THURSDAY, MAY 14, 1903.

THE UNIVERSITY AND THE MODERN STATE.

III.

IN our last article on the above subject, we attempted to show the German view of the proper position of the University in a modern civilised community.

We now proceed to give, so far as a careful study of statistics can help us, a similar indication of the view held in the United States; our object being to show the real basis of the recent progress of those nations which are now outstripping us, not only in commercial enterprises, but in other ways where brain-power comes in. We are glad to know that the importance of universities as well as battleships for the maintenance of the life of a nation is at last being recognised.

Any consideration of what the nation has done for higher education in the United States must be prefaced by a reference to two laws passed in 1787 and 1862 respectively. The first Act, enacted for the government of the territory north of the Ohio, provided that not more than two complete townships[1] were to be given to each State perpetually for the purposes of a "university to be applied to the intended object by the legislature of the State." In 1862 an Act was passed giving to each State thirty thousand acres of land for each senator and representative to which the State was then entitled, for the purpose of founding "at least one college, where the leading object shall be, without excluding other scientific and practical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States shall respectively prescribe, in order to promote the liberal education of the industrial classes in the several pursuits and professions of life."[2]

A reference to Table i. below, showing the number of acres of land in each of the States, the income accruing from which is available for university education, demonstrates more conclusively than any words could do how very fully advantage has been taken throughout the United States of the legislative enactments of 1787 and 1862. The table is due to Dr. Frank W. Blackmar, and is contained in "The History of Federal and State Aid to Higher Education in the United States," published in Washington in 1890.

The grant of 1862 proved insufficient, and in 1890 an Act for the "more complete endowment of the institutions called into being or endowed by the Act of 1862" was passed.

But these land grants do not exhaust the means adopted by the State to encourage higher education in the United States. In the book to which reference has been made, Dr. Blackmar summarises the principal ways in which the several States have aided higher education. They are as follows:—

(1) By granting charters with privileges.

(2) By freeing officers and students of colleges and universities from military duties.

(3) By exempting the persons and properties of the officers and students from taxation.

(4) By granting land endowments.

(5) By granting permanent money endowments by statute law.

(6) By making special appropriations from funds raised by taxation.

(7) By granting the benefits of lotteries.

(8) By special gifts of buildings and sites.

TABLE I.—*Land Grants and Reservations for Universities.*

States and Territories.	Acres.	Dates of Grant.
Ohio	69,120	1792, 1803
Indiana	46,080	1816, 1804
Illinois	46,080	1804, 1818
Missouri	46,080	1818, 1820
Alabama	46,080	1818, 1819
Mississippi	46,080	1803, 1819
Louisiana	46,080	1806, 1811, 1827
Michigan	46,080	1836
Arkansas	46,080	1836
Florida	92,160	1845
Iowa	46,080	1845
Wisconsin	92,160	1846, 1854
California	46,080	1853
Minnesota	82,640	1861, 1857, 187
Oregon	46,080	1859, 1861
Kansas	46,080	1861
Nevada	46,080	1866
Nebraska	46,080	1864
Colorado	46,080	1875
Washington	46,080	1854, 1864
North Dakota } South Dakota } ...	46,080	1881
Montana	46,080	1881
Arizona Territory ...	46,080	1881
Idaho Territory ...	46,080	1881
Wyoming Territory ...	46,080	1881
New Mexico Territory	46,080	1854
Utah Territory ...	46,080	1855
Total	1,395,920	

The result is, as Prof. Edward Delavan Perry, of Columbia University, has said,[1] "At the present time, in each of the twenty-nine of the States of the Union, there is maintained a single 'State university' supported exclusively or prevailingly from public funds, and managed under the more or less direct control of the legislature and administrative officers of the State. These States are the following:—Alabama, California, Colorado, Georgia, Illinois, Indiana, Iowa, Kansas, Louisiana, Maine, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, North Carolina, North Dakota, Ohio, Oregon, South Carolina, South Dakota, Tennessee, Texas, Virginia, Washington, West Virginia, Wisconsin and Wyoming.

"The universal verdict of public opinion in the States where such institutions are maintained is that they, as State organisations supported directly by public taxation from which no taxable individual is exempt, should be open without distinction of sex, colour, or religion to all who can profit by the instruction therein given."

The figures necessary to express how much university education in the United States owes to the American Government are large, and the total amount of the aid is enormous. The following table, drawn up with the assistance of the Report of the U.S. Commissioner of Education for the year 1899–1900, will enable the reader to form some idea of the splendid resources placed at the command of American universities. The grand totals under each heading will be found in Tables v. and vi., so arranged as to show the proportion of each total available for the university education of women.

[1] In surveys of the public land of the United States, a division of territory six miles square, containing thirty-six sections.

[2] "Report of the Commissioner of Education for the Year 1896–7.' Vol. ii. p. 1145. (Washington, 1898.)

[1] See Prof. Nicholas Murray Butler's monographs on "Education in the United States," vol. i.

TABLE II.—*Statistics showing Value, Endowments, Appropriations, Income and Benefactions of Universities and Colleges in the United States in* 1899–1900.

State or Territory.	Value of Libraries, Apparatus, Grounds and Buildings.	Value of Endowments—Productive Funds.	Tuition and other Fees.	Income from Productive Funds.	State, Municipal and U.S. Government Appropriations.	Income from other Sources.	Total Income.	Benefactions.
	£	£	£	£	£	£	£	£
Maine	351,200	377,900	17,600	17,500	14,000	3,000	52,100	13,900
New Hampshire	220,600	460,000	8,900	12,000	2,000	0	22,900	70,000
Vermont	198,700	165,000	3,600	9,100	8,100	1,500	22,300	28,700
Massachusetts	3,084,800	4,083,000	292,500	179,300	0	50,000	521,800	257,600
Rhode Island	301,700	259,400	19,400	15,700	0	300	35,400	30,400
Connecticut	1,577,800	1,414,300	106,900	69,700	0	5,700	182,300	156,400
New York	5,846,400	5,681,500	289,000	257,400	48,300	111,000	705,700	363,300
New Jersey	983,300	563,300	39,600	26,700	8,000	0	74,300	47,200
Pennsylvania	3,075,600	2,381,800	217,000	95,000	43,500	34,600	390,100	170,500
Delaware	34,000	16,600	300	1,000	8,000	600	9,900	—
Maryland	784,000	754,400	54,800	19,700	19,000	11,600	105,100	13,000
Columbia	974,900	279,400	34,300	14,700	20,600	14,700	14,300	14,600
Virginia	753,000	392,600	48,200	20,500	12,800	9,400	90,900	16,400
West Virginia	119,700	33,900	4,100	1,800	28,700	3,600	38,200	10,200
North Carolina	484,500	179,000	38,100	10,101	5,000	11,500	64,700	17,700
South Carolina	303,400	123,800	23,700	6,800	5,900	7,800	44,200	30,400
Georgia	491,600	184,400	37,900	11,400	5,400	8,600	63,300	20,700
Florida	104,800	85,100	4,500	5,400	4,500	0	14,400	3,500
Kentucky	437,100	332,400	33,700	17,000	13,400	9,800	73,900	27,500
Tennessee	992,000	527,000	70,200	26,900	12,700	33,700	143,500	58,800
Alabama	325,800	70,000	20,300	2,400	2,500	6,000	31,200	2,100
Mississippi	233,000	180,300	23,800	8,300	12,900	8,000	53,000	200
Louisiana	436,300	387,900	18,800	25,000	8,600	1,700	54,100	3,000
Texas	444,600	143,900	46,000	7,600	15,600	21,000	90,200	20,100
Arkansas	133,300	33,000	10,000	2,400	13,300	1,600	27,300	3,900
Oklahoma	14,600	—	200	0	3,800	0	4,000	—
Indian Territory	13,500	200	1,200	0	0	1,000	2,200	1,800
Ohio	2,114,900	1,901,500	91,200	84,700	64,400	26,300	266,600	133,600
Indiana	867,200	431,100	30,900	23,000	17,500	5,200	76,600	12,300
Illinois	2,256,000	2,310,500	199,400	96,800	61,500	31,100	388,800	386,900
Michigan	678,800	374,600	50,000	19,300	58,700	10,600	138,600	56,800
Wisconsin	627,300	334,000	22,800	15,300	62,800	4,500	105,400	10,400
Minnesota	627,100	332,700	35,200	15,400	35,100	8,900	94,600	15,200
Iowa	632,500	300,800	48,400	18,900	15,000	31,600	113,900	51,600
Missouri	1,359,800	737,300	77,200	33,800	14,900	19,600	145,500	67,400
North Dakota	47,700	8,000	1,000	600	9,100	0	10,700	4,800
South Dakota	92,400	20,000	4,600	800	6,600	1,100	13,100	19,200
Nebraska	451,300	67,300	13,700	3,800	46,400	4,400	68,300	9,400
Kansas	624,900	84,000	33,900	5,300	24,000	18,500	81,700	23,500
Montana	43,700	—	1,900	2,000	4,300	0	8,200	—
Wyoming	43,300	1,400	100	0	1,000	100	11,200	0
Colorado	343,300	124,000	8,000	7,400	14,400	2,200	32,000	46,600
New Mexico	16,500	—	100	0	2,200	0	2,300	2,700
Arizona	30,900	—	—	0	10,000	500	10,500	—
Utah	126,900	51,400	2,900	1,300	12,300	2,900	19,400	800
Nevada	50,400	—	—	—	11,400	0	11,400	—
Idaho	49,900	—	0	0	10,000	0	10,000	0
Washington	269,600	37,700	11,000	2,500	10,000	500	24,000	45,500
Oregon	124,900	89,000	5,200	4,400	6,000	900	16,500	5,600
California	1,376,000	4,250,200	41,100	78,500	55,300	3,500	178,400	11,300

But, as readers of NATURE are well aware, the universities and colleges of the United States have another source of income in addition to the generous provision made by the State. Every year wealthy American citizens place large sums of money at the disposal of the educational authorities for the purposes of higher education and the encouragement of scientific research. During the eleven years 1890-1901, the amount of these donations reached the grand total of nearly 23,000,000*l.*, as Table iii., compiled by Prof. Nicholas Murray Butler, shows:—

TABLE III.—*Total amount of Benefactions*[1] *to Higher Education in the United States.*

Reported in	£	Reported in	£
1890–91 ...	... 1,515,018	1896–97 ...	... 1,678,187
1891–92 ...	... 1,336,917	1897–98 ...	... 1,640,856
1892–93 ...	... 1,343,027	1898–99 ...	... 4,385,087
1893–94 ...	... 1,890,101	1899–1900	... 2,399,092
1894–95 ...	... 1,199,645	1900–01	... 3,608,082
1895–96 ...	... 1,810,021		

1 Compiled by Prof. Nicholas Murray Butler, Columbia University, and published in "Special Reports on Educational Subjects," vol. xi. part ii.

From 1871–1890, the total amount of benefactions for education of the kind with which this article is concerned, was, the annual reports of the U.S. Bureau of Education show, 16,285,000*l.*, so that for the years 1871–1901, the grand total of forty millions sterling was raised by private effort for American university education.

The question naturally presents itself: What has been done by private effort in this country to assist university education during the same period? Compared with American munificence, the amounts given and bequeathed here are very small. Take in the first place the university colleges, which are largely to be regarded as a growth of the years under consideration. The financial statements contained in the "Reports from University Colleges, 1901," published by the Board of Education, reveal the fact that, including the 400,000*l.* raised for the University of Birmingham, the benefactions to the fifteen university colleges in Great Britain amounted during 1870–1900 to a little more than three millions. In the absence of systematic reports during the same period of the financial resources of the older universities of the United Kingdom, it is difficult to estimate the amount of benefactions received by them during the same thirty years. The parliamentary returns which have been published since 1898, showing the revenue of Scottish universities, suggest that their benefactions in the same time, excluding Mr. Carnegie's splendid gift, may be put at something under half a million, so that for the whole of the United Kingdom the total amount of endowment from private sources raised in these years may, without any risk of under-estimation, be said to be considerably less than five millions.

To give some idea of the result of the broad-minded policy of the legislatures of the several States and of the treatment which higher education has received at the hands of American statesmen and men of wealth, the following short summaries have been drawn up, with the assistance of the Report of the Commissioner of Education of the United States Bureau at Washington, published in 1901, for the year 1899-1900. The first (Table iv.) shows the number of colleges having endowments of certain specified amounts. The second summary (Table v.) shows the total property of all American university colleges, tabulated under the headings of fellowships and scholarships; values of libraries, apparatus, grounds and buildings; and of their productive funds. The next (Table vi.) shows the amounts of income of these colleges, and the last (Table vii.) gives the total number of professors, instructors and students in colleges of university standing.

It is interesting in this connection to compare the number of students taking university courses in this country with those in Germany and the United States. With this object in view, Table viii. has been pre-

TABLE IV.—*Classification of Colleges and Universities for Men and for both Sexes, according to Amount of Endowment Fund.*

£		£	
20,000	to	40,000	56
40,000	,,	60,000	38
60,000	,,	80,000	13
80,000	,,	100,000	14
100,000	,,	120,000	7
120,000	,,	140,000	4
140,000	,,	160,000	5
160,000	,,	180,000	2
180,000	,,	200,000	1
200,000	,,	250,000	8
250,000	,,	300,000	5
300,000	,,	400,000	3
400,000	,,	600,000	4
600,000	,,	800,000	4
800,000	,,	1,000,000	1
1,000,000	,,	1,500,000	2
1,500,000	,,	2,000,000	—
		Over 2,000,000	3

TABLE VII.—*Professors, Instructors and Students in Universities and Colleges of United States.*

Institutions.	Professors and Instructors.[1] Men.	Professors and Instructors.[1] Women.
For men and for both sexes (480 institutions)	12,664	1,816
For women (141 institutions)	697	1,744
	Students. Men.	**Students. Women.**
Total number of students in universities and colleges ...	61,800	35,300

TABLE V.—*Property of Universities and Colleges in the United States* (1899-1900).

Description of institution.	Number of fellowships.	Number of scholarships.	Value of libraries.	Value of scientific apparatus.	Value of grounds and buildings.	Productive funds.
			£	£	£	£
For men and for both sexes	476	7,619	2,138,000	3,027,000	27,267,000	29,478,000
For women	18	447	132,000	157,000	3,129,000	1,088,000

TABLE VI.—*Income of Universities and Colleges in the United States* (1899–1900).

Description of institution.	Fees.	From productive funds.	State or municipal appropriations.	From United States Government.	From other sources.	Total income.	Benefactions.
	£	£	£	£	£	£	£
For men and for both sexes	1,675,000	1,222,000	691,900	197,000	393,000	4,179,000	2,168,000
For women	468,000	57,000	7,000	—	136,000	670,000	118,000

[1] Excluding duplicates.

pared, but it should be pointed out that the number of students in our university colleges includes all above the age of sixteen, which is probably much lower than the age of the students included in the totals for other countries. It is well to remember, too, that the number of American university students is probably too high for a fair comparison with those of Germany. Many university students in the United States are really students in the higher branches of technology, and would in Germany study in technical high schools, the students of which are not included in Germany's total in the table. To make the comparisons as simple as possible the number of university students per ten thousand of population has been calculated.

TABLE VIII.—*Number of University Students per* 10,000 *of Population* (1900).

Country.	Population.	Number of Students.			Number of Students per 10,000 of Population.
			Day.	Evening	
United Kingdom	41,164,000	Universities	12,000		4·98 [1]
		University Colleges	8,500	5,000	
German Empire	56,367,000	44,400			7·87
United States	76,086,000	97,100			12·76

The statistics provided above make it possible to form a good estimate of the comparative amounts of importance attached to higher education in this country and in the United States. Table vi. shows that, neglecting the income accruing from the State land grants, the legislatures of individual States and the U.S. Government together supplied about 900,000*l.* for university education during 1899–1900, while the article in NATURE for March 12, 1903, shows that the total State aid to universities and colleges in the United Kingdom at present amounts only to 155,600*l.* Table vi. also brings out another important principle; it reveals the fact that during 1899–1900 private effort provided more than two and a quarter millions sterling for the colleges of the United States, and thus leads to the conclusion, which is strengthened by Table iii., that interest on the part of the State in higher education leads to a corresponding enthusiasm among men of wealth.

A comparative study of this kind is of vital national interest; our very existence as a nation depends directly upon success in that industrial warfare between the great countries of the world from which there can be no peace. The last article in this series has shown the great importance attached by German statesmen to the higher education of the directors of German industries, and how greatly superior is the provision made for this purpose in Germany to that in this country. A similar conclusion is reached by studying the subject from the American point of view; we are equally behind the United States. Unless our Government, on one hand, and our men of wealth on the other, take immediate steps, and make serious efforts to remedy these deficiencies in our higher education, British manufacturers cannot hope to hold their own successfully with either German or American competitors. The amount by which we fall short of the United States, the deficiency which must be made good simply to bring us level with America in the race for industrial supremacy, will be seen from the following deductions from the above statistics :—

(1) The amount raised during 1871–1901 by private munificence for higher education was, in the United States, more than eight times that similarly provided in the United Kingdom.

(2) In addition to the large income from State land grants, the amount provided by the State for higher education is, in the United States, six times as much as the Government grant for the same purpose in the United Kingdom, where there is nothing corresponding to the land grants.

(3) In the United States there are 170 colleges with an endowment of more than 20,000*l.*; forty-nine of these have endowments of more than 100,000*l.*, and three of more than two millions sterling. In the United Kingdom there are thirteen universities and twenty other university colleges. Four of the universities do little more than examine.

(4) In the United States nearly thirteen of every ten thousand inhabitants are studying during the day at colleges of university status; the number in the United Kingdom is less than five.

(5) The value of the endowments of institutions of higher education in the single State of New York exceeds the total amount of benefactions for similar purposes raised during thirty years in the whole of the United Kingdom. The same is nearly true in the States of Massachusetts and of California.

(6) The number of *professors and instructors* at the universities and colleges included in the list of the U.S. Commissioner of Education is 17,000. The number of *day students* in our universities and university colleges is only about 20,500, so that there are almost as many university *teachers* in the United States as there are university *students* in the United Kingdom!

In considering what should be the strength of the British Navy, the first line of national defence as it is called, it is commonly said that we must aim at making it equal to the combined fleets of any two first-class powers. When rightly regarded, the development of the brain-power of the nation is, in view of the fact that the ability to keep up the Navy depends upon commercial success, of even greater importance. Our provision of higher education, far from being equal to that of two of our chief competitors together, is by no means equal to either of them singly.

A careful study of the tables here brought together will do more than anything else to explain the success which has attended American manufactures and commerce in recent years. America has learnt that to energy and enterprise must be added trained intellect and a familiarity with recent advances in science. Other things being equal, that nation will be most successful in the competition for the markets of the world which makes the most generous provision for the higher education of its people.

We are glad that even if the Government is supine, our captains of industry are waking up, and we may conclude by a reference to the *Times* report of the speech delivered by Sir John Brunner at the remarkable gathering in connection with the Liverpool School of Tropical Medicine on Monday last, in which he repeated what he had already said to Sir Norman Lockyer in private.

"If we as a nation were now to borrow ten millions of money in order to help science by putting up buildings and endowing professors we should get the money back in the course of a generation a hundredfold. There was no better investment for a business man than the encouragement of science, and he said this knowing that every penny he possessed had come from the application of science to commerce."

[1] Excluding Evening Students of University Colleges.

GEOLOGY FOR AGRICULTURAL STUDENTS.

Agricultural Geology. By J. E. Marr. Pp. xi+318. (London: Methuen and Co., 1903.) Price 6*s*.

IN the teaching of any technical subject, like engineering or agriculture, which touches and depends upon several of the pure sciences, there has always been dispute about the amount and nature of the pure science to be exacted from the technical student, the present controversy over mathematics for engineers being a notable example. In the past, as a rule, the pure science man has ruled the roast, secure in a plausible logical position which regards the technical as "applications" of the principles laid down in the pure science, as "riders" in fact; now, however, he has, thanks to the spread of truer conceptions of education, to justify his teaching and discard those intellectual gymnastics which leave the student "as he was," and confine himself to a development of the subject to the given end.

In the book before us, Mr. Marr has put together that portion of geology with which a serious agricultural student ought to be equipped as a basis for his study of soils; more particularly the book is intended for candidates preparing for the examination for the National Diploma in Agriculture.

The earlier part of the book seems to us to be admirably suited to the agricultural student; he will get from it just the introductory knowledge of minerals and rocks, rock structures, and the work of geological agencies that he requires for an intelligent appreciation of the structure of the country. There is nothing superfluous, and, on the other hand, the proper point of view is obtained, the subject is developed as a whole, and not allowed to become a series of scraps of useful knowledge.

Two excellent chapters follow on the construction and interpretation of geological maps and sections, but we should have liked to see the later chapter on "water supply" brought into connection with this section, and treated in much more detail. To the agriculturist, structural geology is in the main important only as bearing upon water supply; it is fundamental that he should be able to read a geological map so as to gauge the probabilities of obtaining either surface or deep-seated water at a practicable depth, or to trace the origin of landsprings and decide upon a plan for tapping them or otherwise drying the land. We trust Mr. Marr will see his way in another edition to work out for the student some examples of the varying conditions of water supply, not by generalised diagrams, but from the actual survey maps.

The weakest part of the book is the last, the chapters dealing with stratigraphical geology; the economic products are but lightly touched upon, and the agricultural character of each formation is dismissed in a very sketchy and generalised fashion. If we compare the two pages or so devoted to the structure of Graptolites—the chitinous rod, the periderm, the hydrothecæ, &c.—with the amusing reference to the clay-with-flints, "Little will grow on it, though in places it has been made to yield good root crops," we see the difference between Mr. Marr the geologist, writing of what he likes and understands, and Mr. Marr "getting up" things for the agriculturist. Lastly, we should have liked a little more about the "drift" and the superficial deposits generally, for the farmer is more concerned with them than with the solid geology. In this connection we should like to know Mr. Marr's evidence for the following statement (p. 128):—

"One very important character of glacial drift from the point of view of soil formation is due to the fact that the disintegrating action of ice is purely mechanical, and, consequently, the soluble constituents of the rocks from which the drift has been derived have not been removed. These soluble constituents may be taken up by the plants but slowly, and accordingly the drift soils may not yield such abundant crops as other soils at the outset, but, on the other hand, they may continue to furnish supplies of these soluble materials long after those of other soils have been exhausted."

We are not sure we understand the meaning of this paragraph, but at any rate we demur to the apparent implication that soils become exhausted by cultivation as practised in this country.

APPLIED MECHANICS.

Elementary Applied Mechanics. By Profs. T. Alexander, C.E., and A. W. Thomson, D.Sc. Pp. xx+575; 281 illustrations. (London: Macmillan and Co., Ltd., 1903.) Price 42*s*.

THE title of this book is misleading. It is really a large and fairly advanced work dealing with certain engineering problems usually, now, classed under the headings "Strength of Materials" or "Theory of Structures." Simple problems in connection with stress and strain are taken up in chapter i., useful numerical examples being given by way of illustration and enforcement. Such examples, in fact, form a valuable feature of the work throughout. The authors—professors at Trinity College, Dublin, and Poona, India, respectively—dedicate the book to the memory of their late teacher, Prof. Rankine. Their study of that great authority has not, however, produced that terseness and lucidity of expression now so much prized. Thus the lengthening of a strut is called "augmentation," and shortening, we are led to infer, is "negative augmentation." Again, we read,

"The *Proof Load* is the stress of greatest intensity which will just produce a strain having the same ratio to itself which the strains bear constantly to the stresses producing them for all stresses of less intensity. If a stress be applied of very much greater intensity, the piece will break at once, &c."

One notices circumlocutions of this kind in various places.

Internal stresses and strains, simple and compound, are next taken up, and a picture of a model for illustrating Rankine's "ellipse of stress" is given and explained.

The stability of earthwork is dealt with in chapter iv. —as usual in such investigations, all depends on a knowledge of the "angle of repose," a very variable quantity, and one not easily found practically. Chapter v. is devoted to the design of masonry retaining walls; the table of thicknesses for walls and the graphical solutions at the end of the chapter are particularly valuable. Chapter vi. commences an important section dealing with transverse stress, and relating mainly to the strength and stiffness of beams. After discussing the position of the neutral axis and the stress at a point in the section, the authors, oddly enough, give a chapter on the parabola, such as one might expect in a work on descriptive geometry. A clearly written chapter on graphical statics might have been introduced here with advantage. Diagrams of bending moment and shearing force are next discussed, and we come to the subject of continuous beams—one of increasing importance. Diagrams of shear and bending for girders with moving loads are then taken up at length, and a model is illustrated showing how the variations in these quantities, as a model loco. passes over a model bridge, may be exhibited to a class.

Combined live and dead loads are next considered, and approximations by the introduction of a so-called "equivalent live load" are dealt with at some length in chapter xiii., after which the *resistance* of a section to bending and shear is discussed, some neat graphical methods of finding the moment of inertia of, and the amount and distribution of shearing force at, a section being explained.

The very interesting use of the polariscope in investigating internal stress and strain, due to the late Prof. Peter Alexander, is fully described. Questions relating to curvature are next dealt with, the integral calculus being freely used. Amongst all the mass of weighty matter one does not find, so frequently as might be, useful practical rules and results set out clearly in heavy type. For instance, the point of, and amount of, the maximum deflection of a beam fixed at one end and supported at the other, with different distributions of loading, is often wanted in practice—we do not notice it prominently given here.

Struts, various kinds of trusses, linear arch ribs, &c., are taken up, analytical methods having the prominence rather than graphic methods, though the latter are employed to a very limited extent.

Tables relating to the "two-nosed catenary," the design of segmental arches, and other like matters bring this not at all elementary, yet valuable, work to a close except for an appendix, in which graphic methods are applied to a roof truss—evidently as an afterthought. R. G. B.

OUR BOOK SHELF.

The Principles of Animal Nutrition, with Special Reference to the Nutrition of Farm Animals. By Henry Prentiss Armsby, Ph.D., Director of the Pennsylvania State College Agricultural Experiment Station. Pp. vii+614. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1903.) Price 17*s*.

THE growth of institutions similar to that with which the classical labours of Lawes and Gilbert in this country are associated has been nowhere more marked than in the United States of America. The natural advantages of unlimited territory and virgin soil have no doubt much to do with the position of agricultural industry in that country, but added to this has been the recognition by the American people that farming, to be a success, must be conducted on scientific principles. Our Canadian cousins cannot be said to be behind their neighbours in this respect. The numerous and valuable memoirs which are being constantly issued from these agricultural experiment stations speak much for the industry and acumen of those engaged in conducting and superintending research there.

Dr. Armsby's book is a very successful attempt to present the present results of such work, so far as it relates to nutrition, in a systematic manner. It is, however, not a mere handbook for the stock raiser, but will amply repay careful perusal by students of physiology. It is a veritable mine of valuable statistics, and nowhere do we remember to have seen more clearly stated the great problems of metabolism and the methods by which they have been, and may be, solved. The law of the conservation of energy is as true for the chemistry of the living organism as it is for that of the laboratory, and it has been Rubner's epoch-making work to demonstrate that this can be experimentally verified. Much in the present book is naturally taken from Rubner; other names prominently quoted are those of Zuntz and Atwater. References are given to all important papers cited, and this materially enhances the value of Dr. Armsby's book. Where so much is excellent, it seems rather like carping criticism to point to minor deficiencies. We cannot, however, help noticing that the author's views on the digestion of proteids taken from a book published nearly ten years ago are somewhat antiquated; Kühne's theory on the hemi- and anti-products of gastric proteolysis has now been abandoned. The statement, also, that the fat of the food is absorbed largely in the form of an emulsion requires revision. In connection with the question of uric acid formation, Dr. Armsby does not appear to have grasped the now well-established fact that the formation of this substance in the bird is mainly synthetical, while in the mammal it is mainly, if not entirely, oxidative; he need not, therefore, hesitate to accept the view of its origin from nuclein and purin in these animals.

We, however, congratulate the author most sincerely on the book as a whole. So many books that one comes across nowadays are repetitions or imitations of others that it is refreshing to come across one which forms a material addition to knowledge.

Chemical Technology. Vol. iv. Electric Lighting. By A. G. Cooke, M.A., A.M.I.E.E., and Photometry, by W. J. Dibdin, F.I.C., F.C.S. Pp. xviii+378. (London: J. and A. Churchill, 1903.) Price 20*s*.

ONE must not expect too much of a book which aims at treating, in less than 300 pages, the whole subject of electric lighting, from the generation of electric energy in the central station to the manufacture of the lamp for its consumption in the user's house. As a work of reference for technical men engaged in other branches of work, but coming occasionally into contact with electrical engineering, this book should prove useful, just as an article in an encyclopædia is useful. And just in the same way as an encyclopædia article is defective, it seems to us that the book before us fails; by endeavouring to give too much information it only succeeds in giving too little. These objections apply rather to the scheme of the work than to the way in which Mr. Cooke has carried it out, which is as satisfactory as possible in the circumstances. In some instances the book is very much up-to-date; thus, it is probably one of the first text-books containing a good description of the Nernst lamp, though it is to be regretted that the type of lamp illustrated is not the one sold in this country. In other places there is an apparent want of knowledge of recent progress, as, for example, where the oscillograph is spoken of as an instrument of little value, the point-to-point method being described as more practical. These, however, are minor blemishes, such as must be expected in a comprehensive work in which different branches are not written by separate experts. On the whole the book is to be commended; the illustrations and curves are good and well selected.

The last hundred pages of the volume deal with the subject of photometry; all the more important types of photometer are described and illustrated, and the various standards of light are carefully considered. It is perhaps to be regretted that this part of the book should refer more especially to gas photometry, since the remainder is devoted to electric lighting; but then it is altogether somewhat surprising to find a book on electric lighting forming one volume of a series on chemical technology. M. S.

Die empiristische Geschichtsauffassung David Humes, mit Berücksichtigung moderner methodologischer und erkenntnistheoretischer Probleme. Eine philosophische Studie von Dr. Julius Goldstein. Pp. 57. (Leipzig: Verlag der Durr'schen Buchhandlung, 1903.) Price 1.60 marks.

THIS essay may be described as a chapter in the history of applied philosophy. In Hume the author sees an unique example of the philosopher applying his own principles to history. In this case the experiment was of little advantage to history. Hume's well-known views on causation, the self, and uniformity leave history destitute of any "inner essence," individuals or real meaning.

The author relieves these somewhat trite observations by concrete examples from Hume's "History of England." Apart from these, the essay has been, in the main, anticipated by Leslie Stephen's "English Thought in the XVIIIth Century." Perhaps we should not forget that this is a German book. Its value lies solely in focusing attention on Hume as an example of the way history should not be written. The real value of Hume's work is hardly touched; he is ranked above Voltaire, but shares with the Enlightenment the glory of having failed well. As to the question of method, there is here only a negative contribution. Not only has the failure of Hume and the Enlightenment left chaos, but the author leaves it quite an open question how history is to become a science. That may be wisdom, but then the title seems disproportionate. In the references to Green and Grose for P.H. (*passim*) read T.H. On p. 51 (note) the reference is i. S. 378, &c. (not ii.). Siegwart is, of course, Sigwart (p. 11). "Aepinus" (p. 39) and the Englishman "Marivaud" (p. 56) are scarcely recognisable, but probably symbolise "Aquinas" and "Merivale." G. S. B.

Arithmetic. Part i. By H. G. Willis, M.A. Pp. viii+256+l. (London: Rivingtons, 1903.) Price 1*s*. 4*d*.

THIS collection of examples on the simpler parts of arithmetic is arranged in a convenient and workable manner. The exercises are divided into thirty-nine groups, each containing work enough for two or three lessons; there are, moreover, duplicate sets of exercises which can, if necessary, be used in alternate terms. Oral questions are set at the beginning of each exercise. A few examination papers, tables of reference, and answers are given at the end of the book. The volume is likely to prove useful for junior forms.

LETTERS TO THE EDITOR.

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

Action of Live Things in Mechanics.

DR. HOBSON (p. 611) appears to hold the view that if dynamical laws are exact and irrefutable, the universe must be a completely determined mechanical system, with only one, and that a necessary, solution.

I hold, on the other hand, that though dynamical laws when properly stated are perfectly true, they do not cover the whole region of existence, and that, accordingly, it is possible for live things to affect the motions of matter in an unpredictable and capricious manner, though always in accordance with the laws of motion.

Dr. Hobson says, or implies, that they cannot so interfere without destroying the complete validity or supremacy of mechanical laws, and that they may as well upset the law of the conservation of energy as any other.

I reply that it is a question of fact whether they do or not. Experience seems to me to prove:—

(*a*) That live animals do introduce fresh considerations and do disturb things—do not take the path of least resistance, for instance; they are actuated by all sorts of non-mechanical motives, climbing the Matterhorn when there is no necessity, and building structures which would not otherwise be built.

(*b*) That in so doing they never run counter either to the conservation of energy or to any other fundamental mechanical law; they utilise the mechanical energies which lie ready to their hands, directing them, but leaving their amount unaltered.

[I emphasise the energy aspect because I so often find philosophers assume that any interference of life with inanimate matter must contradict the consérvation of energy, or else must involve the doctrine that life itself is a form of energy.]

I ask Dr. Hobson to admit that a unique solution of all future material motions is only possible in a problem from which all other aspects of the universe have been abstracted, so that we limit ourselves by hypothesis to a purely dynamical system.

There are many things in the universe beside mechanics, some of which, by odd chance, are enumerated in a footnote accidentally occurring below Dr. Hobson's letter. For simplicity it is customary to eliminate all these from dynamical problems. But the questions at issue are:—

(1) Whether any of these things can interact with or influence a dynamical system at all.

(2) Whether they can so interact without upsetting or contradicting any fundamental dynamical laws.

I wish to answer both these questions in the affirmative. But it must be understood that by "dynamical laws" I mean the fundamental ones—let us say those of Newton. I do not mean modern generalisations or comprehensive summaries, like the principle of Least Action, the applicability of which can only be postulated on certain simplifying assumptions—assumptions or abstractions which, in the present instance, merely beg the question in dispute.

If Dr. Hobson does not agree with this, I trust he will give us the benefit of his further criticism.

May 2. OLIVER LODGE.

The Glorification of Energy.

PROF. TAIT, whenever he wrote of the principle of the conservation of energy, almost invariably spoke of it as the "grand" principle of conservation of energy; and, following his lead, all but the most sober mathematicians use the laudatory adjective when they write about this particular physical principle.

It may not be altogether superfluous to point out that there are other principles equally entitled to the epithet "grand." For example, there is the "grand" principle of the conservation of matter; there is the "grand" principle of the conservation of force, the sum total (algebraic) of which in the universe is zero, according to Newton's

Axiom ii.; there is the "grand" principle of the conservation of momentum, the algebraic sum total of it along any direction in the universe being constant (and possibly zero) by Newton's Axiom iii.; as well as the "grand" principle of the conservation of energy.

Now I hold that it is invidious to apply laudatory epithets of various degrees to these principles; but it may not be wrong to point out that in many respects the momentum principle has a marked advantage over the energy principle, the former being very often very easily, and without any danger of error, applicable, while the latter (owing to the elusiveness of energy) is full of danger to the unwary.

Postulating now the existence of spirit, we find a difficulty in defining this entity; but no greater mystery attaches to it than that involved in matter. The spiritualists imagine that they gain something by calling matter hard and contemptuous names—"mere" matter, "gross" matter, "mere gross" matter, &c. The names are harmless, and do not assist ideas in any way.

Postulating, then, the existence of a spiritual domain, the crucial question arises: does Newton's Axiom iii. hold for the interaction of the domains of matter and spirit? If it does, there is no dynamical principle interfered with; *in the dual domain* there are conservations of force, of momentum and of energy; but in the physical universe, *taken separately*, neither force nor momentum would be conserved, although energy might. On the other hand, if Newton's Axiom iii. does not hold for the interaction of the two domains, no principle of conservation could be enunciated for either domain, or for the system of the two together.

Sir Oliver Lodge is anxious to make out the existence of a spiritual domain, and to allow it a certain influence on the physical, which influence, however, "perturbs physical and mechanical laws no whit." How does he effect this? By assuming (to put the thing into mathematical language) that the forces exerted on material things by the spiritual are forces which do no work—such as are reactions of smooth fixed surfaces, tensions of inextensible cords, &c. These are sometimes called "deviating" forces. Sir Oliver calls them "guiding and controlling" forces. But it matters not what they are called, they fail in their object. They allow, indeed, the physical universe to keep its sum total of energy intact, but they infallibly alter its total momentum and total force in every direction.

When Sir Oliver says "guidance and control are not forms of energy, and their superposition upon the scheme of physics perturbs physical and mechanical laws no whit," he says what is perfectly true of any conceivable forces—whether merely "guiding" or not. However force may be produced on a material particle, the effect on the particle will certainly be in accordance with Newton's Axiom ii.; so that, in the sense in which Sir Oliver's statement is true, there is no necessity to postulate that spiritual forces are forces which act on matter but do no work.

It is a physical and mechanical law that when any system of material particles is subject to no forces but its own internal forces, the centre of mass of the system is either at rest or in uniform motion in a right line, and also that its sum total of energy, kinetic and dynamic, is constant. But if Sir Oliver Lodge implies that *both* of these results can remain unaltered if that material system is acted on by spiritual forces, he is certainly wrong. His deviating, or "guiding," spiritual forces can leave the total energy (kinetic and dynamic) of that material system unaltered, but they must inevitably interfere with the rest, or constant motion, of the centre of mass. Many of his readers may take this meaning out of his words; but I am sure that he cannot intend to be thus understood.

It seems to me that Dr. Hobson in his letter on the subject has done well to direct attention to the real status of the "grand" principle of the conservation of energy.

GEORGE M. MINCHIN.

Coopers Hill, Englefield Green, Surrey.

Psychophysical Interaction.

As a psychologist I have read with deep interest Sir Oliver Lodge's paper in your issue of April 23, and I write to ask him to make clear some points which his paper leaves obscure to my mind. Those of us who are not mathematicians feel themselves to be very much at the mercy of those who are, and we can only beg the physicists to remember our infirmity and to put their statements before us in the clearest, simplest, and most carefully chosen language. Sir Oliver Lodge, as Clerk Maxwell did before him, throws out to psychologists the suggestion that mind may act upon body by exerting guidance without doing work. Such guidance, we are told, may be effected by the application of force to moving masses in the nervous system in directions perpendicular to the direction of the movements of those masses. "Guidance is a passive exertion of force without doing work; as a quiescent rail can guide a train to its destination, provided an active engine propels it." This is the sentence that I find so indigestible. And my confusion is but increased by Sir Oliver Lodge's further illustrations. He distinguishes two kinds of force. "Force in motion is a 'power,' it does work and transfers energy from one body to another. But a force at rest—a mere statical stress, like that exerted by a pillar or a watershed—does no work, and alters no energy; yet the one sustains a roof which would otherwise fall, thereby screening a portion of ground from vegetation; while the other deflects a rain-drop into the Danube or the Rhine." And, again, we read that life can exert "the same kind of force which can constrain a stone to revolve in a circle instead of in a straight line; a force like that of a groove or slot or channel or 'guide.'" My first question is, Is it fair to say that the pillar supporting the roof exerts a force in the same sense as the rail which guides the train, the roof which guides the rain-drop, or the hand which holds the string? In the first case there is no motion, and therefore no change of direction of motion, no alteration of energy; in the other cases there is motion and alteration of direction of motion. Secondly, is it fair to call the rail quiescent? In guiding the train round a curve does not the rail, and the mass to which it is made fast, suffer an acceleration or a change of motion in the direction opposite to that of the train? When I swing round a heavy ball on a string, and feel it pulling my hand centrifugally, and when by muscular effort I resist the pull, is that "a passive exertion of force without doing work"? Or, if the string is fastened to the end of an upright pole, is there not movement of the mass to which the pole is fixed in the direction opposite to the deflection of the movement of the ball? Every kind of mechanical guidance that I can picture to myself seems to imply action and reaction, change of direction of one momentum seems to imply always an opposite change of direction of an equivalent momentum. This is, I suppose, the mechanical law of conservation of momentum, of which Prof. James Ward tells us that it is incompatible with the conception of guidance without work. I ask Sir Oliver Lodge whether we are to understand that he is prepared to throw this one mechanical law to the wolves in order to preserve the rest of the creed of the physicists unharmed by Prof. Ward's attack? Or are we to understand that he repudiates the law of conservation of momentum *in toto*? In that case, I ask him to describe for us clearly a single case of mechanical guidance in which momentum is not conserved, or, since my use of the phrase may be technically incorrect, I ask him to describe a case of change of direction of motion of any mass produced without expenditure of energy or opposite change of direction of motion of other mass or masses.

I submit that Sir Oliver Lodge abstracts from the idea of motion the attribute of direction in space, and that such abstraction is illegitimate, save for certain purely theoretical purposes. All motion has direction in space, which would seem to be an essential element in all considerations of energy values. Sir Oliver tells us that life and mind cannot generate energy, though they can guide moving masses by exerting forces perpendicular to the direction of motion. But consider, then, the following case. Imagine a universe consisting of two inert masses flying through empty space in the same direction and at the same rate, and a soul contemplating them. That universe would be devoid of energy. Then suppose the soul to exert a force upon one of the two masses, perpendicularly to its direction of motion, so as to swing it round through a semicircle until it rushes to meet the other mass. The soul, by "guidance," has then created energy, and I take it that the same considerations would hold true in our more complex universe.

But this difficulty in conceiving that mind or soul can play a part in the world of matter by acting upon masses in the brain exists only for those who persist in holding the untenable hypothesis that all energy is kinetic energy, is the motion of matter. This has proved, of course, an excellent working hypothesis, but that it is true of all forms of energy is nothing more than a pious hope. Yet it is the definition of energy in these terms (tacitly or explicitly) that perpetuates the ancient difficulty of conceiving the relations of mind and body, and it is the persistent adherence to this conception that, on the one hand, has landed so many minds in the absurdities of psychophysical parallelism, and, on the other hand, drives so many others to refuse a general acceptance of the law of conservation of energy, and to believe in an activity of the soul unconditioned by the past, a belief which destroys the rational basis of morals and renders a science of history and of society impossible.

To me it seems that this fundamental problem can only be properly stated when we cease to regard matter as the ultimate physical reality, when with Prof. W. Ostwald we say, "Matter is no longer present for us as a primary conception; it arises as a secondary phenomenon through the constant coexistence of certain forms of energy. We shall therefore have to frame the question in a new form—How are psychical phenomena related to the energy-concept?" and "that in the case of psychical processes we have to do with the rise and the transformation of a special kind of energy, which we, in order to be able to speak of it, will name provisionally psychical energy (geistige Energie)." [1]

Haslemere, April 26. W. McDOUGALL.

I HAVE pleasure in answering Mr. McDougall's questions so far as they are addressed to me.

In the first place I have not presumed to say how psychic control actually is exercised; but, in contradistinction to those who hold that control or guidance is impossible without the generation or introduction of fresh energy, I have pointed out that very simple and familiar mechanical arrangements do constantly exert guidance without doing any work; for instance, a line of rails.

Mr. McDougall thereupon asks me whether the line of rails is really quiescent, whether it is not subjected to an opposite acceleration. I reply yes, but what of that? The yield of rail is infinitesimal, but whatever its magnitude it is such as to make the guidance less effective, not more; it is a passive yield to pressure, not an active exertion of energetic work-performing force in the direction of motion or of change of motion. The recoil of a gun is of no assistance in propelling a bullet.

In so far as the rails yield to the train as it enters Euston by a curve, they guide it not to Euston as it was, but to a slightly shifted destination. No matter, they guide it, and they have had no energetic or propelling power whatever.

He asks me further if I fully admit the principle of universal equal opposite reaction, and the consequent conservation of momentum.

Certainly I do; but I do not admit the (as I think) mistaken use Prof. James Ward makes of the principle in the sentence which he refers to.

Mr. McDougall seems to overlook the fact that kinetic energy is independent of direction. Whether a thing be moving north or south or east or west its energy depends on mass and speed alone. To change the speed, work is necessary; no work is needed to alter the direction. Perhaps it may be a help to him, though it is not really important in this connection, if I say that great momentum does not necessarily imply great energy. The momentum of a recoiling gun or earth is equal to that of the projectile, but the energy of the projectile is enormous in comparison with the energy of recoil.

He asks me for an example of "a change of direction of motion of any mass produced without expenditure of energy or opposite change of direction of motion of other mass or masses." But the two things are not the same. An instance of change of direction of motion without expenditure of energy is afforded by the instances we have already taken, or by any perfectly elastic rebound—that of a comet from the sun, for instance. Undoubtedly the sun thereby acquires an equal opposite momentum, but what of that? The modicum of energy in this momentum is infinitesimal, for one thing, and for another it comes from the comet, not from the sun; it renders the rebound less efficient, not more; it is no supply of energy from the central practically stationary mass. The same thing is true of a ball whirling on a string round a pole. When a boy holds the string in an active hand, it is quite easy and usual to do a little work by moving the hand a quadrant in advance of the ball, and thus to maintain, or even increase, its energy; but the force so exerted by a hand is not purely radial, it has a tangential component, and this part of it is effectively propulsive. An energetic, not a passive, centre is needed for that.

Coming to another part of his letter; his illustration of a great display of available energy being brought about by the reversal of motion of one of two similarly flying bodies, suffers from the confusion of energy with available energy. The flying of air molecules, for instance, is in every direction, sometimes so as to be able to collide, sometimes not, but their energy is quite independent of these directional circumstances. As Dr. Hobson truly says in your issue of April 30, "the principle of energy, if applied to even the simplest dynamical system which is possessed of more than one degree of freedom, is, taken by itself, wholly insufficient for the determination of the motion of such system." That is one part of my contention, technically stated. In so far as a question of absolute velocity seems involved in the energy of a single isolated flying mass, I might refer to a discussion of that aspect of the matter in the *Philosophical Magazine* for October, 1898.

In conclusion, I perceive that Mr. McDougall, like some other philosophers, hopes to jump the admitted difficulties of psychophysical interaction by ignoring "matter" altogether and taking refuge in "energy" alone. I venture to predict that those who attempt this will find that though they may wander in dimness for a time, and may cultivate an unawareness of difficulties by failing to see them distinctly, they will not derive any ultimate satisfaction from the blindfolding; nor do I think that they will be well advised to transplant the definite physical term "energy," even though prefixed by a special adjective such as *geistige*, in order to denominate what is probably a perfectly distinct psychical entity with laws of its own. OLIVER LODGE.

THOSE of your readers who have been interested by Sir Oliver Lodge's article printed in NATURE, April 23, on the "Interaction Between the Mental and Material Aspects of Things," may be glad to be referred to Thomas Solly's essay on the Will, published in 1856.

The suggestion of Solly is that every act of the will is simply a guidance of *mental* activity, infinitesimal, indeed, in its amount in each individual act, but such as to influence, not the external world, but the character of the individual exercising it, so that the same external stimulus operates after each successive act of the will on an individual whose character has been changed by that act, whence same stimulus is no longer necessarily the same motive. By thus regarding each act of the will as a "self-determination of the subject," the acts of choice or guidance are assumed to take place in a region of activity about which we have no physical information whatever, and the interactions of material things are left absolutely untouched.

The significance of the suggestion is made extremely clear in Solly's chapter on "Liberty, a Self-Determination of the Subject," and in subsequent chapters, by means of very happily chosen geometrical illustrations.

Mohuns, Tavistock, April 26. A. M. WORTHINGTON.

Mendel's Principles of Heredity in Mice.

THE issues raised in the case of these mice are as yet of such a simple and familiar kind that the source of Prof. Weldon's difficulty is not easy to surmise. When a gamete G bearing albino and pink-eye meets a gamete G′ bearing coloured coat (in this case fawn) and pink-eye, a heterozygote GG′ was produced, with dark eyes and coloured coat. Such hybrids, as the experiments proved, gave off equal

[1] "Vorlesungen über Naturphilosophie" (Leipzig, 1902).

numbers of gametes G, bearing albino with pink-eye, and G′ bearing colour with pink-eye. Consequently from GG′×GG′ we expect and obtain GG+2GG′+G′G′; and from GG′×G equal numbers (approximately) of GG and GG′. So far, GG are pink-eyed albinos; GG′ are dark-eyed with *some* colour in coat; G′G′ are pink-eyed, but with *some* colour in coat.

If we do not consider what *particular* colour GG′ and G′G′ will have, we may treat all gametes G′ as identical. But after crossing with albino such a condition would be unusual. The colour brought in by the original G′ is generally in part resolved, and various sorts of G′ gametes are formed, viz. *a*G′, *b*G′, *c*G′, *abc*G′, &c. Therefore when the hybrids breed together there will be GG′ zygotes of several colours, viz. G.*a*G′, G.*b*G′, G.*c*G′, &c.; also G′G′ zygotes of several colours, viz. *a*G′.*a*G′, *a*G′.*b*G′, &c. Each combination will have its appropriate colour and frequency, though (if the regularity be maintained) all GG′ will have dark eyes and *some* colour, and all G′G′ pink eyes and *some* colour. But as the hybrid produces G gametes equal in number to the various G′ gametes collectively, GG′×GG′ will give on an average one albino in four offspring (experiment gave nine in thirty-seven); and there is no question of one in nine. We are only concerned with *one* hypothesis (that I have set forth in "Mendel's Principles of Heredity," p. 29), and with this hypothesis the published facts are in admirable agreement.

Heterogeneous offspring from crossing two seemingly pure races may seem to Prof. Weldon an "amazing" phenomenon, but it is one with which the breeder early becomes familiar. Even albinos need not be pure or their gametes homogeneous in characters other than albinism.

Grantchester, Cambridge, May 1. W. BATESON.

MR. BATESON reconciles his statements in NATURE of March 19 and April 23 by explaining that in his first letter, when he describes certain mice as of constitution G′G′, he is deliberately denoting a whole series of different gametes by the same name.

The suggested heterogeneity among the gametes of pure albinos is now said to affect characters other than albinism, and is therefore wholly irrelevant. The avowed vagueness in the use of the symbol G′ makes it uncertain whether the fawn-and-white mice are now supposed to produce gametes of different character (with regard to coat-colour and eye-colour) or not. If the gametes of all the fawn-and-white mice used are similar, then all hybrids between these and albino mice are of similar constitution, and the fact that some are yellow, some grey, and some black is left unaccounted for. If the fawn-and-white mice produce even three kinds of gametes, G'_1, G'_2 and G'_3, then on crossing with albinos the hybrids GG'_1, GG'_2 and GG'_3 may be of different coat-colour; but since the fawn-and-white mice always breed true to colour when paired *inter se*, it surely follows that the combinations $G'_1G'_1$, $G'_1G'_2$, $G'_2G'_2$, &c., which arise from such unions (some homozygotes and some heterozygotes) give rise to mice of similar colour. It is this consequence of heterogeneity in a pure-breeding race which seems to me amazing.

In assuming that coat-colour is resolved into simpler elements when hybrids form their gametes, Mr. Bateson follows Mendel; but in such cases Mendel assumes that all the various kinds of gametes, produced by the hybrid, occur with equal frequency, and Mr. Bateson has elsewhere attempted to bring this assumption into relation with the phenomena of cell-division ("Mendel's Principles of Heredity," p. 30). In trying to fit Mr. Darbishire's facts by a Mendelian formula, Mr. Bateson abandons this hypothesis; he now says that a hybrid mouse produces (1) a series of different kinds of colour-bearing gametes, and (2) a number of gametes bearing the characters white coat and pink eye, *equal to the sum of all the other kinds of gametes together*. This departure from Mendel's hypothesis is masked in Mr. Bateson's first letter by the simple device of calling the whole series of different colour-bearing gametes by the same name G′.

Mendel's own view of the way in which compound characters behave gives a maximum possibility of one pure recessive albino among sixteen offspring of hybrids; a non-Mendelian view, lately put forward by Mr. Bateson in another case of colour-resolution (*Proc.* Camb. Phil. Soc., vol. xii. p. 52), gives a maximum of one in *nine*; the view he now suggests for mice gives one in *four*. By modifying first one and then another of Mendel's statements, his name is made to shelter almost any hypothesis, and almost any experimental test is evaded.

In the next number of *Biometrika* Mr. Darbishire will publish a series of new results, which have an important bearing on the application of Mendel's "principles" to his mice. Until these new facts are available, I do not think further discussion will be profitable, and therefore I do not propose to continue this correspondence.

Oxford, May 6. W. F. R. WELDON.

[This correspondence must now cease.—Ed.]

INTERNATIONAL METEOROLOGICAL COMMITTEE.

THE International Meteorological Committee appointed by the Paris Congress of 1896 in succession to those appointed by previous congresses, commencing with the Vienna Congress of 1873, will meet this year at Southport during the session of the British Association, September 9 to 16. The committee held a single meeting in the room at the top of the Eiffel Tower in 1900; its last normal session was at St. Petersburg in 1899. It has not met in England for twenty-six years. The original "permanent" committee was appointed by the Vienna Congress in 1873, and consisted of six members under the presidency of Buys Ballot; its successor now numbers seventeen members, representing a large number of the official meteorological organisations of the world. Prof. Mascart, of the Bureau Central Météorologique of France, is president, and Prof. H. H. Hildebrandsson, of the Royal Observatory of Upsala, is secretary, having been elected to that office on the resignation of Mr. Scott, who was secretary from 1874 (the Utrecht meeting) until the close of 1899. The other members are Prof. von Bezold (German Empire), Prof. Billwiller (Switzerland), Captain Chaves (Azores, Portugal), W. Davis (Argentine), Sir J. Eliot, K.C.I.E. (India), Prof. S. Hepites (Roumania), Prof. H. Mohn (Norway), Prof. Willis L. Moore (United States), Prof. L. Palazzo (Italy), Prof. Paulsen (Denmark), Prof. J. M. Pernter (Austria), Mr. H. C. Russell, C.M.G. (Australia), General Rykatcheff (Russia), Mr. W. N. Shaw (Great Britain), and Prof. H. Snellen (Holland).

The functions of the committee are to discuss meteorological questions of international interest and formulate proposals for international cooperation in connection therewith. The deliberations have an official character in virtue of the committee being appointed by a congress of representatives delegated in response to an official invitation of one or other of the European Governments, but the committee has no executive authority. It has been the practice for the committee to appoint from time to time various "commissions" or subcommittees to prepare reports upon questions that require preliminary discussion. The members of these subcommittees are not necessarily members of the international committee. They meet from time to time on the invitation of their respective chairmen, and opportunity is often taken of the occasion of the meeting of a subcommittee to obtain more general discussion by inviting other persons interested in the special subjects to take part in the proceedings, and sometimes to become members of the subcommittee. There are at present five subcommittees, constituted as follows:—

(1) *Terrestrial Magnetism.*—Sir Arthur Rücker (chairman), Messrs. Litznar, Moureaux, Palazzo, Paulsen, von Rijkevorsel and Rykatcheff.

(2) *Radiation and Insolation.*—Prof Viollo (chairman), MM. Angstrom, Chistoni, Chwolson, Snellen, Stupart, and Tacchini.

(3) *International Weather Telegraphy.*—Prof. J. M. Pernter (chairman), Messrs. Billwiller, Mohn, von Neumayer, Rykatcheff, Snellen, Tacchini.

(4) *Cloud Observations.*—Prof. H. H. Hildebrandsson (chairman), Messrs. Mohn, Riggenbach, Rotch, Rykatcheff, Sprung, and Teisserenc de Bort.

(5) *Aëronautics.*—Prof. H. Hergesell (chairman), MM. Assmann, Erk, de Fonvielle, Hermite, Jaubert, Pomortzeff, and Rotch.

To the last mentioned the following names have been provisionally added by cooptation:—Messrs. Berson, Angot, Bouquet de la Grye, Cailletet, Rowanko, in 1898; Prince Roland Bonaparte, Tacchini, Teisserenc de Bort, Hildebrandsson, Pernter, Hinterstoisser, Moedebech de Sigsfeld, in 1900, and others in 1902.

The subcommittee on terrestrial magnetism held a very successful meeting at Bristol during the session of the British Association in 1898. All the subcommittees met in Paris in 1900, and the aëronautical committee met in Berlin in 1902. The subcommittee on cloud observations has completed its work for the time being, and Prof. Hildebrandsson's report has just been published.

The subcommittee upon weather telegraphy will meet at Southport, but information as to proposed meetings of other subcommittees is not yet forthcoming.

Two conspicuous considerations point to the forthcoming meeting of the committee as one of exceptional interest and importance. The first is meteorological. The situation of the British Isles with regard to the Atlantic must necessarily attract the attention of all meteorologists. The problems which that situation brings into prominence are doubtless among the most difficult, but at the same time the most interesting of meteorological inquiries. The second is economical or social. This country is a great centre for communication with all parts of the globe, and in spite of, or perhaps because of, its insular position, is easy of access from all quarters. There are, therefore, good grounds for expecting that the hospitality of the British Association and of Southport will result in a meeting of unusual interest as regards meteorology and the kindred sciences.

No programme of proceedings has yet been issued. The executive meetings of the committee must necessarily be exclusive, but opportunity will be afforded for the discussion of meteorological questions of general interest in connection with the meetings of Section A, as was the case with the magnetic subcommittee at Bristol. Among the new subjects which will come before the committee may be mentioned the special question of the relation between meteorology and solar physics, the discussion of which it is hoped may be initiated by the president of the British Association.

Southport has special appropriateness for such a meeting. Its meteorological establishment, the Fernley Observatory, under the direction of Mr. J. Baxendell, is a conspicuously successful example of municipal enterprise in that direction. In connection with the meeting, provisional arrangements have been made for an exhibition of novel meteorological appliances and other objects of meteorological interest. A committee representing the Meteorological Council, the Royal Meteorological Society, and the Scottish Meteorological Society, with some additional members, has been formed to carry out the arrangements.

MAORI ART.[1]

NOT only students of Maori ethnography, but those who are interested in artistic technology, will heartily congratulate Mr. A. Hamilton on the completion of his great work on "Maori Art." Although this magnificently illustrated monograph nominally deals with decorative art, it is by no means confined to that subject, as for many years Mr. Hamilton has been diligently collecting facts and illustrations which bear on the social life of the Maories. Many interesting customs have been omitted as being beyond the scope of the work; usually only those matters are considered which are connected more or less closely with objects which are capable of being figured. Not too soon has Mr. Hamilton applied himself to his labour of love; constantly throughout the book do we find uncertainty as to the exact significance of patterns and designs, and occasionally objects are figured of which the use or meaning is very doubtful. Nor is this indefiniteness due to lack of energy on the part of the author; it is merely another example of the great change that is so rapidly modifying the majority of backward peoples. "How much interesting information," Mr. Hamilton writes, "has been lost can be estimated by the fragments which have been gathered. The system of laws for the government of the body politic known as *tapu*, was the outcome of centuries of experience of practical socialism. However irregular, capricious, and burdensome it may now appear to have been, it was certainly the source of order to them, and was of great use to conserve them as a race, and to sharpen their intellectual and moral faculties, besides retaining the canon of art in its native purity. As Mr. Colenso points out, when all this was swept away, together with polygamy and slavery, without anything to replace them, the nation, as a people, was broken up. 'However distasteful,' he says, 'these three things might be to an European and Christian, they were the life of the New Zealander. They were, perhaps, the three rotten hoops round the old cask, but they kept the cask together.'"

The work consists of five parts, of which the first part contains an account of Maori canoes, with ten plates. Part ii. deals with Maori habitations, with diagrams of the construction of a house, plans and sections of a fortified *pas*, with fifteen plates, and a valuable essay by the Rev. Herbert Williams on Maori rafter patterns, illustrated by twenty-nine coloured examples; these have never been described, and therefore the explanation of Mr. Williams of the patterns is doubly welcome. The weapons and tools are described in the third part, and are illustrated by eleven plates. The fourth part deals with dress and personal ornaments, with fifteen plates. The final part is devoted to the social institutions of the Maori people, with descriptions of their games, amusements, and musical instruments, with thirteen plates. Each of the sixty-four plates contains illustrations of several objects, and there are numerous figures in the text, so that the total number of illustrations is very large, and all of them are of excellent quality and constitute a mass of information for the ethnographer, and a wealth of material for the student of art. A noticeable feature of each part is the list of words relating to the subject-matter of that part, which forms a valuable subject vocabulary, which will prove of great use to students.

The wood-carving of the Maories is very characteristic, as regards both technique and *motive*. The designs are carved with great boldness, considerable relief is employed, and the background is usually filled up with labyrinthine designs, the spaces of which are

[1] "Maori Art." By A. Hamilton. Pp. 439; 64 plates and numerous illustrations in the text. (New Zealand Institute, Wellington, N.Z. Price 4*l.* 4*s.*

frequently perforated. The most common form of surface decoration consists of ridged parallel lines enclosing narrow bands or areas, which are filled up with short cross-ridges, as in Fig. 1, less frequently notched ornamentation, called *taratara o kai*.

The carvings most frequently represent grotesque human figures, often associated with a problematical creature called *manaia* (Fig. 2). Concerning the *manaia*, Mr. Hamilton says:

"On the slab are carved representations of a human figure attended by the monstrous bird or snake-headed figures so frequent in all carvings from the northern portion of New Zealand. At present no explanation is forthcoming of the esoteric meaning of these mystic

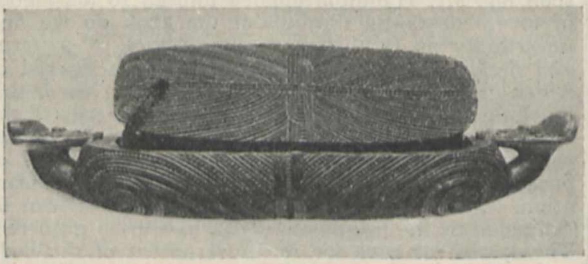

FIG. 1.—*Waka*, or box for holding greenstone ornaments or feathers for the hair.

figures. To advance a theory on the subject without ascertained facts from the *tohungas* (priests) of old would only add to the difficulties of the interpretation. Earle says, 'One of their favourite subjects is a lizard taking hold of a man's head, their tradition being that this was the origin of man.' Possibly these *manaias* may have been considered as representations of lizards. In Samoa *manaia* is the name of a lizard." Pratt, however, in his "Grammar and Dictionary of the Samoan Language," third edition, 1893, gives *manaia* as "fine-looking, handsome; a good-looking man." The interpretation of this *motive* is greatly to be desired, as it is evidently one of great antiquity and importance. Mr. J. Edge Partington has several

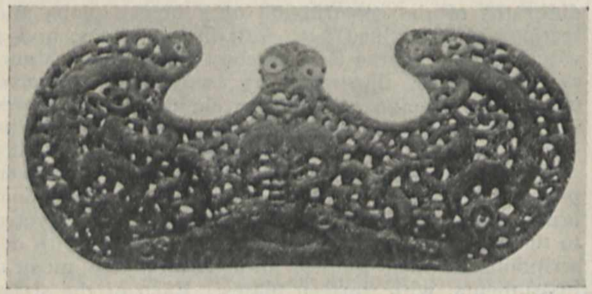

FIG. 2.—Carved *Pare*, or door ornament representing a man, with *manaia* on each side of him.

times attacked the problem (*Journal* Anthrop. Inst., xxix. p. 305; xxx., *Miscellanea*, Nos. 40, 41; *Man*, 1902, No. 17). He believes it to be a lizard, or perhaps a water-snake. The present writer has hazarded the view (*Man*, 1901, No. 55) that it may be a degraded and conventionalised representation of a bird, probably of the sacred bird of the West Pacific, the frigate bird which possesses *mana* (spiritual or magical power) in an eminent degree. The Maori spiral is also called *manaia*, and it appears to be related to the problematical animal. The spiral *manaia* and the less conventionalised *manaia* are associated with human beings on the carvings of the store-houses, and some of these human beings are so grouped as to indicate that they symbolise fertility. It is possible that the *manaia* originally, directly or indirectly, had a similar meaning. If this be so, it would seem as if the carving on these store-houses was a magical formula to ensure the abundance of the crops. Unfortunately, Mr. Hamilton merely says, "the *pataka* was the treasury, and its adornments were not only elaborate and beautiful, but had special significance" (p. 90).

A considerable amount of work yet requires to be done before we can feel that we really understand the symbolism of Maori carvings and the meaning of all the patterns. It cannot be too often or strongly insisted upon that this work cannot be accomplished in European museums; it is necessary for researches to be made on the spot. Let us hope that it be not yet too late.

It seems rather ungenerous to find fault with Mr. Hamilton after all the pains he has taken, but the reader would have been saved trouble if the author had been more careful in his editing. For example, it most frequently happens that the plates on which objects are figured are not referred to in the descriptive text, and *vice versâ*; thus the reader has to hunt through the pages to find the appropriate illustration or description, as the case may be. Sometimes the same class of object is figured on plates some distance apart, and still more troublesome is the case of the illustrations in the text. It is true there are lists of specimens figured in the plates and of illustrations in the text, but the continual turning the pages backwards and forwards to consult these as the text is being read, and the subsequent looking up the illustration, is apt to try the reader's patience.

The study of comparative decorative art will gain greatly by the publication of this work, and we echo the author's expression of sincere thanks to the Board of Governors of the New Zealand Institute at Wellington, N.Z., who have carried out the publication of so costly a work. Messrs. Fergusson and Mitchell, the publishers of Dunedin, also deserve great credit for the beauty of the illustrations and the excellence of the typography.

A. C. HADDON.

THE LONDON EDUCATION BILL.

THE Bill to extend and adapt the Education Act, 1902, to London, passed its second reading on Wednesday, April 29. As was pointed out in the issue of NATURE for April 9, the Bill was introduced by Sir William Anson on April 7, and in referring to the first reading proceedings we summarised its main provisions. As a result of the representations of educationists of different shades of political opinion on the Bill in its present form, the Government made it sufficiently clear during the course of the second reading debate that they were prepared to introduce modifications during the passage of the Bill through the Committee stage.

The central principle of the Bill was defined by the Prime Minister during the second reading debate; it is intended to provide that there shall be a central education authority and other local authorities to which certain powers can be delegated. The central authority is to be the London County Council, and the bodies to which delegation takes place are to be the borough councils. The vote on the second reading affirmed this principle by a majority of 137—163 voting for an amendment that the Bill be read a second time that day six months, and 300 against.

When the Bill is interpreted in the light of what Mr. Balfour has laid down as its fundamental principle, it becomes clear that modifications in its provisions are of great importance, and it is instructive to study the question from this point of view. First, then, as regards the constitution of the central authority; it is proposed that the new Education Committee for London shall consist of ninety-seven members, of whom thirty-six shall be members of the London County Council appointed by that authority; thirty-one shall be members of the councils of metropolitan boroughs appointed by those councils, Westminster and the City of London appointing two each, and each of the other metropolitan boroughs appointing one member; twenty-five are to be co-opted members representing expert educational opinion, and including representatives from such institutions as the University of London, the City Guilds, the City Parochial Charities, and so on; and for the first five years five members of the existing School Board. The question is, Do these proposals provide for the election of a central education authority on which the London County Council, which has the sole rating power, will have paramount influence? The majority of competent judges think not. There seems no good reason forthcoming for the inclusion of representatives of borough councils, and it is hoped that a change in this connection will be made in Committee. This is the more probable, too, as the proposed education committee is too unwieldy, and will from its size be likely to encourage general debate on educational questions rather than specific and intelligent administration of the work of the schools.

Then there is the question of the duties of the borough councils in their capacity of local authorities with delegated powers. The Bill makes these councils "managers of all public elementary schools provided by the local education authority within their borough," and gives them the appointment and dismissal of teachers in these schools and the custody of the buildings. They are to have, too, the selection of sites for new school-buildings. It is to be hoped that the clauses of the Bill dealing with the duties of borough councils will be greatly changed. It is highly undesirable that the teacher should be regarded as the servant of the local rather than of the central authority, and it is a mistake to run the risk of a lowering of the efficiency of the elementary school teachers in the metropolis by allowing the possibility of local prejudices, relationships, wire-pulling, and what not, to influence the selection of teachers. The London School Board has secured the reputation of having selected its teachers on their merits, and it would be a great mistake to make it possible for the teaching in any London borough to deteriorate because its councillors chose teachers from personal considerations rather than on the score of efficiency. So, also, in the case of the selection of sites for new schools; the central authority would undoubtedly choose these because of their suitability for the purpose; the local councils might conceivably select them for quite other reasons, for example, because a prominent councillor with great influence on the council wished to sell. These points require very careful consideration, and it may be safely predicted that during its passage through Committee the Bill will undergo considerable modification in these directions.

But from the point of view of readers of NATURE it is more important to consider the extent to which the provisions for higher and secondary education contained in the Act of last year are affected by the Bill now before the House of Commons. The present Bill being intended to extend the Act of last year to London, it is clear that the conditions which apply to the rest of the country, so far as secondary and higher education are concerned, are also to hold good in London. The Act of last year repealed the Technical Instruction Acts, and as a consequence the old technical instruction committees are disappearing, and their duties are being taken over by the new education authorities. The same thing will, on the passing of the London Education Bill, take place in London. The present Technical Education Board of the London County Council will be merged in the new central education authority which is to be set up, and from this consideration it is of paramount importance that this new authority should be guided by the same broad principles and actuated by the same lofty ideals as the present Technical Education Board has been. The existing board, with its absence of mere local characteristics, has done excellent work for the secondary and higher education of London, and on these grounds alone the introduction of any local element is to be deprecated.

As Sir Michael Foster said during the second reading debate, the University of London and the new education authority must work together for the better education of the people of London, and the new authority must be interested in university as well as in secondary and elementary education. It may be admitted that the new authority should be interested in all kinds of education from beginning to end, and should be prepared to give generous financial aid to education of university type, but there is a danger in admitting this generalisation which must be avoided. There must be nothing in the direction of delegating powers of managing higher education to local bodies of any kind. University education is in a very real sense a question of national importance. It must be guided by men of culture with the broadest possible catholicity. Education may be one and indivisible, just as London itself must be regarded from the point of view of its education, but the men who are competent to look after the schools of elementary grade are not the persons in whose hands the guidance of higher education may with advantage be left. Because every scheme of higher education depends for its success on the existence of youths possessing a sound general education, no efforts should be spared to secure a satisfactory system of secondary and elementary education in London and the country generally, but it must be persistently remembered that this is but a means to an end. Our boys must be satisfactorily educated, chiefly because without this preliminary training it is impossible to obtain a supply of properly qualified students for our universities and colleges, where, somehow, our manufacturers and merchants must be trained in such a way as to enable them to hold their own with the highly qualified competitors to be found in Germany and America.

It would be an excellent thing for London and for the country if well-equipped and highly endowed university colleges could be provided in several parts of the metropolitan area. But though every effort should be made to ensure the active interest of the local municipal councils in the work of such institutions, their management and government should in no sense be of a purely local nature. There should be a real connection with the State as indicating the national importance of university education, a due representation of existing great universities to enable the colleges of the metropolis to benefit by experience gained in other centres, and also members of the governing body elected by the corporations and persons contributing to the endowment funds.

Thus to point out the disadvantages of saddling university colleges with governing bodies actuated with parochial sentiments is surely quite enough to discourage the supporters of such a policy, and amply sufficient to convince everybody that the most strenuous efforts must be made in a contrary direction. It is only necessary to try to imagine the outburst of ridicule and indignation which would greet the suggestion that the government of the Universities of Oxford and Cambridge should be placed in the hands of the municipalities of Oxford and Cambridge respectively to see how indiscreet is a proposal made during the second reading debate to give the control of "all kinds of education from the beginning to the end" to the new Education Committee for London. Such an authority will have at least quite enough to do in building up a properly coordinated and duly unified system of secondary and elementary education, and in continuing the excellent work now being done by the London Technical Education Board. It would be in the highest degree unwise to give the new authority any sort of opportunity to interfere, for example, with the procedure of the Senate of the University of London, though, as has been said, it should be made possible for the new committee to show its sympathy with higher education by contributing to the funds of the University of London and of the metropolitan university colleges.

The university college cannot in any narrow sense be a local institution. To attempt to make it so would be the work of an enemy to higher education; indeed, it would be difficult to imagine anything more likely to play into the hands of our competitors than a disposition to place university education under the control of local authorities. Germany, for instance, would probably be highly delighted if this were done.

At present higher education in the United Kingdom largely depends upon private munificence and upon financial aid from municipal authorities. But, when the Government and the people of this country have been educated to understand that the maintenance of universities on a generous scale is of prime importance to the nation's well-being, it will become evident that the only satisfactory solution of a difficult problem is to regard the adequate provision of higher education as an important function of the State. When this is properly appreciated, the universities will be dependent upon State grants alone; they will no longer find it necessary to solicit financial help from individual munificence, or to secure the voting interest of local councillors with the object of obtaining municipal aid.

NOTES.

AT the closing ceremony of the fourteenth International Congress of Medicine, it was announced that the prize of 5000 francs offered by the Moscow municipality had been allotted to Dr. Metchnikoff, of the Pasteur Institute, Paris, and the prize of 3000 francs offered by the Paris municipality to Dr. Grassi, of Rome. The fifteenth congress will be held in Portugal in 1906, when the president will be Prof. Coimbra Costa. Dr. Miguel Bombarda, who will be the general secretary of this congress, is a member of the Royal Academy of Sciences and president of the Royal Academy of Medical Sciences at Lisbon.

THE death is announced of M. Worms de Romilly, formerly president of the French Physical Society, and a member of the committee of the International Association of Electricians.

PROF. E. RAY LANKESTER, F.R.S., has been added to the departmental committee appointed to investigate experimentally and to report upon certain questions connected with the dipping and treatment of sheep.

DR. ROBERT BELL, F.R.S., acting director of the Geological Survey of Canada, is at present in England for the purpose of receiving personally the degree of Doctor of Science which is to be conferred upon him to-day by the University of Cambridge. Dr. Bell was promoted to the directorship of the Canadian Survey more than two years ago, after being associated with the survey department for forty-six years, but it will surprise all who are not familiar with official routine to know that his appointment has not yet been gazetted, and we presume, therefore, that he does not receive the pay of the appointment.

LADY HUGGINS and Miss A. M. Clerke have been elected honorary members of the Royal Astronomical Society.

THE International Association of Botanists has just held its first congress at Leyden under the presidency of Prof. Goebel, of Munich.

THE *Athenaeum* announces the death of Josef Enzenberger, the director of the scientific station of the German South Pole Expedition. Herr Enzenberger was only thirty years of age.

MR. W. H. PATCHELL has been appointed a member of the committee to inquire into the use of electricity in mines in the place of Mr. James Swinburne, resigned.

THE honorary treasurer of the Cancer Research Fund, under the direction of the two Royal Colleges of Physicians and Surgeons, has received the sum of 1000*l*. from Mr. H. L. Florence for the advancement of the investigation of cancer.

THE *Times* correspondent at Wellington, N.Z., points out that unless the next season should prove more favourable than the last, the *Discovery* will remain fast in the ice, and her ultimate abandonment in the Antarctic is possible. It is imperative, therefore, that the relief ship should return.

SOME additional particulars referring to the British Antarctic Expedition have been brought from New Zealand by the s.s. *Paparoa*, which arrived at Plymouth on Sunday with a member of the *Discovery's* crew, and also one of the crew of the relief ship *Morning*. A remarkable experience is related by a young New Zealander named Hare, who set out from the *Discovery* with a party of officers and men to deposit a record at Cape Crozier. He was separated from the party when returning to the ship, and was buried in a snowdrift. After being asleep in the snow for thirty-six hours he was revived by the warmth of the sun, and was strong enough to rise out of the snow and walk to the ship. With reference to some of the work in terrestrial physics, Mr. Bernacchi says in a letter:—"One of the most typical of the magnetograms for the year 1902–3, with *data* for reduction, has been sent home in case something should happen to us before the return of the expedition. The seismograph has been working the whole year, but very few shocks and tremors are recorded. Our largest are on May 25 and on September 22, which seems to correspond with your record on April 18. There are some irregularities in the line which might be due to the Guatemalan earthquake. There are some tremors, however, which coincide with your record. From October 3 to October 8 a great many tremors were recorded. I also have a year's observations of atmospheric electricity."

IN connection with the celebration of the centenary of Dalton's enunciation of the atomic theory, to be held at Manchester next week, the following extract from the presidential address delivered by Prof. J. Emerson Reynolds, F.R.S., to the Chemical Society, at the last anniversary meeting, is of interest:—"This year is the centenary of the announcement, in a tentative form, of probably the most fruitful and valuable of all scientific hypotheses—Dalton's Atomic Theory. On October 21, 1803, Dalton read a paper

"On the Absorption of Gases by Water and other Liquids" before a select audience of nine members of the Literary and Philosophical Society of Manchester. He appended to that paper a statement which, according to Sir Henry Roscoe and Dr. Harden ('A New View of the Origin of Dalton's Atomic Theory,' Macmillan, 1896), is the first published indication of the atomic theory, though the paper was not circulated in the Manchester *Memoirs* until November, 1805. Thus, just 100 years ago, the conception of the discrete nature of matter was formulated, and used to explain the facts then known as to the constant composition of chemical compounds, and the laws discovered by Dalton as to their formation in definite and multiple proportions. This germ of the molecular theory of matter, which now pervades all thought in chemistry and physics, arose, as Nernst truly says, 'by a single effort of modern science, like a Phœnix from the ashes of the old Greek philosophy.' Therefore, physicists as well as chemists are interested in an event of the highest significance in the development of both branches of science. I am glad to know that a special celebration will shortly be held in that great city which claims Dalton as her illustrious son."

THE Rumford premium of the American Academy of Arts and Sciences, consisting of a gold and a silver medal, has been awarded to Prof. George E. Hale, director of Yerkes Observatory, in recognition of his researches in solar and stellar physics, and in particular for the invention and perfection of the spectroheliograph.

AN International Exhibition of Hygiene, Life-saving, Sports, Fishery, and Ambulance is to be held in Paris from September to November, 1904, at the Grand Palais des Champs-Elysées. Full particulars may be obtained on application to the Commissaire Général, Exposition Internationale de 1904, 3 rue des Moulins, Paris.

THE *Lancet* reports that a new building is to be erected in Manila to provide laboratory space for the chemical and biological laboratories and the serum institute. The building will be divided into sixty rooms, and will be 216 feet long and 60 feet wide, having two storeys. The plans of the building have been drawn so as to accommodate all the work within one building, one half of which will be occupied by the chemical and the other half by the biological laboratory.

WE learn from *Science* that Harvard University, New York University, and the Bermuda Natural History Society unite in inviting botanists and zoologists to spend six weeks in the temporary biological station provided at Bermuda. The two possible dates of sailing from New York are June 20 and July 4. Circulars and detailed information will be supplied on application either to Prof. C. L. Bristol, University Heights, New York City, or to Prof. E. L. Mark, 109 Irving Street, Cambridge, Mass.

WE learn from the *British Medical Journal* that the Croonian lectures before the Royal College of Physicians of London will be delivered this year by Dr. C. E. Beevor on June 9, 11, 16 and 18. The subject will be muscular movements and their representation in the central nervous system. The first course of FitzPatrick lectures will be delivered by Dr. J. F. Payne on June 23 and 25. He has chosen for his subject "English Medicine in the Anglo-Saxon and Anglo-Norman Periods."

A CORRESPONDENT points out that in each of the embroidered designs reproduced in a notice of East Siberian decorative art (April 16, p. 560) it is possible to distinguish a man's face quite as clearly as the conventional cocks which are supposed to be grouped about the central axis.

A CONGRESS commemorative of the fiftieth anniversary of the foundation of the Royal Photographic Society will be held next week. The congress will be opened on Tuesday, May 19, at the New Gallery, Regent Street, at 8.30 p.m., when the president will deliver an address. This will be followed by a conversazione, when the president, Sir William Abney, and council will receive the Society's members and guests. On Wednesday, May 20, at the Society's house, there will be a meeting at which papers will be read, and in the evening there will be a dinner. In connection with the congress there will be a special exhibition at the Society's rooms of objects having interest in the history of photography. The council hopes that this exhibition will represent the various stages of photography from its infancy to the present day. The commemoration of the jubilee will not cease with the congress of which details are given above. It is intended that the annual exhibition shall be distinguished by features which will mark the present year as one of more than usual significance. There will be a special invitation pictorial section in addition to the established pictorial section, and the scientific and technical section will be entirely collected by direct invitation, both having for their object the illustration of the progress and present position of photography.

ON May 5 Lord Avebury, the president of the Selborne Society, took the chair at the annual meeting and conversazione. He alluded to several of the many lines of work upon which the association is engaged, to wit, the interest which it is taking in the Home Counties Nature-Study Exhibition, the bird sanctuaries arranged for, and the protection of plants. Lord Avebury claimed that near London plants now needed more looking after than birds, and quoted instances from his own experience; he also pointed out how easy it was for country clergymen to follow in the steps of the great Gilbert White. Sir John Cockburn also alluded to plants and the advantage of the study of flowers to children, saying that in this respect we might all well be children. As chairman of the Nature-Study Exhibition held last year, he wished all success to the new undertaking mentioned by Lord Avebury. Sir George Kekewich said that of all the objects of the Selborne Society, he would put nature-study first. Dr. Bowdler Sharpe gave an illustrated lecture on Selborne, and Mr. Andrew Pears, who recently bought the Wakes, offered a cordial welcome to the members of the Society who are to visit Selborne in June next.

THE freedom of the city of Rome was conferred upon Mr. Marconi last Thursday by Prince Colonna, Syndic of Rome. The occasion was marked by much enthusiasm; a conference was held in the afternoon and a banquet in the evening, and from all sides Italians welcomed the opportunity of doing honour to their distinguished countryman. Since then Mr. Marconi has been conducting experiments in Rome and the neighbourhood with, it is reported, very successful results; before leaving Rome he intends to select a site for the high-power station which is to be erected near the city.

TELEGRAMS from Ottawa state that Mr. Fielding, Dominion Minister of Finance, speaking in the House of Commons with reference to the Marconi system, said that the system had not been as successful as had been expected, and that the Government did not propose to make any further contributions towards it. It will be remembered that last year the Canadian Government made a contribution of more than 16,000*l*. towards the cost of establishing Transatlantic communication. The Canadian Government is, however, still confident of the ultimate success of the system. The delay in getting the Canadian station into successful commercial operation is said to be due merely to a breakdown of a mechanical nature. It seems as if some other difficulties are also being encountered, as one does not hear of any Transatlantic signalling from either of the two American stations.

The Great Western Railway, following the examples of the London and South Western and North Eastern companies, has decided to run automobile cars on some sections of its line. This method of providing for a more frequent service has been necessitated by the competition of electric tramways, and affords further evidence in support of the view that electric traction is likely to bring about in time a complete revolution in our methods of locomotion. The motor-cars to be used by the Great Western are to be steam driven. A notable feature of the scheme is that provision is to be made for frequent stoppages between the stations to pick up passengers; it is proposed that the cars should stop at all the level crossings—of which there are four on the section between Chalford and Stonehouse, where the first experiment is to be made—and also, if it is feasible, at any points at which foot-paths give access to the line. It is hoped in this way to organise a successful competition with the electric tramway which has been projected and sanctioned parallel to this part of the line. The superiority of electric traction for working of this kind is so well known that one may reasonably expect the Great Western Railway will find it advisable before long to get rid of the steam motor-cars and provide for electrical working over the section, which may pave the way, in the manner that many have prophesied, for the ultimate complete conversion from steam to electricity.

The electrification of our steam-driven railways proceeds apace; the inauguration of the electrical working of the Mersey Railway, which took place a few days ago, is an event which will probably before long be paralleled by many similar inaugurations all over the country. To the Mersey Railway then belongs, we believe, the honour of being the first steam railway in Great Britain to undergo conversion. Special conditions have in this case hastened the change; the long tunnel under the river made a frequent train service impossible without expensive outlay in ventilation, which the company could not afford. Electrical working was therefore decided upon in 1900, and a contract made with the British Westinghouse Co. to carry out the conversion in July, 1901. In considerably less than two years the work has been completed, in spite of the fact that it involved relaying the whole of the five miles of permanent way, together with putting down the two additional lines of rails to serve as conductors (an insulated return being used) and the erection of a power-house and plant, &c. The tunnel has been cleaned and lighted throughout, and electric lighting installed at all the stations; electricity has, in fact, been adopted for almost every detail of the working. A good deal of the work is naturally of American design, and some of it of American construction. It is to be hoped that as we hear more of other railways being converted, we shall hear less of their using foreign machinery; it is probably inevitable that in the not very distant future our whole railway system will be "electrified," but it is not necessary that this word should be synonymous with "Americanised."

We regret to announce the death last week of Mr. Clarence Bartlett, who only recently retired from the post of superintendent of the Zoological Society's Gardens in the Regent's Park, which he had held since the death of his father, whom he succeeded, in 1897. Mr. Clarence Bartlett was the second son of Mr. A. D. Bartlett, and was, we believe, brought up in the service of the Zoological Society. During the early "sixties" he was appointed assistant superintendent (and subsequently clerk of the works) to the Gardens, and in 1866 he was dispatched by the council to Surinam to bring home a young manati, which died a few hours before the vessel arrived at Southampton. A more important mission fell to his lot in 1875, when he was granted special leave by the council in order to accompany, as zoological collector, His Majesty the King (then Prince of Wales) to India. From this tour he returned the following year, bringing home in first-rate condition a large number of living mammals and birds, which were housed in the Society's Gardens. Among these was the elephant "Jung Pershad," which lived for many years in the menagerie, and the mounted skin of which is exhibited in the Natural History Museum, where, by the way, it has just been transferred from the zoological to the geological department, in order that it might stand side by side with the skeletons of its extinct relations. Mr. Bartlett appears never to have contributed anything to the scientific publications of the Society. Soon after the resignation of the secretary in the autumn of last year, ill-health and other reasons rendered it advisable that Mr. Bartlett should retire on a pension, but when he left his house in the Gardens it was apparent to all that he had little prospect of living to enjoy this reward of his services.

The Parliamentary Report of the Meteorological Council for the year 1901–2 has recently been issued in the same form as in the previous year. Among the appendices we find (1) correspondence with the London County Council respecting an inquiry into the occurrence and distribution of fogs in London; the report of the inquiry has been already published. (2) A comprehensive statement of provisions for the supply of information to the public; and (3) an interesting summary of conspicuous meteorological occurrences (with two plates). An application was received from the Royal Meteorological Society to assist in providing means in carrying out experiments on the exploration of the upper air by means of kites. In order to facilitate this important investigation the Council agreed to provide the instruments for the establishment of a base station. At the request of the Registrar-General the Council has undertaken the supply of meteorological tables for his weekly, quarterly and annual reports which had been for many years satisfactorily prepared by Mr. James Glaisher, at great personal labour. A considerable number of returns has been received through the Foreign Office from African Protectorates, and the Council has under consideration the publication of an annual summary of the observations from these and other colonial stations; the reduction and tabulation of these important data will entail much additional work and expense. In order to meet the constantly increasing demands upon the public usefulness of the department, both as regards land and ocean meteorology, some revision of the organisation of the various branches has been necessary, including the opening of the office at 8 a.m. for the service of meteorological telegraphy; the Parliamentary grant, however, remains at the same figure as heretofore.

Mr. Thomas H. Means, of the U.S. Department of Agriculture, was recently sent to Egypt by the U.S. Secretary of Agriculture to investigate and report upon the methods of reclaiming alkali lands, with particular reference to the conditions in America. The abandonment of many acres of once fertile land at the time of the Arabian conquest, and the change from the annual flooding to the perennial system of irrigation through canals, has caused the rise and spread of alkali over vast areas in Egypt. The reclamation of large tracts of this kind is being taken up as a business enterprise by British engineers, and the work has proved a large financial success. The conditions met with and the methods used are set forth by Mr. Means in *Bulletin* No. 21 of the Bureau of Soils, U.S. Department of Agriculture.

IN the New Year's number of NATURE there appeared an account of a basil, *Ocimum viride*, a plant which is known to the natives of Nigeria as a protection against mosquitoes. Captain Larymore, by whom this information was first obtained, in a recent letter to the *Times* mentions that he has brought home a plant which he has presented to the authorities of the Kew Gardens, and that it may be seen there. He also states that the natives believe in its efficacy when taken as an infusion in cases of malarial fever. Further evidence is offered in another letter to the *Times* by Sir George Birdwood as to the knowledge widely spread among the Hindus of these qualities of the basils, which occur wild, and are generally cultivated in India. Thus, during the formation of the Victoria Gardens in Bombay, the workmen were attacked both by mosquitoes and malaria, when upon the recommendation of the Hindu manager basil plants were placed round the gardens, with the result that the unhealthy nature of the locality was effectually changed.

PROF. HOYLE (*Manchester Memoirs*, vol. xlvii. No. 9) points out that the cuttle-fish described as *Loligo eblanae* is identical with the one subsequently named *Todaropsis veranyi*, consequently the name of the species should be *T. eblanae*.

IN the January issue of the *Proceedings* of the Philadelphia Academy Messrs. Anderson and Grinnell draw attention to the birds of the Siskiyou Mountains, California, on account of the fact that they exhibit a mixture of types characteristic of two distinct faunas, namely, the moist coast fauna and the dry Sierran fauna.

FROM a distributional point of view, the occurrence in the Philippines of an indigenous representative of the Australasian gum-trees is a matter of considerable interest, and it is therefore satisfactory to find that, according to Mr. J. H. Madden (*Proc.* U.S. Nat. Mus., No. 1327), *Eucalyptus nandiniana*, which is typically from New Britain, also occurs in the aforesaid islands.

AMONG the articles in the *Journal* of the Quekett Microscopical Club, attention may be directed to one by Mr. W. H. Harris on the "dentition" of flies. Although the various forms assumed by the "teeth" of these insects have not escaped investigation, they seem to have attracted but little attention in this country, and the author has therefore done well in pointing out the possibilities of this branch of study. An excellent plate accompanies the paper, in the course of which Mr. Harris expresses some doubts as to whether the true function of the canals known as pseudotracheæ is to convey liquid-food.

THE position in which different birds carry their legs in flight forms the subject of an interesting paper by Captain Barrett-Hamilton in the *Zoologist* for April. In all birds it appears that the tibia, during continuous flight, must occupy a nearly horizontal position, pointing directly backwards. The position of the metatarsi, on the other hand, depends on whether the legs are required to act as a rudder. During flight, birds must have an efficient rudder, and in cases where the metatarsi are very long, as in the heron, and must of necessity be directed backwards, the legs serve this function. On the other hand, in many strong and rapid flyers, especially those which make sharp turns and twists, the steering is effected by means of a long, and frequently forked, tail. Captain Hamilton gives a list of birds exhibiting these correlations, but points out that our knowledge of the subject is still very imperfect, and that careful observation of a large number of species is required. With the exception of the kites and fork-tailed kites, the birds of prey form an exception to the rule.

A USEFUL summary of our present knowledge of leprosy, its ætiology and prophylaxis, is given by Mr. George Pernet in the April number of the *Quarterly Review*. The author discusses the introduction into, and prevalence of, leprosy in the British Isles in the middle ages, the effects of the segregation of lepers, the characters of the disease and of the leprosy bacillus, and the danger of the introduction of the disease into other countries through the importation of coolie, Chinese, or other labourers belonging to races afflicted with this scourge.

AN important report upon the ætiology and pathology of beri-beri has been published by Dr. Hamilton Wright. A specific organism has so far not been discovered, and Dr. Wright has also failed to isolate one. His theory of the nature of the disease is that it is due to a specific micro-organism which remains dormant in certain localities, but that, having gained entrance to the body by the mouth, it multiplies locally in the digestive tract, producing toxins which on absorption into the general circulation cause the various symptoms characteristic of the disease. It is noteworthy also that monkeys kept in a jail where beri-beri was prevalent suffered from a condition resembling the disease in man.

A NEW pattern of electric lamp is being put on the market by the Linolite Company. The filaments, instead of being in ordinary bulbs, are enclosed in short straight tubes about nine inches long; the filament is given a small curl in the middle to allow for expansion. These tubes are mounted end to end in a metallic casing, which serves as a reflector, and also carries the leads and the sockets into which the lamps fit. There is thus produced a single line of light, which is very suitable for certain forms of illumination, such as shop-window lighting, lighting by reflection from the ceiling, decorative illumination, and the like. The lamps are made for all ordinary voltages, and of the same candle-power and efficiencies as ordinary lamps; they are run in parallel for voltages up to 130, but for voltages above 200 the lamps are run in pairs, the two lamps of each pair being in series. The system has been tried on several occasions recently with very satisfactory results.

AT a recent meeting of the Academy of Sciences of Vienna, Prof. Molisch, of Prague, communicated a paper upon phosphorescent bacteria. He has been able to photograph the colonies of a phosphorescent micrococcus by means of its own light. By inoculating large glass flasks of 1–2 litres capacity containing a suitable culture medium with the organisms, a "bacterial lamp" is obtained with which it is quite possible for an observer at a distance of one to two metres to read a thermometer or to see the time of a watch. On a dark night the "bacterial lamp" is visible at a distance of more than sixty paces. It is suggested that such cultures of phosphorescent bacteria might be employed in powder magazines, or for attracting fish, as the flask might be sealed up and lowered into the water. Under suitable conditions the phosphorescent properties of the cultures last for two to three weeks. It is to be noted that Mr. J. E. Barnard, of the Jenner Institute, some time ago similarly photographed cultures of phosphorescent bacteria, and that at a soirée of the Royal Society two years ago, Prof. Macfadyen and Mr. Barnard exhibited a fine series of cultures of phosphorescent micro-organisms.

THE new issue of the "Psychological Index, a Bibliography of the Literature of Psychology and Cognate Subjects for 1902," published in connection with the *Psychological Review*, has been compiled by Prof. H. C. Warren, of Princeton University, with the cooperation of M. J. Philippe and Dr. W. H. R. Rivers. It includes the titles of original publications in all languages, together with translations and new editions in English, French, and German.

THE third separate issue of the *Annuaire météorologique* is that for 1903, published by the Royal Observatory of Belgium under the supervision of M. A. Lancaster, the director of the Belgian meteorological service. Previous to 1900 there was a single annual publication devoted to astronomy and meteorology. M. Lancaster contributes to the present volume an elaborate article running to 130 pages on the force of the wind in Belgium; it contains an array of useful statistics and several interesting curves.

THE Geologists' Association has arranged an excursion to North Staffordshire for the Whitsuntide holidays. Stoke is to be made the centre from which geological excursions will take place. The members from London will leave Euston on Friday evening, May 29, and return on the following Wednesday evening. Notice should be sent to Mr. E. P. Ridley, Burwood, Ipswich, the excursion secretary, before May 15 by all who intend joining the excursion. An interesting programme of geological work has been arranged, and the daily visits should be enjoyable and instructive.

THE April number of the *Essex Naturalist*, the journal of the Essex Field Club, contains several sensible proposals for a photographic and pictorial survey of Essex, by Mr. A. E. Briscoe; an article on work in the field amongst the fungi, with additions to the flora of Epping Forest made at the fungus foray, 1902, by Dr. M. C. Cooke; and a paper by Messrs. A. S. Kennard and B. B. Woodward on the non-marine Mollusca of the River Lea alluvium at Walthamstow. The journal contains much other interesting material and a number of good illustrations.

MR. JOHN MURRAY has published a third edition of Mr. W. Robinson's "Alpine Flowers for Gardens. Rock, Wall, Marsh Plants, and Mountain Shrubs," which appeared first in 1870. The book has been revised, and should interest all lovers of horticulture in those plants which grow naturally on all high mountain-chains. Since the author states, in the prefatory note to this edition, that "there is not a garden, even in the suburbs of our great cities, in which the flowers of alpine lands might not be enjoyed," the addition of these mountain species to the garden plants usually cultivated in this country should greatly add to the interest of the amateur gardener's work.

THE additions to the Zoological Society's Gardens during the past week include a Black-eared Marmoset (*Hapale penicillata*) from South-east Brazil, presented by Miss Ruby Ray; a Lesser Black-backed Gull (*Larus fuscus*) from Port Said, presented by Dixon Bey; a Capybara (*Hydrochoerus capybara*), a Brazilian Cariama (*Cariama cristata*), a Ypecaha Rail (*Aramides ypecaha*) from South America, presented by Colonel Sir T. H. Holdich, C.B.; a Yellow Baboon (*Papio cynocephalus*) from Africa, two Maholi Galagos (*Galago maholi*), a Leopard Tortoise (*Testudo pardalis*) from South Africa, an Indian Rat Snake (*Zamenis mucosus*), two Indian River Snakes (*Tropidonotus piscator*) from India, an Alligator Terrapin (*Chelydra serpentina*), two Alaska Geese (*Bernicla minima*) from North America, two Ross's Snow Geese (*Chen rossi*) from Antarctic America, three Lesueur's Water Lizards (*Physignathus lesueuri*), a Cunningham's Skink (*Egernia cunninghami*), a Gould's Monitor (*Varanus gouldi*), two Limbless Lizards (*Pygopus lepidopus*) from Australia, a Slender Loris (*Loris gracilis*) from Ceylon, two Large Greaved Tortoises (*Podocnemis expansa*) from the Amazons, three Starred Lizards (*Agama stellio*), a Spiny-tailed Uromastix (*Uromastix acanthinurus*) from North Africa, a Mailed Uromastix (*Uromastix loricatus*) from Persia, deposited.

OUR ASTRONOMICAL COLUMN.

COMET 1903 *b*.—From observations made at Windsor, N.S.W., on April 26, 29, and May 1, and communicated by telegraph to the Kiel Centralstelle, Herren M. Ebell and H. Kreutz have calculated the following elements and ephemeris for the comet discovered by Mr. Grigg on April 17:—

Elements.

T = 1903 *March* 25·5486 *Berlin M.T.*

$$\left.\begin{aligned} \omega &= 186^\circ\ 40'\!\cdot\!7 \\ \Omega &= 213\ \ 14\cdot5 \\ i &= 66\ \ 29\cdot6 \end{aligned}\right\} 1903\cdot0.$$

$$\log q = 9\cdot71054.$$

Ephemeris for 12h. M.T. Berlin.

1903.	α h. m. s.		δ ° ′		log Δ		Brightness.
May 13	... 5 36 33	...	−22 2·8	...	0·1668	...	0·51
17	... 5 57 59	...	−22 53·9	...	0·1779	...	0·43
21	... 6 18 40	...	−23 34·9	...	0·1905	...	0·37
25	... 6 38 34	...	−24 7·2	..	0·2042	...	0·31
29	... 6 57 34	...	−24 32·2	...	0·2190	...	0·27
June 2	... 7 15 40	...	−24 51·2	...	0·2345	...	0·23

The brightness at time of discovery is taken as unity (*Kiel Circular*, No. 59).

A REMARKABLE ALGOL VARIABLE.—Prof. E. C. Pickering, writing to the *Astronomische Nachrichten*, No. 3866, states that the new Algol variable, 4.1903 Draconis, discovered by Madame Ceraski, is of unusual interest on account of its short period and great range of variability.

An examination of the plates obtained with the Draper telescopes shows that the period is 1d. 8h. 34·7m., and the range of variability 2·4 magnitudes. About half an hour before minimum the brightness decreases at the rate of between 2 and 3 magnitudes per hour, a rate probably greater than any other hitherto discovered. A minimum was predicted and observed at Harvard on March 19 at 16h. 24m. G.M.T.

NEW VALUE FOR THE SOLAR PARALLAX.—In view of the probable publication, in the near future, of the results obtained from observations of Eros, Herr B. Weinberg, of the University of Odessa, has collected about 130 of the more trustworthy values for the solar parallax as obtained by different observers, using various methods, since 1825, and has discussed them in a paper communicated to No. 3866 of the *Astronomische Nachrichten*. From the discussion he has obtained

$$8''\!\cdot\!8004 \pm 0''\!\cdot\!00243$$

as his final value for this constant.

INSTRUCTIONS TO OBSERVERS OF THE SUN.—In the April issue of the *Bulletin de la Société astronomique de France* an abstract is given of the first chapter of "Instructions pour l'Observation du Soleil," which will be issued to any-one desirous of systematically recording solar phenomena by the "commission solaire." The instructions give detailed and valuable suggestions on the observation and recording of the positions, size, nature and general details of sun-spots and faculæ, and also suggest the atmospheric conditions which should be recorded concurrently.

The object of the commission is to induce a large number of amateur astronomers, possessing instruments not exceeding 10 cm. in aperture, to participate in the collection of a large quantity of material for the discussion of the eleven-year period of solar variations.

STONYHURST COLLEGE OBSERVATORY REPORT FOR 1902.—This report contains a large amount of useful and detailed information and data as to the observations of meteorological and magnetical phenomena made at the Stonyhurst and St. Ignatius (Malta) Colleges during 1902, together with a report and some notes by Father Sidgreaves.

The sun was observed, at Stonyhurst, on 217 days, and on 110 days drawings of the solar surface were made. The spotted area of the sun observed during 1902 shows a return of solar activity, the figures (unity representing one-five-thousandth of the visible disc) for 1900, 1901, and 1902 being 0·55, 0·29, and 0·33 respectively.

Owing to unfavourable meteorological conditions the stellar spectrographic work was not very fruitful during 1902, but 44 good spectrographs of β Lyræ were obtained, and, as soon as circumstances permit, the results of an investigation of the spectrum of this star will be published.

OPENING OF THE JOHNSTON LABORATORIES FOR MEDICAL RESEARCH IN THE UNIVERSITY COLLEGE, LIVERPOOL.

A WORKING alliance between the forces of science and commerce is a condition of things that has of late been the prayer of many well-wishers to both. It is a happy union which, as we are often told with perfect truth, obtains less in this country than in many others. But in notable degree an exception must be made among our own communities in the case of Liverpool. The opening ceremony performed in Liverpool on Saturday last for the inauguration of the William Johnston Laboratories of the University College exemplified in a remarkable and memorable manner the strength of what is already in fact, and will in a few weeks also be in name, a university of municipal type.

Mr. William Johnston, shipowner, of Liverpool, last year munificently endowed a chair for biochemistry at the College, and also three fellowships for research in physiology, pathology and gynæcology. He has enhanced his splendid and far-sighted gift by now providing a large and well-equipped building for the laboratory purposes, not only of biochemistry, but of tropical medicine, experimental medicine, and comparative pathology. The large block housing these four subjects is built so as to adjoin, and have free internal communication with, the laboratories of physiology and pathology erected five years ago by the Rev. Thompson-Yates. These Johnston Laboratories form a building 90 feet long by from 35 feet to 50 feet wide. They constitute four floors in the entire block, each floor devoted to one separate department of research. It is note-worthy that in this building we find a university building in which there is not a single class-room or lecture-room in the ordinary sense of those words. From basement to roof it is devoted absolutely and exclusively to purposes of research. Tropical medicine is housed in the ground-floor, and is under the direction of Prof. Ronald Ross, F.R.S. The first floor is allotted to experimental medicine, under Dr. Albert Grünbaum, F.R.C.P., and a large proportion of its rooms are already occupied by cancer research. The second floor is entirely given to Prof. Moore's department of biochemistry, and its installation is nearly complete, two workers availing themselves of its equipment and facilities already. The basement, which is, in fact, only half-sunken and extremely well lighted, is entirely given to comparative pathology, under the direction of Dr. Annett.

The character of the arrangement of the fixtures and fittings of the laboratories deserves some notice. The leading idea has been to break up the internal space of the large area enclosed on each floor with the external walls as little as possible by permanent walls. The main floor is therefore cut up into compartments by wooden screens that do not reach the ceiling. These screens serve in many cases to carry, as walls, both shelves and cupboards, but they allow the twelve large windows to distribute light over every nook and corner of the whole. By this arrangement the laboratory is practically divided into bays, in which investigators can work separately, and surrounded on all sides by their working benches or shelves, and yet not obstructing the light of work going on elsewhere. A novel feature is that the floor of the rooms and the tops of the benches are made of polished *lito-silo*, a material which has resiliency, smoothness, and non-absorbent qualities, enabling it to be easily cleaned and disinfected. On all the floors there is a complete supply of water, gas, electric light, electric power, and steam. A lift, as well as a staircase, connects the floors together. The building is warmed by hot water and ventilated by the upper parts of the windows and by extraction shafts arranged down the centre of the rooms.

In the department of experimental medicine, some of the beautiful and costly apparatus provided has been furnished by the fund of 10,000*l.* recently given by Mr. Sutton Timmis for the prosecution of investigation into cancer. Dr. Albert Grünbaum, as the director of the cancer research, has already commenced experimental inquiries in this field on this floor of the laboratories. One of the rooms on the same floor is very fully equipped with electrical therapeutic apparatus of the most modern design.

The whole building forms a set of laboratories giving probably unsurpassed accommodation to the studies which it was raised to house. Certainly we have in the United Kingdom no other so fine laboratories of biochemistry or of tropical medicine. Their erection marks an era in the history of these studies in this country. That these subjects and other kindred direct extensions of physiology and pathology should now demand and obtain spacious accommodation is but one of the many indications that the trend of medical study, and therefore of medical education, has really entered upon a new route. The narrow and facile, but unfruitful and mentally circumscript ways of mere human anatomy are being exchanged for studies of more scientific character, and physical, chemical, zoological, or physiological in method and basis. This will demand, of course, better education in those entering the profession of medicine. It further inevitably connotes a closer association than at present between the art of medicine and pure science. Just as inevitably does it also presage an era probably even more fertile in achievements of biological study than that which we already couple with the names of Darwin and Pasteur.

The formal opening of the new laboratory was presided over by the Right Hon. Walter Long, President of the Local Government Board. A distinguished company attended. In addition to the staff and students of the University College, Mr. William Johnston, the donor, the Lord Mayor of the city, Mr. E. K. Muspratt, Sir John Brunner, Sir Alfred Jones, and many other well-known citizens were present. A large number of visitors, not only from various parts of the United Kingdom, but also from the Continent and America, had gathered to take part in the ceremony. Among these were Sir Michael Foster, Profs. Clifford Allbutt, Armstrong, Halliburton, Schäfer, Waller, Gotch, Stirling, Botazzi, Hausemann, Weigert, Nocard, Grützner, Blanchard, Uhlworm, Eulenberg, Perroncito, Delépine, Woodhead, Ravanel, Steegmann, Lorrain Smith, Macdonald, W. H. Thompson, Trevelyan, Drs. Rose Bradford, Monckton Copeman, Dawson Williams, Seaton, Bulstrode, and many others. In the evening Mr. William Johnston entertained a distinguished company to dinner at the Adelphi Hotel. The President of the Local Government Board, in the course of a vigorous speech on the necessity of progress being maintained in the advance of natural science by research in this country, declared that science was the best friend any worker could call to his aid, whatsoever might be his particular part and calling in labour. Sir Alfred Jones submitted the toast of "Commerce and Scientific Research," replied to by Sir Michael Foster and Prof. Armstrong. To the toast of "Our Foreign Guests," Prof. Ravanel (Philadelphia), Prof. Nocard (Paris), Prof. Weigert (Frankfort), and Prof. Perroncito (Turin) replied.

THE IRON AND STEEL INSTITUTE.

THE annual meeting of the Iron and Steel Institute was held at the Institution of Civil Engineers on May 7 and 8, and was very largely attended.

The report of the council, read by Mr. Bennett H. Brough, the secretary, showed that in 1902 the Institute had made very satisfactory progress. The membership amounted to 1692, and it was announced that the Institute had subscribed 1000*l.*, payable in five yearly instalments, to the funds of the National Physical Laboratory.

After the usual routine business, the retiring president, Mr. William Whitwell, inducted into the chair the president-elect, Mr. Andrew Carnegie. The first duty of the new president was to present the Bessemer gold medal to Sir James Kitson, which he did in felicitous terms. He then handed the Andrew Carnegie gold medal to Mr. A. Campion for his research on the heat treatment of steel, and a special silver medal to Dr. O. Boudouard, of Paris, for his research on the determination of the points of allotropic change of iron and its alloy. The research submitted by Mr. P. Longmuir, of Sheffield, on the influence of varying casting temperature on the properties of alloys was commended, and a further grant of 50*l.* was made to him to complete the work. Mr. Campion also received a further grant of a like amount to enable him to carry his researches further.

For the scholarships for the current year a large number of applications was received, and after very careful investigation of the claims, the council decided to award four scholarships of 100*l.*, each tenable for one year, to C. O. Bannister (London), to P. Breuil (Paris), to K. A. Gunnar Dillner in conjunction with A. F. Enström (Stockholm), and to J. C. Gardner (Middlesbrough), respectively.

Mr. Carnegie then delivered his inaugural address. It differed widely from all that have preceded it in that it dealt not with metallurgical technology, but with a consideration of the best and most economical methods of obtaining harmonious working between the mechanical and business departments of a concern, and of securing hearty cooperation between the employers and the employed. The address was much appreciated, and the thanks of the Institute were eloquently expressed by Sir Bernhard Samuelson and Sir David Dale.

The first paper read was by Mr. B. Talbot, of Leeds, who described the development of the continuous open-hearth process. Since this new departure in metallurgy was first described in 1900, considerable progress has been made, and a furnace of 200 tons has been in successful operation for some months at Pittsburg. Other furnaces of nearly the same capacity are being erected in Great Britain, in France, and in the United States. In the lengthy discussion that followed, Mr. E. H. Martin, of Pittsburg, adversely criticised the paper, whilst Mr. P. C. Gilchrist, Mr. E. Riley, Mr. Saniter, Mr. F. W. Paul, Mr. G. Ainsworth, Mr. Harbord, and Mr. T. H. Colley spoke in favourable terms of the process.

The meeting then adjourned until May 8, when Mr. Camille Mercader gave an account of the development in the manufacture of railway axles on a large scale accomplished at the works of the Carnegie Steel Company at Pittsburg. With the aid of numerous illustrations, he described a method of producing, by pressing, hollow axles having varying diameters. An animated discussion followed, in which Mr. R. M. Daelen and Prof. Bauerman expressed the opinion that the invention had been anticipated by Ehrhard, of Düsseldorf. Sir James Kitson, Mr. E. Windsor Richards, Mr. S. Lloyd, and Mr. Vaughan Hughes also took part in the discussion.

Prof. J. O. Arnold and Mr. G. B. Waterhouse, of Sheffield, then read an important paper on the influence of sulphur and manganese on steel. The steels examined were those experimented upon by Mr. Brinell. The results of the authors' investigations show that sulphide of iron is deadly in its effect upon steel, whilst sulphide of manganese is comparatively harmless; that the above facts are due to the fusibility, the high contraction coefficient, and the tendency of sulphide of iron to form cell walls or enveloping membranes surrounding cells of ferrite, whilst sulphide of manganese is much less fusible, segregates whilst the iron is at a high temperature, and so collects into rough globules, and very seldom into meshes; that manganese retards the segregation of iron and hardenite, and that what is called pearlite in a normally cooled manganese steel is really a mixture of granular pearlite and unsegregated ferrite; and that the complete segregation of the ferrite in a manganiferous steel can be brought about by very slow cooling, but that such annealing injures the mechanical properties of the steel by lowering the maximum stress and the reduction of area per cent. registered by the unannealed steel. An interesting discussion followed, in which Mr. Stead, Mr. F. W. Harbord, Mr. Vaughan Hughes, and Mr. Sidney Houghton took part.

The next paper read was by Mr. A. Keller, of Paris, who described the application of the electric furnace in metallurgy. This furnace, which is apt to be regarded merely as a laboratory appliance, will, the author thinks, find a place in the iron industry on a large scale. He shows that, although the manufacture of alloys which are little used can scarcely entitle it to rank as a metallurgical appliance, the production of ferrosilicon, which is one of the bases of modern metallurgy, and of iron, steel, copper, and nickel, will permit it to be regarded in this light. The success is the result of carefully controlled operations on a large scale at Livet, in the department of Isère. In the discussion, Mr. A. H. Allen, Prof. Arnold, Mr. B. H. Thwaite, Mr. A. Greiner, Mr. Stead, and Mr. Kilburn Scott bore testimony to the value of the invention.

Mr. C. von Schwarz, of Liége, described the best methods for making Portland cement from blast furnace slag, and showed that there is a wide field open to English blast furnace works for carrying on a profitable industry by the utilisation of their principal by-product. In the discussion Mr. Hutchinson described at considerable length the results obtained at Middlesbrough, and Mr. Stead spoke in optimistic terms of the future development of the manufacture.

Mr. Axel Sahlin next described an ingenious blast furnace top designed not to admit air or to permit gas to escape. Although the blast furnace top has been greatly modified and improved of late years in order to enable the furnace gases to be utilised, it still possesses certain defects which occasionally lead to explosions and other hindrances to efficient working. These drawbacks have been remedied in the blast furnace top described. The construction of this furnace top and its adjuncts ensures immunity from explosions, as no air can enter the furnace at the top, whilst it also provides against gas leaks and accumulations of dust. The success of the new top is demonstrated by its adoption at the Iroquois Iron Works, near Chicago, where the first one was started in 1901, and where fourteen are now working.

Mr. B. H. Thwaite then read a paper on the detrimental effect of flue dust upon the thermal efficiency of hot-blast stoves.

Colonel Cubillo, of Trubia, Spain, submitted an elaborate paper on the open-hearth process, in which he gave calculations of the heat balance of the furnace. The experiments on which the paper was based were carried out in a four-ton Siemens furnace of the new form.

Mr. J. E. Stead submitted a note on the alleged cementation of iron by silicon announced by Moissan and Lebeau. Mr. Stead's experiments show that at temperatures between 1100° and 1200° C. solid iron and free silicon do not combine, and that cementation by silicon is impossible when the iron and steel operated upon are in solid masses.

Prof. Thomas Turner, of Birmingham, submitted an analysis of a specimen of Sussex iron, some 200 years old. The results were as follows:—graphitic carbon, 2·89; combined carbon, 0·32; silicon, 0·62; sulphur, 0·08; phosphorus, 0·56; manganese, 0·77; and iron (by difference), 94·76.

The memoirs submitted by the Carnegie research scholars were taken as read, and are open to discussion by correspondence. The paper by Mr. A. Campion, for which the gold medal was awarded, covers seventy-five pages, and is illustrated by fifteen plates. It deals with the heat treatment of steel under conditions of steelworks' practice. The paper by Dr. O. Boudouard, of Paris, for which a special silver medal was awarded, covers eighty pages, and deals with the determination of the points of allotropic change of iron and its alloys by the measurement of the variations in the electric resistance. Results are given for carbon steels, chrome steels, tungsten steels, manganese steels, and nickel steels. The remaining memoirs presented by the Carnegie research scholars deal with the influence of varying casting temperature on the properties of alloys, by Mr. P. Longmuir, of Sheffield, and with the manufacture of tool steel, by Mr. E. Schott, of Berlin.

The proceedings concluded with the usual votes of thanks to the Institution of Civil Engineers, proposed by the president and seconded by Prof. Gowland, and to the president for his conduct in the chair, proposed by Prof. Syed Ali Bilgrami and seconded by Mr. F. Samuelson.

In the evening Mr. Carnegie presided at the annual dinner, which was attended by about six hundred members. The Prime Minister congratulated the Institute on its international and scientific character, and speeches were made by the Duke of Devonshire, Sir H. Campbell-Bannerman, Mr. John Morley, Viscount Ridley, Sir Henry Fowler, Sir James Kitson, and Sir Samuel Chisholm.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The 248th meeting of the Junior Scientific Club was held on Friday, May 8. Mr. R. T. Günther read a paper on "Changes of Land Level," in which he gave an account of researches he had carried out on this subject in the neighbourhood of Naples. The paper was illustrated by slides showing photographs of the coast in this district. Mr. N. V. Sidgwick, Lincoln, read a paper on "The Emission of Heat by Radium Salts."

CAMBRIDGE.—The council of the Senate propose that the Hartley University College, Southampton, should be adopted as an institution affiliated to the University of Cambridge.

The syndicate on the Mathematical Pass Examinations have issued an important report (*University Reporter*, May 12, 1903), in which they recommend a number of far-reaching changes in respect to the geometry, arithmetic, and algebra required in the previous examination. They "are of opinion that it is no longer desirable to insist on the maintenance of Euclid's Elements as a text-book."

The Board of Agricultural Studies report that during the past year 169 students have received instruction in agricultural science in connection with the department. The income of the department, about 3700*l.*, is practically balanced by the expenditure. The need of a permanent building to accommodate the various branches of the work is becoming apparent, and the Board are considering how the need can be supplied.

Dr. Ruhemann, university lecturer in organic chemistry, has been appointed the university delegate to the Congress of Applied Chemistry to be held next month in Berlin.

A bust of the late Dr. John Hopkinson was unveiled at the engineering laboratory on Monday. The vice-chancellor presided, and the speakers included Sir Joseph Lawrence, M.P., Lord Kelvin, Prof. Ewing, and Principal Hopkinson.

DR. CHARLES CHILTON has been offered and has accepted the professorship of biology at Canterbury College, Christchurch, New Zealand, in succession to Prof. Dendy.

THE *Pioneer Mail* states that the site assigned to British India by the Mysore Government for the Indian University of Research to be created in consequence of Mr. J. N. Tata's munificent offer of an endowment measures about 370 acres, is situated in the north-west of Bangalore Cantonment, about four miles beyond the municipal boundary. Besides this gift the Mysore Government have offered five lakhs for initial expenses, and they hold out hopes of further assistance. Prof. Masson and Colonel Clibborn calculate the annual expenditure at 10,000*l.* sterling.

BOOTHAM SCHOOL, at York, was one of the few schools which received medals at the Nature-Study Exhibition last year for their exhibits showing the extent and nature of the work in nature-study done by the pupils. The sixty-ninth annual report of the Natural History Society of this school serves to explain the success then achieved. The study of natural objects is continued throughout the year, and is carefully arranged by the science masters so as to avoid waste of time and effort. A boy with a love for any branch of natural history receives every encouragement, and there can be little doubt of the good effect this sympathetic treatment has on the education imparted.

THE fiftieth report of the Charity Commissioners for England and Wales shows that in the three years ending December 31, 1901, the total amount of charitable bequests in England and Wales reached 6,542,110*l.*, of which 279,890*l.* was intended for education. It has often been pointed out in these columns what large sums are given to higher education in the United States. During the three years dealt with by the Charity Commissioners in their report, benefactions for higher education alone to the extent of 10,392,000*l.* were reported in the United States. That is to say, for every pound sterling given during 1899–1901 for education in all its grades in England and Wales, more than thirty-seven pounds were given by American benefactors for university education alone. The sums devoted by private persons to higher education in the United States were nearly twice as great during these three years as those for every form of charity in England and Wales.

NUMEROUS changes in the regulations for examinations at the University of Oxford have recently been announced. Among the alterations are those in mathematics for the first public examination (pass), in connection with which it is stated that any method of proof will be accepted which shows clearness and accuracy in geometrical reasoning, and that in the case of propositions 1–7, 9, 10 of Book ii., algebraical proofs may be used. The Board of the Faculty of Natural Science has also made similar changes in the mathematical requirements of the Final Pass School, Group C. (1). These changes come into force at the examinations of Michaelmas term, 1904. There are additions to the schedule of mechanics and physics for the preliminary examination of the Honour School of Natural Science, which come into force on and after Trinity term, 1905. The practical examinations, especially in physics, are to be more extensive than hitherto.

A COPY of the report and handbook for the session 1902 of the Technical Instruction Committee of the Essex County Council has been received. It contains detailed information of every department of the work of the committee, and provides another example of the thorough manner in which the county councils have performed the educational duties entrusted to them by the Technical Instruction Acts, now repealed. In connection with the agricultural instruction in Essex, field meetings were held at seven centres. The objects of some of the meetings were to demonstrate the destruction of charlock in field crops by spraying with solutions of copper sulphate and nitrate of soda; the improvement of derelict grass land by manures; no verbal description could adequately convey an idea of the improvement effected by basic slag, which was one of the manures used, on either of these fields, and the farmers attending were strongly impressed by the almost miraculous effect of this manure both on the quality and quantity of the herbage.

THE annual exhibition of the work of pupils in the day, evening continuation, truant, blind, deaf, and special instruction schools of the London School Board was opened last Saturday by Lord Reay at the Examination Hall, Thames Embankment. The exhibits were very numerous and thoroughly representative of the work of children of all ages, from the lowest classes of infant schools to the evening classes for youths. Though considerations of space only permit particular reference to the section including the science exhibits from the schools of the Board, it may be said that the work shown from the manual training schools, the classes in domestic subjects, the institutions concerned with the physically and mentally defective, and from the classes in art subjects was highly creditable, and served admirably to show the extent and excellence of the work being done in the public elementary schools of the metropolis. The collection of pieces of apparatus to assist the teaching of science was this year much smaller than on previous occasions, the reason being that the offer of prizes for the most successful work was this year discontinued. It was satisfactory to notice that the plan recommended more than once in these columns was on this occasion carried out for the first time, and added much to the convenience of the visitor—we refer to the separation of the work of teachers and that of pupils. Judging from the exhibits, more attention appears to have been given during the past year to work with squared paper and to nature-study subjects, and there were some excellent relief maps made by boys of thirteen which would have been a credit to much older students. Altogether there is good reason to believe that the science work being done in the schools of the London Board, under the direction of Dr. Stewart and Messrs. Hubble and Todd, will lead to the development of habits of careful reasoning and alert observation.

SCIENTIFIC SERIAL.

American Journal of Science, April.—On the gaseous composition of the H and K lines of the spectrum, together with a discussion of reversed gaseous lines, by John Trowbridge. The continuous spectra observed in Geissler tubes when submitted to powerful disruptive sparks are not due to incandescence of the glass walls. The lines obtained coinciding closely with calcium lines, wave-lengths 3968 and 3933 are not due to calcium, but are true gaseous lines. The conclusion is drawn that the method of sifting out air lines from metallic spectra by observing the lines which are apparently common to these spectra and setting down such lines as air lines is a fallacious method.—The Boys radiomicrometer, by C. C. Hutchins. The simplicity and sensitiveness of this instrument indicate its employment in several lines of work, but the difficulty of preparing the small circuit which forms its fundamental part is very great. Details are given of the methods suggested by the author of overcoming these difficulties.—Meteoric iron from N'Goureyma, near Djenne, Province of Macina, Soudan, by E. Cohen. This meteorite belongs to the comparatively rare group of coarsely granular irons, and presents peculiarities of structure which appear to be unique. More than 97 per cent. of it consists of nickeliferous iron, the remaining constituents being schreibserite, troilite, daubreelite, lawrencite, and chromite.—Notes on the collection of Triassic fishes at Yale, by G. F. Eaton.—The mechanics of igneous intrusion, by R. A. Daly. A comparison of the hypothesis of overhead stoping in the formation of magma chambers with the laccolithic theory of crustal displacement, and with the theory of marginal assimilation of invaded formations.—*Brachiosaurus altithorax*, the largest known Dinosaur, by E. S. Riggs.—Some new structural characters of Palæozoic cockroaches, by E. H. Sellards.—The Bath furnace meteorite, by H. A. Ward. This meteorite fell on November 15, 1902, the date on which the orbit of the Leonids cuts that of the earth. The stone consists essentially of olivene and pyroxene, with troilite and metallic sprinklings. There is also present in small quantities a completely colourless, almost isotropic mineral, which is probably maskelynite.—The use of a rotating kathode in the electrolytic determination of the metals, by F. A. Gooch and H. E. Medway. An ordinary platinum crucible, rotated by a small electric motor at a speed of 600 to 800 revolutions per minute, is used as the kathode. Details of experiments with copper, nickel and silver are given, from which it would appear that much higher current densities may be employed than with the usual apparatus without any appreciable loss of accuracy.

SOCIETIES AND ACADEMIES.

LONDON.

Chemical Society, April 22.—Prof. W. A. Tilden, F.R.S., president, in the chair.—The following papers were read:—The velocity and mechanism of the reaction between potassium ferricyanide and potassium iodide in neutral aqueous solution, by F. G. **Donnan** and R. **le Rossignol.** The velocity of this reaction can be investigated by titration of the iodine liberated; the simplest interpretation shows that it is quinquemolecular.—A microscopic method of comparing molecular weights, by G. **Barger.** Small quantities of the two solutions are introduced into a capillary tube, where they form bi-concave, discoid drops, care being taken to use the solutions alternately, so that each drop of one solution is enclosed between two drops of the other. The capillary tube is then sealed at both ends, and the length of each drop is measured microscopically from day to day until no change in volume is apparent. At this point the solutions are equimolecular.—Note on the spectrum of pilocarpine nitrate, by W. N. **Hartley.** The author states that the curve recently described by Dobbie as that of the ultra-violet absorption spectrum of pilocarpine nitrate is that of nitric acid slightly modified by the alkaloid present.—Isomeric change of dipropionanilide into propionyl-*p*-aminopropiophenone, by Dr. F. D. **Chattaway.** Under the influence of various catalytic reagents, *e.g.* zinc and hydrogen chlorides, dipropionanilide, like diacetanilide and dibenzanilide, undergoes transformation into propionyl-*p*-aminopropiophenone; the latter and some of its derivatives are described.—Note on the formation of di- and hexamethylammonio-cadmium chlorides, by W. R. **Lang.** Dry methylamine and cadmium chloride react at $-11°$ to form a white powder of the composition $CdCl_2,6CH_3.NH_2$. This, when heated to 100°, furnishes a stable substance of the composition $CdCl_2,2CH_3.NH_2$.

Royal Astronomical Society, May 8.—Prof. H. H. Turner, president, in the chair.—The president announced that the council had elected Lady Huggins and Miss Agnes M. Clerke honorary members of the Society.—The secretary read a paper by the Rev. S. J. **Johnson** on a possible cause of the moon's obscurity on April 11, in which the author suggested that the presence of volcanic dust in the earth's atmosphere was the cause of the darkness of the moon's disc during the recent partial eclipse.—Mr. **Lewis** gave an account of a series of measures of double stars made with the 28-inch refractor at the Royal Observatory, Greenwich, during 1902, and described the orbits of some stars of especial interest.—Mr. Bryan **Cookson** gave a short account of his work on the satellites of Jupiter during a recent stay of two years at the Royal Observatory, Cape of Good Hope.—The Astronomer Royal exhibited and explained a series of diagrams of sun-spots and magnetic disturbance observed at the Royal Observatory during the years 1874 to 1901.—Dr. **Rambaut** read a paper on occultations of stars observed at the Radcliffe Observatory, Oxford, during the lunar eclipse, as well as observations of the colour of the shadow, penumbra, &c.—The president suggested certain subjects for discussion, and a short discussion took place on Mr. Percival Lowell's recent proposal of a standard scale of "seeing."—Mr. A. R. Hinks read extracts from a letter from Mr. **Ritchey,** of the Yerkes Observatory, in which he described his methods of developing photographs of nebulæ, &c. Mr. Ritchey stated that with regard to such nebulæ as those of Andromeda or Orion he made his prints from a negative in which the central portions had been reduced. He considered that the star images are smaller on a negative that had been developed extremely slowly.

Anthropological Institute, April 28.—Mr. H. **Balfour,** the president, exhibited specimens of the tools used by the natives of North-West Australia in the manufacture of glass spearheads. The tools consist of a piece of a sheep's leg-bone and of a water-worn pebble of a purely natural shape. The pebble was used in the earlier stages of the spearhead's manufacture, while the bone was used in its final shaping. Mr. Balfour also exhibited a spearhead which had been made with these tools. A full account of the exhibit, illustrated with a plate, will be found in the May number of

Man.—Mr. E. N. **Fallaize** read a paper on the classification of the subject-matter of anthropology. After defining anthropology quite generally as the "science of man," and pointing out how vast was the scope of such a science which must include all that man *is* and all that man *does*, Mr. Fallaize suggested the following classification of the questions with which the science has to deal:—A. Man's place in Nature, including under this head the investigation of man's place in time and man's place in space, the first section (for which the term palæanthropography was suggested) dealing with the origin and descent of man, Tertiary man, the physical types of the Stone, Bronze, and Iron ages; the second with the distribution of mankind, and the classification of races by physical types—general ethnology. Under B. fall all questions dealing with physical structure—anthropography; while C. deals with the functioning of the organs—physiological anthropology—including such questions as heredity, atavism, racial fertility, and the like. Section D. deals with specifically human activities in the following order:—(*a*) gratification of the senses, including dancing and the æsthetic arts; (*b*) gratification of the intellect, the sciences, especially in the earlier stages of their development; (*c*) communication of ideas, language and writing; (*d*) social structure, the individual and the social organism; (*e*) man's intercourse with Nature: (α) material nature—technology; (β) immaterial nature—the study of religion and folklore.—Mr. J. **Gray** read a paper on the measurements of the Colonial Coronation contingent. The paper contained an analysis of the measurements of about one hundred men of the native troops encamped at the Alexandra Palace during the Coronation celebrations. Amongst the races measured were natives of Sierra Leone and the West Coast of Africa, Nigeria, Lagos, Old Calabar, Central Africa and Somaliland; also Fijians, Maoris, Chinese and Singhalese. The mean values of the head dimensions and stature were calculated for each group, and also possible deviations from the mean in other samples. The results were plotted out on a chart, and the conclusions arrived at were that broadly the same race stretches from Sierra Leone to Somaliland, but that towards North Africa the breadth of the head increases. The Asiatic and Polynesian races, such as the Chinese, Fijians, and Maoris, were infallibly distinguished from the African races by the greater breadth of their heads. The measurements of the African races showed remarkably good agreement with Mr. Randall MacIver's measurements of the Berbers, and Sir H. Johnston's measurements of the Central Africans.

Zoological Society, April 21.—Dr. Henry Woodward, F.R.S., vice-president, in the chair.—Mr. Henry **Scherren** read a short paper dealing with the literature of feather-tracts as found in the writings of Hunter and Linnæus. The author directed attention to a figure in the "Amœnitates" (1766) in which these tracts were shown, and suggested that a passage in "The Garden of Cyrus" proved that Sir Thomas Browne knew of them, and that they varied in extent and position in different birds.—Mr. Oldfield **Thomas** read a paper on some mammals collected by Captain H. N. Dunn in the Egyptian Soudan. Nineteen species were enumerated, of which five were described as new.—In a paper on the geographical distribution of the Mygalomorphæ, an order including the trapdoor spiders and the species formerly grouped together under the comprehensive title Mygale, Mr. R. I. **Pocock** pointed out that the known facts justified the mapping of the world into the following zoological regions:—(1) The Holarctic, including Europe north of the southern mountain chains, North Asia, and North America north of about the 45th parallel of latitude. (2) The Mediterranean, including South Europe, Africa north of the Sahara, and the desert regions of South-western Asia. (3) The Sonoran, including the United States of America south of about the 45th parallel of latitude and the plateau of Mexico. (4) The Ethiopian, including Africa south of the Sahara, South Arabia, and Madagascar. The last-mentioned island ranks merely as a subregion of the Ethiopian. (5) The Oriental, including India, Ceylon, Burma, Siam, and all the Indo- and Austro-Malayan Islands to Australia, "Wallace's line" being non-existent so far as spiders are concerned. (6) The Australian, including Australia and New Zealand, the latter being worthy of recognition as a subregion. (7) The Neotropical, including Central America, apart from the Mexican plateau, the West Indies and South America. These spiders, moreover, furnished very strong evidence in favour of a former union between Africa and South America, and of a connection between the Afro-Mascarene and Austro-Zelandian continents on the one hand, and Austro-Zelandia and the southern extremity of South America on the other.—Mr. **Woodland** read a paper on the phylogenetic cause of the transposition of the testes in mammals.—A communication from Mr. F. F. **Laidlaw** dealt with the marine Turbellaria collected during the "Skeat Expedition" to the Malay Peninsula. In it ten new species were described, three of which were referred to new genera.

MANCHESTER.

Literary and Philosophical Society, April 21.—Mr. Charles Bailey, president, in the chair.—Mr. Spencer **Bickham** read a paper on caoutchouc, in which he described the methods of collection and preparation employed in the different countries where this product is obtained, and remarked upon the geographical distribution of the trees from which caoutchouc is extracted.

PARIS.

Academy of Sciences, May 4.—M. Albert Gaudry in the chair.—Notice on Admiral Ernest de Faulque de Jonquières, by M. E. **Guyou**.—Waves of the second order with respect to their velocity in vitreous media, possessing viscosity, and affected by finite movements, by M. P. **Duhem**.—On some physical properties of trimethylcarbinol, by M. **de Forcrand**. Determinations of the melting and boiling points, specific heat in the solid and liquid states, heat of fusion and volatilisation are given.—On glycuronic acid in the blood, by MM. R. **Lépine** and **Boulud**.—On the ancient lines of the Pliocene and Quaternary beaches on the French coasts of the Mediterranean, by M. Ch. **Depéret**. A preliminary study of the changes of level of the Mediterranean from the Pliocene epoch up to the present time. Four distinct lines of beach can be made out; the early Pliocene at an elevation of 170 to 175 metres, the recent Pliocene at an elevation of 60 metres, early Quaternary at an altitude of 25 metres, and a later Quaternary at an altitude of 4 to 5 metres. The hypothesis of a simple series of negative movements lowering the level of the sea is insufficient to explain these facts.—Remarks by M. Edmond **Perrier** on the sixth volume of his "Traité de Zoologie."—Secular perturbations, by M. Jean **Mascart**.—The period of the sun-spots and the mean annual temperature variations of the earth, by M. Charles **Nordmann**. The work of Köppen has shown that it is only in tropical stations that any connection can be traced between the mean annual temperature and the sun-spot frequency. A study of the observations made at twelve tropical stations shows that the mean annual temperature undergoes a variation the period of which is sensibly equal to that of the sun-spots. The effect of the spots is to diminish the mean terrestrial temperature, that is to say, the curve which represents the temperature variations is parallel to the inverse curve of the sun-spot frequency.—On the twilights observed at Bordeaux during the winter of 1902–1903, by M. **Esclangon**. The hypothesis of finely suspended dust being the cause of the phenomenon would appear to be insufficient. It is more probably due to clouds.—On the Γ function and its analogues, by M. A. **Pellet**.—On the approximation of numbers by rational numbers, by M. Emile **Borel**.—On the relative motion of the work and the tool in cutting the section of a mechanism, by M. G. **Koenigs**.—A transmission dynamometer giving directly the work in kilogrammetres, by MM. **Gaiffe** and **Günther**. An electrical contrivance by means of which the work can be directly read off on an ammeter. The apparatus can be easily arranged to be self-recording.—The theory of electric and magnetic dichroïsm, by M. Georges **Meslin**.—The repulsion of the anode light by the kathode rays, by M. **Salles**.—On metallic diaphragms, by M. Andre **Trochet**. If a plate of platinum is interposed between the two electrodes of a copper voltameter, when the current has attained a certain density, copper is deposited on the platinum. The dependence of this deposit upon the current and the shape of the bipolar electrode is studied quantitatively.—On compounds of aluminium chloride possessing the function of a ferment, by M. G. **Gustavson.** A study of the action of the intermediate compounds formed in the Friedel and Crafts reaction.—On the action of phosphorous acid on erythrite, by M. P. **Carré.** Phosphorous acid acts towards erythrite as a less energetic dehydrating agent than phosphoric acid. Prolonged action gives a neutral phosphite of erythran, and this is immediately decomposed by water, the acid ester being formed.—Contribution to the study of organic acids, by MM. Œchsner **de Coninck** and **Raynaud.** An examination of the relative stability of the lower members of the fatty acids towards hot concentrated sulphuric acid.—On the heat of formation of some barium compounds, by M. **Guntz.** Starting with metallic barium containing about 98·5 per cent. of the metal, the thermal changes associated with its solution in water and dilute hydrochloric acid have been determined, and the heat of oxidation of barium deduced.—On the chlorides of chlorocinnamylidene and bromocinnamylidene, by MM. Ernest **Charon** and Edgar **Dugoujon.**—The transformations of diphenylcarbonic esters and monosalicylic esters, by M. R. **Fosse.**—On a new diiodophenol, by M. P. **Brenans.** A description of the mode of preparation, properties, and chief derivatives of the diiodophenol (OH) : I : I,1 : 3 : 4.—On some new bases derived from the pentoses, by M. E. **Roux.** The new bases, arabinamine and xylamine, are prepared by the reduction of the oximes of arabinose and xylose.—The action of alkalis on glycerol. The application of the reaction to the estimation of glycerol, by M. A. **Buisine.** On heating potash lime with glycerol three different reactions may take place according to the temperature. At 320° the products are potassium acetate, potassium carbonate, water and hydrogen, and a method suitable for the estimation of small quantities of glycerol can be based on the measurement of the hydrogen.—On the existence of arsenic in the egg of the fowl, by M. Gab. **Bertrand.** All parts of the egg were found to contain appreciable amounts of arsenic. These results confirm the existence and probable function of arsenic in all living cells.—The influence of the radium rays on fertilised eggs, and on the first stages of development, by M. Georges **Bohn.**—On the formation of melanic pigment in the tumours of the horse, by M. C. **Gessard.** The abnormal production of black pigment in the healthy or morbid tissues of man is rare, but is very common in the horse. The chromogenic substance is tyrosine, the oxidation of which by tyrosinase which is present gives the colouring matter.—The law of action of trypsin on gelatin, by MM. Victor **Henry** and Larguier **des Bancels.** The action was followed by the changes produced in the electrical conductivity.—On the increase in weight in white mice, by Mdlle. M. **Stephanowska.**—On a new secreting apparatus in the Coniferæ, by M. G. **Chauveaud.**—The development and anatomical structure of the seminal tegument in the Gentianaceæ, by M. Paul **Guerin.**—A respiratory hygrometer, by M. Pierre **Lesage.** A modified form of dew-point hygrometer. It has been found that the pressure of the water vapour in expired air does not correspond to the saturation pressure, and varies with state of the man.—The germination of the spores of truffles, the culture and characters of the mycelium, by M. Louis **Matruchot.**—On the echinitic fauna of the Gulf of Suez, by M. R. **Fourtau.**—On the closed basins of the Swiss Alps, by MM. Maurice **Lugeon,** Maurice **Ricklin,** and F. **Porriraz.**

DIARY OF SOCIETIES.

THURSDAY, MAY 14.

ROYAL SOCIETY, at 4.30.—The Combination of Hydrogen and Chlorine under the Influence of Light: P. V. Bevan.—On the Photo-Electric Discharge from Metallic Surfaces in Different Gases: Dr. W. Mansergh Varley.—The Elasmometer, a new Interferential Form of Elasticity Apparatus: A. E. Tutton, F.R.S.—Meteorological Observations by the Use of Kites off the West Coast of Scotland, 1902: Dr. W. N. Shaw, F.R.S., and W. H. Dines.—On the Radiation of Helium and Mercury in a Magnetic Field: Prof. A. Gray, F.R.S., and Dr. W. Stewart; with R. A. Houston and D. B. McQuistan.—A New Class of Organo-Tin Compounds containing Halogens: Prof. W. J. Pope, F.R.S., and S. J. Peachey.—The Xanthophyll Group of Yellow Colouring Matters: C. A. Schunck.

ROYAL INSTITUTION, at 5.—Proteid-Digestion in Plants: Prof. Sidney H. Vines, F.R.S.

MATHEMATICAL SOCIETY, at 5.30.—Generational Relations Defining an Abstract Simple Group of Order 32736: W. H. Bussey.—Points in the Theory of Continuous Groups: Dr. H. F. Baker.—On Fermat's Numbers: Lieut.-Col. Cunningham and Messrs. Western and Cullen.

SOCIETY OF ARTS, at 4.30.—The Province of Assam: Sir James Charles Lyall, K.C.S.I.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Applications of Electricity in Engineering and Shipbuilding Works: A. D. Williamson.—Electric Driving in Machine Shops: A. B. Chatwood.

FRIDAY, MAY 15.

ROYAL INSTITUTION, at 9.—The Origin of Seed-Bearing Plants: D. H. Scott, F.R.S.

MONDAY, MAY 18.

SOCIETY OF ARTS, at 8.—Mechanical Road Carriages: W. Worby Beaumont.

TUESDAY, MAY 19.

ROYAL INSTITUTION, at 5.—The Astronomical Influence of the Tides: Prof. G. H. Darwin, F.R.S.

ROYAL STATISTICAL SOCIETY, at 5.—The Growth and Direction of our Foreign Trade in Coal during the Last Half Century: D. A. Thomas, M.P.

WEDNESDAY, MAY 20.

CHEMICAL SOCIETY, at 5.30.—Isomeric Partially Racemic Salts containing Quinquevalent Nitrogen. Part xi. Derivatives of *dl*-Methylhydrindamine and *dl-neo*-Methylhydrindamine. Isomeric Salts of the Type $NR_1R_2H_3$: G. Tattersall and F. S. Kipping.—The Conditions of Decomposition of Ammonium Nitrite: V. H. Veley.—Note on the Action of Methylamine on Chromic Chloride: W. R. Lang and E. H. Jolliffe.—The Action of Liquefied Ammonia on Chromium Chloride: W. R. Lang and C. M. Carson.—Cholesterol. A Preliminary Note: R. H. Pickard and J. Yates.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Exhibition of Pond Life.

ROYAL METEOROLOGICAL SOCIETY, at 4.30.—The Relation of the Rainfall to the Depth of Water in a Well: Charles P. Hooker.—The Frost of April, 1903: William Marriott.

THURSDAY, MAY 21.

ROYAL INSTITUTION, at 5.—Proteid-Digestion in Plants: Prof. S. H. Vines, F.R.S.

FRIDAY, MAY 22.

ROYAL INSTITUTION, at 9.—Dictionaries: Dr. J. A. H. Murray.

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