, especially in the form of the orbit, the narrowness of the nose, and the great size and forward projection of the malar bones. It is by the latter character especially that it differs from the European cranium. The prominence of the nasal bones is sometimes the only distinction to be found between American and North Asiatic skulls. Although Mongolian in the general type of face, it never presents such an extreme exaggeration of that type as is to be seen in the Eskimo, from which it can always be readily distinguished. The best argument for the unity of the American race (using the word in a broad sense) is the great difficulty of forming any natural divisions founded upon physical characters. Although certain special modifications prevail in different districts, and the Mongolian resemblance is greatest on the north-western coast, the same form constantly reappears at widely separated parts of the continent. Skulls from Vancouver's Island, from Peru,

[1] Abstract Report of Prof. Flower's lectures at the Royal College of Surgeons, March 1 to March 19, on the Comparative Anatomy of Man. Continued from p. 61.

and from Patagonia, can be shown which are almost undistinguishable from one another, but the materials at hand, at all events in European collections, are not yet sufficient for following out this interesting investigation to a satisfactory conclusion.

Races of Africa.—Of the great primary divisions of the human species no one is more distinctly characterised than the Negroid race, if under this term we include the whole of the dark-coloured, frizzly-haired people who inhabit considerable portions of the equatorial region of the so-called Old World, from the West Coast of Africa eastward to the middle of the Pacific. The oceanic branches of the group are not at present under consideration, but only those which inhabit the continent of Africa. The physical features of the Ethiopian negroes have remained unchanged since the earliest historic period, as they are depicted in ancient Egyptian drawings much as we see them now, but geographical and geological considerations tend to indicate a much vaster antiquity for the race. The present northern limit of the negro population of Africa, extending from the River Senegal on the west across the continent in a nearly due easterly direction, corresponds with the Ethiopian region of zoologists, characterised by a fauna altogether different from that of the more northern parts of the continent. The cause of this difference is accounted for by the undoubted fact that at a comparatively recent geological epoch the Sahara was covered with sea, and the portion of Africa lying to the south of it was isolated from the great continental track composed of Europe, North Africa, and Asia. The distribution of the races of man so closely coincides with that of the remainder of the fauna that it is natural to suppose that it must arise from the same cause, and we may thus attribute to the long separation of the races north and south of the Sahara, during the period in which the waters of the Atlantic flowed over it, their strongly opposed physical characteristics. Since the two races have come in contact by the drying up of these waters much intermingling has taken place along the frontier line, but, considering the immense period of this stage of their existence, it is remarkable how little the original geographical boundary has been shifted.

The physical characters of the negro, in his most typical form, as found in the equatorial regions of Africa, have attracted much attention from anatomical anthropologists. In discussing the possible range of differences between different members of the human species the African negro has, on account of his structure being better known than that of any other of the lower races, always been taken as the antithesis of the white man of Europe, and in numerous treatises on the subject the differences between them have often been either exaggerated or softened down, according to the bias of the writer. The black colour of the skin of the negro, due to an increased number of pigment granules in the cells of the epidermis, is proverbial, but very few negroes, if any, are really black. The Joloffs of Senegambia are described as being "jet black," or even "blue black," but various shades of brown, or even yellow, are more common. The iris is dark brown and the conjunctiva yellowish. The hair is always black, except in the not unfrequent case of albinism. Its peculiar character, its flattened elliptical section, and tendency to assume very close spiral coils, giving the general effect commonly called "woolly," or more properly "frizzly," are well known. The division of the negro races into two distinct groups, those in which the hair grows evenly scattered over the scalp (*eriocomi*) and those in which it grows in distinct tufts, with bare intervals between (*lophocomi*), though often demonstrated to have been based upon fallacious observations, holds its ground with great tenacity, and is still adopted in most treatises on anthropology. The report of a committee of the Paris Anthropological Society on the growth of the hair of a negro in one of the hospitals of that city, published last year in the *Bulletin* of the Society, ought to set the question at rest for ever.

The features of the negro are so well known as scarcely to need description. Their chief characteristics are, a narrow but rather vertical forehead, small but rather prominent eyes, full cheek bones (intermediate between those of European and Mongolian), flat broad nose, prognathous mouth, with very full and everted lips, often projecting beyond the level of the nose, large white teeth, and a small chin. In stature there is considerable variation, some tribes being equal or even above the average of Europeans, others much smaller, and there is some evidence of the existence of a true race of pygmy negroes in the interior of Africa. Two thousand black soldiers of African descent in the United States of America, carefully measured during the war, gave an average of 66·21 inches, or nearly one inch below the average of whites (67·15). The difference in the proportions of the different parts of the body in different races have received much attention from anatomists, and comparison between the negro and the standard European is more completely elaborated than that between any other races; but owing to the paucity of skeletons, on which alone perfect accuracy of measurement can be obtained, much still remains to be done. As regards the length of the clavicle, Broca and Pasteau find that this bone is slightly longer in the negro than in the European, that is as compared with the humerus; but the comparison is not a satisfactory one, the latter bone being, as will be shown, peculiarly short. Compared with the femur, which is a better standard, as its proportionate size to the height is nearly the same in the two races, the clavicle (as far as the materials available permit the comparison) appears to be shorter than in the European, as was shown last year to be the case with the Andaman Islanders. The differences in the form of the scapula have been fully described by Broca and Livon of Paris. All observers agree that the arms of the negro are longer in proportion to the height than are those of Europeans. This is illustrated by the measurements taken in the American war, which show that when standing upright the mean distance between the tips of the fingers and the upper end of the patella was 2·88 inches in the negro, and as much as 5 inches in the white. The legs are also longer in proportion to the height, though to a less extent. The arms, compared to the legs, are slightly shorter than in Europeans. This is caused by the shortness of the humerus, its length as compared with the femur being as 69 to 100 in the negro and 73 to 100 in the European. The radius is longer even as compared with the femur or with the height, and *à fortiori* as compared with the humerus. The humero-radial index is therefore one of the most characteristic distinctions between the two races. In Europeans it averages 74 (the humerus being 100), in negroes 80. The femoro-tibial index presents a similar but less striking difference, being in Europeans 82, in negroes 85. Some of these characters, as the humero-radial index, approximate the proportions of the negro to those of lower forms, but others, as the shortness of the humerus and the greater length of the lower limbs as compared with the height, do not do so, and only present signs of divergence from the European standard, but not of inferiority. The other black races agree generally with the typical African negro in such proportions as he differs from the European, and hence these might be used as valuable distinctive characters in the classification of man; but difficulties arise when the negro is compared, not only with the European, but with other races generally held to be distinct. Although very few of them have been measured in sufficient numbers to give reliable averages, the indications already obtained show that in many points the proportions, though they may distinguish the negro from the European, do not separate him from others, which in many respects are most dissimilar. In the humero-radial index, for instance, the Peruvian and

the Malay (judging by the skeletons in the College Museum) agree with the negro rather than with some other branches of the so-called Mongoloid races, as the Eskimo and the Samoyede. But this is a subject for further observation rather than hasty generalisation.

The difference between the pelvis of the African negro and that of the European has been pointed out by Vrolik and others. It consists mainly in the increase of the antero-posterior diameter as compared with the transverse, expressed by the pelvic index, or ratio between these diameters, the latter being taken as 100. In the European male the average index is 80, in negroes, according to various observers, from 90 to 100. As in the proportions of the limbs, many of the Mongoloid races conform in the characters of the pelvis rather with the negro than with the European.

In the cranial characters the distinctions between the negro and the white races are strongly marked. The average capacity of the cerebral cavity is undoubtedly smaller in the former, even in individuals of approximately the same height. It is, however, considerably higher than in the Australian. The difference between the average capacity of English and negro crania in the College Museum is 123 cubic centimetres, between the latter and the Australian 80 c.c. Broca's totally independent measurements of skulls at Paris give a difference in the former case (Parisians being substituted for English) of 128 c.c., and in the latter of 83 c.c., so that the results are substantially identical. The general form of the cranium is expressed by the cephalic or latitudinal index, or relation of breadth to length, the latter taken as 100. The average index of forty-two negroes of various tribes in the College Museum is 73·6. Of these more than half are between 70 and 75, or dolichocephalic; less than half are above 75, or mesaticephalic; but very few are either below 70 or above 80. The average index of eighty-five negroes from the West Coast of Africa, measured by Broca, is 73·4, and of fifty-three from East Africa, measured by Lederle, is 73·9. These remarkable agreements with our own measurements show that between 73 and 74 may be fairly taken as a general average of the cephalic index of the African negro, and that he belongs, therefore, to the moderately dolichocephalic races. The height, measured from the basion to the bregma, is almost identical with the breadth, the average of the forty-two College specimens giving 73·5. The negro skull in these proportions differs greatly from that of the Fiji Islanders previously described. Differences in the position of the foramen magnum, in the angle formed by its plane, with the horizontal of the skull, and in the various facial angles, which have been pointed out as characterising the negro skull as compared with that of the European, can only be explained by means of diagrams. The facial characters are generally eminently characteristic. The forehead, though narrow, is not retreating. The glabella and supra-orbital ridges are sometimes well developed, but more usually this region is smooth and flat. The orbits have a moderate index, 85·5 (Broca), or 86·3 according to measurements of the College collection. The nose is distinctively platyrhine, the average index being 55 or 56. The nasal bones are small and flat, their external surfaces directed forwards, the two meeting in front at a very open angle, instead of a narrow one as in Europeans. The lower margin of the nasal aperture is usually rounded off instead of sharp and strongly defined. Equally characteristic is the prognathism, which is very rarely absent. The measurement from the basion to the middle of the alveolar border is greater than that from the basion to the naso-frontal suture, whereas in Europeans the reverse is almost always the case.

The teeth are regular, well developed, and generally free from caries. The third molars (wisdom teeth) appear to be always in their place before the closure of the basilar suture, whereas among Europeans they are often much later in coming into place. The size of the teeth varies in different races, but hitherto no accurate measurements have been made to express their difference. The length of the molar series, in a straight line between the anterior edge of the first premolar and the posterior edge of the third molar, may be conveniently used to indicate the size of the teeth, and called *d*. This may be compared with the length of the cranio-facial axis, or basi-nasal length (B N), and a dental index formed from $\frac{d \times 100}{B\ N}$. This will give at all events a fair approximation to the relative size of the teeth compared with the skull, as the length B N is one of the least liable to variation of any in the cranium. Unfortunately for the investigation, in a large proportion of the crania in Museums the teeth are wholly or partially lost, and a larger number of specimens must be measured than are at present available. The following indices (which must be regarded as provisional) are however of considerable interest. In the first place it must be observed that the teeth of women, though smaller absolutely, are larger relatively to the cranio-facial axis than those of men. For instance, in Europeans the dental index of males is 40·5, of females 42·0. In Australians the disproportion is greater still, being 45·7 for the males, and 48·4 for the females examined. In the following table males only will be included. Europeans 40·5, Ancient Egyptians 40·8, Hindoos 41·2, American Indians 42·5, Chinese 43·8, African Negroes 43·9, Andamanese 44·2, Fijians 45·4, Australians 45·7. It will thus be seen that in the size of the molar teeth the negroes hold an intermediate position between Europeans and Australians, but approaching nearer to the latter. The actual average length of the molar series in European males is 40·8 millimetres, in Africans 45·4, in Australians 46·7. The anthropoid apes give a higher index than that of any of the races of man.

(*To be continued.*)

ON SYSTEMATIC SUN-SPOT PERIODICITY

AT the present moment, when a good deal of attention is being directed to sun-spots and their possible influences, it may not be amiss to discuss the question of their systematic periodicity.

We have to ask ourselves whether we can by a limited application of labour so disentangle the apparently complicated and capricious phenomena of sun-spots as to exhibit certain well-defined recurring periods, the superposition of which upon each other may ultimately explain the march of these phenomena. It will be apparent that such an analysis of the past is the first and indispensable step towards any prediction for the future. I will now bring before the readers of NATURE the first results of an attempt of this kind. As the subject will be more fully discussed in another place, I will in the meantime mainly exhibit the results obtained, referring as briefly as may be to the method used in procuring them. The method is that which (in conjunction with Mr. Dodgson) I have already brought before the notice of the Solar Physics Committee and of the Royal Society. It has been applied to thirty-six years of sun-spot observations, beginning with 1832 and ending with 1867. The first portion of these has been derived from the records of Hofrath Schwabe, the second from those of Carrington, while the latter portion has been derived from De la Rue's Kew series. My first object has been to ascertain to what extent these records exhibit indications of certain systematic inequalities having periods not far differing from twenty-four days. I will limit the present communication wholly to this issue.

These thirty-six years have been split up into three series of twelve years each, and treated after the manner

TABLE I.—Exhibiting a Sun-Spot Inequality of Period 24·022 Days for every Four Years from 1832 to 1867, and also for every Twelve Years

(1) *Every Four Years*

1832—35	− 239	− 405	− 664	− 613	− 477	+ 131	+ 284	+ 196	+ 249	+ 25	+ 15	− 226	+ 6	+ 406	+ 630	+ 150	+ 47	+ 374	− 49	− 47	− 48	+ 100	+ 138	+ 5
1836—39	− 332	− 325	− 419	− 427	− 64	+ 47	+ 43	+ 272	+ 392	+ 487	+ 467	+ 292	+ 209	+ 337	+ 237	+ 214	+ 226	+ 279	− 123	− 164	− 377	− 520	− 427	− 337
1840—43	− 426	− 350	− 501	− 528	− 158	− 220	+ 150	+ 307	+ 170	+ 339	+ 250	+ 342	+ 699	+ 1132	+ 362	+ 136	+ 266	+ 296	− 109	+ 12	− 729	− 315	− 566	− 675
1844—47	− 774	− 488	− 315	− 107	− 71	+ 175	+ 752	+ 668	+ 548	+ 340	+ 513	+ 337	+ 296	+ 226	− 2	+ 143	− 47	+ 104	+ 140	+ 261	− 323	− 621	− 990	− 767
1848—51	− 98	− 8	− 171	+ 107	+ 364	+ 355	+ 151	+ 175	− 231	− 200	− 42	+ 117	+ 177	+ 92	− 161	− 140	+ 91	+ 4	− 274	− 168	− 327	− 82	− 9	− 148
1852—55	− 903	− 712	− 568	− 608	− 411	− 185	− 94	+ 266	+ 424	+ 642	+ 915	+ 653	+ 464	+ 476	+ 297	+ 68	+ 401	+ 632	+ 298	+ 53	− 54	− 196	− 657	− 1213
1856—59	+ 121	+ 103	− 146	+ 107	+ 126	− 156	− 122	− 294	− 326	− 115	− 76	+ 122	+ 225	+ 137	− 14	− 195	− 108	+ 218	+ 160	+ 233	+ 56	− 87	+ 58	− 39
1860—63	− 800	− 700	− 308	− 186	− 362	− 330	− 153	− 96	+ 138	+ 494	+ 488	+ 601	+ 617	+ 527	+ 298	+ 374	+ 267	+ 178	+ 329	+ 202	− 53	− 404	− 506	− 617
1864—67	− 340	− 571	− 361	− 164	− 119	− 205	− 262	− 297	+ 89	+ 353	+ 452	+ 470	+ 558	+ 382	+ 541	+ 424	+ 148	+ 133	+ 12	− 129	− 234	− 363	− 253	− 276

(2) *Every Twelve Years*

1832—43	− 997	− 1080	− 1584	− 1568	− 699	− 42	+ 477	+ 775	+ 811	+ 851	+ 732	+ 408	+ 914	+ 1875	+ 1229	+ 500	+ 539	+ 949	− 281	− 199	− 1154	− 735	− 855	− 1007
1844—55	− 1775	− 1208	− 1054	− 608	− 118	+ 345	+ 809	+ 1109	+ 741	+ 782	+ 1386	+ 1107	+ 937	+ 794	+ 134	+ 71	+ 445	+ 740	+ 164	+ 146	− 704	− 899	− 1656	− 2128
1856—67	− 1619	− 1168	− 815	− 243	− 355	− 691	− 537	− 687	− 99	+ 732	+ 864	+ 1193	+ 1400	+ 1046	+ 825	+ 603	+ 307	+ 529	+ 501	+ 306	− 231	− 854	− 701	− 932

(3) *Whole Series*

1832—67	− 3791	− 3456	− 3453	− 2419	− 1172	− 388	+ 749	+ 1197	+ 1453	+ 2365	+ 2982	+ 2708	+ 3251	+ 3715	+ 2188	+ 1174	+ 1291	+ 2218	+ 384	+ 253	− 2089	− 2488	− 3212	− 4067

TABLE II.—Exhibiting a Sun-Spot Inequality of Period 24·329 Days for every Four Years from 1832 to 1867, and also for every Twelve Years

(1) *Every Four Years*

1832—35	− 653	− 590	− 150	+ 280	+ 84	+ 19	+ 478	+ 750	+ 689	+ 490	+ 785	+ 245	+ 10	− 199	+ 88	+ 6	− 192	− 299	− 363	− 456	− 391	− 122	− 235	− 408
1836—39	− 889	− 774	− 697	− 537	− 429	− 281	− 38	+ 83	− 63	+ 270	+ 455	+ 609	+ 424	+ 639	+ 519	+ 349	+ 500	+ 509	+ 250	+ 87	− 138	− 195	− 276	− 407
1840—43	+ 248	+ 661	+ 717	+ 284	− 106	+ 107	− 56	+ 229	+ 440	+ 291	− 207	− 82	+ 61	− 234	− 585	+ 65	− 112	− 429	− 329	− 161	− 180	− 242	− 179	− 221
1844—47	− 83	− 84	+ 71	+ 353	+ 382	+ 18	+ 109	− 61	+ 108	+ 195	+ 123	− 6	+ 92	+ 184	− 22	+ 204	+ 198	+ 72	− 184	− 346	− 278	− 162	− 317	− 596
1848—51	− 286	− 108	− 185	− 182	− 171	+ 13	+ 222	+ 420	+ 269	+ 302	+ 387	+ 473	+ 184	+ 86	+ 145	+ 322	+ 171	+ 197	+ 67	− 292	− 495	− 518	− 517	− 434
1852—55	− 253	− 147	− 160	− 155	− 63	− 32	− 34	+ 348	+ 225	− 89	− 99	+ 261	+ 359	+ 274	+ 288	+ 111	+ 17	+ 275	− 44	− 150	− 84	− 209	− 354	− 314
1856—59	− 341	− 342	− 345	− 372	+ 120	+ 172	+ 768	+ 779	+ 348	+ 473	+ 416	− 60	− 2	+ 112	+ 12	+ 2	− 149	− 123	+ 71	− 100	− 264	− 595	− 430	− 210
1860—63	+ 19	+ 54	+ 157	+ 97	+ 68	+ 114	+ 211	+ 79	+ 89	+ 20	+ 154	+ 83	+ 19	+ 106	+ 22	− 83	− 216	− 185	− 227	− 122	− 199	− 107	− 77	− 106
1864—67	− 248	− 285	− 193	− 459	− 374	− 275	− 112	+ 20	− 26	− 61	+ 57	+ 107	+ 88	+ 164	+ 428	+ 511	+ 212	+ 210	+ 208	+ 75	+ 15	+ 177	− 22	− 247

(2) *Every Twelve Years*

1832—43	− 1294	− 703	− 130	+ 27	− 451	− 155	+ 384	+ 1062	+ 1066	+ 1051	+ 1033	+ 772	+ 495	+ 206	+ 22	+ 420	+ 196	− 219	− 442	− 530	− 709	− 559	− 690	− 1036
1844—55	− 622	− 339	− 274	+ 16	+ 148	− 1	+ 297	+ 707	+ 602	+ 408	+ 411	+ 728	+ 635	+ 544	+ 411	+ 637	+ 386	+ 544	− 161	− 788	− 857	− 889	− 1188	− 1344
1856—67	− 570	− 573	− 381	− 734	− 186	+ 11	+ 867	+ 878	+ 411	+ 432	+ 627	+ 130	+ 105	+ 382	+ 462	+ 430	− 153	− 98	+ 52	− 147	− 448	− 525	− 529	− 563

(3) *Whole Series*

1832—67	− 2486	− 1615	− 785	− 691	− 489	− 145	+ 1548	+ 2647	+ 2079	+ 1891	+ 2071	+ 1630	+ 1235	+ 1132	+ 895	+ 1487	+ 429	+ 227	− 551	− 1465	− 2014	− 1973	− 2407	− 2943

which is fully described in the communications already alluded to. By this means the positions of the various inequalities around twenty-four days have been indicated on the time-scale. I have next taken two of these and attempted to eliminate from them the influence of all neighbouring inequalities, in order to see with what success it is possible to disentangle the various periods from each other. In order to test this success I have exhibited in the tables on p. 81 the result of this elimination applied to each four years of sun-spot records, and I think it will be manifest to every one that there is such evidence of repetition, that one cannot doubt the reality of the periods therein indicated. I have likewise begun to apply to these records Gen. Strachey's test, and with a good result so far as I have yet gone.

No kind of smoothing or equalisation has been applied, and the elimination has been carried on only to the first stage, so that more accurate determinations will probably result from a further application of labour.

BALFOUR STEWART

PRIMITIVE MAN[1]

IT is a familiar fact that from time to time wrong-headed but enthusiastic persons appear in the scientific arena boldly challenging the truth of some one or other of the most firmly-established and essential doctrines of the scientific creed. Sometimes a clever investigator discovers that we moderns are all in the wrong, and that the sun after all goes round the earth; another will have it that the moon does not revolve on its axis; a third disputes the correctness of the theory of gravitation; whilst a fourth finds no difficulty whatever in squaring the circle. Such men have cropped up at intervals throughout the historical period. They are not without their usefulness in their generation, for they afford some little mirth, and give an opportunity sometimes to men of science to reconsider their standpoints and settle themselves more firmly upon them. It seems uncertain whether Prof. Dawson, of McGill College, Montreal, is to be classed with these malcontents, or whether his scientific heresies are to be explained as conforming to the general law that superstitions generally survive and even thrive in colonies long after they have died out in their mother country.

No greater contrast could well be conceived than is presented by the two works on Primitive Man which have just appeared, and which form the subject of the present article.

Prof. Boyd Dawkins, in accordance with the teachings set forth in his "Cave Hunting" and all other works which have proceeded from his pen, treats his subject in a thoroughly scientific and unprejudiced manner, and the results which he lays before his readers are in keeping with the conclusions now fully accepted by all anthropologists and admitted by educated persons generally. Prof. Dawson, on the other hand, has actually written a book at this present time, the object of which is to attempt to show that mankind first made its appearance on the earth not more than 6,000 or 8,000 years ago. He sums up thus:—"What evidence the future may bring forth I do not know, but that available at present points to the appearance of man with all his powers and properties in the Post-glacial age of geology, and not more than 6,000 to 8,000 years ago." His book is described as "an attempt to illustrate the characters and condition of prehistoric men in Europe by those of the American races." His arguments are old stagers long ago upset. Such, for example, as that because some savages, such as the Veddahs of Ceylon, who are degraded Singhalese, are degenerate, therefore all savages are the degenerate offspring of highly-cultivated races. On similar grounds we might infer that because barnacles and ascidians can be shown to be degenerate animals, therefore all lower animals have undergone "degeneration," to use Prof. Ray Lankester's term, and all monkeys are degenerate men.

The main argument of the book is however apparently that derived from the results of excavations made on the site of Montreal. On this site, as we know from Cartier's narrative, stood in 1535 the native town of Hochelaga, which was fortified, as shown in the plan of the town at the end of the third volume of Ramusio's collection of Voyages and Travels, by means of a circular triple wall of wooden beams, the outer of which were inclined to meet one another at the summit. The native town, its huts and walls, naturally disappeared within a century, and all that now remains of it are the implements and bones which are to be dug out on its site, and of which Prof. Dawson gives an interesting account. There are tobacco pipes of various kinds, stone weapons, pottery, and bones of animals and men. If it had not been for Cartier's visit and published narrative antiquarians might have ascribed a very early date to these remains, argues the author, therefore in all cases where a very early date has been assigned to human remains of the palæolithic age in Europe a similar error has been committed. We cannot follow Prof. Dawson through his attempts to contort the data of modern science into accordance with Chaldæan cosmogonies and mythology as familiar to us in Jewish dress. He gravely refers the remains found at the camping ground at Solutre which, according to M. de Mortillet, mark a special epoch (the Solutrian) in the palæolithic age, to the *antediluvian* epoch, and reminds us how Jabal, before the flood, according to Genesis, initiated the nomadic mode of life, suggesting that the old inhabitants of Solutre who hunted the mammoth, the cave lion and cave bear, were Jabalites. It is delightful to find how beautifully everything fits into its place when freely interpreted by Prof. Dawson. The results of his ethnographical and antiquarian researches appear to be more or less summed up in the biblical text, "God shall enlarge Japhet, and he shall dwell in the tents of Shem, and Canaan shall be his servant." This means, as he aptly explains, that the Aryan or Japetic races were to be endowed with "the higher control of the physical forces and the greater power of expansion and propagandism," in short, amongst other exploits, to exterminate the Redskins and colonise America; whilst the Semitic races were to receive historical and spiritual revelations, and Canaan in the text represents unprogressive humanity generally.

Prof. Dawson's intimate acquaintance with the details of prehistoric religion is most startling. He holds up the faith of palæolithic, or *palæocosmic*, man, as he prefers to call him, as a warning and a pattern to the degraded Ritualist, at whom he cannot help having a dig even with palæolithic weapons, being evidently a staunch Protestant. He slays evolutionists with the same thrust. It is an unexpected honour for them to die in such company. No doubt the association is meant to give the Ritualists the hardest dig. He wishes "distinctly to affirm that the prehistoric religions, and what we call heathenism or animism of untaught tribes, were nearer to God and truth than are either the ritualisms and idolatries or the materialistic scepticisms of more civilised times, when men, 'professing themselves to be wise, become fools.'" Till we read this passage it seemed to us that Prof. Dawson professed himself throughout his book to be very wise indeed, but of course he cannot have intended to pose in that attitude. The chapter concludes by calling on "all men everywhere to repent," and so we do heartily of having followed so far Prof. Dawson's, shall we call it "wisdom"?

We turn with relief to Prof. Boyd Dawkins's fine volume. It is sumptuously printed, and contains 168

[1] "Early Man in Britain and His Place in the Tertiary Period." By W. Boyd Dawkins, M.A., F.R.S., &c. (London: Macmillan and Co., 1880.) "Fossil Men and their Modern Representatives." By J. W. Dawson, LL.D., F.R.S., &c., McGill College, Montreal. (London: Hodder and Stoughton, 1880.)

excellent illustrations, the sources of which are given in a table at the commencement of the work, a detail of importance often omitted.

The first chapter deals with the relation of geology to archæology and history, these three sciences all contributing to the building up of the account of early man in Britain. There appears to be a slip in the table showing the specialisation of mammalia in the tertiary period, where the period is divided into the eocene, miocene, pleiocene, pleistocene, prehistoric, and historic stages. The latter stage is said to be characterised by living species of mammalia and no extinct species, which is rather misleading, since Steller's sea-cow is almost certainly extinct, and several other mammalia are verging on extinction.

FIG. 1.—Flint River Drift Implement, Gray's Inn Lane, ½.

After an interesting sketch of the physical conditions and the successive faunas and floras of preceding geological periods in Britain, the account of the miocene age is concluded with a paragraph headed "No Proof of Man in Europe in the Miocene Age." High authorities such as Dr. Hamy and M. de Mortillet have maintained that man did exist in France as early as the middle of the miocene age, basing their conclusions on the evidence given by splinters of flint found in mid-miocene strata at Thenay by the Abbé Bourgeois, and by a notched fragment of a rib found at Pouance by M. Delauny. The author seems a little in doubt whether these flakes and notches are in reality artificial, but if they be so he prefers to conclude, with Prof. Gaudry, that they were made by the anthropomorphous apes then inhabiting France rather than by man. This appears to be a somewhat wild suggestion, and the author is evidently led to it by considerations which are set forth in the same paragraph, and which seem to him to prove that from zoological grounds man could not have existed in the miocene age, as to the cogency of which considerations we cannot at all agree with him. His argument is that because no other living species of land mammal has been met with in the miocene fauna, therefore man could not have formed an exception to this supposed rule, and "had no place in a fauna which is conspicuous by the absence of all the mammalia now associated with him." "If miocene man had existed it is incredible that he alone of all the mammalia living in these times in Europe should not have perished or have changed into some other form in the lapse of ages." The author adds: "Those who believe in the doctrine of evolution will see the full force of this argument against the presence of man in the miocene fauna not merely of Europe but of the whole world." Now we, we hope in common with all the readers of NATURE, are thorough-paced evolutionists, but we should have said rather that those who understand the doctrine of evolution would consider this argument as completely unsound. Evolution, wherever variedly manifested in its action, does not produce any comprehensive similar effect on any group of different objects on which it acts. According to the varying conditions partly surrounding, partly embodied in each object, evolution singles out certain of the objects for higher specialisation, others for degradation, others again for extinction; whilst others again it, as it were, leaves alone to survive unchanged through ages amongst hosts of modified descendants of their near relatives. The survival of some form, larval or adult, or of some organ of great antiquity in unchanged condition, where all the concomitants have become profoundly modified, is one of the most familiar facts explained by the evolution theory. How is it else that the brachiopod Lingula has survived in nearly identical form to the present day from the earliest geological times, whilst all its then contemporaries are extinct or have changed? How is it else that the vertebrate structure survives in

only one or two of the degenerate Ascidians? How is it else that some savages are still in their stone age, and that Prof. Dawson still believes that mankind is only 6,000 years old?

We see no reason whatever, from evolutionary grounds, why man should not have existed in the miocene times. Anthropomorphic apes were already in those times abundant and varied, and comparative anatomy points to the progenitor of man having been an ancestor of the present existing anthropomorphs, combining many of their several characters. At the same time we do not wish to appear to assert that man did then exist, but we think it rather a pity that the author did not give good illustrations of the miocene flint flakes and the notched rib if only to show, as we believe is the case, that they do not exhibit any very definite traces of handiwork, and has not formed a more certain judgment as to whether the objects are artificial or not.

We have dwelt upon this matter at some length, because an important question of principle is involved in which we are at variance with the author. With regard to everything else in the book we cannot but offer our best thanks to him. His extended experience in cave-hunting, his critical knowledge of geology and of the later tertiary mammalia, have long rendered him an authority of first rank on the subject of which he treats, and he has in the present volume combined with great care all available published information with the results of his own investigations. The book represents with great clearness the present state of our knowledge with regard to the antiquity of man, for though it treats principally of Early Man in Britain, no details of importance with regard to discoveries bearing on the subject on the Continent or elsewhere are omitted.

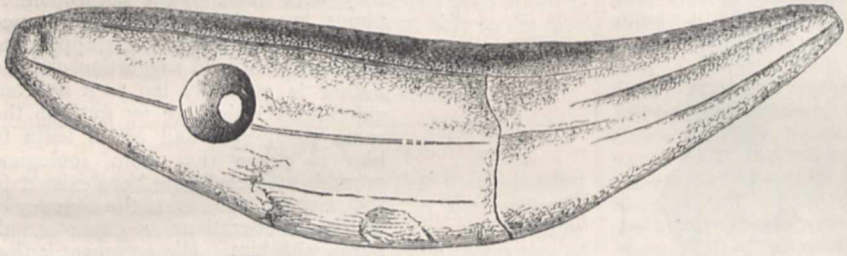

FIG 2.—Tooth of Cave lion, Duruthy Cave. ½.

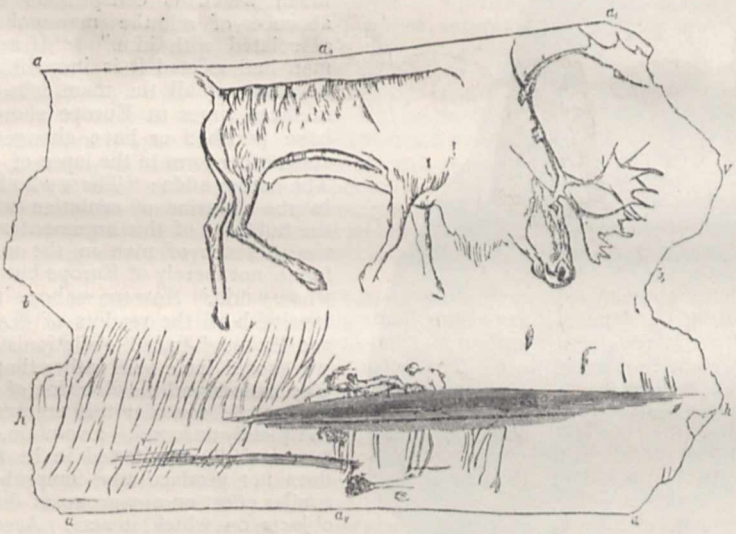

FIG. 3.—Reindeer incised on antler, Kesserloch, ⅔.

FIG. 4.—Stone hatchet, Robenhausen,

The whole account is most clearly and logically arranged, and written in a very readable and entertaining style. It is popular as well as scientific.

The author considers the evidence of man in early pleistocene strata as doubtful. It is in the mid-pleistocene deposits that man first appears without any doubt, as proved by flint implements found in the lower brick-earths at Crayford by the author himself. Man was at that period associated in the Thames valley with six extinct species of mammalia, viz., three species of rhinoceros, *R. megarhinus*, *tichorhinus*, and *leptorhinus*, the mammoth and *Elephas antiquus*, and the Irish elk. Large herds of horses, stags, and bisons frequented the open country, the hippopotamus floated about lazily in the Thames, whilst the thickets were inhabited by wolves, foxes, brown and grisly bears, huge lions, hyænas, and wild boars.

We cannot here follow the author throughout his well-told story, but can only dip here and there into his work to give our readers a sample of its qualities. Most interesting is a palæolithic implement discovered in England so long ago as the year 1690. It was found with the remains of an elephant in the heart of London in the gravel at Gray's Inn Lane, and having been preserved in the Sloane collection in the British Museum for more than 150 years, was ultimately recognised by Mr. A. W. Franks as identical with those discovered so long afterwards in the gravels of Amiens and Abbeville. It belongs to the late pleistocene river deposits. The accompanying

figure of it is taken from Mr. John Evans's "Ancient Stone Implements."

The author carefully considers, as far as the evidence will permit, the question of the range of the Cave men as compared with the River-drift men. The remains of the "Cave men," who are characterised by the use of certain peculiar implements, are found throughout the whole of France, and are remarkably abundant in the caverns of the Pyrenees. They occur also in Switzerland, Germany, Belgium, and England, but are limited in range, being unknown as yet in the caves south of the Alps and Pyrenees, and north of a line passing east and west from Derbyshire through Belgium. The Cave men differed in race from the River-drift men. They were ignorant of pottery, but they had a varied assortment of implements and weapons of bone, ivory, and stone. They prized ornaments, and in the cave at Duruthy forty canine teeth of the bear and the lion were found perforated to form a necklace, "a magnificent trophy of the chase."

The Cave men were also artists, and engraved drawings of very considerable artistic merit on bones, ivory, and antlers. Their drawings of the mammoth on its own ivory are familiarly known. We reproduce here a figure of a reindeer incised on an antler from the Kesserloch, near Thaynigen.

Drawings of the great Irish elk, bisons, the ibex, and bears have also been discovered, but those of man are extremely rare, and comparatively badly executed. Mr. John Evans is inclined to hold that the River-drift and Cave men belonged to the same age and the same race, but the author concludes that they must be referred either to two distinct races or to two sections of the same race which found their way into Europe at widely different times; the River-drift men being of far higher antiquity in Europe, and probably having lived for countless generations before the arrival of the Cave men and the appearance of higher culture. "The discoveries of the last twenty years have tended to confirm the identification of the Cave men with the Eskimos."

The account of the Cave men is followed by that of the prehistoric period, of the neolithic civilisation, the age of polished stone implements and of the prehistoric farmer and herdsman. Wild boars, the great wild ox, the urus, the Irish elk, the reindeer, the brown and grizzly bear still inhabited Britain during that period. The Irish elk is remarkable for being the sole survivor amongst land mammalia from the pleistocene to the prehistoric age which has since become extinct. Its rarity in Britain forms a marked contrast with its abundance in Ireland. It has been found in England, near Newbury in Berkshire, and at Maybole in Ayrshire. In the neolithic period the dog, horse, sheep, goat, shorthorn, and hog were already domesticated.

"Of all the neolithic implements the axe was by far

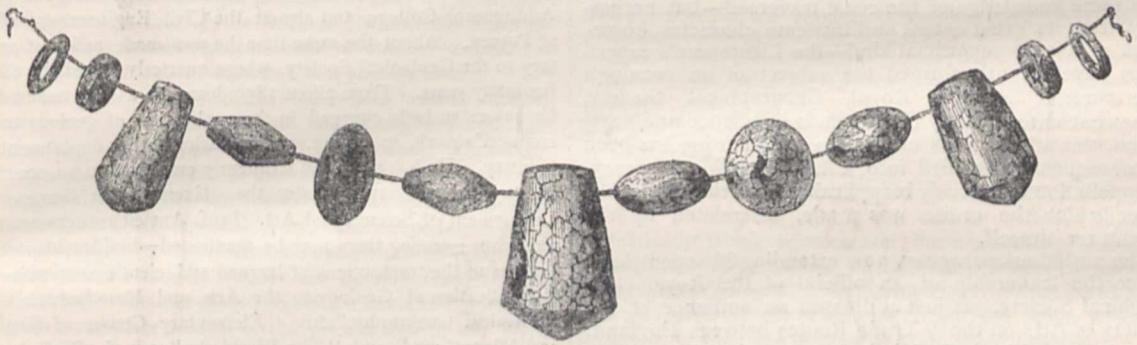

FIG. 5.—Amber necklace. Lake, Wilts, ¾.

the most important. It was by the axe that man achieved his greatest victory over nature, by clearing the land of forest. It was immeasurably superior to the rude flint *hâche* of the palæolithic hunter, which could not make a straight cut in wood, and which was very generally intended for use in the hand, without a handle. It is therefore chosen as the symbol of the neolithic culture."

In New Guinea and its neighbourhood land is still cleared of forest by the natives for culture by the aid of fire and the stone hatchet.

Chapter X. treats of the further development of culture, the Bronze age, and the invasion of the British Isles by the Celts, who are proved by their tombs, scattered over the face of the country, alike in England, Scotland, Wales, and Ireland, to have conquered nearly every part of the British Isles. In the Bronze age the number and variety of the weapons, implements, and ornaments belonging to the men of the period become greatly increased, and their culture presents a far more complicated problem for study than that of their simpler predecessors. Mr. John Evans, who, as the highest authority on early bronzes, is followed by the author, divides the Bronze age into two periods—the Early and the Late; the first of these was a period of transition, when the use of bronze was superseding that of stone, and is characterised by the presence of bronze daggers and plain wedge-shaped axes, originally modelled from stone prototypes. The later division of the Bronze age is characterised by the appearance of swords, spears, palstaves, and socketed celts. Already in the early Bronze age such articles of advanced development as tweezers and combs of bone, amber and glass beads, jet buttons, and bronze finger-rings and ear-rings were in use. The accompanying woodcut represents an amber necklace of the Bronze period found at Lake, in Wiltshire. Even gold is found amongst the remains of this age.

We cannot follow the author in his account of the temples of the Bronze age, Avebury and Stonehenge, nor

FIG. 6.—Golden cap. Devil's Bit, Tipperary.

in his description of the methods by which the bronze was worked, of the artistic designs of the period, and of the curious hoards of bronze merchandise which have been found in France, and the pick of which has, we believe, found its way into Mr. John Evans' hoard. The twelfth chapter deals with the prehistoric iron age north of the Alps, the arms and equipage, personal ornaments, late Celtic art, Etruscan influence on art, &c. Arts in

this period reached a very advanced development indeed, as may be seen from the appended figure of a golden cap found in Tipperary. It is most beautifully ornamented in *repoussé*.

Silver and gold ornaments in this age became abundant. The concluding chapters in the book are on the Overlap of History (the Egyptian, Assyrian, Phœnician, and Greek Influences) and on Britain in the Historic Period (the Exploration of the British Coasts, and Roman Britain). We cannot follow the author further, but commend his book to our readers as one that will well repay perusal throughout.

THE HYDROGRAPHIC DEPARTMENT

WE observe that some of our contemporaries have opened their columns to certain strictures upon a public department standing well, and to our knowledge deservedly so, in the estimation of scientific circles in this and other countries.

It would appear that a Lieutenant of the Royal Navy, unknown, as we are informed, in his profession from the fact of his having retired from its active service at an early age, amused himself some few years back by a yachting excursion on the shores of Norway, in a small and crazy decked boat, undergoing, as might have been anticipated, some hardships in this excursion, which extended into the rigorous winter of that region. Gaining thus some knowledge of the coast traversed—but necessarily, from its great extent and intricate character, knowledge of a very superficial kind—the Lieutenant's experiences have recently formed the subject of an evening's entertainment at the Royal Geographical Society. Somewhat unfortunately for the ends of science and navigation, this adventurous cruise in a crazy barque has been in consequence dignified into a hydrographical survey, an appellation ludicrously inapplicable from the conditions under which the cruise was made, as related by the adventurer himself.

The ambitious *voyageur*, now extending his operations, under the leadership of an official of the Royal Geographical Society, has just addressed an audience at the Society of Arts on the "Trade Routes between England, Norway, and Siberia." We had expected at least some shreds of information on this topic, but find ourselves treated instead to a rude and ungenerous attack on the Hydrographic Department of the Admiralty, for some supposed shortcomings in its dealings with the officer, to whom the department had confided—mistakenly it seems—the revision of the sailing directions of that part of Norway on which the Lieutenant claimed to be an authority.

The Society of Arts commends itself to all reasonable men for the breadth and strength of its operations; we regret that it should in this instance have been exploited and made the arena, under cover of a legitimate object, for an attack, from personal motives, on a public department which has done and is doing good and honest service for the seamen of all nations. We believe we are only performing an act of merited justice in directing attention to the endeavours of a small, obscure, but self-asserting clique, bent apparently on discrediting a valuable and efficient department, affiliated in many ways to science, and well known to many of its ablest workers.

NOTES

PROF. W. H. MILLER died at Cambridge on Thursday, May 20, in his eightieth year. He graduated in 1826, being Fifth Wrangler, and shortly afterwards became a Fellow of St. John's College. He served his college as tutor during several years. On the resignation of Dr. Whewell in 1832 he became Professor of Mineralogy. He published his celebrated "Treatise on Crystallography" in 1838. This work was at once adopted by some of the most eminent foreign crystallographers, and may now be said to be universally accepted. It was translated into German and French. His "Manual of Mineralogy" appeared in 1854, and, like the former book, forms an era in the history of the science. It is full of the results of his own careful research. He is the author of several other books, and of numerous memoirs published in the various scientific journals. The memoir on the standards of weights is a classical research on the subject of weights, and is a monument of delicate and careful research. He was Foreign Secretary of the Royal Society, and was presented with the Society's gold medal in 1870 for his numerous contributions to science. Cambridge has especial cause to be grateful to him for the very splendid collection he has brought together. The collection consists almost entirely of donations; and the two noble gifts of the Hume and Brooke collections mark in a striking manner the appreciation in which Prof. Miller was held by lovers of minerals.

ON the same day as Prof. Miller died Prof. David Thomas Ansted, F.R.S., at the age of sixty-six years. Prof. Ansted was born in London in the year 1814. He graduated at Jesus College, Cambridge, was a Wrangler in 1836, and was elected in due course a Fellow of his college. In 1840 he was appointed to the Professorship of Geology in King's College, London. Five years later he became lecturer on geology at Addiscombe College, and also at the Civil Engineering College at Putney. About the same time he was made assistant secretary to the Geological Society, whose quarterly journal he edited for many years. From about 1850 down to a very recent date he was extensively engaged in the application of geology to the engineer's work, in mining, and in various other departments of industry. He has also been frequently employed as an examiner in physical geography under the officers of the Government Department of Science and Art. Prof. Ansted's works are very numerous; among them may be mentioned—besides his contributions to the transactions of learned and scientific societies—his "Application of Geology to the Arts and Manufactures," his "Physical Geography," his "Elementary Course of Geology and Mineralogy," and "The World we live in." Prof. Ansted was elected a Fellow of the Royal Society in 1844.

GENERAL MYER has sent a letter to his numerous correspondents, requesting, on behalf of the United States, that the hour for taking the simultaneous meteorological observations, from which are constructed the U.S. Weather Maps, be changed to a time thirty-five minutes earlier than at present; in other words, as regards the British islands, that the observations be made at oh. 8m. p.m., instead of oh. 43m. p.m. Greenwich mean time, and that the change be made to take effect on September 1, 1880. The proposed change being rendered necessary by the exigencies of the Signal Office, the request will doubtless be gladly acceded to.

THE second example of *Archæopteryx* is, we are informed, at present merely *on deposit* in the Geological Museum of Berlin, under the care of Dr. Beyrich, although it is expected that arrangements will shortly be made for its purchase by the authorities of that institution. It was bought from Dr. Haeberlein, of Pappenheim, by Herr Siemens, of Berlin, for the sum of 20,000 marks (1,000*l*.), in order to save it from an impending transfer to America, and to secure this valuable specimen for German science.

THE "Leopoldinische-Carolinische" Academy of Naturalists at Halle has presented this year's Cothenius medal to Dr. A. Michaelis, Professor of Chemistry at the Polytechnic High School of Karlsruhe, in recognition of his valuable researches in organic substances containing phosphorus.

AMONG the names mentioned for the honour of D.C.L. at the approaching Oxford Encænia is that of Prof. Sylvester.

WE regret to announce the death of Dr. Richard Biedermann, editor of the *Centralblatt für Agricultur-Chemie*. He died at Leipzig on May 10, at the early age of thirty-seven years.

IT is a fact worth noting that M. Chevreul, who is now in his ninety-fifth year, has begun his course on Chemistry at the Paris Museum of Natural History, with as much apparent zest and energy as he did fifty years ago when he first entered on his duties of that chair. The programme of his course, *Les Mondes* informs us, is beautifully and firmly written in his own hand. Notwithstanding his approach to the centenary, he still looks young and fresh.

A CORRESPONDENT, writing from Cherry Hill, Arnold, near Nottingham, informs us that he brought home from the Geisberg, in the autumn of 1877, a few specimens of the Edelweis, which he planted amongst some rock-plants in his pleasure-grounds situated on an eminence. It disappeared gradually altogether until last spring, when it came out to perfection. Towards the autumn he lost sight of it again, but a fortnight since signs of its reappearance were so developed that no doubt exists of its full growth, and in greater perfection than ever.

THE two first parts of a new botanical work by Dr. Dodel-Port, of Zürich, have just been published by Herr Cæsar Schmidt of that city. The title of the work is "Illustrirtes Pflanzenleben," and it promises to become one of unusual interest. In part 1 the lower fungi are described in a popular manner. The author undertakes to popularise the results hitherto attained in our knowledge of putrefaction- and contagion-fungi. He describes their forms, their size, and their manner of propagation; introduces the reader to their mode of life, and points out the danger arising to the human race from these minute organisms. The description is accompanied by two excellent plates, in one of which we recognise a reproduction on a small scale of a plate from the same author's famous "Atlas der Botanik für Hoch und Mittelschulen." Another chapter treats of miasma and contagions, and gives a complete account of the present state of our knowledge of infection-fungi. Part 2 is devoted to carnivorous plants, and is even more generally interesting perhaps than the first. The work is profusely illustrated with the author's original drawings. Altogether it is sure to form a very welcome and valuable addition to botanical literature.

THE death is announced of Dr. J. G. Mulder, Professor of Chemistry at Utrecht University. Dr. Mulder's name was well known in the scientific world; he died at the age of seventy-seven years.

THE Iron and Steel Institute holds its autumn meeting this year at Düsseldorf, by invitation of the German iron trade, on August 25 and four following days. An extremely interesting programme of excursions and meetings has been arranged.

AN interesting Report on the Meteorology of the Italian Mountains has been presented by the Rev. Prof. F. Denza to the International Congress of Alpine Clubs at Geneva. It appears that observations are regularly made at 113 mountain stations, the names, elevation, and geographical position of which are given in the report. Some of these stations, from their altitude and position, are of the greatest importance for the study of meteorology in the higher regions of the atmosphere. Three of them are specially worthy of notice, viz., Stelvio (2,543 metres), Valdobbia (2,548 metres), and Piccolo S. Bernardo. All stations are provided with good instruments, and meteorological observations are taken at some stations every three hours from 6 a.m. until 9 p.m. The results of the observations are carefully printed and circulated by Prof. Denza.

A GENERAL MEETING of the Mineralogical Society of Great Britain and Ireland will be held at the Meteorological Office, 116, Victoria Street, London, S.W., on Tuesday evening, June 1. The chair will be taken by Prof. T. G. Bonney, F.R.S., vice-president, at 8 p.m. The following papers will be read:—"On a New Face on Crystals of Stilbite, from Scotland and Western Australia," by the president; "On a Portable Chemical Cabinet for Quantitative Work," by A. E. Arnold (communicated by J. H. Collins); "On Kaolinite and Kaolin," by J. H. Collins. Other communications intended to be read at this meeting should be sent to J. H. Collins, Hon. Sec., care of Mr. R. H. Scott, at the above address.

THE Society of Telegraph Engineers have done valuable service to science by publishing the "Catalogue of Books and Papers relating to Electricity, Magnetism, the Electric Telegraph, &c., including the Ronalds Library," compiled by the late Sir Francis Ronalds, F.R.S. Some idea of the extent and value of this catalogue may be obtained from the fact that it occupies 560 pages. The work of editing has been carefully and judiciously done by Mr. A. J. Frost, who has prepared a useful memoir of Sir Francis Ronalds. The Catalogue contains 13,000 entries, though we regret that, by the conditions of the trust, the Society were not permitted to bring it up to date. They will, however, we are glad to learn, at no distant date, publish a supplement to the Catalogue, which will remedy this defect. The two together will form an invaluable reference-book in the subjects included in it.

IN reference to a note in NATURE, vol. xxi. p. 525, taken from the *Journal of Applied Science*, on the composition of the well-known Vevey cigars, Messrs. Grant, Chambers and Co., of Fenchurch Street, send us a letter from Ormond and Co., of Geneva, the manufacturers, in which they state that if such cigars exist as we referred to, "it can only be with the object of fraudulently taking advantage of the name of the goods we make, which have enjoyed an increasing reputation for more than thirty years past. The Vevey cigars manufactured by us are composed entirely of selected North and South American tobaccos, without any mixture or adulteration whatever."

A NEW scientific paper now appears at Leipzig every three weeks. It is called *Centralzeitung für Optik und Mechanik*. Dr. O. Schneider is the editor. The avowed object of the paper is to report on the progress in the manufacture of scientific instruments and apparatus, and in the scientific domain where such instruments and apparatus are employed.

A PROPOSAL has been set on foot for lighting the Sheldonian Theatre, Oxford, and the Camera of the Radcliffe Library with the electric light. In a circular addressed to the curators of the Theatre and of the Bodleian Library and to the visitors of the Ashmolean Museum by those interested in the question, it is stated that it has long been regretted by many members of the University that the Sheldonian Theatre is not available in the evening for any purposes of public interest, however great, for want of lighting. The neighbourhood of the Bodleian Library has, however, been a bar to any proposal for lighting by means of gas or any ordinary method. The care with which the heating apparatus of the Theatre has been inclosed within a fire-proof chamber is sufficient evidence of the importance attached by the curators of the Theatre to absolute security in this respect. The development of the electric light has now rendered it possible to illuminate public rooms by a process absolutely free from danger of fire. It has been adopted largely in the reading-rooms of our public libraries, and notably in the reading-room of the British Museum. The security is absolute and unquestionable, provided that the motive power is external to the building: the boon to readers in such reading-rooms is enormous. After dis-

cussing the question of the motive power and deciding in favour of a gas-engine, the memorial goes on to state:—"It is suggested that Dr. Siemens, F.R.S., D.C.L., to whom the electric light owes much of its recent development, might with advantage be consulted in connection with this proposal. Whether a permanent institution or an experimental trial is in question, all parties concerned can have the most perfect confidence that everything will be done as it should be in his hands. It is suggested that an experimental trial should be first made, which could be done at comparatively little expense. The memorialists feel confident that if this is conceded the permanent adoption of the light will follow." The memorial is already signed by Professors Henry S. Smith, W. Acland, H. Nettleship, Sayce, Sir Gore Ouseley, and Mr. Warren De la Rue.

THE enterprising Naturalists Society of Dundee had a very successful dredging excursion off the mouth of the Tay and in St. Andrew's Bay on Wednesday last week. Considerable hauls were obtained of familiar denizens of the coast waters, though we regret to learn that under the influence of the gentle swell in St. Andrew's Bay several of the budding naturalists suffered some disturbance of their equanimity, and we fear were not able to do perfect justice to the dinner and tea which were liberally provided on board. At the annual meeting of this Society a satisfactory report was presented, though we do not altogether approve of the movement for the publication of abstracts of the proceedings of the Society in the form of a journal. Such publications, we are inclined to believe, are more gratifying to the vanity of provincial societies than conducive to the promotion of science in any way. We see the Society is uniting with several other Scotch societies to endeavour to obtain the benefit of the Gilchrist Lecture Trust; why do they not take a hint from the line of action in reference to a journal, and endeavour to bring about a union of the various Scottish natural history societies for this and other purposes?

A CORRESPONDENT of the *Scotsman* writes that a colony of rooks has taken possession of a garden which is next to St. Magnus Cathedral, Kirkwall, and built about a score of nests. It is only two or three seasons since rooks made their first appearance in Orkney, and it is supposed the absence of trees in the country districts has caused them to take up their abode in the centre of the town.

Cotton is the title of a new weekly journal for manufacturers and planters.

AN important discovery is stated to have been made in the neighbourhood of Sydney, New South Wales. Boring for coal has been going on in Moore Park for ten months, and about the middle of March a quantity of oily matter was observed to come up, one gush lasting half an hour. This liquid is believed to be crude kerosene, but the analysis was not complete when the last mail left.

THE *Reale Istituto Lombardo di Scienze e Lettere* at Milan offers the following prizes:—For a treatise on Miasma and Contagions (Term May 31, 1881), a prize of 1,500 lire and a gold medal worth 500 lire. For determining by experiments whether the virulent principle of hydrophobia is an organised germ or not, a prize of 6,000 lire (Term February 28, 1882). For a descriptive treatise on the Motor-centres of the Periphery of the Brain, the sum of 2,000 lire (Term April 1, 1881). For the illustration by new research of the ætiology of cretinism and idiotism, 2,000 lire (Term May 31, 1882). Further details can be obtained by application to the Secretary of the Institution.

THE *Forester* is the title of a magazine published in connection with Nottingham High School, No. 7 of which has been sent us. The contents are varied, one paper being on the "Origin of Sandstones."

M. DEHAIRAN has opened the course of lectures that he is to deliver at the Museum d'Histoire Naturelle, on Vegetable Physiology. This chair has been recently created by M. Jules Ferry.

A SCIENTIFIC examination of the Ibaraki mountain range in Japan has resulted in the discovery of marble of different colours. One mountain is believed to be a mass of white statuary marble, and in another place black marble of the finest description was found.

THE additions to the Zoological Society's Gardens during the past week include a Black-faced Kangaroo (*Macropus melanops*) from South Australia, four Short-tailed Wallabys (*Halmaturus brachyurus*), three Vulpine Phalangers (*Phalangista vulpina*), three white-backed Piping Crows (*Gymnorhina leuconota*) from West Australia, presented by Sir Harry St. George Ord, C.B., F.Z.S.; a Javan Chevrotain (*Tragulus javanicus*) from Java, presented by Mrs. L. Dudfield; a Brown Capuchin (*Cebus fatuellus*) from Guiana, an Ocelot (*Felis pardalis*) from South America, a Ring-tailed Lemur (*Lemur catta*) from Madagascar, presented by Mr. Chas. A. Craven: a Pinche Monkey (*Midas œdipus*) from New Granada, presented by Mrs Henry Druman Macaulay; a Long-eared Owl (*Asio otus*), British, presented by Mr. G. E. Dobson, C.M.Z.S.; an Eyed Lizard (*Lacerta ocellata*), an Æsculapian Snake (*Celuber æsculapii*), six Viperine Snakes (*Tropidonotus viperinus*) from San Remo, North Italy, presented by Lieut L. L. Fenton; two Toco Toucans (*Ramphastos toco*) from Guiana, a Brown Passerine Owl (*Glaucidium phalænoides*), a Rusty Urubitinga (*Urubitinga meridionalis*), a Downy Owl (*Pulsatrix torquata*) from South America, deposited; two Guilding's Amazons (*Chrysotis guildingi*) from St. Vincent, West Indies, two Black-tailed Hawfinches (*Coccothraustes melanurus*) from Japan, four Golden Sparrows (*Auripasser euchlorus*) from Abyssinia, four Blood-breasted Pigeons (*Phlogœnas cruentata*) from the Philippine Isles, two Nightingales (*Daulias luscinia*), a Canary Finch (*Serinus canarius*), a Gannet (*Sula bassana*), British, purchased; a Black Wallaby (*Halmaturus ualabatus*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

THE LATE PROF. PETERS.—Prof. Christian August Friedrich Peters, whose death was mentioned last week, was the son of a merchant at Hamburg, and was born on September 7, 1806. His father's fortunes suffered in the war times, and his son's education was attended with difficulties, though he endeavoured to cultivate to the best of his power the natural bent for mathematical studies which was very early evinced. After some years the attention of Schumacher was drawn to the young Peters, and he employed him in various calculations for his ephemerides and geodetical works, and in 1826, and for several years subsequently, he was actively engaged in such operations at Hamburg and in Holstein, at the same time pursuing his studies and incidental employment under Schumacher. He then became for a time a pupil of Bessel, and in 1834 was appointed assistant in the observatory at Hamburg, whence in 1839 he was promoted to a position in the newly-founded Central Russian Observatory at Pulkowa, where he worked in theoretical and practical astronomy for ten years. In 1849 he was named Professor of Astronomy in the University of Königsberg, where he remained until 1854, in which year he was appointed to succeed Petersen in the direction of the observatory at Altona, and at the same time editor of the *Astronomische Nachrichten*, which he conducted up to the period of his decease. He removed to Kiel when the observatory at Altona was transferred to that place, and died there on the 8th inst., after a severe illness of many months' duration.

The works by which Prof. Peters was perhaps more widely known were his "Numerus constans Nutationis ex Ascensionibus Rectis Stellæ Polaris in Specula Dorpatensi Annis 1822 ad 1838 observatis deductus," which appeared in the *Transactions* of the Imperial Academy of Sciences of St. Petersburg in 1842, and the "Recherches sur la Parallaxe des Etoiles Fixes," printed in the same *Transactions* in 1846. For these important

memoirs he received the gold medal of the Royal Astronomical Society at the hands of Prof. J. C. Adams in 1852. His researches on the proper motion of Sirius also attracted much attention, and many other papers on various astronomical and mathematical subjects were contributed by him to the Altona journal. His later work at Altona and Kiel chiefly bore upon the determination of differences of longitude; the last, "Altona-Göttingen," is to be detailed in a memoir to be published in a few weeks.

MINOR PLANETS.—Circular No. 136 of the *Berliner Astronomisches Jahrbuch* notifies the re-observation of *Hilda*, the most distant of the group of small planets yet known to us, and one which, with *Ismene* No. 190, must at times experience considerable perturbations from the action of Jupiter. It has been found at Pola as an object of 13·5 m., many degrees from the position assigned in the ephemeris last published, but there seems reason to suspect error of calculation. Thus if the elements of Dr. Kühnert in the *Berliner Jahrbuch* for 1880 are employed, though there is a later orbit, the error of the computed place is much less than that shown by the ephemeris in the Berlin Circular, No. 135. The difference of positions appears to indicate that the true period of revolution is even longer than has yet been calculated.

In the same Circular, No. 136, are new elements of *Philomela*, attributing to that planet an almost circular orbit, the angle of excentricity being only 0° 18′ 36″·8, so that $e = 0{\cdot}005414$, which is less than in the case of *Venus*.

Medusa, to which has been assigned the shortest period of any of the minor planet group, has apparently passed the last opposition without being re-observed, but in addition to much uncertainty as to position, it was likely to fall in a region of the sky which is crowded with small stars, and therefore a search would be attended with much trouble and difficulty.

Vesta should now be well discernible without the telescope, being in opposition and perihelion this year nearly at the same time, as we have before remarked, magnitude 5·9. The planet is in perihelion on May 28.

COMET 1880, II.—The following ephemeris is calculated from elements depending upon observations to May 8:—

12h. G.M.T.	R.A. h. m. s.	Decl. ° ′	Log. distance from the Earth.	Sun.
June 1 ...	6 29 32 ...	+51 38·8 ...	0·4108 ...	0·2683
3 ...	30 41 ...	50 52·4		
5 ...	31 49 ...	50 7·0 ...	0·4168 ...	0·2660
7 ...	32 57 ...	49 22·7		
9 ...	34 5 ...	48 39·4 ...	0·4221 ...	0·2640
11 ...	35 13 ...	47 57·0		
13 ...	36 20 ...	47 15·6 ...	0·4267 ...	0·2623
15 ...	37 27 ...	46 35·0		
17 ...	38 33 ...	45 55·2 ...	0·4307 ...	0·2609
19 ...	39 38 ...	45 16·1		
21 ...	6 40 43 ...	+44 37·7 ...	0·4340 ...	0·2599

PHYSICAL NOTES

PROF. LEMSTRÖM, of Helingsfors, has recently described to the Physical Society of St. Petersburg a singular experiment which, unless otherwise explained by some of the circumstances of the experiment not yet published, must be regarded as a fundamental fact in the physical theory of electricity. He finds that a ring of insulating material when rotated about its axis of symmetry with a high velocity acts like a galvanic circuit, and produces a magnetic "field" in the space within it. Prof. Lemström is a disciple of Edlund, and regards this experiment as confirmatory of Edlund's theoretical views on the nature of electricity. According to Lemström, the ether in the insulator, being dragged along by the ring, produces vortical motion of the ether in the central space, which vortical motion he conceives to be the essential condition of a magnetic field. Arguing from these premises, Lemström proceeds to build up an ingenious theory of terrestrial magnetism. The converse operation of rotating an iron bar within a hollow insulating body or insulating medium ought also to produce magnetism in the bar. The earth being a magnetic body rotating in an insulating medium, ought to be magnetised by rotation about its axis, the axis being the axis also of magnetisation, unless the irregular internal disposition of the magnetic constituents produced an irregular distribution of the magnetism, or unless the distribution were affected by the induced magnetism due to movements of electricity in the atmosphere, as in the *aurora*, or by the magnetism which would, on Lemström's theory, be generated by the revolution of the earth round the sun, and by the motion of the solar system through space.

M. DUMAS, who has been examining the property of certain metals in occluding gases, has found that aluminium may occlude as much as one and a half times its bulk of hydrogen gas, and also shows traces of carbonic acid. The gases were given up when the metal was heated to redness under exhaustion. Magnesium behaves similarly. Were these metals distilled *in vacuo* they could probably be obtained pure. It is possible that these observations may throw some light on the anomalous behaviour of aluminium when used as an electrode in the voltameter.

THE cone of rays entering the eye from a peripheric point is never again united to one point, but it must present somewhere a minimum of cross section. The geometrical place of this minimum of cross section Herr Matthiessen (*Arch. f. Ophthalm.* (4) 25, 1879) designates the "theoretic retina." He finds that it is a spherical surface, the middle point of which coincides with the middle point of the corneal ellipsoid. To a distance of 75° from the fovea centralis the theoretical retina corresponds very exactly to the actual (according to the determinations of Arlt and Helmholtz). At greater distances the retina is formed hypermetropically, and so is within the "theoretic retina."

THE influence of magnetisation on the tenacity of iron has been lately studied by Signor Piazzoli (of the Catanian Academy of Sciences). Iron wires were hung between two hooks and ruptured by pouring water into a vessel suspended from them. They were about 350 mm. long, and were inclosed in a spiral with four windings one over another, which were either all traversed by a current in one direction, or two by a current in one direction, and two by an equal opposite current, so that in both cases the wires were equally strongly heated by the spiral, but in one case they were magnetised, in the other not. The weights required to break wires annealed in charcoal (weight of one metre, G = 0·299) were, during magnetisation, P = 1260–1306; without magnetisation, P′ = 1213–1270. In the case of wires annealed in carbonic oxide (where G = 0·46 g.), P = 1732·4 – 1742·7; P′ = 1703·62 – 1719·87. In the case of wires annealed in hydrogen P = 1289·5 – 1310·1; P′ = 1263 – 1299·7. In each separate series, accordingly, the difference P – P′ was frequently less than the difference between the highest and lowest weights required for rupture of apparently identical wires; still, the mean values in each of the (14) series, were from about 1 to 3 per cent. greater for the magnetised than for the unmagnetised wires, showing that the tenacity of iron increases on magnetisation. This, it is remarked, need not be attributed to a change of cohesion of the iron, but may be due to ordinary magnetic attraction of the successive parts of the wires. In eleven out of fourteen cases the relative elongation of the magnetised wires at rupture was greater than that of the unmagnetised, in three cases less.

IN a recent note to the Vienna Academy, Prof. Ludwig gives the results of the first of a series of observations on the decomposition of organic compounds by zinc powder. This relates to alcohols, and it is stated that in distillation of these over zinc powder heated to 300 – 350° C., the higher ones—from ethylic alcohol upwards—are split up into the corresponding olefine and hydrogen. Under the same conditions methylic alcohol is decomposed simply (if the small quantities of marsh gas be neglected) into carbonic oxide and hydrogen. The similar decomposition of ethylic alcohol into marsh-gas, carbonic oxide and hydrogen, only occurs at a considerably higher temperature—with dark red glow. On the ground of these decompositions, which indicate that the combination of the carbon and the oxygen must be a very strong one, it is supposed that the decomposition of the higher alcohols is no simple reduction to the saturated hydrocarbons, from which, then, by separation of hydrogen, the olefines might arise, but that in the first phase of the process the alcohol is split up into the olefine and water, and that the hydrogen concentrated in the gases is due to a reduction of the generated steam by the zinc powder.

PROF. RIGHI has recently described to the Bologna Academy an arrangement of Holtz's electric machine, in which the whole machine except the handle and the electrodes is inclosed, along with a small friction machine for excitation, in a glass case tightly

closed by means of strips of fur, and dried interiorly with chloride of calcium, so that in all weathers the machine acts well.

HERR ZEHFUSS has lately given (*Wied. Ann.*, 4) some personal experiences of the phenomenon of "after images of motion" (about which Plateau and Oppel have before written). These after images may be had, *e.g.*, in a train, if one look at a point on the horizon for a little, then turn to look at (say) a horizontal fibre in the wood of the carriage, or close one's eyes. Motions then seem to be still perceived; in the latter case, *e.g.*, a stream of sparks seems to be moving to the right (or if the point originally looked at have been between the observer and the horizon, there is a stream of sparks above going to the right and one below to the left). Herr Zehfuss offers a physiological explanation, in preference to the partly psychical ones proposed by Plateau and Oppel. Each individual nerve rod, he supposes, has special blood-vessels, which, when the original image of a moved object goes to the right, directs the course of the blood to that side, just as in ordinary light the decomposed blood is promptly replaced by fresh. By this preponderant direction of blood to the right a heaping up occurs in each retinal element on the right, which gives rise to return currents as soon as the outer cause has ceased to act. As the blood flows back there arise, in consequence of the specific excitability of the rods, those spark-streams, which are projected as elementary motions to the right.

IN a recent number of *Wiedemann's Annalen* (3) Herr Schönn describes a method of making visible ultra-violet prismatically decomposed light in such a way that exact measurements can be made. One feature of it is the use of a disk of fine calking paper saturated with sulphate of quinine, and contained in a small cell which is brought close before the Ramsden ocular, which can be directed at once on the disk and on a luminous line (its axis is not inclined like that of Soret's, but coincides with the axis of the telescope). The author gives measurements of the ultra-violet spectrum of cadmium, zinc, and thallium.—In the same number Herr Glan describes a "spectro-telescope," with which objects can be seen in any homogeneous colour at will. The instrument has various applications, especially in astrophysics.

IN a paper on the thermic theory of the galvanic current (*Wied. Ann.*, No. 4) Herr Hoorweg lays down the following propositions:—Wherever two conductors come into contact, motion of heat results in development of electricity; therefore a constant electric difference arises between the two substances. 2. If in a closed circuit, the total sum of the differences of potential be different from zero, there arises in this circuit a continuous electric current. 3. This current exists at the cost of the heat at one part of the point of contact, and has heat-production in the other for a result. 4. All voltaic currents are thermo-currents. 5. The chemical action in the battery and the decomposition apparatuses is a result of the galvanic current.

AN interesting series of experiments has been recently made by Dr. König on the vibrations of a normal tuning-fork (*Wied. Ann.*, No. 3). He finds that, practically, at least to 50° to 60° of heat, the influence of heat on a tuning-fork may be regarded as constant. Thick tuning-forks are more affected by heat than thin ones of the same pitch, indicating (it is remarked) that change of elasticity, and not change of the length of the arms, is the primary cause of the change of pitch. The influence of heat on tuning-forks of different pitch, and of not very different thickness, is proportional to their number of vibrations. Generally the period of vibration of a tuning-fork is increased or diminished $\frac{1}{5045}$ by a difference of temperature of 1° centigrade. The general change in pitch of the normal fork $Ut_3 = 512$ vibrations per second at 20°, through the temperature difference of 1° C. is 0·0572 vibrations per second. Dr. König has constructed a fork which, at any temperature, will exactly give 512 vibrations.

SOME quotations by Herr Oehler (*Wied. Ann.*, No. 3) from Jacob Hermann's work, "Phoronomia sive de Viribus," &c., published in 1716, have a curious significance in relation to the history of the mechanical theory of heat. In the twenty-fourth chapter, "De motu intestino fluidorum," the following paragraph occurs:—"Hoc nomine non intelligitur hoc loco internus molecularum motus fluidi cujuscunque in suo statu naturali consistentis, sed is particularum motus, qui in fluidis a causis externis et accidentalibus excitari solet, quo calor præsertim est referendus, qui dubio procul ex concitatiore particularum motu in corpore calido a causis externis producitur. Utut vero ejusmodi motus intestinus admodum perturbatus sit, nihilo tamen minus regula physice satis accurata pro ejus mensura media tradi potest. In another place Hermann offers a demonstration of the theorem that "Calor, cæteris paribus, est in composita ratione ex densitate corporis calidi, et duplicata ratione agitationis particularum ejusdem."

GEOGRAPHICAL NOTES

LIEUT. A. LOUIS PALANDER, of the Swedish Royal Navy, was last week elected a Corresponding Member of the French Geographical Society, in acknowledgment of his brilliant services to geography as commander of the *Vega* during the late Arctic Expedition. We understand that the Swedish Royal Academy of Sciences have just caused a handsome bronze medal to be struck in commemoration of the successful accomplishment of this enterprise. This medal shows on one side the heads of Prof. Nordenskjöld and Lieut. Palander, and on the other a well-executed representation of the *Vega* surrounded by ice.

AT the Anniversary Meeting of the Geographical Society, on Monday next, the Earl of Northbrook will take the chair for the last time, and will deliver an address on recent geographical progress. The formal presentation of the Royal Medals will also take place at this meeting, though neither of the recipients (Lieut. Palander and Mr. Ernest Giles) can be present. The Duke of Edinburgh, Honorary President of the Society, will preside at the Anniversary Dinner in the evening, which will be held, as usual, at Willis's Rooms.

LORD ABERDARE, it is understood, will succeed the Earl of Northbrook as President of the Geographical Society.

A BEGINNING is about to be made to carry out Lieut. Weyprecht's proposal for a circle of observing stations around the North Polar region. The Danish Government has resolved to establish a station at Upernivik, in West Greenland; the Russian Government has granted a subsidy for an observatory at the mouth of the Lena, and another on the new Siberian Islands; Count Wilczek is to defray the expenses of a station on Novaya Zemlya under the direction of Lieut. Weyprecht; the U.S. Signal Service, under General Myer, has received permission to plant an observatory at Point Barrow, in Alaska; and it is expected that Canada will have a similar establishment on some point of her Arctic coast. At the Hamburg Conference it was announced that Holland would furnish the funds for a station in Spitzbergen; and it is expected that Norway will have an observing post on the extremity of the Province of Finmark. This is a good beginning, and we hope that some sort of agreement will be established to have all the observations made after a uniform method, otherwise their value will be greatly decreased.

BARON EGGERS, of St. Thomas, West Indies, sends us a prospectus of a plan for the scientific exploration of the West Indies, especially as regards their natural history, his main purpose evidently being to make complete collections of plants, insects, and shells. Such collections he offers at certain rates to all who express their wish to become subscribers, the subscription to be paid on delivery of the collections. Details may be obtained from Baron Eggers or from his agent in Europe, Dr. Eug. Warming, Copenhagen.

M. PAUL SOLEILLET, who was compelled to return to Senegal in his attempt to reach Timbuctoo, is now in Paris, and expresses his determination to embark again in July, to make another attempt.

A SOCIETY of Geography for the north of France has been established at Douai.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—The election to the Professorship of Mineralogy, vacant by the death of Dr. W. H. Miller, F.R.S., will be held in the Senate House on June 12.

In the fourteenth Annual Report of the Museums and Lecture-Room Syndicate, Lord Rayleigh, the recently-appointed Professor of Experimental Physics, says:—"On visiting the Cavendish Laboratory in December last, after my appointment to the Professorship of Experimental Physics, I was at once struck with the

great deficiency of apparatus. The building itself appears to me to be very convenient and adequate to its purpose, but the advantages which it should afford cannot be fully realised without a large addition to the existing stock of apparatus. Even with an adequate outfit, a considerable annual expenditure is necessary for renewals and to meet the wants of students engaged in original research. Knowing that the University is not likely for several years to be in a position to meet the want, and feeling that Cambridge ought not to remain in this respect behind several Continental and American Universities, I have been endeavouring to raise an apparatus fund, to be spent in eight or ten years at the discretion of the Professor, by inviting contributions from persons interested in Cambridge and in science. I have been fortunate enough to secure the co-operation of the Chancellor, to whom the University is already indebted for the building and for most of our existing apparatus; and the proposal has met with such a degree of support from others that it may be considered to be already a partial success. It is difficult to form an exact estimate beforehand, but I should suppose that 2,500*l.* will be required during the next ten years to put the institution upon a proper footing." Lord Rayleigh announces that he has received promises and donations amounting to 1,825*l.*

In connection with the Science and Art Department at South Kensington the following courses of instruction for science teachers will probably be organised this summer:—(1) Chemistry, from July 7 to 29, Dr. W. R. Hodgkinson. (2) Light, from June 29 to July 14; (3) Magnetism and Frictional Electricity, from July 15 to 30, Prof. Guthrie, F.R.S. (4) Applied Mechanics, from June 30 to July 22, Prof. Goodeve, M.A. (5) Geology, from June 30 to July 22, Prof. Judd, F.R.S. (6) Botany, from July 7 to July 29, Prof. W. T. Thiselton Dyer, F.R.S.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 13.—Abstract of paper "On the Chemical Composition of Aleurone-Grains," by Dr. Vines.

This paper continues the account of this investigation, which appeared in the *Proceedings* for 1878. It was therein shown that the aleurone-grains of the Lupin consist of three proteid substances, namely, of two globulins—the one belonging to the myosin group, the other to the vitellin group—and of a substance, allied to the peptones, provisionally termed hemialbumose. In the present communication the results of the investigation of the grains of the peony and of the castor-oil plant (*Ricinus*) are given. The grains of the peony are found to be readily soluble in distilled water. Treatment with 10 per cent. NaCl solution, however, proves the existence of a myosin-globulin. Apparently no vitellin-globulin is present. The grains contain hemialbumose in considerable quantity. The grains of Ricinus present a complex structure. They consist of a mass of ground-substance of proteid nature, inclosing a crystalloid of proteid substance and a globoid which consists of inorganic matter. The ground-substance is found to be composed, like the grain of the Lupin, of the two globulins and of hemialbumose. The chemical nature of the crystalloid is not so clearly made out. It is slowly soluble in 10 per cent. NaCl solution, and readily soluble in 20 per cent. or in saturated NaCl solution after treatment with alcohol. The crystalloids of several plants were investigated with the view of ascertaining their relative solubility in solutions of this salt. Those of *Viola elatior* and of *Linum usitatissimum* were found to resemble those of Ricinus in this respect; those of Bertholletia and of Cucurbita are readily soluble in 10 per cent., and saturated NaCl solutions; those of *Musa ensete* and *hiltii* and those of *Sparganium ramosum* are either insoluble or only partially soluble in these solutions.

The points of more general interest are the action of alcohol in promoting the solution of the crystalloids of Ricinus in 20 per cent. and in saturated solutions of NaCl, and the fact that long-continued exposure to alcohol does not render the vegetable globulins insoluble in these solutions.

The author finally expresses his opinion that the caseins which Ritthausen has extracted from various seeds consist to a considerable extent of precipitated hemialbumose.

Physical Society, May 8.—Sir William Thomson, president, in the chair.—New Members: E. F. Bamber, Dr. E. Obach, R. D. Turner, E. Woods, H. E. Roscoe, H. Watts.—Prof. Minchin, of Cooper's Hill Engineering College, described his further researches on the subject of photoelectricity, brought by him before the last meeting of the Society. He has found that the current in a sensitive silver cell does not always flow from the uncoated to the coated plate. It does when chloride or bromide of silver is used, but when the sensitive emulsion is iodide of silver and the liquid water tinctured with iodide of potash, the current is from the coated to the uncoated plate. He demonstrated that the current set up by the fall of light on the cell could be sent by wire to a receiving cell, and made to produce a *local* effect on the sensitive plate therein. He also proved that electricity is developed in fluorescent bodies by the action of light, and hopes to show that it is also developed in phosphorescent bodies. Neither heat nor the red rays produce this electricity, but it is the blue and violet rays which do so. The fluorescent silver plates he employed were coated with an emulsion of eosine and gelatin, and had been kept sensitive for twelve days. They would thus be a permanent source of photoelectricity, did the eosine not tend to leave the gelatin. Mr. Wilson had suggested naphthaline red for eosine, as not apt to leave the gelatin, and he had found it give good results.—Dr. O. S. Lodge described certain improvements which he had made in his electrometer key designed for delicate electrical and especially electrostatic experiments. Assisted by the British Association, he had made it more convenient, and fitted it into an air-tight case which could be artificially dried. The contact-pins were now of phosphor-bronze gilt instead of platinum, and the contacts were made by press-pins from the outside. Dr. Lodge also exhibited a new inductometer or modified form of Prof. Hughes's induction balance, conbining a Wheatstone balance, and expressly designed for comparing capacities and resistances, especially the resistances of coils having no self-induction. A telephone takes the place of a galvanometer in the bridge, and the current in the primary coil is interrupted by a clockwork make and break. There is one primary coil of fine wire $3\frac{1}{2}$ ohms in resistance and two secondaries, one on each side of it, of fine wire, each about 270 ohms. These are fixed, but the primary is adjustible by a screw. Prof. Hughes remarked that he had pointed out in his paper to the Royal Society that the induction-balance could be used in this way; and Dr. Lodge disclaimed any novelty in the apparatus beyond its arrangement. Sir W. Thomson added that it was satisfactory to see so serviceable an adaptation of the induction-balance to research.—Dr. Hopkinson, Prof. Perry, and Sir W. Thomson offered remarks on the element of time in comparing discharges from condensers of different dielectrics. Sir William said that, in 1864, he had made experiments on air and glass dielectrics, and found the discharge about the same for the first quarter-second.—Prof. Adams then took the chair, and Sir. W. Thomson made a communication on the elimination of air from a water steam-pressure thermometer, and on the construction of a water steam-pressure thermometer. He said it was a mistake to suppose that air was expelled by boiling water, because the water dissolved less air when warm than when cold. The fact was due to the relations between the density of air in water and the density of air in water vapour. There was fifty times more air in the water vapour over water in a sealed tube than in the water below. If this air could be suddenly expelled only $\frac{1}{50}$th part of air would remain, and of this only $\frac{1}{2500}$ in the water, the rest being in the vapour. This suggested a means of eliminating air from water, whichhe had employed with success. It consisted in boiling the water in a tube, and by means of a fluid mercury valve allowing a puff of the vapour to escape at intervals. Sir W. Thomson also described his new water-steam thermometer now being made by Mr. Casella. It is based on the relations of temperature and pressure in water-steam as furnished by Regnault's or other tables, and will consist of a glass tube with two terminal bulbs, like a cryophorous, part containing water, part water-steam, and the stem inclosed in a jacket of ice-cold water. Similar vapour-thermometers will be formed, in which sulphurous acid and mercury will be used in place of water, or in conjunction with it. For low or ordinary temperatures they will be more accurate than ordinary thermometers.

Geological Society, May 12.—Robert Etheridge, F.R.S., president, in the chair.—Rev. Samuel Gasking, Thos. J. George, and Cuthbert Chapman Gibbes, M.D., were elected Fellows of the Society.—The following communications were read:—On the structure and affinities of the genus *Protospongia*, Salter, by W. J. Sollas, F.G.S.—Note on *Psephophorus polygonus*, von Meyer, a new type of Chelonian reptile allied to the leathery

turtles, by Prof. H. G. Seeley, F.R.S.—On the occurrence of the Glutton (*Gulo luscus*, Linn.) in the forest-bed of Norfolk, by E. T. Newton, F.G.S. Remains of the Glutton have hitherto been obtained only from cave-deposits. The author has lately received from Mr. R. Fitch, of Norwich, a portion of the lower jaw of this animal obtained from the forest-bed of Mundesley, Norfolk. The specimen consists of about two inches of the left ramus, bearing the first true molar and the hinder half of the fourth premolar in place. The jaw is smaller than in average specimens of the recent Glutton, but presents all the characters of the species as described in detail by the author.—A review of the family Diastoporidæ, for the purpose of classification, by George Robert Vine. Communicated by Prof. Duncan, F.R.S. —On annelid jaws from the Wenlock and Ludlow formations of the West of England, by G. J. Hinde, F.G.S.

Entomological Society, May 5.—H. T. Stainton, F.R.S., vice-president, in the chair.—Mr. Peter Inchbald, of Hovingham, York, was elected a member of the Society.—Mr. W. C. Boyd exhibited a very pale specimen of *Nyssia hispidaria*, taken at Cheshunt.—Mr. M. J. Walhouse exhibited some Geodephagous beetles, which were found only on the summits of some of the highest mountains in India.—Mr. W. L. Distant exhibited a long series of specimens of the Madagascar homopteron *Ptyelus goudoti*, Benn., to illustrate the extreme variability of the species. The series showed a gradation from melanic to albinic forms, and one specimen was asymmetrical in the markings of the tegmina, thus exhibiting the characters of two varietal forms, an occurrence which Mr. Distant stated was not altogether exceptional in extremely variable species of the order Rhynchota.—Mr. T. R. Billups exhibited two living specimens of *Carabus auratus*, which had been found in the Borough Market. In reference to a prediction by Mr. Wallace that a sphinx moth would be found in Madagascar with a proboscis of sufficient length to reach into the nectary of *Anagræcum sesquipedale*, Mr. Pascoe stated that he had heard a rumour that such an insect had been discovered, and endeavoured without success to find any corroboration of the statement from members of the Society. —Miss E. O. Ormerod made some remarks as to the contents of a work which she had edited and presented to the Society, and which contained the meteorological observations taken by Miss Molesworth for a period of forty-four years. Some attempt was made to contrast the meteorological conditions with the dominant phases of plant and animal life during that period.

Victoria (Philosophical) Institute, May 10.—A paper upon the data of ethics, with special reference to Mr. Herbert Spencer's views, was read by Prof. Wace.

PARIS

Academy of Sciences, May 17.—M. Edm. Becquerel in the chair.—The President presented the new edition of the works of Laplace, with letter from Laplace's granddaughter.—The following papers were read:—Meridian observations of small planets at the Greenwich and Paris observatories during the first quarter of 1880; communicated by M. Mouchez.—On saccharine, by M. Peligot. It is dextrogyrous, like ordinary sugar; its rotatory power, in Laurent's polarimeter, represented by 93° 5′ (sugar, 66° 18′). Saccharine from starch-glucose, and that from crystallised levulosate of lime, showed the same rotatory power. The essential character of saccharine is its relative stability and its inertia towards agents which act on other matters of the sugar group. It is much more easily got from crystallised levulosate of lime than from inverted sugar or starch-glucose.—Researches on the proportion of carbonic acid in the air; second note by M. Reiset. He made (ninety-one) fresh experiments in the country from June to November last year, day and night, and the average obtained was 29·78 CO_2 in volume, for 100,000 dry atmospheric air at 0° and 760 mm.; (this closely agrees with the figure 29·42 he got in 1872-73). He describes a new absorption apparatus, with the aid of which six or seven hours was sufficient to ascertain the yield of 600 litres of air. 28·91 was the average proportion of CO_2 for the day, 30·84 for the night. The maxima were in times of fog and mist; the average of twelve such cases was 31·66; the absolute maximum, 34·15, in a dense fog on September 3. He questions the accuracy of the method by which MM. Levy and Allaire found variations last year ranging from 22 to 36.—On the Furens dam, by M. de Lesseps. The dam of the Chagres (40 m. high) should be built on this type, and not cost over 25,000,000 fr.—M. Peters' death was announced.—On some nutritive effects of alkaline substances in moderate doses, from experimentation on man in good health, by MM. Martin Damourette and Hyades. The substances tried were bicarbonate of soda (3 gr. daily) and Vichy water from the spring Elizabeth de Cnaset (0·5 to 1 lit. a day). So taken, they are trophic agents, and they diminish uric acid largely (though the former causes gastric disorders).—Position of the comet *b* of 1880, determined at Bordeaux Observatory, by M. Rayet.—On the transcendants which play a fundamental *rôle* in the theory of planetary perturbations, by M. Callandreau.—On the number of cyclic groups in a transformation of space, by M. Kantor.—The tensions of saturated vapours have different modes of variation according as they are emitted above or below the point of fusion, by M. de Mondesir. The passage through the point of fusion always gives a variation at least four or five times greater than that found in two liquids in an equal thermometric range.—On the interversion of temperatures of the air with the height, by M. André. This is shown to occur (under like conditions) within much shorter vertical distances than those indicated by M. Alluard.—On the freezing mixtures formed of an acid and a hydrated salt, by M. Ditte. In such a mixture the cooling is not due to simple dissolution of the salt; there is always a double decomposition, conformably to the law of maximum work. The salt containing much water, this separates out, and the change of state absorbs the heat liberated by the reaction, borrowing from the liquid itself the surplus of energy necessary to its complete accomplishment. Hence results a considerable lowering of temperature.—Influence of alkaline or acid media on the life of crayfish, by M. Richet. Acid or basic liquids are not poisonous in the direct ratio of their acidity or basicity. With equal weight nitric acid is five times more toxical than sulphuric acid, and twenty-five times more than acetic acid. Generally bases have a more hurtful action than acids. The least toxical is baryta; a crayfish will live two or three hours in water containing 3 grs. of it per litre. Soda and lime are fatal in two or three hours in proportion of 1·5 grs. per litre; potash in one of 1 gr. Ammonia, however, is the most poisonous of all; in the proportion of 0·8 gr. per litre, its action is almost instantaneously fatal. It is thirty times more toxical than baryta, and fifteen than soda. —On some of the conditions of cortical excitability, by M. Couty. The movements caused by faradisation of the brain seem to vary like the less complex contractions caused by faradisation of the central end of the sciatic, pointing to a common origin of the two orders of movements in the same bulbo-medullary elements.—Local and general anæsthesia produced by bromide of ethyl, by M. Terrillon. The substance seems especially suited for short operations not requiring complete muscular resolution. It acts rapidly, is less dangerous than chloroform, and the awaking is not disagreeable.—Variations of urea in poisoning by phosphorus, by M. Thibaut.—Influence of the fattening of animals on the constitution of fats formed in their tissues, by M. Muntz. In animals submitted to a fattening process the fat is always poorer in solid fatty matters.—On the fixity of composition of plants; analysis of *Soya hispida*, or Chinese oleaginous pea, by M. Pellet.—On the respiratory and circulatory apparatus of some larvæ of diptera, by M. Viallanes. The heart of insects is at first a simple tube open only at its two ends. So long as it has no lateral orifices it is completely arterial.

CONTENTS

	PAGE
MATHEMATICAL JOURNALS. By J. W. L. GLAISHER, F.R.S.	73
OUR BOOK SHELF:—	
Edwards's "Six Life Studies of Famous Women"	75
LETTERS TO THE EDITOR:—	
Lord Rosse's Telescope.—Lord ROSSE, F.R.S.; OTTO STRUVE	75
Brain Dynamics.—GEORGE J. ROMANES, F.R.S.	75
The Inevitable Test for Aurora.—PIAZZI SMYTH	76
Variability of 60 Cancri.—JOHN BIRMINGHAM	76
Notes of the Cuckoo.—JOHN BIRMINGHAM	76
Fall of Dust	76
Monkeys in the West Indies.—D. G. G.; JOHN IMRAY	77
The Recent Volcanic Eruption in Dominica.—EDMUND WATT	77
Cup Stones, Cup-Marked Stones, or Cups and Rings.—R. MORTON MIDDLETON, Jun.	77
A Double Egg.—T. ALLWOOD	78
COMPARATIVE ANATOMY OF MAN, II. By Prof. FLOWER, F.R.S.	78
ON SYSTEMATIC SUN-SPOT PERIODICITY. By Prof. BALFOUR STEWART, F.R.S.	80
PRIMITIVE MAN (*With Illustrations*)	82
THE HYDROGRAPHIC DEPARTMENT	86
NOTES	86
OUR ASTRONOMICAL COLUMN:—	
The Late Prof. Peters	88
Minor Planets	89
Comet 1880, II.	89
PHYSICAL NOTES	89
GEOGRAPHICAL NOTES	90
UNIVERSITY AND EDUCATIONAL INTELLIGENCE	90
SOCIETIES AND ACADEMIES	91