THURSDAY, JULY 21, 1870

WAR

THE dogs of war are again let loose, and in the two most highly civilised countries of Europe, where, a week ago, science, education, and commerce were in full sway, all the arts of peace are already neglected, and in prospect have gone back a quarter of a century. We can hardly yet realise that at the present moment railways are being torn up, lighthouses dismantled, lightships towed into harbour, and monuments of engineering skill, such as the bridge over the Rhine at Kiel, undermined, so that they may be destroyed at a moment's notice. But these, after all, are calamities of the second order; education is stopped; science schools are broken up; while we write both professor and pupil are forsaking the laboratory and the class-room, and the whole machinery of progress has come to a stand-still.

This journal, of course, has nothing to do with Politics: the function of Science is to unite the whole human family, whereas the function of Politics seems to be, both in the case of the human family and of each nation, to create parties and to emphasise them as much as possible, the object in each case being place for the partisans—whether that place be an income of a few thousands a year in one case or increased territory in the other. But although we cannot discuss politics, we may point out that as Science advances such policies will be overridden—that when Science and Education have taken their proper position—when the sword has given place to brain—when more of the best men of each nation take part in each nation's counsels, the dreadful thirst after blood will give way to something better; monarchs will see the folly of being surrounded merely with empty helmets and uniforms, or at all events if they do not, others will; and much will have been done when the pampering of armed men shall cease.

There is one point however in connection with the coming war which we cannot point out too strongly—one duty which England owes to herself, and which, if it be well done, may make her after all a gainer from the dreadful strife. We have already stated, and the statement is not an exaggeration, that the war will throw the countries engaged in it back a quarter of a century. Now, England at the present moment, be the cause what it may, is in many things a quarter of a century behind France and Prussia, notably in education of all kinds, and especially in scientific education.

The following extract from the Report of Mr. Samuelson's Committee on Scientific Education—a report which we believe has not even yet been taken into consideration by our Legislature—is so much to the point that we give it here:—

"Nearly every witness speaks of the extraordinarily rapid progress of Continental nations in manufactures, and attributes that rapidity, not to the model workshops which are met with in some foreign countries, and are but an indifferent substitute for our own great factories, and for those which are rising up in every part of the Continent; but, besides other causes, to the scientific training of the proprietors and managers in France, Switzerland, Belgium, and Germany, and to the elementary instruction which is universal amongst the working population of Germany and Switzerland. There can be no doubt, from the evidence of Mr. Mundella, of Prof. Fleeming Jenkin, of Mr. Kitson, and others, and from the numerous reports of competent observers, that the facilities for acquiring a knowledge of theoretical and applied science are incomparably greater on the Continent than in this country, and that such knowledge is based on an advanced state of secondary education.

"All the witnesses concur in desiring similar advantages of education for this country, and are satisfied that nothing more is required, and that nothing less will suffice, in order that we may retain the position which we now hold in the van of all industrial nations. All are of opinion that it is of incalculable importance economically that our manufacturers and managers should be thoroughly instructed in the principles of their arts.

"They are convinced that a knowledge of the principles of science on the part of those who occupy the higher industrial ranks, and the possession of elementary instruction by those who hold subordinate positions, would tend to promote industrial progress by stimulating improvement, preventing costly and unphilosophical attempts at impossible inventions, diminishing waste, and obviating in a great measure ignorant opposition to salutary changes.

"Whilst all the witnesses concurred in believing that the economical necessity for general and scientific education is not yet fully realised by the country, some of them consider it essential that the Government should interfere much more actively than it has done hitherto, to promote the establishment of scientific schools and colleges in our great industrial centres."

It is impossible that we can say anything stronger than this in favour of taking the fullest advantage of the opportunity of regaining our intellectual and therefore our commercial prestige.

If England is to prepare for war, the abnormal condition, so let it be; but surely, *a fortiori* she should *prepare for peace*, the normal one, as well. This has never struck her ministers, and the reason is not far to seek.

But this is not all; the same disregard for science, arising from the ignorance of science among our rulers, has probably placed us in another position of disadvantage. While France and Prussia have been organising elaborate systems of scientific training for their armies, a recent Commission has destroyed what little chance there was of our officers being scientifically educated at all. As there is little doubt that a scientific training for the young officer means large capabilities for combination and administration when that officer comes to command, we must not be surprised if the organisation of our army, if it is to do its work with the minimum of science, will, at some future time, again break down as effectually as it did in the Crimea, or that our troops will find themselves over-matched should the time ever come when they will be matched with a foe who knows how to profit to the utmost from scientific aids.

While, therefore, the Continent is being deluged with blood, let us *prepare for peace* as well as for war; let us prepare ourselves for victories in the arts, conquests over nature; let us, by means of a greater educational effort, more Science Schools, a truer idea of the mode in which a nation can really progress, fit ourselves to take our place among the nations when peace returns. Surely if there be statesmen among us, such a clear line of policy will not be overlooked.

Education and Science at the present moment are England's greatest needs.

HEIGHT AND WEIGHT

WITHIN the last few years public attention has been drawn to the question of what individuals weigh, by the facilities afforded for weighing by the construction of weighing-chairs. These chairs are not only to be seen at the Crystal Palace, where diminutive boys tout for custom, offering to tell your "correct weight," but they are also seen at the stations of the Metropolitan Railway and many other places. The practice, therefore, of getting weighed is obviously on the increase, and we want to utilise the knowledge thus gained by showing how it may be turned to most advantage. It will be easily seen that to know the weight of a person without reference to some other standard, such as height, would be of little advantage. But if by taking the height of a person we can say what he ought to weigh, then we have a means of ascertaining what persons ought or ought not to weigh. The difficulty on this subject has been to determine what a man of a certain height really ought to weigh. If this can be determined, then we can say whether a man of a certain height exceeds or falls short of the average weight of men of his stature.

One of the earliest efforts made to obtain anything like a fixed relation between height and weight was that of Dr. Boyd, who weighed a certain number of inmates in St. Marylebone Workhouse. He took the height and weight of 108 persons labouring under consumption, and found they measured 5ft. 7in., and weighed ninety pounds. He then measured and weighed 141 paupers who were not consumptive, and found that their average height was 5ft. 3in., and that they weighed 134lb. This subject attracted the attention of the late Dr. John Hutchinson, and he determined to take the height and weight of all classes of persons in the community. In this way he collected the height and weight of upwards of 5,000 persons. This list, however, included persons who exhibited themselves as giants and dwarfs, and other exceptional cases. He therefore reduced his instances to 2,650 persons, all of whom were men in the vigour and prime of life, and included sailors, firemen, policemen, soldiers, cricketers, draymen, gentlemen, paupers, and pugilists. This group of cases was intended to make one class as a set-off against another, so as to get a fair average. The following is the result of Dr. Hutchinson's observations :—

Height.		Weight.		Height.		Weight.	
ft.	in.	st.	lb.	ft.	in.	st.	lb.
5	1	8	8	5	7	10	8
5	2	9	0	5	8	11	1
5	3	9	7	5	9	11	8
5	4	9	13	5	10	12	1
5	5	10	2	5	11	12	6
5	6	10	5	6	0	12	10

Of course the result of these investigations of Dr. Hutchinson can only be considered as approximative, and he himself thought that a larger number of observations would lead to a more perfect law. The fact is, his observations are quite sufficient to establish all that we need, and to show that amongst a certain set of healthy men his estimate of weight and height may be regarded as an approach to a healthy standard. It is only where considerable departures from the estimates given by Dr. Hutchinson take place that any particular case demands attention. If this table is examined, it will be seen that the increase in weight for every inch of height is a little more than five pounds. In fact, allowing for any error in observation, we may say that Dr. Hutchinson's table is reducible to the law that for every inch of stature beyond 5ft. 1in., or sixty-one inches, a healthy man increases five pounds for every inch in height. If this deduction be accepted, we may very much simplify Dr. Hutchinson's table, and say that as a rule, a man's weight increases at the rate of five pounds for every inch of height, and this rule holds good for all practical purposes. Starting then with a person 5ft. in height, who, according to the assumed law, should weigh 8st. 3lb., we obtain the following results :—

Height in inches.	Height in feet.		Weight in pounds.	Weight in stones.	
in.	ft.	in.	lb.	st.	lb.
60	5	0	115	8	3
61	5	1	120	8	8
62	5	2	125	8	13
63	5	3	130	9	4
64	5	4	135	9	9
65	5	5	140	10	0
66	5	6	145	10	5
67	5	7	150	10	10
68	5	8	155	11	1
69	5	9	160	11	6
70	5	10	165	11	11
71	5	11	170	12	2
72	6	0	175	12	7
73	6	1	180	12	12
74	6	2	185	13	3
75	6	3	190	13	8
76	6	4	195	13	13

Although this law is approximately good for a certain number of cases, even above and below this table; it is practically found, and especially in the case of children and growing persons, that there is a wide difference of weight at heights below 5ft.

Attention may also be drawn here to the fact that there will constantly occur in the community instances of persons where either the muscular or bony systems are excessively developed, and who consequently weigh more or less than their height. Dr. T. K. Chambers, in his admirable essay on corpulence, published in 1859, calls especial attention to the researches of Mr. Brent on the assumed weights of the statues of antiquity. In order to get at this, Mr. Brent immersed in water accurate copies of these statues, and by ascertaining the quantity of water they displaced he calculated their weights. Dr. Chambers has taken the pains to reduce the absolute weights of these statues to assumed heights, and thus compared the heights and weights of these statues of antiquity with Dr. Hutchinson's modern man. Without giving the whole of the heights and weights, we present the series at the assumed height of 6ft. Thus :—

	Height.	Weight.	
	in.	st.	lb.
Bronze Tumbler .	60	11	4
Hutchinson's Man	60	12	10
Dying Gladiator. .	60	14	0
Theseus, Brit. Mus.	60	15	0
Hercules, ,, ,,	60	16	10
Farnese Hercules.	60	18	7

On this table Dr. Chambers remarks: "Of the statues here selected, the Bronze Tumbler may be taken as the type of extreme lightness and activity, the Dying Gladiator of robust strength. In Theseus and the smaller Hercules the sculptor's idea of a hero where the bodily strength must be equal to that of any possible man. The Farnese Hercules exhibits a development of muscle greater than is ever known to exist in the human species."

Dr. Chambers also gives the height and weight of certain celebrated prizefighters, the result of Mr. Brent's observations, which makes it very obvious that in certain cases the great weight depends on muscular and osseous development.

	Height.		Weight.	
	ft.	in.	st.	lb.
Perrins	6	2	17	0
Caunt	6	2	14	7
Spring	5	11	13	3
Jackson	5	11	14	0
Bendigo	5	9	12	0
Johnson	5	8	13	5
Slack	5	8	13	10
Mendoza	5	7	12	4

The conclusion we come to with regard to these weighings and measurings is that all ordinary departures from the average height and weight of the body deduced from Dr. Hutchinson's tables are due either to an increase or decrease of the fatty matter or of the adipose tissue in the body. Thus, taking the composition of a human body weighing 154lb. and measuring 5ft. 8in., it will be found that it contains 12lb. of fat.* It is then mainly due to the diminution or increase of this substance that human beings weigh more or less than the standard weights given in the above table. It will be therefore here worth while to inquire what is the use of fat in the system, and what indications are afforded by the height and weight of the human body for caution in diet and regimen.

The exact way in which fat is produced in the tissue of plants and animals is not known, but there is evidence to show that it is found very generally in the tissues of plants and especially in the seeds. Oil when used for commercial purposes is mostly obtained from the seeds of plants, as seen in castor oil, rape oil, linseed oil, cocoanut oil, palm oil, and a hundred others. As it is found in the seeds of plants, so it is found in the eggs of animals. The embryo of all animals is developed in contact with oil, of which we have a familiar instance in the yelk of the egg of birds. It appears also that the muscular and other tissues grow under the fostering influence of the adipose tissue.

Besides this primary influence on the growth of the body, fat subserves many other purposes. In the first place it seems to be a reserve of material for producing muscular force when needed. Animals grow fat in summer, but as the supply of this material becomes scanty in winter they lose their fat and get thin. Man himself gets fat in summer and grows thin in winter from the demand on this store for heating purposes. Hybernating animals go to their winter sleep sleek and fat, but wake up in the spring lean and meagre, from the loss of fat in maintaining the animal heat necessary for life. Fat is thus seen to be an essential of animal life. Where there is too little deposited for the purposes of life, then serious disease has already commenced or may set in; whilst on the other hand a redundancy of this deposit may seriously interfere with the functions necessary to life.

* See Guide to the Food Collection, South Kensington. Third Edition.

It is from this point of view that the value practically of a knowledge of the height and weight of individuals becomes apparent. When the weight of a person is much below his height, then it may be suspected that some disease has set in, which may go on to the destruction of life. One of the earliest symptoms of consumption, the most fatal disease of the civilised inhabitants of Europe, is a tendency to loss of weight. Long before any symptoms are present of tuberculous deposits in the lungs, this loss of weight is observable in persons afflicted with consumption. And at this stage a large amount of evidence renders it probable that the fatal advance of this disease may be prevented. Within the last thirty years a practice has been resorted to with great success of administering to persons losing weight and threatened with consumption, cod-liver oil, pancreatic emulsion, and fatty substances, as articles of food, for the purpose of preventing or arresting the tendency to loss of fat, which obviously results in the production of fatal disease. In fact, it may be stated generally, not without exceptions, that wherever the weight is much below the height, there the commencement of dangerous disease may be suspected, and precautions taken to prevent the loss of fat. That this treatment has been successful in really preventing disease, and loss of life as the consequence, is the conviction of a host of intelligent practitioners of medicine. At the same time, it should be remembered that it is not only necessary in these cases to administer cod-liver oil or pancreatic emulsion as medicines, but that the consumptive should have recourse to a fatty diet, and should eat butter, cream, cream-cheese, fat, and fatty articles of diet.

On the other hand, this knowledge of the true relations of height and weight presents us with individuals who weigh a great deal more than the standard presented by the above tables. In certain individuals, and, in fact, in particular families, there is a tendency to develope adipose tissue. However free from fat may be the food, what little it contains is arrested in the tissues of these individuals, and they become "fat;" that is, they weigh more than their height. The consequences of this fatness are very various. The fat may be so deposited all over the system as not to be an obvious obstruction to the functions of life; but every one can understand that, in the case of two men of equal stature, say 5ft. 8in., one having to carry eleven stone and the other twelve, the latter will be at a disadvantage. This arises from two causes. The heavier man carries, in the first place, a greater weight, and in the second place, his heart has to project into the tissues of the body a larger amount of blood in order to keep him alive. For every pound a man weighs above his height, his system is at a disadvantage, and he suffers in various ways. When fat is equally distributed about the body then no immediate disadvantage is felt. But when fat is accumulated in particular parts of the body, interfering with the functions of particular organs, then its evil influences become speedily apparent. The most accurate account of the effects of the accumulation of fat in the viscera of the chest, will be found in a pamphlet by Mr. Banting, who, although not at all what we should call a fat man, nevertheless, so suffered from fat in the chest that he could not walk forwards downstairs, or stoop to buckle his shoe. There is no doubt that in his case there was a necessity for immediate relief, and he obtained it by abstaining from articles of food which supply fat to the system.

When persons weigh much above their height, it is obviously a matter of importance that they should as much as possible relieve the tax put upon their muscular and circulating system by diminishing their weight. Fortunately, this is not a very difficult thing to do, but it should be done with caution. "To Bant" with success requires caution. The immediate withdrawal of all fatty food, and the substances, such as starch and sugar, which produce fat, is frequently attended with dangerous results. Mr. Banting's diet, although so beneficial in his case, was not altogether a judicious one, and we have no doubt that many of our "stout" friends have found an early grave by their determination to reduce themselves to the standard of weight for their height. With regard to stout people, or those who weigh more than their height, it should be recollected that if they have suffered no inconvenience from their weight, it is better to leave well alone. There are few people living in the scientific circles of London who are not well acquainted with the portly forms and genial faces of well-known men from seventy to eighty years of age. It would be folly on the part of the men who have thus achieved the normal age of threescore years and ten to commence any system of artificial diet, when their natural instincts have guided them, in spite of their weight, to their present green old age.

When studied from a judicious point of view there is no doubt that an estimate of the height and weight of an individual ought to enter into every estimate of the possible chances of life. In medical practice it may become the deciding point of the treatment of disease; whilst in those estimates which Assurance offices are obliged to make of the prospective value of life, it is of the utmost importance. Whenever the weight is below the height there is a fair suspicion of scrofulous or tuberculous disease, which no Insurance office is justified in overlooking. Whilst, on the other hand, when the weight is greatly in excess of the height, there is a tendency to those sudden impairments of muscular and especially circulating powers, which may lead to premature and unexpected death. E. LANKESTER

FOSSIL MAMMALS OF NORTH AMERICA

The Extinct Mammalian Fauna of Dakota and Nebraska; together with a Synopsis of the Mammalian Remains of North America. By Dr. Leidy. With an Introduction on the Geology of the Tertiary Formations of Dakota and Nebraska; with a map. By Dr. Hayden. (Philadelphia, 1869. London: Trubner and Co.)

II.

IN the preceding article the Miocene portion of Dr. Leidy's great work has been reviewed. That part of it relating to the Pliocene and the Quaternary still remains for analysis. That we are able to classify the American Mammalia as the Miocene, Pliocene, and Quaternary, we owe to Dr. Leidy; and his definitions of the two former of these are amply supported by the results arrived at by the Geological Survey of the district, under the direction of Dr. Hayden. The Pliocene strata on the Niobrara River, and in the valleys of the Platte and Loup Fork Rivers, rest on the Miocene beds, which furnished the Mammalia treated of in the first essay. And thus there is evidence that the one series is of later age than the other. Palæontologically, also there is a most remarkable break. Not one species and only one or two genera, namely, Rhinoceros and Castor (Aceratherium ?), are common to the two. With this exception, all the Miocene Mammalia had disappeared during the time that intervened between the formation of the two lacustrine deposits in that region. This fact implies that the one formation is separated from the other by a shorter interval than their European analogues; for in the latter many genera, such as the Mastodon, Hipparion, Hyæna, Elephant, and others, pass from Miocene into Pliocene in such a way as to cause one group of life gradually to shade off into the other, and to render it sometimes impossible to define the last stage of the one from the first of the other.

In the American Pliocenes a Ruminant, the *Merycohyus*, possessed of a full complement of teeth, represented the family to which the Oreodon of the preceding epoch belonged. One species, *M. elegans*, was about the size of a sheep, while a second, *M. medius*, was rather larger. Since the latter is founded only on one upper and three lower molars, it is rather hard to follow Dr. Leidy when he defines the animal as being "one half larger in diameter than *M. elegans*, and intermediate in size between the lama and camel." From such a slender premiss, any exact estimate of the size of the animal must be worthless. The camel tribe were represented by three distinct genera. The Procamelus is distinguished from the camel by the presence of an additional premolar in the upper, and two in the lower jaw. One species, *P. robustus*, was about the size of the living camel. The Homocamelus is remarkable for its large canine, and for the isolated position of the first upper premolar; while the *Merychodus necatus* had molars without an accessory column between the lobes, as in the sheep. The deer is represented by one small species, *Cervus Warreni*, with antlers small and bifurcating, like those of the *C. trigonalis*, figured by M. Gervais from the French Pliocenes, and the *C. dicranoceros* from the Suffolk Crag, and the Miocene of Eppelsheim. One small bifurcating antler, or horncore, may possibly be the solitary evidence of the presence of the antelope in America, but it more probably belongs to a species of deer. In none of the living antelopes is the horncore prolonged into the branch of the horn. *Cosoryx furcatus* therefore cannot fairly be quoted in proof of the range of those herbivores as far as North America.

The Pliocene American Rhinoceros (Acerathere?) *R. crassus*, belongs to the brachydont division, characteristic of the Pliocenes and Miocenes in Europe. The Mastodon, *M. mirificus*, was devoid of tusks in the lower jaw, and belonged to the tetralophodont section of Dr. Falconer. A species of elephant (*E. imperator* Leidy) was also living during the American Pliocenes. So far as the fragmentary condition of the molar will admit of decision, it belongs to the coarse-plaited variety *E. columbi* of Dr. Falconer. There were also at least three species of Hipparion, and two ancient forms of horse (*Merychippus* and *Protohippus*), which recall to mind the simplicity of pattern represented by equine milk molars. The true horse was represented by *Equus excelsus*; the beaver by the *Castor tortus*, which was half its size. There was also a porcupine (*Hystrix venustus*) which, strange to say, is more closely allied to the crested European than to the living American species. The wolves and foxes of the American Pliocenes are scarcely to be distinguished from those still living in the United States. One (*Canis sævus* Leidy) "is a near relative, if not progenitor, of the existing American wolf (*C. occidentalis*)." *C. temerarius* is intermediate between the prairie wolf and the red fox, while Dr. Leidy admits that the third (*C. vafer*) "may reasonably be supposed to belong to the existing swift fox." The fourth (*C. Haydeni*) probably belonged to a large variety of the western wolf. The larger felines are represented by the Pseudælurus (*Felis quadridentatus*), which was intermediate in size between the panther and the American lynx; and the bear-tribe by the *Leptarctus primus*, a creature allied to the coati.

The evidence afforded by this group of animals, of the physical geography of North America during Pliocene times, is extremely valuable. The absence of the Edentata and of the Rodents of South American type implies that North America at the time was insulated from the south by a barrier which could not be overcome by those animals. The absence of the opossums also points in the same direction. The Isthmus of Panama had not yet risen above the waves to sever the Atlantic from the Pacific Ocean, and to be a bridge for animals migrating from the one continent to the other. On the other hand, the Pliocene genera which dwelt in the basin of the Mississippi point indisputably to an influx of animal life from some other area. The deer, the mastodon, and the elephant, the hipparion, and the true horse, and among the carnivores the genus *Canis* and the Pseudælurus, are perhaps the most significant of the new forms which characterise the American Pliocene. From what region did they come? A glance at the Miocene and Pliocene Mammals of Europe affords a satisfactory answer to this question. All these genera sprang into being during the European Miocene, and with the exception of the last lived also in the succeeding period. It is therefore only reasonable to infer that they found their way into North America from the Euro-Asiatic area, and the fact that they are Miocene genera in Europe renders it possible that their migration began at that time. Whether this reasoning be accepted or not, the lapse of time required, not merely by one or by two genera, but by a group of herbivores with their accompanying carnivores, to fight their way from Europe or Asia into the Southern States—a region which was already occupied by the Oreodonts and other forms—must have been enormous, and probably sufficient to account for the difference between the American and European Pliocenes. If the migration be not admitted, then we must fall back on the now exploded hypothesis of different centres of creation, for there is no other mode of accounting for the presence of the same genera or species in now widely separated regions. It may therefore be inferred from the study of American Mammals, that North America was isolated from the great southern mainland, and that it was connected with Euro-Asia during the Pliocene, as well as during the preceding Miocene epoch.

The Quaternary group of Mammals, in Dr. Leidy's synopsis, points to a considerable geographical change having taken place in the interval that separates the epoch of their existence from the Pliocene. The strange extinct South America Edentates, the Megatherium, Megalonyx, and Mylodon spread over the Southern States, and testify that the barrier, which had confined them to their ancient home in South America, had been removed. In other words they poured northwards over the bridge offered by the Isthmus of Panama, and occupied the valley of the lower Mississippi. They were accompanied also by extinct forms of the Chinchilla and Cavy. In this way the date of the elevation of Panama above the waves may be satisfactorily ascertained. The Northern extension, therefore, of the South American genera, which at the present time range as far as Mexico and occupy the province of "Austro-Columbia," dates from the Quaternary or Post-Pliocene epoch.

There was, however, no similar geographical change in the relation of North America to the old world. The bisons, horses, and elks, if not identical specifically, are merely varieties or representative species. The Mammoth is common to the whole of North America, and to the vast area in the old world north of a line drawn through the Altai mountains, the Caspian, and the Mediterranean Seas. The musk sheep, so widely spread through Europe in the Quaternary, ranged through Asia along with the Mammoth to the Arctic Ocean, and was found by Captain Beechy in the frozen loam on the American side of Bheerings Straits. In the basin of the Mississippi it is represented by a cognate species, *Ovibos bombifrons* (female), and *O. cavifrons* (male). That these remains really belong to one species of Ovibos, is rendered almost certain by the concurrent and independent testimony of Dr. Rütimeyer and myself. The Cave-lion of Europe was also represented by the *F. atrox* of Natchez. Many other cases might be quoted to show that in those days the connection by land between North America and Asia must have been maintained. It therefore follows, as one might have expected from the soundings in Bheerings Straits, that Northern Asia has been separated from North America in comparatively recent times.

There is one striking fact to be noted in the Post-Pliocene America fauna. Just as certain European Miocene genera appear in the American Pliocene, so two forms which in Europe died out in the Pliocene, the Mastodon and Hipparion, lived on in America into the Post-Pliocene age. It would almost seem as if America was the refuge of forms which had been driven from the old world. That the musk sheep of the Post-Pliocenes of Europe and Asia still lingers only in the high northern latitudes of North America, is a parallel case. These inferences are based on facts accumulated with very great care by Dr. Leidy. His work is an admirable attempt to grapple with most difficult problems; it would have been of far greater value had its author abstained from founding species and genera in some cases from very scanty materials, and in others on the slightest variations from the ideal type.

W. BOYD DAWKINS

OUR BOOK SHELF

Of the *Bulletin de la Société Impériale des Naturalistes de Moscow*, we have just received the first, second, and third parts for the year 1869. The greater part of the important papers in the second part are on Botanical subjects. They include a monographic revision, with tables of species, of the Heliotropes of the eastern Mediterranean region, in which seventy species are cited, and twenty-two of them described as new; a notice of the occurrence of the white Truffle (*Rhizopogon albus*) in the neighbourhood of Moscow; a note on *Empusa muscæ*; and a revision of the species of Characium found in the vicinity of Charkow. Colonel Motschoulsky continues his seemingly interminable "enumeration" of the new species of Coleoptera collected by him during his travels, leading us to wonder how any one man could have collected so many beetles, and, having got them, how he can write so much about them. This, however, is but a small instalment. Another entomological paper of more consequence is a monograph of the genus *Abacetus* by Baron Chandoir; M. Solsky has a notice of some beetles from Eastern Russia, and M. E. Ballion another on two species of sawflies. The most interesting zoological paper is on the anatomy and development of *Pedicellina* (Sars), by M. B. Uljanin, illustrated with two plates. In this paper our countryman, Mr. Gosse, is absurdly quoted as "Goose." The remaining papers are by Dr. Ferd. Müller on the determination of the magnetic inclination, and by M. R. Hermann on the composition of Fergusonite. The last part consists of a series of *éloges* on Alexander Von Humboldt, read at a centenary celebration of the great German philosopher. These papers, by different authors, treat of Humboldt from various points of views: as a man and as a naturalist; in his relations to Russia; as an investigator in the domain of electro-physiology; as a botanist; as an investigator of physical geography and climatology. As they are all in Russian we fear these memoirs will find few readers in this country. A German translation of the first of these will, however, be found in the first part of the *Bulletin*, which includes a variety of papers on Natural History subjects. An important geological paper is one by Prof. Trautschold, on secular elevations and sinkings of the earth's surface. Dr. D. Zernoff's memoir on the olfactory organs in the Cephalopoda, which is illustrated with two plates, is a valuable contribution to the anatomy of the Mollusca. In an important memoir, also accompanied by two plates, M. J. Borsenkow describes the developmental history of the ovary and egg in the common fowl. For the botanist we have a continuation of M. L. Gruner's catalogue of plants collected on the Dnieper and the lower part of the Kouka; and a notice, by M. Alexander Becker, of Sarepta, of a journey to Debent, which also, as usual, includes entomological notices. For the entomologist finally we have a catalogue of the Coleoptera of the vicinity of Jaroslaw, by M. von Bell; remarks upon some species as cited in Harold's great catalogue of Beetles, by M. E. Ballion; and, from the inexhaustible Motschulsky, a further instalment of descriptions of new species of Coleoptera.

Für Baum und Wald. Eine Schutzschrift an Fachmänner und Laien gerichtet. Von Dr. M. J. Schleiden. (Leipzig: Engelmann. London: Williams and Norgate.)

A treatise on arboriculture, in which, mingled with some extravagant sentimentalism, are many useful hints as to the growth of trees and forests. There can be no doubt that within the last 2,000 years a great amelioration has taken place in the climate of Central and Northern Europe. Varro speaks of the climate of the south of France as unfavourable to the growth of the vine or olive. Virgil describes the Crimea as subject to the rigours of an eight-months' winter; Diodorus Siculus narrates how whole armies crossed the frozen Rhine, Rhone, and Danube; and there is unanimity of testimony among other writers to the same effect. Dr. Schleiden attributes this change in the climate, to a great extent, to the destruction of forests when the country became more thickly peopled, combined, no doubt, with improved drainage. He points out, however, that disforesting may be carried too far, until it becomes positively injurious instead of beneficial. The judicious mean he believes to have been arrived at in England and Ireland, while in some parts of Continental Europe, especially Switzerland and the Tyrol, the almost entire destruction of the timber has caused a diminution of the rainfall to an extent very prejudicial to the crops. Another result in mountainous countries has been the constant accumulation of rain-clouds around the mountain-peaks, and consequent destructive floods and devastating avalanches. In confirmation of Dr. Schleiden's views, it may be stated that in some parts of India the drought has been so severe for several successive years since the destruction of the forests, that the Government has ordered the planting of an enormous number of trees.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

Twelve-wired Bird of Paradise

It may be interesting to many of your readers to know that a specimen of the rare and beautiful twelve-wired Paradise Bird (*Seleucides alba*) is now alive in the Royal Zoological Gardens at Florence. Signor G. E. Cerruti, who has recently returned from an official tour in the Moluccas and New Guinea, writes me that he obtained it from the Rajah of Salwatty, and that although very wild at first, it soon became tame and quiet; and that he had very little trouble in bringing it home. Here is another proof that these wonderful birds can be brought to Europe without difficulty, and once here, with proper care and ample space, there is little doubt they would be long-lived.

Alfred R. Wallace

Spontaneous Generation

Dr. H. C. Bastian, who has recently called attention to the nature of the evidence before scientific men in favour of the theory of so-called spontaneous generation, has supplemented it by fresh experiments of his own. The dilemma in which the opponents of this doctrine are now placed is that they must either admit it, or else allow that a temperature of 150° C. maintained for four hours, and applied by means of liquid, is incapable of killing the germs of infusoria. Many, doubtless, of these opponents will courageously mount this horn of the dilemma, and make the requisite enlargement of their ideas on the subject of vital resistance to change. There are, however, other difficulties in the way. For instance, great difficulties are involved in the assumption that the atmosphere constitutes a storehouse of germs of all kinds ready to burst out into life on the occurrence of suitable conditions.

However small these germs may be, still they must weigh something. And there must be very many of them, seeing that there must be an immense number of kinds of germs, if a volume of air is to supply to any given infusion precisely the right kinds of germs suitable to the conditions provided by the infusion.

Now chemists are in possession of data showing that the possible amount of organic nitrogenous matter in common clear water and common good air is remarkably small—so small, indeed, that the question may fairly be asked—Is it large enough to admit of the requisite number of germs, the existence of which the vitalists assume in water and air?

By the employment of our ammonia method, Chapman, Smith, and myself have shown that the organic ammonia from a kilogramme of good filtered water often falls as low as 0·05 milligramme, and Dr. Angus Smith has shown that a kilogramme of good air sometimes contains as little as 0·085 milligramme of organic ammonia.

A gramme of air—that is about 700 cubic centimetres—contains only 0·000085 milligramme of organic ammonia. Expressing the organic ammonia in its equivalent of dry albumen we have in 700 cubic centimetres of air 0·00085 milligramme of dry albumen. Translated into volume this 0·00085 milligramme of dry albumen will fall short of a cube, the face of which is $\frac{1}{10}$th millimetre in diameter.

Expressed in English measures, the result is, that rather more than one pint of average atmospheric air does not contain so much organic nitrogenous matter as corresponds to a cube of dry albumen of the $\frac{1}{250}$th part of an inch in diameter.

Now is this quantity adequate to admit of the existence of the immense multitudes of germs, the existence of which in atmospheric air is assumed by the vitalists?

J. ALFRED WANKLYN

Colour of the Sky

WITH reference to Mr. Brett's observations on the colour of sea and sky, I have one or two remarks to offer which I think may be of interest. Smokers have all noticed that the smoke from the end of a pipe or cigar is bluer than that which they puff from the mouth, and many may have wondered, as I did for a long time, what the reason of this could be. The contrast may be well seen on a bright sunny day. This is, in fact, the simplest form of the experiment of the condensation of vapours causing them to pass through a fine blue to a white condition, which Professor Tyndall exhibited about two years ago, and which he employed to explain the blue colour of the sky, and the remarkable polarisation of its light. The finer state of division in the freshly-formed smoke gives it its bright blue colour, as does the finely divided aqueous vapour give to the blue sky; the smoke which has passed through the pipe-stem and mouth has become more condensed, and consequently gives a whiter cloud.

The colour of water is, it appears, to a great degree dependent on the same cause as that of the sky. The investigations which Mr. Brett asks for have been already commenced. M. Soret, of Geneva, soon after Professor Tyndall's researches on the cause of the blueness of the sky were published, made similar researches on the waters of the lake of Geneva, and found that the light from the water, when blue, was polarised as the light from the sky, and, so far, there was the probability of the cause of the colour being similar in the two cases. (See *Comptes Rendus* (Paris), April, 1869.) That particles in a fine state of division are the cause of the blueness of water as well as of sky is also made evident from a comparison of the waters of different lakes, seas, and rivers. There are two popular theories as to the cause of the colour of masses of water, which have very deep root, and yet must, it seems, be abandoned. One is that seas or lakes are blue by reflecting the blue sky. On this ground I have heard Mr. Brett's picture in the Academy this year of a deep blue sea, severely criticised, because the sky, which he has painted with it, is not correspondingly blue, and could not furnish the sea's tint by reflection. Mr. Brett is, however, quite right in his fact, as many people know well enough; and the criticism was misplaced, if the blue colour of a mass of water is dependent on the reflection of light from within water containing finely-divided particles—not from the surface only—as explained above. The second popular theory which seems to be ill-founded is that the green colour of lakes, rivers, and seas is due to plants growing on the bottoms and giving their colour by reflection. The green colour is produced in the same way as the blue in all probability, and may be due to a yellowness of the water in some cases, but it is less easily accounted for than the blue colour. M. Sainte-Claire Deville is quoted by M. Soret as stating that waters which give a white residue on evaporation are *blue*, whilst those which give a yellow residue are *green*. Reflection of the colour of the sky, and of the plant colour from the bottom, does no doubt produce colour of water in some cases, but it is only in shallow pools that the latter can have any effect, or through perfectly smooth surfaces that the former can be effective. Some cases of water-coloration which I have noted will be not out of place here:—1. Intensely blue on a bright day, with pale sky and large cumulous clouds, was the colour of water in reservoirs twenty feet deep at Plumstead, depositing chalk (by means of which the water is softened according to a patent process). 2. Intensely blue (the bluest here noted)—Mediterranean at Marseilles. 3. Bright blue—Lake of Geneva. 4. Darker blue, tending to Indigo—sea near Guernsey; also the Laacher See, in the Eifel. 5. Pale blue—sea near chalk cliffs, being at a little distance from the coast green or greyish. 6. Pale blue or greyish blue—the Rhone, the Mosel, glacier streams, &c. 7. Green—the Rhine, the Scheldt (very markedly so at Antwerp, as testified in Belgian pictures), the Seine, Thames Estuary, &c. 8. Intense green—in patches on the Lake of Geneva; in the evening, when the sun was just below the mountains, more frequently on the Lakes of Thun and Lucerne. 9. Bright green—the sea, on a windy day, with bright sun, off the Isle of Man. 10. The sea round the coral reefs of Florida is said to be intensely green; when away from the coast it is deep blue. 11. On a heavy, clouded day, with rain, gleams of sunshine out at sea give patches of green colour and reddish brown. 12. Water standing in an old copper mine at Killarney was intensely green, whilst the water in the lake at the side was black in the mass. 13. Red colour is produced in some seas by algæ, in others and in some rivers by the breaking up of soil coloured red by iron. 14. Opaque green colour is produced in ponds (Serpentine and ornamental waters) by unicellular organisms, which sometimes swarm in these waters. They may similarly become red. Perhaps the most remarkable instance of blue colour, due to the optical properties of water, is the blue grotto of Caprera, where, at any rate, the reflection of the sky is eliminated. A similar phenomenon is the glorious blue and green of the glacier fissures.

Leaving the question of surface reflection aside, which can only come into play in the case of road-side pools and such mirror-like waters, and also leaving aside the appearance of vegetation in clear shallow streams and ponds, it seems that at the present time we may ascribe the blue colour of masses of water to a peculiar reflection of the light from within the water, accompanied with polarisation, and depending on suspended particles. Blackish, brownish, and yellow colour is due to vegetable matter in solution; reddish brown to iron, sometimes; green, sometimes, to copper or algæ, but the green commonly seen on seas, lakes, and rivers, like that of glacier-fissures, probably admits of a similar explanation to that of the blue. I trust some physicist may be induced to enter into the subject in these pages. Has not the production of a series of tints at sunset an origin which may tend to explain the various tints of blue and green waters? I find that Mr. Sorby in the *Philosophical Magazine*, November, 1867, ascribed the blue colour of the sky and the successive yellow orange and red tints of the setting sun to the absorption of the red rays more than the blue, by the fine aqueous vapour of the higher regions of the atmosphere, and of the blue rays more than the red by the coarser vapours near the earth's surface—as *e.g.* a fog.

The foregoing notes may suggest to others similar observations of greater importance, which it would be interesting to collect. It would be very satisfactory, and of interest to many readers, if some one who could speak with authority on the physics of light, would discuss these phenomena, however suggestively, in your pages.

E. RAY LANKESTER

Poisonous Fishes

IN answer to your correspondent M.D.'s second question in your issue of June 30th, I beg leave to refer him to Dr. Günther's article in this Society's "Proceedings," on a Poison Organ in a genus of Batrachoid Fishes. (P. Z. S., 1864, p. 155.)

Zoological Society of London, P. L. SCLATER
11, Hanover Square, London, W., July 10

Fall of an Aerolite, 1628

YOUR correspondent T. W. Webb may be glad to know that a graphic account of the Aerolite he refers to (NATURE, July 14) as having fallen in Berkshire in 1628, will be found in Vol. II. of Chambers' Papers for the People, published 1850, in an article entitled "Memorabilia of the 17th Century," p. 10. This article also contains many other very extraordinary and well-described accounts of earthquakes, floods, mirages, and various startling atmospheric phenomena which occurred during the 17th century. Amongst the latter the accounts of parhelia, or mock suns, and haloes, and the falls of two or three aerolites, are worth noticing.

Unfortunately, throughout the article the sources whence the various notices have been taken is uniformly omitted.

Alderley Edge, Manchester, July 17 J. P. EARWAKER

Are Jupiter's Cloud-belts due to Solar Heat?

A CIRCUMSTANCE which, so far as I know, has not yet been noticed, seems to me to afford very strong evidence in favour of my theory that the cloud-belts of Jupiter are caused by heat existing in the planet itself. If the cloud-belts were caused by solar heat, they should exhibit a characteristic corresponding to what is observed in the case of the earth's equatorial cloud-zone. "At the equator," Kämtz remarks, "the sun nearly always rises in a clear sky; towards mid-day the heavens are clouded; towards evening the clouds disperse." Now it follows that to an observer regarding the earth as we see Jupiter, there would appear at all times only a fragment of an equatorial belt, near the middle of the disc. But the belts of Jupiter present no such fragmentary appearance; there is a change in their aspect close by the edge of the disc, but the change is one obviously arising from the foreshortening.

Another circumstance also is worth noting. If the cloud-belts of the outer planets were sun-raised, the great tropical belt of Saturn ought to follow the sun as the tropical calm zone of the earth does. The fact that the Saturnian belt remains persistently equatorial is very significant. RICHD. A. PROCTOR

The Rotundity of the Earth

IN your number for July 14th, after publishing an *ex parte* statement, you ask, "Will nothing stop Parallax's mouth?" I hope you will allow me to say, in your next issue, that only one thing can operate in doing so! That one thing is a practical experiment fairly conducted, honestly reported, and logically applied. Your readers will notice that although my signature (Parallax) is appended to the "copy of agreement," it does not appear in the "copy of certificate," and it is proper they should know the reason. It had been agreed that the flags should be fixed in my presence, and that the spirit-level employed should be in good working order and to my satisfaction in every respect. On arriving at the "scene of operations" at the appointed time, I found that the flags had been fixed, and that the spirit-level had been adjusted for some time before my arrival. I immediately protested, and demanded that I and the friends with me should go and measure the altitude of each flag, but an obstinate resistance was offered to this, and also to any interference with the adjustment of the "level." I therefore at once declined to be longer present, and returned to Norwich, where the whole matter was exposed at a public meeting. Notwithstanding the manifest injustice of the attempt, and my refusal to have anything to do with it the moment I discovered its unfairness, these wise and clever and very just Newtonians would have the world believe that they had once and for ever settled the question of the earth's true form and magnitude. Such tricks are unworthy of the cause, and the men who can condescend to deal in them can do no real service to the school to which they belong.

I beg to give the friends of the Newtonian system the following simple challenge: To select six miles of still water, place a boat at one end, with a flag say six feet above the surface of the water. Now, at the other end, let a good telescope be fixed at an elevation of eighteen inches; I affirm that the boat and its flag *will be distinctly visible*; whereas, if the earth is a globe of 8,000 miles diameter, the top of the flag would be more than seven feet below the intervening arc of water. This is my challenge, and let the Newtonians decide that it shall be accepted; saying with me, "let us stand or fall by the result!"

1, Hawley Villas, Chalk Farm Road, PARALLAX
London, July 18

[We print "Parallax's" letter, but we warn everybody against accepting his challenge. Mr. Wallace's treatment at the hands of these gentry shows us what to expect. Let "Parallax" take a good telescope and a return ticket to some seaside place and watch the ships travelling to and fro over the horizon. We offer him space in NATURE to detail his observations, and to explain them, if he can, on any other theory than the received one.—ED.]

Eclipse of the Moon

THE eclipse of Tuesday evening (July 12) exhibited some interesting variations in tint and degree of illumination in different parts of the shadow. There seems to have been a dark spot, perhaps half the moon's diameter, about the centre of the umbra, nearly, if not quite, free from refracted light; outside this a ruddy zone; and beyond this again, to the edge of the shadow, a region strongly illuminated, comparatively speaking, with yellowish pink, as it appeared when projected upon the entering, or yellowish green upon the emerging moon. It is true that just after the commencement, and some little time before the end of the eclipse, the part just within the shadow appeared darker than the eclipsed limb; but this, I think, must have been an optical effect caused by the overpowering light of the uneclipsed portion.

When, however, about two-thirds or three-quarters of the moon's surface was covered, both before and after totality, the illumination of the umbra near its boundary was very conspicuous. The "seas" reflected less light than the other portions, and the regions along the south-limb, and between the north limb and Mare Imbrium, were specially bright. These gave almost the effect of the illuminated cusps of the moon being distorted, and prolonged into the shadow. When the eclipse became total, the eastern hemisphere, about the region of Oceanus Procellarnus, was covered by a dark shade, so dark that the extreme eastern limb was scarcely if at all visible. A short time after totality the moon was quite hidden by clouds, and remained so, excepting occasional momentary glimpses, during which nothing could be seen, excepting that she was visible as a dull, pinkish light, till just before the end of the total phase, when the clouds broke away from her neighbourhood in a marvellously dramatic way. The emerging was wonderfully beautiful; first a strong, greenish light appeared along the eastern limb; this changed to silvery; then bright, full yellow. The eclipsed part was moderately bright, shining with a reddish light, excepting a deeper shade over the western hemisphere. In fact, the appearance was exactly analogous to that at the commencement of totality. I regretted extremely that I had not the opportunity of watching whether the dark spot really traversed the disc from side to side, but I have little doubt that at the time of central eclipse the moon presented a well-marked annular phase.

As the gathering of clouds, and their sudden dispersion at the end of the total phase, seems a striking instance of the supposed influence of moonlight in dissipating vapour, it is perhaps well to mention that after the end of the eclipse, clouds appeared to be again gathering round the moon.

The telescope I used was a $3\frac{1}{2}$-inch refractor, armed with a power of 35. GEO. C. THOMPSON
Cardiff, July 17

Wave-lengths of Complementary Colours

IN applying Mr. Maxwell's observations to the verification of a hypothesis (see NATURE for July 7), Mr. Murphy identifies complementary colours by their *names*, overlooking the fact that the observations themselves afford pretty accurate determinations of several pairs. Separate results are given for two observers in Tables VI. and IX. of the memoir formerly cited by Mr. Murphy (NATURE, April 28), and are laid down graphically in figures 4 and 5. From the latter form of the data, as the more convenient, though no doubt the less accurate, the following formula was obtained by interpolation, for the relation between complementary wave-lengths:—

$$(\lambda - L)(L' - \lambda') = M^2;$$

where λ is a wave-length between 2350 and 2100 (in Fraunhofer's measure); λ' is its complementary between 1820 and 1700; and L, L′, M are quantities differing for different eyes, and having the values

2076	1842	77·9	for observer "K;"
2132·5	1859·4	51·2	for observer "J."

Mr. Murphy's complementaries are not in general really complementary for either observer. Independently of this, Mr. Murphy's probable error is about ·53, that is, over one in 100: the probable error of the formula is certainly under one in 500, between the limits stated. C. J. MONRO

THE APPLICATION OF PHOTOGRAPHY TO MILITARY PURPOSES

MODERN warfare may in many respects be considered as so many applications of science. Not only is war *matériel* designed and manufactured nowadays upon the most approved data, and according to theories worked out with mathematical accuracy, but a large section of our soldiers are educated in such a manner as fully to appreciate the value of their resources, and so to overcome difficulties which years ago would have been regarded as impossibilities. No instance demonstrates this more satisfactorily than the recent Abyssinian expedition, which, whatever may be said of it as a campaign, cannot but be regarded as one of the most wonderful feats of engineering accomplished in modern times. The nearer warfare approaches perfection, the more decisive, and therefore less cruel it necessarily becomes, as witness the brief duration of the wars of late years on the Continent; and for this reason the improvements in warfare effected by science cannot by any means be regarded as a misapplication of knowledge.

Our present remarks bear reference to the applications made of a very modest branch of science, if science, indeed, it can be called, our object being to demonstrate the many uses made by the War Department of Photography. In the special application of this art-science to military matters, our government is certainly in advance of others, if we except, perhaps, that of France. No less than three establishments have been organised in connection with the army in which photography is extensively practised, the most important of them being the General Establishment at Woolwich; but besides these, there are again many Royal Engineer Stations, both at home and abroad, which are furnished with photographic requisites and employ the camera for divers purposes. At Chatham, the photographic establishment assumes the character of a school of instruction, at Southampton it forms an adjunct to the Ordnance Survey Office, while at Woolwich, of which department we desire more particularly to speak, the duties performed by aid of the camera are as various as they are numerous. For registering patterns, recording experimental results, imparting military instruction, and for other purposes too multifarious to enumerate, photography is extensively used, the faithful accuracy of sun pictures, as likewise the facility with which they are produced, causing the art to be eagerly employed in any way where it can be made available.

As an example of the value of photography in instruction, we would cite an interesting series of pictures taken to illustrate ordnance drill. This series comprises upwards of one hundred views, and demonstrates the practical working of the various kinds of guns, mortars, rockets, &c., in the service. One picture, for instance, will illustrate the command "Prepare for action"; a gun will be shown surrounded by a group of artillerymen in the positions they have been instructed to occupy on the issue of that order, each man having his respective number attached to his cap as a distinguishing mark. The next illustration in the series is probably that of "Load," and the next again "Fire," both of which will represent the change in position of the men, as one operation succeeds another, and the various duties performed in turn by each gunner or number, for it must be remembered that in gun-drill every man is told off to a particular number and entrusted with a separate and distinct duty. Thus, on the promulgation of any new system of drill, or of any modification in the method of working, it is merely necessary for the military authorities to forward pictures of this kind to the different instructors, who cannot fail at once thoroughly to understand the new exercise; and even the rawest recruit who had assigned to him a certain number at a gun would see at a glance the exact position he is to occupy by a reference to the photographs.

Another not less striking instance of the importance of photography in this connection may be given. At the outset of the Abyssinian campaign it will be remembered that several thousands of packsaddles were required for transporting war *matériel* into the interior. These packsaddles were made in and sent direct from England to Annesley Bay, so that the troops coming from Bombay knew nothing of their construction, nor of the method in which they were to be packed. This ignorance in the hurry of affairs would have been of serious consequence (for a military packsaddle of the present pattern is a somewhat complicated contrivance) had not the authorities at home been fully alive to the subject and foreseen the threatening difficulty. A mule at Woolwich was harnessed and packed, after some experience had been acquired in the matter, in the most suitable and approved manner, and the animal then carefully depicted by the aid of the camera; the disposal of the harness and trappings and the correct way in which the packages were to be carried, were thus clearly shown in a photograph, numerous copies of which were immediately sent out to Annesley Bay and distributed among the officers of the Quarter-Master-General's department.

In recording experimental results photography again fulfils a duty which could not be discharged so rapidly and impartially by any other means. The stout iron-cased shields and armoured targets built up of metal plates of different thicknesses, and then fired at with shot and shell of all descriptions, are carefully photographed after each decisive experiment, and a record of indisputable accuracy thus obtained. With a picture before us of a target, constructed to represent the side of an armour-plated vessel which has been experimented on, we can at once form an accurate estimate of the impressions made upon the iron wall by shot of different calibres, while rear and side views of the structure will show plainly the amount of damage which the backing or skin of the shield has suffered. As may be imagined these prints form important illustrations to the written reports made from time to time to the War Office authorities.

The photographing of newly adopted government patterns, whether in the shape of guns, carriages, waggons, mantelets, tents, &c., is also an important section of the work undertaken at Woolwich, as likewise that of producing pictures relating to army equipment, such, for instance, as demonstrate the setting up of cooking apparatus, disposal of ambulances, refitting of ordnance in the field, &c. There is, moreover, the pursuit of photo-lithography to be mentioned, by means of which designs and sketches are copied and transferred to stone for printing off in the ordinary manner.

The subject of working photography in the field is a matter to which much attention has been given at the general establishment, for it will be readily conceived that the simplest and most effective methods of working, as likewise the different uses to which the camera may be put during warfare are questions for very serious study.

The photographic copies, many thousands of which are annually produced and distributed over all parts of Her Majesty's dominions, are not now printed upon silver paper in the ordinary way, but by the so-called carbon or autotype process, a method which produces prints of an absolutely permanent character. Ordinary silver prints are always liable to become faded and stained after the lapse of a few years, owing to the presence in the paper itself, or in the atmosphere with which it comes into contact, of sulphur compounds which attack the metallic silver composing the image. In the carbon pictures, however, no silver at all is present, the composition of the image being a mineral pigment in combination with an insoluble chromium.

Our description of the General Photographic Establishment at Woolwich has been very brief indeed, but enough has been said to show to what an important extent the art is employed in connection with the War Office; the department which we have described is a branch of the chemical establishment of the War department, which was first organised, in 1854, by Mr. Abel, and has gradually become intimately and indispensably connected with every branch of the military service.

THE PHYSIOLOGY OF DIGESTION

I. MASTICATION

I PROPOSE in this and the following papers to give an account of the physiology of digestion, or, in other words, to describe the operations to which food is submitted, and the alterations it undergoes, before it is absorbed into the system and becomes adapted to the nourishment of the body.

With this end in view, it will be expedient to divide the alimentary or digestive tract into a series of sections, each comprising a portion in which certain definite and, in general, well-ascertained processes are effected. The first of these is clearly the mouth, where the food, provided it be not already of a fluid nature, is ground to a pulp and mingled with saliva, or, in other words, where it undergoes mastication and insalivation.

In order to prevent the ingestion of substances that, from their temperature, hardness, acridity, putrefaction, or other chemical or physical properties, are inappropriate as articles of food, the mouth, or vestibule of the alimentary canal, is guarded by three sentinels that, were due attention paid to the impressions derived from them, would rarely be found to mislead: *Touch*, possessed to an exquisite degree by the ruddy lips and tongue; *Taste*, possessed by the tongue and palate; and *Smell*, which, though comparatively neglected by man, is constantly employed by animals as a means of discriminating suitable from unsuitable substances.

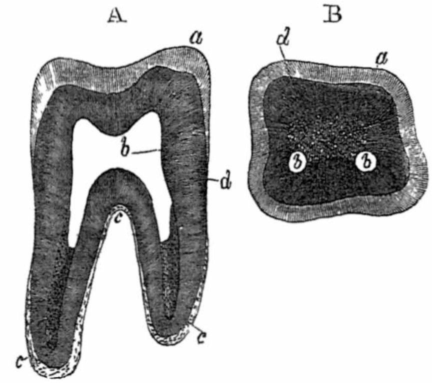

Fig 1—A, vertical; B, horizontal section of a bicuspid tooth, *a*, enamel of the crown; *b*, pulp cavity: *c*, cement of the fangs, *d*, dentine: magnified three diameters.

The act of mastication is designed to comminute the food, and thus to present a larger surface to the action of the several digestive fluids, saliva, gastric and intestinal juices, &c., as well as to render it more readily capable of incorporation with them. It is more important that it should be thoroughly performed in the case of vegetable than of animal food, since the latter is usually of a softer and more succulent nature, besides being already analogous in composition to the body; whilst the nutritive material contained in the former is enclosed in firm cell-walls that are slowly dissolved in the act of digestion, and requires the action of the several fluids to be long continued before it is fitted for nutrition; and it is accordingly found that the means for effecting such comminution is far more complete in the vegetable than in the animal feeders. In a teleological point of view it is interesting to notice that in the infant living on milk, which does not require mastication, no teeth exist till the fourth or fifth month.

Mastication is accomplished by the movements of the jaws, the margins of which are very generally armed with teeth. Amongst Mammalia the teeth are only absent in the whalebone whales, the anteater, manis, and echidna—many rows of small, sharp, hard, epidermal spines situated on the palate and base of the tongue, however, supplying their place in the last-named animal, whilst the two former may be said to live on animal food that is already, in proportion to the bulk of their bodies, extremely comminuted. Teeth are indeed absent in the whole group of Birds, and in the Chelonia, doubtless in the former case on account of their weight, which would interfere with flight, but their place is supplied in both by the cutting beak and in the latter also by the powerful gizzard. They are absent in the toad amongst Amphibia, and in the sturgeon, paddlefish, pipefishes, ammocete and amphioxus amongst Fishes, but are elsewhere constantly found amongst the Vertebrata; they are very frequent also amongst the Invertebrata, though many live by sucking the juices of the animals on which they subsist.

In regard to the teeth of man, it need only here be mentioned that they are twenty in number in the child, and thirty-two in the adult; that the six front ones, namely, the four incisors and two canines in each jaw, are chiefly employed for cutting and tearing the food; and the remaining back teeth, including the four premolars and the six molars, for pounding and bruising it. The teeth are the hardest parts of the skeleton. Four parts may be distinguished in them—(1) the pulp, which, occupying a cavity (*b*) in their centre, is extremely small in quantity, and contains an artery vein and nerve; (2) the dentine (*d*), which forms the greater portion of the tooth and confers upon it its general configuration; (3) the enamel (*a*), which caps the free or exposed surface of the tooth, or that portion which projects beyond the gum; and (4) the cementum (*c*), which invests the fang.

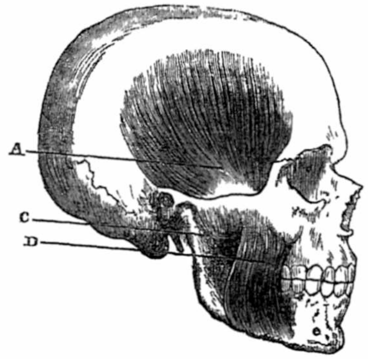

FIG. 2.—View of the external muscles of mastication. A, temporal muscle; D, superficial; and C, deep portion of the masseter muscle.

The Dentine (*d*) is composed of a series of tubes traversing a homogeneous matrix, and extending from the pulp cavity to the outer limit of the dentine. The course of these tubes is undulatory, and they give off numerous branches as they pass outwards. It is difficult to trace their minutest ramifications even with high powers of the microscope. Their interior is occupied by delicate solid threads called dentinal fibres, which, however, it has recently been shown by Neumann are not in immediate contact with the matrix, but are separated from it by a resisting membrane or dentinal sheath. The presence of these fibres accounts for the sensitiveness which it is well known the dentine when exposed possesses, whilst there can be no doubt they are subservient to the slow processes of nutrition which are continuously taking place in even the most superficial parts of these hard organs.

The Enamel (*a*) is composed of a series of six-sided, solid prisms, which contain scarcely more than 2 per cent. of organic matter, but consist almost exclusively of phosphate and carbonate of lime. In the rabbit, rat, squirrel, and all Rodentia, it forms the cutting edge of their chisel-shaped incisor teeth.

The Cement (*c*) is a peculiar kind of nonvascular bone, and though small in quantity and comparatively unimportant in man, enters largely into the composition of the teeth in many of the lower animals. The statement advanced by Jean Jacques Rousseau, on the one hand, that man is a herbivorous animal, and by Helvetius on the other, to the effect that he is carnivorous, both seem to be refuted by the general characters of the teeth, so far as any evidence can be derived from such a source; for in this point of structure man occupies an intermediate position between the Carnivora and the Herbivora, and appears to be adapted for the consumption of both animal and vegetable substances, though doubtless life can be well preserved with a due selection and sufficient supply of either, as we shall subsequently see.

The lining of the mouth is a mucous membrane of considerable thickness, containing numerous glands, and covered with many tiers of tesselated epithelial cells, into the deep surface of which sensitive and vascular papillæ from the membrane itself project.

The movements of the lower upon the stationary upper jaw in man are effected by the muscles, exhibited in Figs. 2 and 3.

They comprise vertical, lateral, and backward and forward movements. The *depression* of the lower jaw is accomplished with considerable rapidity by the contraction of three or four small muscles—the digastric, stylo-genio, and mylo-hyoid—forming the floor of the mouth, the first-named being the principal agent in the Carnivora.

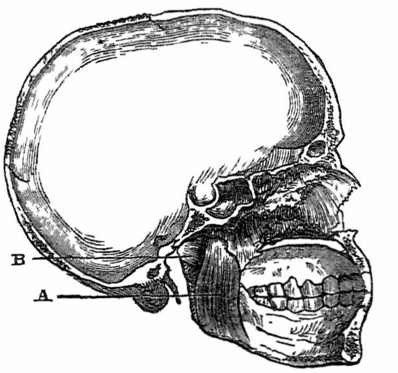

FIG. 3.—View of the internal muscles of mastication. A, *internal* pterygoid muscle; B, *external* pterygoid muscle.

From the position of the joint or pivot on which the lower jaw moves, the front teeth can be nearly twice as widely separated from one another as the back. The difference in the gape of the jaws varies in different people, and to a greater extent than might at first sight be supposed. In some measurements that I have made, I find that whilst the distance between the free borders of the front teeth does not, in some instances, exceed one inch, in others it amounts to upwards of two inches. The segment of a circle formed by the upper is usually somewhat larger than that of the lower jaw. Its *elevation*, which is a far more energetic movement, is performed by the temporal (A, Fig. 2), masseter (C, D, Fig. 2), and internal pterygoid muscles (A, Fig. 3). All these muscles are attached to the jaw between the fulcrum or condyle of the jaw, shown in Fig. 2, just in front of the external opening of the ear, and the weight to be moved or fore-part of the jaw. They therefore constitute levers of the third order; and hence, though acting promptly, are placed at a comparative disadvantage for exerting their fullest force. Still their power is immense even in man, who is again surpassed by many of the Carnivora. It is not easy to estimate it. I have endeavoured to do so, however, by ascertaining the pressure required to crush a Brazil-nut, which seems to be about the limit of the power possessed by young people with good teeth. At least very few can crush the stone of the peach. I find that a weight of about 84lb., but varying from 56lb. to 100lb. is requisite to break a Brazil-nut when placed on one of its flat sides, and this probably is not a very unfair representation of the average power of the three above-mentioned muscles. The lateral movements of the lower jaw are effected by the alternate contraction of the external pterygoids (B, Fig. 3), which are consequently seen in their highest state of development in the Ruminants. They are feeble in man. The forward and backward movements, also feeble, are due, the former to the external pterygoids, the latter to the deep portion of the masseter (C, Fig. 2), the posterior fibres of the temporal and the internal pterygoid.

Another muscle deserves to be noticed—the buccinator—which forms a considerable proportion of the thickness of the cheek, and which is an important agent in preventing the accumulation of food between the teeth and the cheek, the occurrence of which is so troublesome in some cases of paralysis. It is remarkable that all these muscles are supplied by one and the same nerve, the fifth; the last-named, however, receiving some additional motor filaments from the seventh or portiodura.

The movements of the tongue, which are under the influence of the hypoglossal nerve, are of very great importance also in aiding mastication, since its wonderful tactile sensibility enables us to feel for and thrust back between the teeth portions of food which have escaped their action. The centre for co-ordinating the various movements required for mastication appears to be situated in the medulla oblongata.

Having thus considered the mechanical process to which the food is subjected in the mouth, we shall proceed in another article to consider the chemical changes effected in it by the act of insalivation. H. POWER

NOTES

WE have more than once had to notice the liveliness recently exhibited by science at the Antipodes. This has now found expression in the issue of a monthly journal in Australia called "The Scientific Australian," a journal of industry and instruction, specially devoted to those engaged in scientific, artistic, and industrial pursuits, and to the promotion of technological education amongst the operative classes. The editor, Mr. J. S. Knight, Assoc. Inst. C.E., F.R.I.B.A., appears to have enlisted the services of the most eminent scientific men, not only in Victoria, but in the sister colonies of New South Wales, Queensland, South Australia, Western Australia, Tasmania, and New Zealand, and the articles, as a general rule, are to be signed. It is gratifying to find these signs of life in our colonies; we shall watch with interest the career of our contemporary, the first number of which was to be published at Melbourne on the 1st of the current month, and wish it every success.

AT the public sitting of the Paris Academy of Sciences, held on the 11th inst., the following prizes were awarded:—"The Astronomical Prize, Lalande foundation, to Mr. J. Watson, for the discovery of eight new asteroids in one year. The Mechanical Prize, Monthyon foundation, to M. Arson, for his experimental researches on the flow of gases in long conduits. Statistical Prize, Monthyon foundation, to M. Chenu, for his medico-chirurgical statistics of the Italian campaign of 1859-60. Prize established by the Marchioness Laplace, to M. F. A. Voisin. Trémont Prize to M. Le Roux, to aid and encourage him in the pursuit of researches on the index of refraction for certain vapours, and on the measurement of the heat developed by electric currents. Poncelet Prize to M. J. R. Mayer, of Heilbronn, for his memoirs on the mechanical theory of heat; Prize for Medicine and Surgery: a medal of the value of 3,000 francs, to MM. Legros and Onimus, for their works on the application of electricity to therapeutics; a medal of the value of 2,000 francs to M. Cyon, for a similar work. Prize for Experimental Physiology: to M. Famitzin for his researches on the influence of light on the nutrition of plants; a prize of 600 francs to MM. Tripier and Arloing for their discoveries respecting the cutaneous sensitive nerves. Prize for Medicine and Surgery, Monthyon foundation: a prize of 3,000 francs to M. Junod for his MS. work, entitled *Des médications hémospasique et aérothérapique;* two prizes of 2,000 francs to M. H. V. Luschka for his works on anatomy and to MM. Paulet and Sarazin for their treatise on topographic anatomy. Prize for the Unhealthy Arts: two prizes of 2,500 francs to M. Pimont for his *Calorifuge plastique* and to M. Charrière for his life-preservers. Bréant Prize: a prize of 5,000 francs to M. Fauvel for his works on the etiology and the prophylaxis of cholera. Cuvier Prize to Professor Ehrenberg, of Berlin. Bordin Prize, for a monograph of an invertebrate marine animal, divided between M. Marion, author of "Zoological and Anatomical Researches on the non-parasitic imarine Nematoida," and M. A. Wagner, author of a monograph of the *Ancei* of the Gulf of Naples. Jecker Prize to M. Friedel, for his researches on the compounds of silicon corresponding to the compounds of organic origin. Barbier Prize, divided between M. Mirault on the surgical occlusion of the eyelids in the treatment of double ectropion, and M. B. Stilling, for the perfecting of the operation of ovariotomy. Godard Prize to M. Hyrtl, for his researches on the genito-urinal organs of fish. Desmazières Prize, divided between M. L. Rabenhorst for his European flora of fresh-water and marine algæ, and M. A. Hofmann, for his memoir on Bacteria. Thor Prize to M. Bonnet, for his work on the edible truffle. The Mathematical Prize of 3,000 francs, the Damoiseau Prize for the theory of the satellites of Jupiter, and the Medical and Surgical Prize for the application of electricity to therapeutics have not been awarded.

THE monument to Kepler, to which we alluded some weeks since, was inaugurated on the 24th June, with great *éclat*, at his native place, the little town of Weildiestadt, in Wurtemburg. The statue is of bronze, ten feet high, in a sitting posture. In his left hand, supported on a celestial globe, he holds a parchment on which is drawn an ellipse; in his right hand is an open compass; he is looking towards the heavens. The four corners of the pedestal are adorned with statues, five feet in height, representing M. Mastling, the Professor at Tübingen who taught Kepler mathematics, Copernicus, Tycho Brahé, and Jobst Byrg, the mechanician who assisted in the construction of his optical and astronomical instruments. In the centre of the pedestal is the single word, KEPLER; on each side are bas-reliefs, representing different circumstances in his life:—Kepler, at the age of seventeen, entering the lecture-room of Professor Mastling, at Tubingen, who holds the young pupil by the hand, and explains to him the Copernican system; the discussion between Tycho Brahé and Kepler on the system of the world, in the presence of the Emperor Rudolph and of Wallenstein; and Kepler and Byrg in their workshop at Prague, making their first use of the telescope for astronomical observations. The monument is the work of the sculptor, Kreling, director of the School of Fine Arts at Nüremberg; the statues and bas-reliefs were cast and chiselled in the workshops of MM. Lenz and Hérold in the same town; the pedestal of red sandstone, from a quarry in the neighbourhood of Weildiestadt, was constructed by the architect Egle, of Stuttgart.

AT the Working Men's International Exhibition now being held at the Agricultural Hall at Islington, one of the most interesting objects is a reflecting telescope, exhibited by Mr. T. W. Bush, a baker and grocer in one of the more humble streets of Nottingham. It has specula about thirteen inches in diameter, is equatorially mounted, and presents several novel features of construction that are claimed as improvements. Mr. Bush is a self-taught astronomer, mathematician, and mechanic. He has made, without assistance, the whole of the calculations necessary for the construction of the instrument, and has constructed the models for all its parts. With the exception of the prism and some of the more bulky parts, the whole of the telescope, the brass and iron work, the cutting of the sections, the graduation of the circles and verniers, the casting, grinding, and polishing of the metal speculum, the grinding and polishing of the glass speculum, and even the making of the tools and machinery required, have been the work of his own hands. The specula have been tested by Purkiss's process and proved correct, and the telescope has been found to divide satisfactorily such double stars as η Coronæ, ζ Boötis, and ζ Herculis. Its performance on the moon and on nebulæ is also very fine, and it has been used with a magnifying power of 1,400. Unfortunately, Mr. Bush lives in a low situation close to the River Lene, to a canal, and to smoke-yielding factories, and his observations have been hindered by the state of the atmosphere in his vicinity.

ANOTHER object of interest at the same Exhibition is a display of iron, obtained by a process invented by Sir Antonio Brady, from some of that dockyard refuse irreverently described as "Seely's pigs," and which has been the subject of discussion both in Parliament and by the Press. These pigs were of different qualities, but were all largely contaminated with phosphorus and sulphur, and were supposed to be of little or no value. The presence of phosphorus renders iron brittle when it is hot, the presence of sulphur renders it brittle when it is cold. The pigs containing both were worth in the market about 2*l.* 5*s.* per ton. By Sir Antonio's process the sulphur and the phosphorus can be extracted at a cost of about 35*s.* per ton, and the residual iron is superb. It bears any and every test. One of the pieces exhibited had been beaten cold to the thinness of writing paper at one end, drawn to a point at the other, and then twisted by hand eight turns in an inch at a single heating. Massive bars had been beaten cold until the surfaces on each side of the bend came into perfect contact, and a plate six inches wide and half-an-inch thick had been beaten till its edges were in contact, the flat surface remaining horizontal. In neither case were there any traces of a flaw either at the convexity of the curve, where the metal was stretched, or at the concavity, where it was compressed. Holes in a thick plate had been enlarged by driving cones into them, and, in a word, the iron had been knocked about in every possible way. At a very low estimate it is worth 14*l.* per ton, and as there is plenty of the raw material to be had, the profit of the invention seems likely to be great.

WE regret to have to announce the death, at the Villa Pisani, near Lucca, of A. H. Haliday, A.M., of Carnmoney, Co. Antrim, which event occurred on the morning of the 13th July. Mr. Haliday entered Trinity College, Dublin, in 1822, at the age of 15, and graduated five years afterwards as a gold medalist. Shortly after he was called to the bar; but he never practised. He was High Sheriff of Antrim in 1843. As an entomologist his name will always rank with those of his friends, Curtis, Sichel, Westwood, Dohrn, and Walker, while his quiet and retiring manners, and his great scholarship endeared him to a large circle of friends.

WE regret to have to announce the death of the distinguished Anglo-Saxon scholar, Mr. Benjamin Thorpe, which took place on Tuesday last, the 19th inst. Mr. Thorpe was in his eighty-eighth year.

A REPORT which has recently appeared in the papers about Dr. Livingstone, is referred to by Sir Roderick Murchison in a letter to the *Times*. The statement (communicated by Sir Thomas Maclear, late Astronomer Royal at the Cape of Good Hope) was that one Mr. Anderson, commanding a vessel bound from Zanzibar to the United States, had informed Sir Thomas, on or before the 14th of March, that Dr. Kirk, the consular agent at Zanzibar, had informed him that he had had a recent letter from Dr. Livingstone, who was quite well and about to proceed northwards. Sir Thomas Maclear had indeed (the president of the Geographical Society writes) "communicated the same to me; but I at once saw that the story was false, for I had in my possession a letter from Dr. Kirk, of two months' later date than the 14th of March, in which he could give me no information whatever respecting the great traveller. Since then I have again heard from Dr. Kirk at Zanzibar. I have for some time, and in concluding the geographical session, announced to all concerned that for at least eight months we did not expect to hear any definite news respecting Dr. Livingstone, inasmuch as the supplies and carriers to be sent to him and the answers to letters could not be obtained for a long period. I allude to those supplies which were obtained from Her Majesty's Government, and which only left England a few weeks ago."

WE cull this note from the *Pall Mall* and commend it to Mr. Lowe:—"To scientific English ears still tingling from Mr. Lowe's famous declaration as to Government aid to science, part of the proceedings in the Corps Législatif on Thursday last must have been very tantalising. Chapter 29 of the Budget contained an item of 800*l.* to assist Captain Gustave Lambert's expedition for the discovery of the North Pole. M. Stephen Liégeard moved that the grant should be 4,000*l.*, and with the help of a few words from M. Picard his amendment was carried. To be sure it was the day before war was declared. M. Liégeard pressed a good many points into a brief speech. Since 1818 it appears there have been forty-two expeditions in search of this famous mathematical entity, all of which have failed. The three modes of search now urged are—that of Captain Sherard Osborn, by sledges over the frozen ocean (but, says M. Liégeard, what was thought to be a crust of ice is an open sea); the proposal of Augustus Petermann, of Gotha, to follow the route between Spitzbergen and Nova Zembla; and Captain Lambert's, to try the passage through Behring's Straits, which Cook would have done, "had he not fallen under the hatchet of the savages of the Sandwich Islands." It appears further that in the polar region, so fatal to explorers, "there are rich products to conquer—whale oil, fossil ivory, gold, copper, coal, and everything else that 800,000,000 of still unexplored polar hectares can conceal." Captain Lambert has held 200 meetings on this subject, and collected 16,000*l.*, besides subscriptions from chambers of commerce, learned societies, the Emperor (2,000*l.*), and others. The exploring vessel, the *Boréal*, is ready; Captain Lambert, "an intelligent man, full of faith and courage, with a constitution of iron," will leave Paris on the 1st of February next, and in the month of August, 1871, so M. Liégeard says, he will—perhaps to the cry of Ohe! Lambert—"plant the French flag on the prolongation of the terrestrial axis." As for Captain Lambert, we do not wish to damp his courage or rust his constitution, but Voltaire wrote a curious prophetic sentence on the 30th of June, 1760, in a letter to Thiriot;—"Il vaut mieux attendre tout du temps en France que d'aller chercher l'ennui et le malheur sous le pôle."

AT a meeting of the Council of the Society of Arts, held on the 8th inst., M. de Lesseps received from the Prince of Wales the Albert gold medal for "services rendered to arts, manufactures, and commerce by the realisation of the Suez Canal."

THE testimonial to Professor Morris was presented on Thursday last by Sir R. I. Murchison in the rooms of the Geological Society, Somerset House.

L'ABBE MOIGNO makes an appeal in *Les Mondes* on behalf of the Niépce de Saint-Victor subscription, which at present hardly exceeds 400 francs; the widow is in great distress and wants the means for educating her two sons. As his inventions were of equal importance to French and English photographers, it seems fitting that England should bear her share in recognising his services. We shall be happy to receive subscriptions.

THE editorial chair of the *British Medical Journal* is about to become vacant. Candidates are to forward their application to the President of the Council, W. D. Husband, Esq., York, on or before the 30th inst.

IN reference to the recent appointment of Dr. A. R. Simpson to his late uncle's chair of midwifery in the University of Edinburgh, we have received a card with the following statements:—(1) That he had never given a course of lectures on midwifery, or on any other subject; (2) That he had never had a pupil (in the proper sense of the word); (3) That he had never held an hospital appointment; (4) That he had never sent in a single testimonial of his fitness for the chair to which he had been appointed; (5) That he had never written or published any paper that attracted considerable notice. The correctness of these facts being assumed, we can well understand the indignation of the faculty in London at the appointment, especially as one of the most eminent practitioners of this branch of surgery, Dr. Matthews Duncan, was a candidate. The time seems to have arrived when the appointment to Professorships in Scotch Universities should be placed in more competent hands than the Town Council. At the recent election the appointment rested with seven electors, four of them members of the Town Council, three men of distinguished literary and scientific position. The three latter voted for Dr. Duncan, the four baillies for Dr. Simpson, thus carrying the election by a majority of one.

M. CH. LE MAOUT calls attention in two recent numbers of *Cosmos*, to the popular belief that constant firing of guns has a tendency to bring down a heavy fall of rain, a belief which appears to be supported by the experience of the last Austro-Prussian war, the siege of Antwerp, and the battle of Solferino. M. Le Maout suggests that a series of experiments to test the soundness of the theory should be tried at the fortifications of Cherbourg, and at Brest, under opposite hygrometrical conditions, in the one case during a moist south, in the other during a dry east wind.

THE Acclimatisation Gardens in the Bois de Boulogne have just received from Java a fine female Orang, three years old, and larger than any that has hitherto been brought to Europe. It is described as extremely docile, and possessed of such a strong sense of propriety as to wash its bust, arms, and shoulders with soap and water whenever it feels to need it. It is allowed a walk every morning in the gardens, when it displays great activity in climbing to the top of the tallest trees. Its height when standing upright is about that of a child five years old.

THE Government of Nicaragua is trying to develop the waters of the Lake of Nejapa, which are reported to be efficacious in syphilitic affections of the system. The official report on the specimens sent to Paris states that the water is turbid, and contains a quantity of matter in suspension, having the smell of rotten eggs, due to sulphuretted hydrogen. The taste is alkaline. Such is the condition of the specimens in Paris, but in its natural situation the water is inoffensive in odour. The present analysis is therefore considered as capable of modification. The qualitative analysis gives us *bases*, magnesia, soda, potass, lime, iron, *acids*, sulphuric, hydrochloric, carbonic. The quantitative analysis states that 500 grains evaporated gave a residuum of 4·15 grains, which in treatment left, as the contents of each 500 grains of water

Bicarbonate of soda	1·90
„ potass	2·40
Sulphate of magnesia	0·55
Chloride of sodium	0·05
Sulphurets of calcium, iron, &c.	1·25

Although the analysis admits of correction with better specimens, it places the Nejapa water in the alkaline class with those of Vichy and Vals.

MR. G. H. HURLBUT, an American, has been appointed engineer to the Government of the United States of Columbia at a salary of 480*l*. per annum.

A LARGE public swimming-bath is proposed at Calcutta, and meets with support.

IN Bolivia there is great excitement in consequence of the discovery of rich silver mines in the Sierra del Limon Verde, fifteen miles from the small settlement of Calama, and seventy-five miles from the shore, in the maritime prefecture of Cobija. In a short time 150 mining licenses had been taken out at the prefecture, and there was a great rush from Cobija.

THE Queensland Acclimatisation Society have sent a parcel ot seeds to the Peruvian Government. These have been placed in the Lima Botanic Garden, but are said tobe in bad condition. The Peruvian Government has communicated its thanks to H. B. M. Minister, and has directed a corresponding gift to be sent to the Queensland Society. The transaction has had a very good effect.

ANOTHER coal district has been discovered in India by Mr. W. T. Blanford, F.G.S., in the bed of the Hasdo river, just below the village of Korba, in the Bilaspore district. Mr. Blanford is of opinion that the seam is favourable for working, and that it surpasses the Chanda coal, and is in portions equal to that of Raneegunge.

IRON has been rediscovered in Gwalior in large quantities. It was formerly worked, but abandoned on account of the scarcity of fuel.

AT Chicholi in the Central Provinces of India, a vein of silver has been discovered yielding on assay 9oz. 19dwts. 6grs. of silver to the ton of ore.

THE Observing Astronomical Society entered upon the second year of its existence on July 1st. The recent election of officers for the ensuing year has resulted tn the re-election of the former president, treasurer, and secretary and committee. The Rev. R. E. Hooppell, M.A., L.L.D., F.R.A.S., is the president; Mr. William F. Denning, the treasurer and secretary; and the following are the members of the committee: Messrs. S. P. Barkas, F.G.S.,; James Cook, A. W. Blacklock, M.B., H. Michell, Whitley, and Albert P. Holden. The society numbers forty-six members, and was formed for the purpose of aiding the spread of practical astronomy.

THE most recently published part of Martius's "Flora Brasiliensis" is an important one, comprising the ferns of Brazil (orders *Cyatheaceæ* and *Polypodiaceæ*) by Mr. J. G. Baker of the Kew Herbarium. Mr. Baker makes about 250 species; it is to be regretted that at the same time M. Fée had been working at Brazilian ferns from the very same materials in his *Cryptogamie vasculaire du Brésil*, which we have just received; and, following out the practice too much in vogue among Continental botanists, had made a distinct species of almost every slightly different form, thus enormously multiplying their number; his names will claim priority of publication over Mr. Baker's by a few months. The part is illustrated by fifty splendid plates, twenty of them nature-printed by Ettingshausen of Vienna, the remainder representing details of structure and fructification of every sub-genus, large plates of fifteen new and interesting species, and sections of trunks of the arborescent kinds. The *Hymenophyllaceæ*, *Gleicheniaceæ*, and other small orders by Sturm have been published some years; the *Isoetaceæ* and *Equisetaceæ*, by A. Braun, to be published very shortly, comprising only a small number of species, will complete the volume.

THE preparations for the New York Industrial Exhibition are making rapid progress, but it is not expected that it will be pened before the spring of 1872.

THE HARVEIAN ORATION

THE following extracts from Dr. Gull's Harveian oration, delivered at the Royal College of Physicians, on June 24th, form a fitting sequel to the researches of Dr. H. C. Bastian, which we reccently published, on the Spontaneous Generation of Living Things:—

"If it is ascertained beyond all doubt that, in respect of its materials, a living body contains no more than it has received; that, however strange and mysterious its organs and their functions, the warp and woof are of substances with which we are acquainted under simpler conditions, cannot the same be maintained of the forces it exhibits? . . . . It may be objected that there is lurking a kind of *petitio principii* in the supposed relations of simpler forces to their higher forms; that for the conversion of the former into the latter it is necessary to postulate material conditions of a certain kind, and that for the organic conversion we must begin with a living body or its germ; that the boast of the physiologist is like the boast of Archimedes. If he wanted a πõυ στῶ, they require germs or ova and a living body. But it is clear that such an objection has no weight as in favour of a vital force which is not material, since it is abundantly proved that, whatever be the conditions required, they do not generate any power, but only vary the form of it. They who maintain the hypothesis of a separate vital force, independent of the ordinary forces of nature, and which has no essential relation to them, do, by the very terms of the hypothesis, assume that the phenomena in living things are out of the proper range of science, and they consign us to a perpetual mental inactivity and ignorance in that region of knowledge in which above all others man is interested. . . . . An hypothesis, like that of a separate vital principle, which demands so much, which stops inquiry at once, making progress impossible, by removing the steps by which it could ascend, should at least have the highest sanction of our intellect. . . . The dogma 'omne vivum ex ovo,' for the truth of which Harvey so justly contended against the fanciful notions of his age, cannot perhaps be now maintained in its integrity. Whether, to use an expression of that day, living things are ever produced automatically—that is, *de novo*—through putrefaction or otherwise, is, like the question of the limitation or universality of the germ power, still a matter upon which opinion is divided; and as it is my duty on this occasion to exhort you to investigate nature by way of experiment, I must ask you not readily to accept negative conclusions which impose limits where none may really exist. . . . . The time is passing in which the human mind can remain satisfied to rest under the fetters it has imposed upon itself, or to cherish its own phantasms, as if its very existence depended upon them. 'Man knows only what he has observed of the course of nature' is the notorious dictum of science, showing the limit and the mode of the acquirement of our knowledge: the limit as wide as nature itself; and the mode is but readiness to be taught. Notwithstanding, therefore, the adverse decision of schools and dogmas, science still occupies itself with the possibilities of occasional automatic generation. And that it should be so, let it not raise antagonism in the minds of those whose pursuits (inquiries) lie in another direction, since the infinity of nature may well include facts which at first seem to be antagonistic. . . . . We have lately been rather blamed for not gratefully accepting the germ theory of disease; but to this college the theory is not new, and, I think I may add, has not been proved to be true. It will be in the remembrance of many present that in the year 1849 a theory was put forth that epidemic cholera was due to fungi and their germs. Peculiar bodies, it was said, had been found in the rice-water evacuations, and also in the air and drinking waters of the infected localities. It was confidently asserted that we had substantial facts in support of the theory, and that it fulfilled the conditions required of being both true and sufficient. This college thought the subject of such moment that a sub-committee was formed from the Cholera Committee of that day for its investigation. The drinking water of infected places was examined, the air of rooms in which cholera patients were dying was condensed, that it might afford whatever floated in it for examination; dust was collected from cobwebs, window-frames, books, surfaces of exposed food, and every imaginable place, to try it for cholera germs. . . . The supposed germs, when really germs (for many shapes had been included in the supposed direful growth), were found to be spores of known harmless fungi and confervæ, of which, if even the startling number of thirty-seven and a half millions should be contained in about two drachms of water, as quoted by Tyndall, from Mr. Dancer's examination,* it is probable that the whole or repeated units of such millions might be harmlessly swallowed. But for the most part the supposed germs were not germs of any kind, but broken scraps of vegetable and animal tissues, spiral vessels from dried horse-dung, hairs, wings, and legs of insects, detrita of dress, and the like. The results were, in fact, entirely negative of any peculiar bodies to which the epidemic disease could be referred. One general result arrived at at that time, however, agrees with the observation of Tyndall in his recent investigation of dust by a beam of light—viz., that the floating particles in the air are chiefly of an organic nature. This we might have been prepared for, from the specific weight of dried organic material, enabling such dust to float, when the heavier inorganic substances would be deposited. That the infectious diseases spread by emanations from the sick, must have been long known, and that such emanations are of a solid nature, we may infer from the fact that they may be dried and conveyed from place to place; but in what state, whether as amorphous material or as germs, we know no more to-day than was known a thousand years past. No new fact bearing upon the propagation of contagious disease has been reached by the recent investigations on dust; nor can we infer the nature of summer catarrh because the nasal mucus under such circumstances and at no other time, was found peopled by vibriones, since decomposing mucus is always populous with this common race of infusoria. The phenomena of fermentation and putrefaction in dead and decomposing substances afford no explanation of the changes observed in a living body in a fever process. The purulent matter produced in small-pox, is not, as we know, in any way comparable to the yeast formed in fermenting fluids. On the contrary, the microscope demonstrates that the forms, as for instance in variolous pus, are not different from those contained in other purulent and innocuous exudations. Nor have we any reason to conclude that any forms which are observed are germs which convey the disease. It is to be regretted that a confusion in terms has been made. Instead of dust and disease it ought rather to have been dust and putrefaction, or dust and fermentation, since the relation of dust to disease has not been revealed anywhere in the inquiry. That the air conveys the material causes of the infectious diseases from the sick to the healthy, is a notorious fact, which had equal force before these inquiries were instituted, though, owing to the exigencies of social intercourse, a fact more neglected than in times of comparative ignorance. It is difficult to vindicate exactness in progress without seeming to be at the same time a hinderer of it. The onward and the regulating forces of a machine, though not incompatible, but necessary, require the nicest balance. This reflection suggests itself by the way the spread of infectious diseases has been handled. The theories it has given rise to have been so easily put forward as to thereby create distrust. But the spirit of science is no favourer of negations. 'Der Geist der stets verneint' finds no greater friend in medicine than in theology. Still it will be admitted that no progress can be made by the ready acceptance of every proposition, however distinguished the source from which it emanates. The parasitic origin and nature of epidemics *may* be true, but it has yet to be proved. As an hypothesis, it admits of proof or disproof, and so has further claim upon the industry of those who have put it forward as a suggestion. Without going to the length which this hypothesis demands, we must admit, however, that we know enough to uide us much further than we have yet gone in .the practice of prevention."

* Proceedings of the Royal Institution of Great Britain, Jan. 21, 1870.

PROFESSOR TYNDALL'S LECTURES AT THE ROYAL INSTITUTION, ON ELECTRICAL PHENOMENA AND THEORIES

PROF. Tyndall completed a short course of seven lectures at the Royal Institution, on Thursday, June 9th, upon "Electrical Phenomena and Theories," which were made as interesting as all his lectures are, by the ingenuity and completeness of the experimental illustrations; in this particular case the apparatus of his distinguished predecessor, Faraday, being largely drawn up, in addition to considerable accessions of more recent date, many of them derived from the kind help of individuals who have made themselves high reputations in the various branches of Electrical Science. The scope of the Professor's demonstrations covered the entire range of Electrical and Magnetic Science, commencing with the phenomena of voltaic electricity, and passing through the various leading manifestations and peculiarities of electro-magnetism, magnetic force, frictional electricity, electro-chemistry, magneto-electricity, and, of course, electric telegraphy, and the relations of electric motive force to heat.

One remarkable peculiarity in these lectures of Professor Tyndall is, the effective way in which several of the more subtle effects of electrical change and power are made manifest to a large audience by the instrumentality of beams of electric light, manipulated in various ways. Thus, for instance, the elongation of a solid bar of iron, when it is thrown into the magnetic state, by being encircled in the folds of a voltaic current, conveyed by a helix, is shown by the starting of a spot of light, some six or eight inches upon a screen, when the molecular condition of magnetism is excited by the passage of the current. A beam of light falls upon a small mirror, carried at the extremities of the arm of a lever, so resting upon the end of the iron bar, that when the lever is lifted by the magnetic elongation of the bar, the beam of light is shot off from the mirror as a long weightless index. The change in the position of the molecules of iron by the action of magnetism is also proved by throwing the beam through a vertical cell of glass, containing magnetic oxide of iron suspended in water. When the cell is exposed to the influence of the poles of a strong electro-magnetic, the light passing through the cell and contained liquid to a screen beyond, brightens, in consequence of the metallic molecules turning themselves "end on" to the incidence of the beam. The lines of magnetic force assumed, when iron filings are sprinkled over the poles of a magnet, are portrayed by the intervention of a system of lenses, which depicts the image upon the screen. The formation of the "tree of lead" upon the negative electrode of a voltaic current, when a salt of lead is decomposed by the current, is shown in the same way; the arborescent crystals glowing and dissolving alternately on the opposite poles, immersed in the solution as the direction of the current is reversed. The very beautiful colours and patterns of Nohili's rings, formed when lead is thrown down by voltaic decomposition upon a polished plate of steel, are exhibited by a similar intervention of lenses, and the illumination from the electric beam. An artificial telegraph cable, whose resistance to the transmission of the electric current is made identical with 14,000 miles of an actual marine cable, is formed by introducing into the path of the current gaps, consisting of feebly conducting liquids and condensers, so distributed as to represent the respective distances by telegraphic route of Gibraltar, Malta, Suez, Aden, Bombay, Calcutta, Rangoon, Singapore, Java, and Australia. A mirror, belonging to each gap, lies in the path of the currents, carried by a galvanometer, constrained to deflect its needle from the position of both on the instant that the passage of the current is felt. Before the current is sent through the apparatus, ten dots of light, cast from the mirrors by the instrumentality of electric illumination, lie upon the screen, in a straight vertical range. When the current is passed through the apparatus, dot after dot starts aside upon the screen, as the current fills the condenser immediately before each mirror, and then flows beyond to deflect the galvanometer immediately in advance. The deflection of the successive galvanometers, and the corresponding traverse of the beam of light upon the screen, is seen, under this arrangement, to take place at successive steps or intervals, which exactly express the intervals of time which the electric current would require to reach the several stations named, in the actual progress of telegraphy. The starting aside of spot after spot upon the screen when the current is sent through the apparatus, and the subsequent return of spot after spot to the position of original test in inverse order, forms a very striking illustration of the fact that the resistance of an electric cable is in some degree dependent upon its length, and that time is consumed in overcoming this resistance. The most interesting and telling of all these beam-of-light illustrations, however, is certainly the one which is employed to indicate the excitement of diamagnetic force in a tube of copper, when it is suspended between the poles of an electro-magnetic. The tube is carried by a string of silk, and rotates rapidly under the influence of a twist given to the string. The string also carries above the tube a series of small mirrors, which reflect the light of an electric beam, so that a continuous elliptical band of illumination is formed on the screen whilst the twisting is continued. The instant the electro-magnet is made active by the transmission of the current through its helix, the copper tube acquires diamagnetic polarity by induction, and under the influence of this polarity the rotation is arrested, and the band of lights upon the screen is changed into a small stationary spot of illumination. When the electro-magnet is unmade by the arrest of the voltaic current, the spot of light again becomes an elliptical band, under the resumption of the twisting of the silk string with its mirrors and copper tube.

Of the numerous other very pleasing and telling illustrations exhibited in these lectures, space only permits allusion to be made to a very few which have been selected from the series, as being worthy of especial mention. The sound produced by the molecular vibration in iron when its mass is transiently magnetised by the voltaic current, is made audible by suspending an iron poker upon two sounding boards, and making it the core of a helix, conveying an electric current. An assistant is converted into an extemporised electrophorus, by flapping his black coat with fur while he stands upon a glass-legged stool. Small fish of gold leaf are made to float in the air current given off from the knob of a charged Leyden jar. A thick drinking glass is shattered by the expansion of the water contained in it, when sparks formed under the intensifying power of fifty condensers joined "in cascade," and primarily charged by a voltaic battery of one thousand cells, are passed through the liquid. To demonstrate the relation of resistance to heating power, a long line of wire is arranged in alternate links of platinum and silver, and when a voltaic current of due intensity is passed through the length, each stretch of the platinum wire is seen to glow with brilliant red heat, while the stretches of silver wire between remain still invisible. A beautiful series of Geissler's vacuum tubes were brought into successive operation, in which the auroral discharge was broken into stratified leaves, in which the glow was extinguished by the approximation of the poles of an electro-magnet, in which a feeble glow was converted into bright stratified light by the influence of a magnet; and beautiful beyond all the rest, the light from the enclosed negative terminal of the voltaic battery was arranged into the well-known lines of magnetic force, when subjected to the influence of the poles of a magnet.

It would be unnecessary in alluding to these very admirable lectures, to say one word of Prof. Tyndall's clearness and power as an expositor of the phenomena of Physical Science. These are now well known to the hundreds who are attracted to Albemarle Street on the frequently renewed occasions when the Professor performs this portion of his functions as a lecturer of the Royal Institution. It is, however, well worth while to draw attention to a device which the Professor adopts, with the happiest effect, to render his lectures as complete in their instruction as they can be made. He prints a series of well-digested "Notes" of the entire range of the subjects he passes over in each lecture, has them placed in the hands of each individual as he enters the lecture room, and then refers from time to time to the systematic outline, as occasion suggests the expediency of doing so. By this procedure the Professor is able to give full attention and time to each step of his illustrative demonstration, without being hampered with the need of telling everything that he has marked out beforehand—an extremely difficult thing to accomplish in a brief unextensible interval, where *viva voce* teaching has to be employed. Under this management any broken or omitted link in the full argument is readily recovered by glancing the eye over the range of printed notes after the conclusion of the lecture. This plan is well worthy of adoption, wherever popular lectures upon science are delivered to large audiences, with a view to instruction as well as amusement.

ZOOLOGY

Plateau on the Flight of Coleoptera

M. Felix Plateau has supplemented the recent labours of Marey and others upon the flight of insects by examining the movements of the wings of certain Coleoptera. Specimens of the common May-beetle and *Oryctes nasicornis* were selected for experiment. The apparatus used consisted of two pulleys, fastened one above the other, at a distance of two centimetres, on a vertical support; the upper pulley made twelve turns for each one made by the lower, and could be caused to rotate twenty-four times in a second. The insects were killed by ether vapour immediately before each experiment; and the wings could be fastened, by a simple contrivance, to the front prolongation of the axis of the upper pulley.

A wing, in its folded state, was fixed on the instrument in such a manner that its plane made, with the plane of rotation, an angle of 45°, as in the living animal. On turning the pulleys, it struck the air obliquely by its upper surface and front margin; but the small diameter of the apparently continuous revolving disc (as indicated by a graduated scale) proved that the wing was still folded, and that centrifugal force had not affected it. When rotation was produced in an opposite direction, so that the wing struck the air both by its posterior membranous margin and inferior surface, the increasing diameter of the disc gave proof of the expansion of the wing, which, indeed, continued to be much extended when motion was arrested. When the plane of a wing was perpendicular to the plane of rotation, and the revolution of the wheel was such that the wing struck the air by its dorsal or upper surface, no extension ensued; when it struck by its lower surface, only partial extension followed. Now the oblique, not the perpendicular plane is that chosen by nature, and is, as has been seen, much more favourable for flight.

On fixing an open wing on the axis so as to make an angle with the plane of rotation, and turning in one direction, the wing remained open; on reversing the direction (*i.e.* acting on the upper surface) it became partially closed.

SCIENTIFIC SERIALS

In the *Revue des Cours Scientifiques* for July 9, we have an important article on the Axioms of Geometry, by Prof. Helmholtz, which has, however, already appeared in an English form in the *Academy*, and the translation of an article by Mr. E. J. Reed, on *Navires blindés*; while M. Bernard concludes his course on Suffocation by the Fumes of Charcoal. In the number for July 16 there is an address by M. Dumas, delivered before the Academy of Sciences in honour of M. Pelouze, which occupies nearly the whole of the number, leaving room for only a short abstract of M. Bienaymés paper read before the Academy, on the military mortality in the Italian campaign of 1859-60.

Annales de Chimie et de Physique, May, 1870.—"Researches on the Gaseous Products of the Combustion of Coal," by M. A. Scheurer-Kestner. This important paper commences with an historical notice of experiments on this subject by Péclet, Ebelmen, Debette, Commines de Marsilly, Ebelmen and Sauvage, Foucou and Amiguis, and Cailleet, pointing out several causes of inaccuracy which are to be traced in their researches. The author then describes the process employed by him in collecting and analysing the gases from the flue of a steam boiler, Through the brickwork of the furnace a hole was bored, and in it was placed a platinum tube about 700 millimetres long and ten in diameter. To one end of this tube a copper pipe surrounded by a Liebig's condenser is soldered, the other end being closed with a plug. A narrow slit extends the whole length of the platinum tube, so that the air drawn through it is an average specimen of the gas in the flue. It is found also that the gas must be slowly aspirated through the slit in order to obtain a fair average of the gas passing through the flue during a considerable space of time. The author connected the apparatus with a water aspirator, by which he drew $\frac{1}{1000}$ of the total gas which passed up the chimney through the platinum tube; at the same time, from $\frac{1}{250}$ to $\frac{1}{500}$ of the aspirated gas was removed by a branch and collected in a bottle of three litres capacity, from which mercury was allowed to flow very slowly. Thus about $\frac{1}{500000}$ of the gas in the chimney was collected over mercury, and with this the analyses were performed. For the analytical processes we must refer the reader to the original paper, merely pointing out the conclusions at which the author has arrived. The gases of the chimneys were almost always found to contain carbonic oxide and hydrocarbons, even in the presence of oxygen arising from excess of atmospheric air. It was also found that the quantity of carbon lost in the form of smoke in the presence of sufficient air was about $\frac{1}{2}$ per cent., and that the loss of carbon as combustible gases does not exceed 2 or 3 per cent. when the excess of air amounts to 30 per cent. or more. The paper concludes with a section on the theory of the formation of smoke in the presence of an insufficient quantity of air, in which the author discusses the observations of Sainte-Claire Deville on dissociation, and of Berthelot on the action of heat on hydrocarbons, and points out their application to this subject.

To the number for June, 1870, M. P. P. Dehérain contributes an extremely interesting paper "On the Evaporation of Water and the Decomposition of Carbonic Acid by the Leaves of Vegetables." After mentioning the works of previous investigators, he describes the process adopted and the results obtained in his experiments. The leaves were surrounded by a very light flask with a wide and short neck, or by an ordinary test tube in the case of long and narrow leaves, like those of graminiferous plants. The difference between the weight of the globe or tube before and after the experiment gave the quantity of water which was condensed from the leaves. The author finds that the evaporation takes place quite readily, even when the atmosphere surrounding the leaves is saturated with moisture. Different species of plants evolve very different quantities of water under similar conditions, and the proportion of water seems to increase as the size of the leaf diminishes. Thus large leaves of colza evolved between 1 and 2 per cent. of their weight of water in an hour; smaller leaves 11 or 12 per cent., leaves of wheat between 70 and 90 per cent., and of rye between 90 and 100 per cent. In direct sunlight the water evaporated very much exceeds that emitted in diffuse light and in perfect darkness. Thus barley evolved 74·2 per cent. in direct sunlight, 18·0 per cent. in diffuse light, and only 2·3 per cent. in the dark. Numerous experiments are cited to show that this is not caused by heat alone, for when the tube was surrounded with cold water, or even with melting ice, the quantity of water collected was increased, doubtless owing to the more complete condensation of the water. Another series of experiments was made to determine if light of different colours had any influence on the amount of water excreted; and it was observed that yellow light, which also produces more rapid decomposition of carbonic anhydride under the influence of green leaves, is the most favourable to the evolution of water. It has recently been asserted by M. Prillieux that the variations observed when experimenting on the decomposition of carbonic anhydride by green leaves under the influence of light are influenced more by the intensity of the light than by its colour. M. Dehérain has performed numerous experiments with liquids of different colours, but of the same transparency, and shows that the yellow light is the most energetic, then follow red, blue, and finally green.—"On the Determination of Graphite in Cast Iron and Steel." By M. Boussingault. The author treats the iron with corrosive sublimate mixed with water, and heats the residue to volatilise the mercurous chloride. The black substance which is left consists of graphite, amorphous carbon, and silica. This is then heated in the air, the amorphous carbon burns off, and the loss of weight indicates the quantity of carbon in combination with the iron; the residue is next heated in oxygen, so as to cause the combustion of the graphite, which is likewise determined by loss. When the metal is dissolved in hydrochloric acid, the combined carbon is evolved in combination with hydrogen, and part of the silicon present passes into solution.

SOCIETIES AND ACADEMIES

Geological Society, June 22.—Mr. Joseph Prestwich, F.R.S., president, in the chair. Mr. Horace Pearce, 21, Hagley Road, Stourbridge, and Mr. Samuel Spruce, of Tamworth, were elected Fellows of the Society.

1. "Notes on the Lower portion of the Green-slates and Porphyries of the Lake District between Ulleswater and Keswick." By Dr. H. Alleyne Nicholson, F.R.S.E., F.G.S., lecturer on Natural History in the Medical School of Edinburgh. The author describes the characters presented by the lower part of that series of rocks, named by Professor Sedgwick the "Green-slates and Porphyries," which overlie the Skiddaw Slates in the Lake District. He notices the sections of this series in Borrowdale, on the east side of Derwentwater, between Keswick and the Vale of St. John, in the Vale of St. John, in Matterdale, in Eycott Hill, between Ulleswater and Haweswater, and in the neighbourhood of Shap. In the Borrowdale section the sequence of the rocks is given by the author as follows:—Resting on the Skiddaw slates there are (1) a felspathic trap; (2) a great series of ashes, breccias, and amygdaloids, often showing slaty cleavage and worked as slates, but with several intercalated bands of trap; and (3) a second trap. This appears to be a normal section, and is repeated, but diversified by the results of folding and faults in the other localities described by the author, except that in the Vale of St. John the true slaty series seems to be entirely wanting.

2. "Observations on some Vegetable Fossils from Victoria." By Dr. Ferdinand von Müller and Mr. R. Brough Smyth, F.G.S. Mr. Smyth stated that the fossils, of which specimens were forwarded by him, were obtained in one of the deep leads at Haddon, near Smythesdale. No leaves have been obtained from the bed, which consists of a greyish-black clay; the fruits and seed-vessels were obtained about 180 feet from the surface, and represent a flora not very dissimilar to that now characterising some parts of Queensland. The specimens sent include the fruits of a supposed new genus of Coniferæ, described by Dr. von Müller under the name of *Spondylostrobus*. It is most nearly allied to *Solenostrobus*, Bowerbank, but its five valves are not keeled. The columella forms the main body of the fruit; and the seeds are apparently solitary. The species was named *Spondylostrobus smythii*. The remaining specimens consisted of a solitary fruit of a genus of Verbenaceæ; an indehiscent compressed fruit, probably belonging to the Proteaceous genus *Helicia*; a nut nearly allied to the preceding; a large, spherical, unilocular, 3-seeded nut with a thick pericarp, perhaps from a Capparideous plant; a 5-valved capsule of an unknown genus; and fruit-valves of three other plants, probably belonging to the Sapindaceæ, and perhaps allied to *Cupania*. One of the last may belong to the Meliciaceous genus *Dysoxylon*. Dr. Müller considered that these remains indicate a former flora analogous to that of the existing forests-belt of Eastern Australia.

3. "Note on some Plesiosaurian Remains obtained by Mr. J. C. Mansel, F.G.S., in Kimmeridge Bay, Dorset." By Mr. J. W. Hulke, F.R.S., F.G.S. The remains described in this note represent two new species of *Plesiosaurus*. The dorsal vertebræ of the first species are distinguished by extremely short centra, with hollow articular faces. The antero-posterior diameter of 4 centra ranges between 1 and 1·3 inch, the transverse horizontal diameter between 4 and 4·6, and the vertical between 3·8 and 4 inches. For this Plesiosaur the author proposes the specific name of *P. brachistospondylus*. The other species, of which the greater part of the spinal column and portions of the breast and pelvic girdles and limbs are preserved, is a long slender-necked Plesiosaur exceeding 16 feet in length. Its limbs are much larger in proportion to the whole length than in the typical Liassic forms of this genus; but what particularly distinguishes it from these are the massiveness of the humerus and femur, the longer size of the wing-like expansion of the postaxial border, a well-developed trochanter, and especially three articular facets at the distal end of the femur, corresponding to which the second segment of the paddle, representing the leg, contains three coequal bones. The author noticed the impression of a third bone in this segment in the matrix, in which a paddle of *Pliosarurus portlandicus* is imbedded, and the ossicle on the postaxial border of the fibula in *Plesiosaurus rugosus*. He compared the paddle-bones of the Kimmeridge *Plesiosaurus* with those of *Ichthyosauri* and of the Liassic Plesiosaurs and of *Pliosaurus*, he drew attention to the very close resemblance of the humerus and femur to type specimens of the femora of *Pliosaurus brachydeirus* and *P. trochanterius* in the British Museum, and traced a similar resemblance between the elements of the cnemion and tarsus, and those of the Dorchester and Portland Pliosaurian paddles. For this creature, combining a long truly Plesiosaurian neck with Pliosaurian-like limbs, the author proposed the name of *Plesiosaurus manselii*.

4. "Notes on the Geology of the Lofoten Islands." By the Rev. T. G. Bonney, M.A., F.G.S., Tutor of St. John's College, Cambridge. The author described the general appearance of the Lofoten islands, which have commonly been described as composed of granite, but which he stated really consist of gneissic rocks. The scenery of some of the islands, on which he did not land, resembled that of the Cambrian and Cambro-Silurian districts of Wales and Cumberland; and the interior of Hassel showed dark rounded fells, resembling in outline some of the softer Welsh slates. At Stokmarknæs and at Melbo there is a granitoid rock of pinkish-grey colour, consisting of felspar and platy hornblende, with some mica and quartz. The Svolvaer Fjeld in Ost Vaagö shows a distinctly bedded structure in the cliffs near Svolvaer, the *débris* at the foot of which consist of a rock resembling syenite, and a quartzite containing a little hornblende and felspar. Bedding was also observed towards the Oxnæs Fjord. The islets near this coast consisted chiefly of a granitoid rock resembling a syenite, showing traces of bedding to the west of Svolvaer. Seams and veins of quartz, hornblende,

&c., occurred in some of the islets, and these were sometimes too regular to be explained by deposition in fissures. Near the Svolvaer post-office there was gneiss coarsely foliated, containing hornblende and mica, with pink orthoclase felspar. The author concluded, from his observations, that, with few exceptions, the so-called granites of the Lofoten islands are stratified, highly metamorphosed rocks, quartzites, and gneiss, generally with much felspar in the latter, and with more or less hornblende in both, and that they are inferior in position to the gneiss and schists of the mainland, and to the more slaty rocks of the southern and western parts of the same islands. He compares them with some gneiss from Dalbeg on the west coast of the island of Lewis.

5. "On *Dorypterus Hofmanni*, Germar, from the Marl-slate of Midderidge, Durham." By Mr. Albany Hancock, F.L.S., and Mr. Richard Howse. Communicated by Prof. Huxley, F.R.S., F.G.S. The material for this paper consisted of four specimens of *Dorypterus Hofmanni*, which have been discovered by Mr. Joseph Duff, in the marl-slate of Midderidge, and are believed to be the first examples of this fish which have been obtained in this country. The stratum from which they were procured is the same as that described by Prof. Sedgwick in his paper published in the Transactions of this Society (2nd series, vol. iii. pp. 76, 77). The specimens showed that the "ribbon-shaped" process mentioned by Germar is part of a peculiar exoskeleton, and that *Dorypterus* possessed ventral fins, which were situated in front of the pectorals, or "jugular." Hitherto no fishes with ventral fins other than "abdominal" in position have been known to occur earlier than the Cretaceous epoch. The tail is heterocercal, not homocercal, as Germar supposed. The dentition is not displayed in any of the specimens, and the teeth were probably small and inconspicuous; but the general structure of the fish shows it to be most nearly allied to the Pycnodonts.

6. "Observations on Ice-marks in Newfoundland." By Staff Commander J. H. Kerr, R.N., F.R.G.S. Communicated by the Royal Geographical Society. The author describes and tabulates the grooves and scratches observed by him on rock-surfaces in various parts of Newfoundland, especially Conception Bay, the neighbourhood of St. John's, and the north of Bonavista Bay. From the diversity of the direction of the markings and other considerations, he considers that they must have been produced by glaciers, and he believes that the main features of the country were much the same as at present before the glaciation took place. The author thinks that the land has not been submerged since it was freed from its coating of ice.

7. "On the Glacial Phenomena of Western Lancashire and Cheshire." By Mr. C. E. De Rance, F.G.S. The author described the general form of the ground and the preglacial condition and glacial deposits of the districts of Wirral and Western Lancashire, and draws from his observations the following general conclusions. That before and at the commencement of the glacial epoch the north-west of England was more elevated above the sea-level than at present, but afterwards gradually subsided, during which process marine denudation produced the plains of Wirral and Western Lancashire. Part of the latter has since been covered with glacial deposits 200 feet thick. The valleys running in the strike of the Triassic strata appear to have been formed by subaerial agencies. It is probable that when the glacial epoch commenced the hilly country was covered with immense glaciers, or with an ice-sheet, which, as the land sunk, reached the sea. The *High-level lower Boulder-clay* was probably produced by this land-ice. The land continued subsiding until it stood 100 feet lower than at present, submerging the lowlands of Lancashire and Cheshire to a depth of rather less than 25 fathoms, the coast-line being surrounded by an ice-foot, which received on its surface quantities of pebbles and boulders from the lake-district. These, on the breaking up of the ice-foot, were spread over the lowlands, forming the *Low-level Lower Boulder-clay*. The climate then improved, although subsidence still continued, and the sandy and gravelly deposits of the middle drift were produced; these deposits, at whatever elevation they occur, having been found in shallow water during the constant subsidence of the coast-line. The surface of the middle Drift shows traces of what seems to have been subaërial erosion, leading to the supposition that the land must have risen and suffered denudation before that depression during which the Upper Boulder-clay was deposited, at which period the climate again became extremely cold, and fresh glaciers were formed. Before the elevation of the Upper Boulder-clay the climate was greatly ameliorated.

8. "On the Preglacial Deposits of Western Lancashire and Cheshire." By Mr. C. E. De Rance, F.G.S. The author believed that after the deposition of the Esker Drift the country rose to from 200 to 300 feet higher than at present; but in the course of this elevation there was a pause, during which denudation took place, and the low plains, now covered with peat-moss, came into existence. From the consideration of the present depths of the channel between Great Britain and Ireland, the author inferred that an elevation of 200 feet would have caused the coast-line to run from the Mull of Galloway to St. David's Head; and Ireland would have been so connected with Wales as to render possible the migration of mammals, plants, and of man himself. Glaciers probably still persisted in the lake-district during the whole of this period of elevation. During a subsequent subsidence drainage became greatly obstructed, peat was formed, the sea encroached upon the land and worked its way eastward over the sea-bottom of postglacial times, a movement yet in progress. Here and there sand has begun to blow, forming dunes.

9. "Observations on Modern Glacial Action in Canada." By the Rev. W. Bleasdell, M.A., Rector of Trenton. Communicated by Principal Dawson, F.R.S., F.G.S. The author described some phenomena of ice-transport observed in Canada, especially those produced by the flood, anchor, or pack-ice produced in the rapids of the Canadian rivers. To this he attributed the entire disappearance of Crab Island in the River St. Lawrence, near Cornwall. This island occupied about an acre and a half within the memory of men now living; it has now entirely disappeared, and the water above it is gradually deepening. The island, according to the author, has been carried away piecemeal by the action of miniature icebergs, floated off by a rise in the water produced by a dam of anchor-ice below.

10. "On an altered Clay-bed and Sections in Tideswell Dale, Derbyshire." By the Rev. J. M. Mello, M.A., F.G.S. The author describes the sequence of the rocks seen in a quarry in Tideswell Dale as follows:—Beneath a thin layer of surface-soil is a bed of Toadstone, containing concretionary balls, and much decomposed above; beneath this is Toadstone in large blocks of indefinite shape, very hard, dark-green, and apparently doleritic, nine or ten feet thick, passing downwards into a coarse and much decomposed bed, partly amygdaloid, partly vesicular, about one foot thick. Beneath the Toadstone rocks, and without any sharp line of demarcation, is a thick bed of indurated red clay, three yards in thickness, presenting a regularly prismatic-columnar structure, resting on a thin bed of greenish-yellow clay, containing fragments of limestone, which covers beds of good Derbyshire marbles containing corals. The author suggests that the columnar clay-bed may perhaps be a local development of that which forms partings in the limestone near Litton Tunnel.

Brighton

Brighton and Sussex Natural History Society, *Microscopical Section*. June 23.—Mr. Glaisyer, vice-president, in the chair. The subject for the evening was *Infusoria*, by Mr. Wonfor. Every one is aware that if any vegetable or animal substance is placed in water, in a few days the water will be found full of minute organisms, to which the name *Infusoria* or infusion animalcules has been given; many forms, though at first figured and described as distinct species, are now proved to be the early stages of other animals; others have been classed among another group of animals, and a larger number arranged among plants. The class *Infusoria* is much more limited than at one time supposed to be; and further, an increased knowledge might prove that many more were only the early stages of other and higher types of life. Mr. Wonfor then proceeded to point out the nature of their substance, their modes of development, increase, and propagation. So widely were they distributed that scarcely anywhere could water be found which did not contain some *Infusoria*. Many would live only in fresh water, others in salt or brackish water, while others were only to be met with in water containing decomposing vegetable or animal substances. Hence, water contaminated by sewage matter always showed certain types. While some were only to be found in particular infusions, others were common to several. Their appearance, under certain conditions, had led to theories on spontaneous generation, a much debated and debateable point; but as the atmosphere, according to Tyndall and others, appeared to be full of germs, their sudden appearance under favourable conditions was not surprising. The water in which cut flowers were kept was sure to yield some sorts; in fact, he had obtained an abundant supply of one kind from some water in which mignonette had been only three days. The water in bird fountains and in water bottles, if not looked after and frequently changed, would be sure to contain *Infusoria*. The rest of the evening was spent in examining the different forms of *Infusoria* brought for exhibition. Before separating it was announced that the subject for the next meeting in July, would be the "eggs of *Articulata*," *i.e.* of insects, &c.

PARIS

Academy of Sciences, July 4.—M. Serret presented a report upon a memoir by M. Bouquet, on the theory of ultra-elliptical integrals.—M. E. Catalan presented some remarks upon M. Darboux's note on the surface of the centres of curvature of an algebraic surface.—M. Janin read a reply to the observations of M. H. Sainte-Claire Deville, upon the variation of temperature produced by the mixing of two liquids, in which he discussed the theory proposed by M. Deville, and maintained the correctness of his own theory, according to which, he stated, the elevation of temperature of mixtures of liquids may be explained and calculated.—M. H. Sainte-Claire Deville made a few remarks upon M. Janin's paper, and also presented a third memoir on the action of water upon iron and of hydrogen upon oxide of iron, the results of which he sums up as follows :—The increase of tension of the hydrogen formed by the contact of iron and aqueous vapour is a continuous phenomenon when the tension of the aqueous vapour is caused to vary progressively without any change in the temperature of the iron ; the tension of the hydrogen corresponding to an invariable tension of the aqueous vapour decreases continuously when the temperature is gradually increased ; and the same laws are followed in the inverse phenomenon of the reduction of oxide of iron by hydrogen.—A note on a property of Volta's condenser, by M. P. Volpicelli, was read.—Some magnetic observations made at Makerstown, and at Trevandrum, near Cape Comorin, by M. Broun, were communicated.—An extract from a letter from M. Legrand to M. Jamin, on Deluc's thermometers, was read, in which the author stated that the difference between the temperature of the blood given by Deluc, and that now admitted, was due to the difference of atmospheric pressure at which the thermometers were graduated.—A note by M. Amagat, on the compressibility and dilatation of gases, was communicated by M. Balard.—M. Delaunay presented a note by MM. Wolf and Rayet on the light of Winnecke's Comet (Comet I. 1870) in which the authors describe their observations on the very feeble spectrum of that comet.—M. Delaunay also presented a note on the pyramids of Villejuif and Juvisy, the extremities of the geodetic base of Picard and Cassini.—M. Chapelas communicated a note on the spring of 1870, in which he noticed the phenomena of temperature, the direction of the winds, and the amount of rain observed at Paris during the months of April, May, and June of the present year.—M. Daudin communicated a memoir relating chiefly to the drought of the present year, which he ascribed to the prevalence of north-west and north-east winds, caused by some phenomena occurring in the Arctic regions.—M. Janin presented, in the name of M. Fonvielle, a notice of solar halos ; and M. C. Sainte-Claire Deville a note by M. Grad on the climate of Alsace and the Vosges.—M. A. W. Hofmann presented a note on the isomers of the cyanuricœthers in reply to M. S. Cloëz.—A paper on the phosphoplatinic compounds, by M. P. Schützenberger was read, in which the author announced that he had separated the radicals from the chlorine compounds described by him in his former paper.—M. A. Béchamp communicated a paper on the carbonic and alcoholic fermentation of acetate of soda and oxalate of ammonia, in which he described the growth of microscopic vegetation in solutions of those salts, and the production of alcohol thereby, from which he inferred that the synthesis of alcohol is effected by the vegetation, although the constituents of alcohol may not be present in solution. He went further, and stated that the same vegetation produced the same effect even in distilled water !—M. Élie de Beaumont presented a note on the rocks traversed in forming the tunnel between Modane and Bardonnèche in the Western Alps, a distance of 12,220 metres (or nearly 8 miles). The paper includes a long catalogue of the rocks observed, with their depths, which will prove of great value to the geologist.—M. Descloizeaux presented a note by M. C. Velain on the position of the *Terebratula janitor* limestones in the Basses-Alpes ; he referred them to the Neocomian stage, of which he regarded them as the lowest portion.—M. Duchartre communicated a note by M. E. Prillieux, containing an account of some experiments upon the withering of plants, also a note by M. Cave on the generatory zone of the appendages of plants.—M. Chantran presented some interesting observations on the natural history of the Cray-fish, in which he described the mode of copulation of those crustaceans, their oviposition and their changes of skin. The last-mentioned phenomenon takes place fifteen times in the course of the three years during which the animals grow to their adult state.—A note by M. J. B. Noulet contained a statement that in the neighbourhood of Toulouse the house martins all build their nests in accordance with what M. Pouchet calls the old fashion, that is to say, with a small round entrance notched in the upper margin of the nest. The swallows (*H. rustica*), on the contrary, according to the author, build nests resembling those described by M. Pouchet, and M. Noulet evidently considers that the latter naturalist has mistaken the nests of one bird for those of the other. Two physiological papers were communicated ; one on the vitality of the vaccine virus, by M. Melsens ; the other on an unequal production and difference of composition of the milk in the two breasts of the same woman.

PHILADELPHIA

Academy of Natural Sciences, February 1.—Dr. Ruschenberger, president, in the chair. The following paper was presented for publication : "Note on the relations of Synocladia, King (1849), to the proposed genus of Septopora, Prout (1858)." By F. B. Meek and A. H. Worthen.

March 1.—Dr. Ruschenberger, president, in the chair. The following paper was presented for publication : "Descriptions of new species and genera of fossils from the Palæozoic Rocks of the Western States." By F. B. Meek and A. H. Worthen. Prof. Leidy directed attention to a specimen received from the Smithsonian Institution for examination, which he said was the upper two-thirds of the right humerus of one of the extinct giant sloths, and was obtained in Central America by Capt. J. M. Dow. It agrees so nearly in form, proportions, and size, with the corresponding portion of the arm-bone of the *Mylodon robustus* of Buenos Ayres, as described and figured by Prof. Owen, as to render it probable it may belong to the same species. The specimen is unworn, black, not petrified, has no adherent rock matrix, and looks as if it had been obtained from alluvial mud. The interior of the shaft presents a long wide cavity, which might be viewed as the medullary cavity were it not that all the known extinct giant sloths have the limb bones solid. There would perhaps have been less hesitation in deciding as to the character of the cavity, were it not that comparatively recently a reverse condition was observed in a bone where it would not have been anticipated. A short time ago Mr. James Orton, of Rochester, N.Y., submitted for examination a collection of bones from the valley of Quito, Ecuador, S.A. The specimens were obtained at an altitude of 10,000 feet, and from Mr. Orton's account, were imbedded in a cliff of unstratified silt 400 feet in height. Among the bones, besides those of horses, lamas, &c., there was the femur apparently of a Mastodon, but solid or devoid of a medullary cavity. If the hollow interior be the natural condition of the *Mylodon*-like humerus under inspection, it would not belong to *Mylodon robustus*. Independently of the cavity indicated, the bone is sufficiently different in size and form to indicate a different species from the *Mylodon Harlani* of North America. The humerus from Oregon, described by Perkins (Am. Jour. Sci. 1841, xlii. 136), and referred to the latter by Prof. Owen, is not only much larger, but it is of greater breadth in relation with its antero-posterior diameter. The fragment of a humerus from Big-Bone-Lick, Kentucky, represented in fig. 3, plate xiv. of my "Memoir on the Extinct Sloth Tribe," is somewhat smaller than the corresponding part of the Oregon specimen, and is more compressed or wider in comparison with the antero-posterior diameter. Prof. Leidy further observed that there appeared to be a point of some significance in the anatomy of the mandible of *Dromatherium sylvestre* worthy of attention, though the appearance may turn out to be a deceptive one. Prof. Emmons had discovered three isolated rami of mandibles of this most ancient of American mammals in the triassic coal of North Carolina. Of the specimens, one is represented in fig. 66 of Emmon's American Geology, repeated in outline in fig. 650 of Dana's Geology. Another specimen Prof. Emmons presented to the Academy, and is contained in our museum. The point of interest to which reference is made is the apparent absence of a condyle. This process may have been lost, but in the two specimens seen by Prof. Leidy—that figured by Prof. Emmons, and that preserved in our museum—a separation of the process is not obvious.

March 8.—Dr. Carson, vice-president, in the chair. Prof. Leidy made the following remarks :- The reptilian remains from the cretaceous formation near Fort Wallace, Kansas, presented to the Academy by Dr. T. H. Turner, and described by Prof. Cope under the name of *Elasmosaurus platyurus*, belong to an Enaliosaurian, as originally suggested by Prof. Cope. The anatomical characters of the different regions of the vertebral column, those of the shoulder and pelvic girdles, and of the preserved portions of the skull and teeth, are decidedly Plesiosaurian.

March 15.—Dr. Ruschenberger, President, in the chair. The following paper was presented for publication :—"Cross Fertilisation and Law of Sex in Euphorbia." By Thomas Meehan. Mr. Charles Darwin's interesting observations on cross fertilisation have opened a new world for original discovery. The list of plants which seem to avoid self-fertilisation is already very large. I think *Euphorbia* may be added to the number. Certainly this is the case with *E. fulgens*, Karw. (*E. jacquinaflora*, Hook) which I have watched very closely in my greenhouse this winter. Several days before the stamens burst through the involucre, which closely invests them, the pistil with its ovarium on the long pedicel has protruded itself beyond, exposed its stigmatic surfaces, and received the pollen from the neighbouring flowers. The way in which the pollen scatters itself is curious. In most flowers a slight jar or a breath of wind will waft the pollen to the stigmas, but I have not been able to notice any to leave the flowers in this way; for as soon as the anther cells burst, the whole stamen falls from its filament-like pedicel and either drops at once on the pistils of other flowers or scatters its pollen grains by the force of the fall. This *Euphorbia* also furnishes another contribution to the theory of sex which I have advanced. The plan on which the male and female organs are formed is evidently a common one; and the only reason why some flower-heads have a pistil in the centre, and others are wholly staminate, is, that there is greater axial vigour when the female flower is formed. Whenever the common peduncle (below the scarlet involucre) is weak, a pistil never appears in that head of flowers. A few which seem strong neither have them, but the great majority of the strong peduncles are those which bear the female blossoms. Another interesting fact is that the number of male flowers is less in those heads which also bear a female, than in those which are wholly staminate. This seems to add to the point I made in my paper on *Ambrosia*, that after the flowers have been partially formed in embryo, and before the sex has been finally determined, the female flower, being primordially the stronger, has the power of absorbing the males or their partially formed elements into its system. It is certainly remarkable that in both these instances the number of male flowers should decrease in proportion to the existence or vigour of the central female one. The male and female flowers of *Euphorbia fulgens* are formed much alike. the female occupies the centre, and seems really but a prolongation of the main stem, on the top of which is an articulation from which the ovarium springs. The capsula readily falls from this articulation when mature. From the base of the female central peduncle spring weaker peduncles, colourless, appearing indeed almost like filaments, articulated at about the same height as the female, only above the point bearing a short filament and anther—the caduceous part before referred to. No one can fail to see the correspondence of plan in these different parts, and I think that nothing but the favourable position in the direct line of axial vigour made the central flower a female one. Cases occasionally occur in which a tolerably strong head of wholly male flowers will develop the central axis into a pedicel almost as long and vigorous as those which bear female flowers. But the flow of vital force—if I am correct in using this term —not being quite sufficient, the final goal of natural perfection in the female form was not reached. These cases do not occur often, but are well worth looking for, as they show so clearly the dividing line between the forces which govern the male or female sex.

March 22.—Dr. Carson, vice-president, in the chair. The following paper was presented for publication : "Descriptions of Fossils collected during the U.S. Geological Survey under the charge of Clarence King." By F. B. Meek.

April 5.—Dr. Carson, vice-president, in the chair. Prof. Leidy made the following remarks on "Discosaurus and its Allies." The body of the last vertebra in the series of caudals belonging to the Kansas saurian, described by Prof. Cope under the name of *Elasmosaurus*, has the length less than the depth or breadth, which latter is the greater diameter. It is moderately contracted towards the middle, the sides below the neural arch and the surface below the costal articulations being fore and aft concave, and bounded in front and behind by an acute margin from the articular ends. A ridge extends fore and aft between the chevron articulations, and the included surface is concave, and exhibits a single lateral venous foramen. The costal articular processes project from the middle of the side of the body, reaching nearer the fore than the back end of the latter. They are transversely oval, about three-fourths the length of the body, and the height about half. They form a deep concavity, with acute margins extending peripherally. The articular ends of the body are transversely oval and defined from the intermediate portion of the latter by an acute everted margin. A short distance within the position of the latter the surface is marked by a narrow groove, and within the circle of this groove the surface projects in such a manner as to appear like a distinct disc or epiphysial plate applied to and coössified with the body. The surface of the disc is convex at the periphery and moderately concave towards the centre. The articular surface beyond the groove defining the disc appears as an everted ledge, and the triangular articular facets for the chevrons appear as deflections of the ledge. The extension of the latter inferiorly is greater at the posterior extremity of the body than at the anterior extremity, thus producing a larger provision of surface in that position for the articulation of the chevron. The neural arch in the specimen has apparently been so much laterally compressed, that its original condition cannot be ascertained.

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ENGLISH.—Lay Sermons, Addresses, and Reviews: By T. H. Huxley. (Macmillan and Co.)

FOREIGN.—(Through Williams and Norgate)—Essai de Philosophie Positive au xix[me] siécle: A. d'Assier.—Ueber die Chimie des Weines: Dr. C. Neubauer.—L'ancienneté de l'homme: Le Marquis de Nadaillac.—Description physique et naturelle de l'île de Crête, Vols. 1 and 2, with Atlas, Tome i. and ii.; V. Raulin.—Cryptogames vasculaires du Brésil: A. L. A. Fée. Mémoires de l'Académie impériale des Sciences de St. Petersburg, vii[me] série, Tome xv., No. 2, Flora Caucasi, part 1: F. J. Ruprecht.

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