THURSDAY, OCTOBER 11, 1883

THE METAPHYSICAL FOUNDATIONS OF NATURAL SCIENCE

Kant's Prolegomena and Metaphysical Foundations of Natural Science. Translated, with a Biography and Introduction, by Ernest Belfort Bax. (London: George Bell and Sons, 1883.)

THE pages of NATURE are not the appropriate place for the review of works on general metaphysics. The genius and methods of science are so different from those of philosophy that, as their respective histories have amply shown, these branches of intellectual activity are as a rule best kept asunder. But there is at least one important point of contact which cannot be overlooked. And it is just because in the writings of Kant, and particularly in the second of the two treatises which are translated in this volume, that alleged point of contact was formulated for the first time that his work rightly or wrongly demands notice in these pages. As regards the translation, Mr. Bax has done his work with care. He has undertaken simply to furnish a literal and accurate translation of the "Prolegomena" and "Metaphysische Aufangsgründe," and he has fulfilled his undertaking. We should have been glad could he have seen his way to banish such inelegant and inaccurate renderings of "Vorstellung" and "Anschauung" as "representation" and "intuition," and to substitute for them "idea" and "perception," which, despite their vagueness, are English words of intelligible significance. But no one can fail to find in the translation, as it stands, a faithful and consistent rendering of the original.

In an essay on the relation of philosophy to science contributed to a volume entitled "Essays in Philosophical Criticism," I had recently occasion, in conjunction with my brother, to formulate in some detail what are conceived to be not merely Kant's own criticisms of the subject, but certain definite results obtained by the application of the Kantian analysis of the nature of knowledge to some of the methods of science. I mention this circumstance because that essay has undergone vigorous criticism at the hands of Mr. Romanes in a review which appeared in NATURE of August 23 (p. 386), and because the concise and definite objections taken by him *in limine* to the title of the theory of knowledge to criticise certain of the leading scientific conceptions, form a point of application for a review of Kant's teaching.

In the first place it is necessary to state at the outset what the somewhat increasing number of people who read Kant intelligently think about science. That science has justly dominated the region of knowledge generally is for them a truism, and they repudiate in emphatic language any attempt to speculate by *a priori* reasoning upon matters which fall within the province of observation and experiment. Whenever there occurs a question which is really one of fact in nature, that question they recognise as for science alone. But then they say that it is not the faith but the scepticism of men of science which is too small. They ask men of science to consider their general conceptions—to criticise their categories—a little more than they have been in the habit of doing. They doubt whether such questions as the common one whether the phenomena denoted by the word "life" came into existence at a particular time as the effect or creation of some cause or conditions (whether inorganic or supernatural is irrelevant) are really questions of fact. They profess to be able to show that the dilemmas raised in such cases are the result of the application of conceptions which have really no application, and that such dilemmas have as little foundation as that which arises when, to refer to Mr. Romanes' illustration, we ask whether a piece of mechanism is comical or not comical. It is alleged to be the achievement of Kant to have shown that such questions as we have indicated are irrational and absurd, and that their existence necessitates on the part of men of science the possession of philosophical knowledge. Of this class of questions there may be mentioned by way of illustration the general problems of the commencement or non-commencement of the universe or of life in time, and of the existence of an absolutely First Cause, and the validity of a multitude of assumptions in our inquiries into the facts of nature which pass more or less unquestioned.

In the article already referred to, Mr. Romanes peremptorily refuses to accept the result that it is impossible to regard biological phenomena as the effect of mechanical causes, or, more accurately, to find in experience a case of *abiogenesis*. "It is," he says, "the worst form of dogmatism thus to affirm on grounds of metaphysical speculation alone the antecedent impossibility of any discovery in science, most of all with reference to a matter touching which we are so much in the dark." Now this "demurrer to the relevancy" is an *ignoratio elenchi*. Such a question is for Kant not one of discovery in science at all, but a false issue, which discloses its unintelligible and absurd nature whenever we ask ourselves the preliminary question, what is meant by organisation and mechanism. Let us examine more closely the point made by Mr. Romanes. The living organism is derived from one more simple, and the latter from one yet more simple, the process extending back without an apparent limit. Therefore, says Mr. Romanes, it is unscientific to deny the possibility that there may be a case of organisation so simple that it will be seen to be a mere mechanical arrangement. But the series in like manner tends to reach its limit and the curve to touch the asymptotic line, and yet it is neither unscientific nor unwarrantable *a priori* reasoning to show that a coincidence will never be found in experience. We learn what we have here by defining what is involved in the nature of the series and the limit of the curve. Nobody wishes to deny that organisation and the present state of the world generally may have been attained by a process of evolution from a mass of gaseous vapour. What is denied is that it is the same thing or other than an unintelligible statement, to say that organisation is or may have been evolved out of a mere mechanical arrangement. There is a great distinction between these propositions. Science is a process of abstraction in which attention is concentrated on a certain kind or category of relation to the exclusion of other kinds. For instance, in physical science we look only at those dynamical and statical relations which are expressed in time and space, such as causation and reciprocity. Again, in biology

we have before us the facts of organisation and development. But it is one thing to consider a single set of relations, such as those of causation, to the exclusion of the rest, for the sake of clearness of knowledge, and quite another to say that this particular aspect of the object exclusively constitutes it. Mr. Romanes thinks that biologists do not require any transcendental analytic to inform them that an organism is something more than a mechanism. But he finds it startling to be told that in the investigation of an organism we are to rise above the category of causality, and carry into our inquiry the conception of teleology. Surely the latter proposition is the logical consequence of the former. No one says that the category of causation is not to be used in the investigation of the phenomena of organisation. In anatomy, and in its dynamical correlative physiology, the parts of the organism are constantly treated as independent of each other, and related as cause and effect. But this is an abstract point of view employed for a special purpose—the obtaining of measurements—and is qualified by the recognition of the complete conception of the organs as part of a self-conserving whole or system. This is all that is implied by the unfortunate term "teleology" when used in the theory of knowledge. What Kant professes to show is that this fact of nature cannot be reduced to or expressed in terms of the dynamical and statical relations of time and space. No doubt the laws of matter and energy apply in biology as strictly as elsewhere, but they do not express, much less exhaust, biological phenomena. And therefore we must be careful in biology not to distort those conceptions or hypotheses which are, despite assertions to the contrary, the necessary guides and interpreters of observation and experiments by the exclusive employment of categories which, like causation, neither are drawn from, nor are adequate to, the facts. The subject of the detailed effect of the neglect in this reference of Kant's warning I will not pursue here, as my brother has treated it at some length, with special reference to the objections made by Mr. Romanes, in a paper which will appear elsewhere. It ought to be borne in mind, as illustrating the point of view here emphasised, that Kant himself was one of the first to advance the nebular hypothesis. The truth is that, in speaking of the universe as having presumably originated from a mass of incandescent vapour, Kant, and everybody else, so far from reducing life to mechanism, is really raising mechanism to life. Kant would have told us that in the phenomena of such a developing mass there were potentially present all the relations of the universe as we know it. No doubt the approximate conceptions for the advance of knowledge are at this point the laws of matter and energy. But these do not exhaust the object, and if we have abstracted from the others we have done so in just the same way as we have abstracted from fact that the phenomena are there only for a percipient subject.

Such considerations and the doubts they raise may seem remote. But the number of those is increasing who think that they should be better known to and understood by men of science. It will not do to say that such criticism has no bearing on scientific inquiry until it has been ascertained whether its neglect has not already—even in matters of minute detail—misled and stultified certain phases of such inquiry. Fact and theory are not so very easy to distinguish. With scientific method no one wishes to interfere. But we would subject to closer investigation the question whether what are commonly taken to be the legitimate problems of science are really what they profess to be. It is not to the "Hannibals" of science, but to her Don Quixotes that Kant addresses himself.

R. B. HALDANE

LETTERS TO THE EDITOR

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

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

The "Transmission Eastwards Round the Globe of Barometric Abnormal Movements"

THE following questions suggest themselves in connection with the above matter :—(1) Is it a fact that atmospheric movements of such small amplitude take the form of waves, and, if so, that the waves have so slow a rate of travel? (2) How is it to be accounted for that the waves travel eastward more slowly than westward? And (3) How can it be explained that they appear at an eastward station with a greater amplitude than at a westward?

With regard to the first question, it may be said that almost absolute proof of the existence of such waves can be brought forward. A recent investigation, the results of which are not yet published, has shown that a barometric wave measuring from maximum to minimum only ·108 inch, which occurred in Western India in 1877–78, was accurately reproduced over the same region three years later, namely, in 1880–81. The wave at the time of its reappearance had all the larger details which it possessed during its original appearance, these details agreeing in many cases to within less than ·001 inch. But whereas the amplitude in 1877–78 was ·108 inch, in 1880–81 it was only ·048 inch. Waves have also been recognised which appear in the summer half of the year at the northern part of Western India and travel southwards, arriving at the southern parts between two and three months after their appearance in the north; and also waves which appear in the winter half of the year at the south and travel northwards. This movement from north to south and from south to north during alternate halves of the year has been traced regularly since 1869; and indeed is so constant that in many cases it has been possible by means of it to calculate quantitatively the average position of the barometer during the next three months.

The second question was answered in my paper which you were good enough to publish in your issues of the 9th and 16th ult. Owing to the upper air currents travelling from equatorial to higher latitudes, and the lower air currents travelling equatorwards, there must be in high latitudes a general movement of the atmosphere eastwards, whereas in tropical and subtropical regions there must be a general movement westwards. This at once explains why in tropical and subtropical regions the atmospheric waves should travel more rapidly westwards than eastwards.

The third question is a difficult one, and the answer not perhaps quite satisfactory. If it were the case that undulations in fluid bodies become heaped up and increased in amplitude when travelling in a direction opposite to that of a current, and are affected in a contrary way when travelling with the current, a satisfactory answer might be furnished.

But an explanation may be sought in a different direction. If the circumstances of any latitude situated a little way from the equator be considered, it will be noticed that two principal air currents are flowing there—a lower one with a westward component of a certain velocity, and an upper one with an eastward component of a less velocity. Now it may be supposed that these two currents are affected by waves of two kinds, the first being waves common to the two currents, the second being waves which have been generated in the two currents in regions from which they are proceeding. And there are two reasons

why this latter class of waves should affect the barometer more strongly in the case of the current with the eastward component. In the first place that current is proceeding from the tropics, the region in which all great atmospheric movements originate; and in the second place there is a greater mass of matter moving with it than with the other current, there being not only an equal quantity of dry air returning northwards to compensate for that which is flowing southwards, but there being also a considerable quantity of water vapour, which does not return southwards in the form of vapour, but, having been precipitated as rain, returns with the ocean currents. It may not be easy, but still it is perhaps possible, to demonstrate how this fact should explain the greater amplitude of the eastward than of the westward transmitted waves. A. N. PEARSON

Meteorological Office, Bombay, September 4

Apparent Disappearance of Jupiter's Satellites

ON the morning of October 15 next Jupiter will appear to be deprived of the satellites usually attending him. This somewhat rare phenomenon has only been observed on four occasions during the present century, as follows:—

May 23, 1802	September 27, 1843
April 15, 1826	August 21, 1867

In 1826 the disappearance of the Jovian moons extended over an interval of 2 hours; in 1843 the interval was thirty-five minutes; in 1867 1 hour 45 minutes; but on October 15 next the phenomenon only endures 19 minutes (*i.e.* from 3h. 56m. to 4h. 15m. a.m.). The second, third, and fourth satellites will be in transit across the disk, while the first will be occulted by the planet. On August 21, 1867, the first, third, and fourth were in transit, while the second was eclipsed, and afterwards occulted. These occasions offer excellent opportunities for comparing the appearance of the satellites while in transit, and for re-detecting the dusky spots which were formerly distinguished upon them by Dawes, Secchi, and others. On August 21, 1867, I observed the phenomenon with a $4\frac{1}{4}$ inch refractor, and noticed that the satellites appeared nearly as dark and distinct as their shadows while projected on the disk of their primary.

There is a remarkable agreement in the intervals separating this rare occurrence. Between the disappearances of May 23, 1802, and April 15, 1826, there is a period of 24 years less 38 days (= 8728 days), and between those of September 27, 1843, and August 21, 1867, 24 years less 37 days (= 8729 days). The other intervals are irregular, there being 17 years 165 days between that of 1826-1843, and 16 years 55 days between that of 1867-1883. If, however, there is a regularly-recurring cycle of nearly 24 years, as the above dates apparently indicate, after every alternate disappearance of these satellites, then we may expect a repetition of the phenomenon on about September 7, 1907. W. F. DENNING

Bristol, October 6, 1883

The English Viper

IN regard to the English viper, I send a small contribution to the information that Mr. R. Langdon seeks in your issue for August 2 (p. 319). During a residence of more than twenty years on the outskirts of the Forest of Dean, the following facts concerning the adder's bite came more or less under my notice:—

1. A girl was bitten on the thumb, she sucked the bite, and her head, throat, and tongue swelled so much that she nearly died of suffocation and starvation. She was laid up more or less for six months, and folks said that she was never herself again, but became "silly-like," but so far as my memory goes she was but weak minded before the bite.

2. A gamekeeper was bitten on the thick part of the hand. He could hardly get home, and did not leave his bed for three months afterwards.

3. A woman in the Forest was bitten on the thumb, her arm swelled, and became black, but on the application of a herb (which I cannot identify, though she called it "adder's tongue"), the swelling went down at once, and in a day or so no trace of the bite remained.

4. Though the following case did not occur in our neighbourhood, yet as the patient was a family connection, and the details were given me by his mother, I bring it forward. The young man was bitten in the hand, and his arm swelled rapidly to such a size, that the coat sleeve had to be cut open. The youth was ill for many months, and more than a year afterwards had not regained his former mental and physical condition.

5. Cows were often bitten on the legs, but more often on the udder; they never died from the bites.

6. Sheep often died; and lambs, so far as memory serves, did so invariably.

7. A pointer was bitten on the chest. The bite did not bleed, but the dog swelled quickly and could not walk; it was ill for a long time, but did not die.

8. I remember hearing that a little girl had died from the bite of an adder; but I mention the case with little confidence, as it did not come within the limits of my observation.

In 1865 or 1866 adders were more numerous in our neighbourhood than the "oldest inhabitant" had ever known them to be. The farmers were advised to turn their pigs into the fields, and and the result was that wherever the pigs ranged the adders were nearly exterminated. A student of folk-lore would find a wide field in the traditions respecting the adder and its bite. In our neighbourhood the fat of the adder, especially that of the biter, was considered the best antidote for the bite. To roast an adder alive was not only a means of relieving the sufferer, but by making "the varmin squeal" it was said to draw others from their holes, and thus lead to their destruction.

KATHARINE B. CLAYPOLE

THOUGH not precisely in reply to Mr. Langdon's question, yet I add a short postscript to my wife's letter.

In this district we have two venomous snakes, the rattlesnake and the copperhead. The former is now becoming scarce, but the latter is still common. I have never been able to learn that any human being has been killed by the bite of either of these snakes in this neighbourhood. Bites of the rattlesnake are exceedingly rare, but I have known some, and heard of many persons who have been bitten by copperheads.

1. A lady was bitten on the foot at her garden gate; the leg swelled up to the thigh, and was exceedingly painful. She was more or less ill for a week.

2. A boy was bitten on the foot, and the leg swelled and turned black. No remedies were applied for many hours. A poultice of some herb which I have not been able to identify was put on the wound, and in twelve hours more the swelling had gone down, and the boy could walk.

3. In a third case of which I have heard the wound was said to reopen, or at least to become irritable, every year at the date of the bite.

4. A friend of mine had a dog which was bitten by a copperhead. He treated the wound with new milk, but the dog died.

5. In one case of which I have heard a man was bitten by a rattlesnake, but though I do not know the details of the case, the man is still alive.

6. A dog belonging to the friend mentioned above was bitten by a rattlesnake, and treated with new milk. He recovered.

I have heard of and known other cases of snakebite, but similar results followed. The remedies recommended for snakebite are too numerous to mention. Whisky in large doses is the most popular, and it never seems in such cases to produce intoxication. The common remedy—"the fat of the snake that bit you"—is, I suspect, an ingenious device for insuring the destruction of the reptile. It would appear as if the bite of the two snakes which I have mentioned can hardly be as deadly as is commonly supposed. The frequent swelling of the head and tongue appears to me to be caused by sucking the poison from the wound when a sore may have existed in the mouth. Much probably depends on the size and condition of the snake, the time of year, and the place and depth of the bite.

E. W. CLAYPOLE

New Bloomfield, Perry County, Pa., September 3

Solar Halo

I HAD the pleasure of witnessing, this morning, what Mr. Backhouse refers to in the last number of NATURE (p. 515) "as seen on rare occasions—a small portion of an ordinary halo brilliantly coloured."

Looking from a window at 9.40 a.m. towards the south-east, I saw a brilliant patch of light which for a moment I took to be the sun, but which I soon perceived was part of a solar halo, the sun being (roughly speaking) 20° distant in a horizontal line.

The colours were exactly those of the rainbow, especially at

the red end; at the violet the light was so brilliant as to appear almost white. The only clouds at the time were bars of white cirri, and it was across some of these that the halo showed itself. This lasted for eight minutes, and then began to fade as the cirri moved away, but the colours again brightened, and were still visible, even when the sky was apparently clear, although, where the patch of colour remained, very faint cirri could still be perceived behind and through the brightness. At 9.51 the whole had disappeared. The wind at the time was nearly due north. I should like to know whether these solar halos are considered to be produced by ice-crystals in the higher regions. They appear to me quite as prevalent in summer as in winter.

Great Malvern, October 2 E. BROWN

A Remarkable Rainbow

THE phenomenon of supernumerary bows noticed by "L. C." on September 24, has been repeatedly observed and described. Various explanations have been suggested; and "L. C." will probably find what he wants in Archdeacon Pratt's paper in *Phil. Mag.*, 4th series, vol. v. pp. 78–86 (1853).

A. RAMSAY

Meteor

A SPLENDID meteor was seen yesterday (Saturday) evening at about nine o'clock. It passed from the north-east, beneath the Pole star, to the west, where it vanished instantaneously without bursting. The nucleus measured, I should say, at least 5′ of arc in breadth, and was extremely brilliant. A. TAUN

31, Mornington Road, N.W., October 7

A Palæolithic Flake

IT may interest some of your readers to know that I found last week a Palæolithic flake in some gravel at Gray's Inn Lane, where they are now making excavations for sewers. It is a somewhat large, flattish, subtriangular flake of implement-like form, exhibiting a large cone on the plain side towards the butt, and the other side showing several facets; ochreous all over, and somewhat abraded. There is one in the British Museum from this spot, only it is an *implement*, black, lustrous, and spear-shaped, and seems to have come from a higher stratum than the flake before mentioned. Mr. W. G. Smith has an implement from Drury Lane—brought to him by an excavator instructed by him to look for implements at Shacklewell, and while at work at Drury Lane he found one, and, recognising it as an implement, brought it to Mr. Smith. It is subtriangular, worked all over on both sides, blackish indigo, lustrous, and very slightly abraded. These are as yet the only relics of Palæolithic man recorded as found in Central London.

49, Beech Street, E.C. G. F. LAWRENCE

Hop "Condition"

I OBSERVE that it is asserted in a German technical journal that the golden microscopic dust on hops, which English growers call "condition," and in which the finest properties of the hop are supposed to reside, does *not* increase in quantity, as generally it is supposed to do, with the growth of the inflorescence. The quantity on the plants is declared to be as great when the buds are first developed as at maturity. Can any of your readers oblige me with observations or references in point?

H. M. C.

JOACHIM BARRANDE

THE announcement that Barrande has passed away will be received with sincere regret in every quarter of the globe where geology is cultivated. His death severs another of the few remaining links that connect the present generation of workers with the early pioneers of geological science. Born in 1800, he was eventually appointed tutor to the young Duc de Bordeaux. So attached did he become to the royal family of France, that when Charles X. abdicated he voluntarily went into exile, accompanying his young pupil to Prague, which remained his domicile thenceforward to the end of his long life. It was during the early years of his exile that he gave himself to natural history pursuits. In a brief visit to Vienna he came upon a copy of Murchison's "Silurian System," then recently published, and finding some of the fossils therein figured to resemble others which he had himself picked up in Bohemia, he on his return began to look more attentively at the rocks of his neighbourhood. Getting more interested with every fresh excursion, he began to open quarries and employ workmen to search for fossils. In order the more easily to direct their work he laboriously acquired their language. Year after year he continued these researches, devoting to them his time, energy, and fortune. He became the prince of fossil collectors. But at the same time he applied himself with unwearied industry to the scientific study of the fossils and of the rocks containing them. By degrees his labours took shape, and there resulted from them his colossal work, the "Système Silurien de la Bohême," a noble monument of scientific enthusiasm. It was begun as far back as 1852. Since that time no fewer than twenty-two massive quarto volumes of text and plates have been published. Undeterred by the remonstrances of a publisher who would insist on counting the cost and the sale, Barrande was his own publisher, and prosecuted his labour of love down to the end of his life. His numerous separate papers on geological subjects began to appear in 1846, and have been continued to the present time. Living in exile for upwards of half a century, Barrande occasionally visited his native country, and took a keen interest in scientific progress there, but remained an unflinching royalist, refusing to do anything or accept any distinction which might seem to compromise his political principles. He even declined to be nominated a corresponding member of the French Academy. But honours were heaped upon him by the scientific societies of other countries. Due tribute will no doubt be paid to his scientific achievements; for the present we have time only to offer these few lines to the memory of one of the most unwearied and profound students of palæontology, and one of the most upright and honourable of men.

THE SANITARY CONGRESS ON HOUSE SANITATION

A CONSIDERABLE amount of attention was given at the recent Congress of the Sanitary Institute in Glasgow to the question of house construction, and to the evils which are attendant upon the present system under which human habitations are erected both in the metropolis and elsewhere. When it is remembered how large a portion of time the inhabitants of this country are compelled, by reason of climate and otherwise, to spend inside their dwelling houses, it is obvious that the health both of the present and of future generations must be largely dependent on the sanitary condition of those dwellings, and that very earnest consideration should be given, both by experts in matters of building and also by the public themselves, to the sanitary details of house accommodation. And yet it is notorious that houses, which are faulty in almost every particular relating to health, are week by week being run up by hundreds and thousands; that even where money does not enter into consideration the dwelling-rooms of mansions are left without any provision for ventilation whatever; and that both the wealthy and the poor are stricken with disease by reason of the foul air which has been conveyed from the sewers into their homes as the result of arrangements which are, in point of fact, almost always more costly than should have been the more simple appliances which would have prevented the possibility of such an occurrence.

As the law now stands there are certain evils which

cannot be controlled either by any existing statute or under by-laws. Thus, whereas a reasonable width of street may be secured by means of a by-law, there is absolutely no provision to prevent the erection of houses of such a height as effectually to exclude sunlight, and so it comes to pass that windows open, not on to bright, dry, open spaces, but into comparatively narrow thoroughfares which tend to remain damp and imperfectly lighted. Prof. Tyndall's experiments as to the arrestation of infusorial life by solar light should alone suffice to secure for the spaces about our dwellings ample exposure to the rays of the sun, for he has clearly shown that, after infecting certain sterilised infusions and exposing one set where no sun could reach them and another set to the influence of the sun, infusorial life was much more rapidly developed in the former than in the latter; and this notwithstanding the fact that the temperature of the flasks exposed to solar influence was far more favourable to the development of low forms of life than was the case as regards the others. It has also been decided by the law officers of the Crown that the height of rooms cannot be regulated either under any general statute or by means of a by-law. As to this, however, we note that Mr. John Honeyman, a well-known architect, strongly advocated at the Congress the desirability of low ceilings in small houses, alleging that such an arrangement, by inducing economy in construction, facilities for warming, and other incidental advantages, would tend to prevent overcrowding and also add to the comfort of the lower classes. There can be no question that wherever the height of a room is such that the upper portion becomes a mere reservoir for overheated, stagnant, and vitiated air, and whenever adequacy of floor space per head of the occupants is sacrificed on account of an increased cubic space resulting from a high ceiling, then distinct harm results from the loftiness of the apartment; but, due regard being paid to ventilation by means of windows opening nearly up to the ceiling level and other contrivances, a reasonably high apartment has distinct advantages over many of the low ones which are now constructed.

Turning, however, to matters which are well within the control of sanitary authorities, the members of the Congress were unanimous in condemning the present system by which dwelling-houses are now constructed. Thus, instead of covering the ground surface of the sites of new houses with concrete so as to prevent both moisture and effluvia from any neighbouring leaky drain from ascending into the dwelling, the builders round about London and elsewhere either put their brick foundations directly on to the clay or other soil, or else they provide a material which can only be regarded as a make-shift in so far as imperviousness is concerned, and even this is only placed immediately beneath the house walls. Then again, pieces of tarred felt are inserted in the place of adequate damp courses, and so it comes to pass that, within a few months of occupation, the residents are, apart from other evils, exposed to one of the principal predisposing, if not exciting, causes of phthisis. As for drainage, this work can, as soon as completed, be hidden out of sight, and it is notorious how much illness has resulted, and how many lives have been sacrificed, to the want on the part of builders of the most elementary knowledge in connection with the construction and adequate ventilation of house drains.

In dealing with these and other allied subjects, the several speakers paid a tribute of praise to the Model By-laws which have been issued by the Local Government Board, and which in their annotated form fully explain, by means of diagrams and otherwise, how all the various health and other requirements may be most effectually provided. But even where such by-laws have been adopted, we fear they are in many instances not enforced; and evidence was given at the Congress to the effect that the principal offenders are themselves often members of the authorities whose duty it is to see the several provisions carried out. As long as this is the case, subordinate officers can hardly be expected to perform their duties efficiently, and the principal remedies needed are, firstly, by means of congresses, lectures to working men, and such measures, to spread broadcast, and in an easily acquired form, a knowledge as to the elements of house sanitation; and, secondly, a determination on the part of the public to elect as members of local authorities only those who have such knowledge and who will use it for the public benefit.

THE ASTRONOMISCHE GESELLSCHAFT

[From our Vienna Correspondent]

THE meeting of the Astronomische Gesellschaft was held this year on September 14, 15, and 16, in the Academy of Sciences in Vienna. There was a good attendance, and among others present we observed the astronomers Auwers of Berlin, Gould of Cordoba, Pickering of Cambridge, U.S., Elkin of the Cape, Lœwy and Janssen of Paris, Foli of Liége, Gylden of Stockholm, Engstroem of Lund, Oudemans of Utrecht, Foerster of Berlin, Vogel of Potsdam, Gautier, sen. and jun., of Geneva, Thiele and Pechule of Copenhagen, Wagner, Hasselberg, and Dubiago of Pulkova, Bruhns of Leipzig, Wolf and Schönfeld of Bonn, Gruey of Besançon. England was represented by Prof. G. Forbes. The head of the Ministry of Public Instruction in Austria, Dr. Siedler, having welcomed the assembly in the name of the Government, the president, Prof. A. Auwers, briefly addressed the Congress. For the second time, he said, the Congress held its sittings in those halls. The first time they met there they found in this building the old observatory. They now beheld an institution which in magnificence was hardly matched by any other institution in the world and surpassed by none. The President then thanked the Government for their friendly welcome, and the assembly for the large attendance present. The subjects which were the order of the day were then taken up. From the report of President Auwers on the great zone undertaking, it appeared that the observations of all the observatories in connection therewith might be deemed completed, so that next year they would be in a position to enter on the printing of the official catalogue. It was further shown that the preparations for extending this enterprise to the south as far as 23° or thereabout, southern declination, an object which for several years had been in contemplation, were so far advanced that the scheme might now be considered as secured. In the course of the three sittings of the Society a large number of interesting addresses were given and demonstrations made, most of them followed by lively discussions.

Prof. Bruhns spoke on astronomical refractions, and on the formulæ according to which from the observed refraction the law of reduction of temperature in the atmosphere might be determined. Gylden referred to investigations he had made on the subject of the perturbation theory of planets, and to the labours of the Stockholm Observatory towards drawing up tables of planets in accordance with his theory. Prof. Weiss (Vienna) produced the two printed volumes of the annals of the Vienna Observatory, as also the first sheets of his new edition of "The Wonders of the Heavens" by Littrow, and showed drawings of Jupiter and Saturn, executed by help of the 27-inch instrument of the Vienna Observatory, together with drawings of lunar maculæ taken by means of the 12-inch instrument of the same observatory. Photographs of the sun's corona taken in full daylight, sent by Dr. Huggins and laid before the meeting by

Prof. Weiss, were received with much approval. Dr. Elkin reported parallax determinations of southern stars executed by him and Gill at the Cape, especially that of *α* Centauri, which might be fixed at about '75 sec., and that of Sirius, which increased to '4 sec.

Pickering drew attention to photometric investigations carried out at the observatory of Harvard College. Janssen (Meudon) spoke on the observations which had been made in connection with the sun's eclipse of May 6 this year, discussed the photographs of the corona they had taken, and referred to the efforts made by Palisa with a view to discovering an intra-Mercurial planet, efforts which, as was well known, had yielded a negative result. Prof. Foerster gave an interesting account of observations made in the Berlin Observatory, by which he endeavoured to prove that the one ground-pillar of the Berlin Observatory on which investigations had hitherto been conducted had for the last twenty-five years been subjected to angular movements which were connected with the eleven years' period of solar spots. The annual averages of inclinations of the pillar from 1856 to 1881 adhered as closely to Wolf's relative numbers as did the annual averages of the magnetic declination. From these facts Prof. Foerster drew the conclusion that very considerable effects could be traced from the radical changes of the eleven years' solar period. In connection with this communication of Foerster's, B. A. Gould reported how he had made quite similar observations on the sea-coast. Prof. Oppolzer (Vienna) spoke of investigations he had made in the Vienna Observatory with a view to determining the length of the seconds pendulum and the influence of the simultaneous oscillations of the stand. Foli gave an account of his examinations into the daily nutation and precession of the earth and his new tables of precession, and communicated some information regarding the observatory of Liége. Pechule (Copenhagen) sought to refute Stone's assertion that there was a difference of 1½ sec. between the former and the present Julian year, an assertion which had already been declared by Airy to be incorrect. He pointed out where Stone had committed an error in his calculations, and brought forward proof to show that the difference amounted to but four seconds every thousand years. Oudemans (Utrecht) corrected an assertion of Stone's that there was an error of 28 sec. in the reduction from median to sidereal time. Steinheil (Munich) referred to new constructions of telescopes calculated by him, and to the influence of the prism in the case of refracting telescopes on the sharpness of the image, in respect of the achromatism of the images, and to the means by which he counteracted the prejudicial effects in such cases.

On Sept. 15 the members of the Congress visited the Observatory. The astronomers were highly satisfied with the arrangement of the observatory and the system of apparatus. The 27-inch instrument, supplied by Grubb of Dublin, and described in NATURE shortly after its completion, was an especial object of interest. Unfortunately the sky was clouded, so that it was impossible for the astronomers to carry out the observations they had intended with this powerful instrument. In reference to administrative matters we have also to mention Foerster's report on the conclusions of the International Commission respecting Kiel as an international centre, particularly in regard to the contributions of the respective astronomical institutes. On September 16 a social excursion was made to the neighbouring Kahlenberg, and this event was also made the occasion of the baptism of several newly discovered planets; the planet 234, discovered by Peters, receiving the name of Barbara; the three discovered by Palisa (Vienna) being called (229) Adelinda, (231) Vindobona, (225) Henrietta. It was resolved that the next meeting of the Society should be held at Geneva in 1885.

THE NORWEGIAN CIRCUMPOLAR STATION

IT is with pleasure that I respond to the invitation of NATURE to give an account of our labours here during the last twelve months, and I may, in doing so, state that I have purposely delayed writing these lines, in order to be able to give the result of our researches during a whole year.

The Norwegian Government have contributed their share to the international research of the physical conditions of the Polar regions by the establishment of the observatory here at Bossekop in Alten (Finmarken). The station, which is situated at the bottom of the Alten Fjord in 69° 58′ lat. and 23° 15′ long., commenced its labours on August 1, 1882, which are to be continued until September 1, 1883, in accordance with the programme of the Polar Congress held in St. Petersburg in 1881. The equipment and instruments of the station, as well as its whole organisation, are also in accordance with the principles formulated by the Polar Congresses held in Hamburg in 1879, in Bern in 1880, and in St. Petersburg in 1881. The *personnel* of the station consists of the writer as chief, Doctors C. Krafft, sub-chief, J. Schroeter and F. Hesselberg, observers, and Herr O. Hagen, instrument maker and caretaker.

The obligatory observations embrace astronomical observations, readings every hour of the meteorological and magnetic variations, absolute measurements of the terrestrial current's three components, and studies of the aurora borealis. For the hourly observations the day and night have been divided into four watches of six hours each, which are taken by each one in turn.

In order to effect the astronomical observations, *i.e.* the determination of time and place, a small observatory 25 m. in length, breadth, and height has been erected of deals, the roof and the southern and northern walls of which are provided with shutters to be opened during meridian observations. On a fixed pillar in the centre is placed a universal instrument by Repsold, besides which we possess three box chronometers by Frodsham, Kessels, and Mewes, the last named being regulated by star time, as well as two pocket chronometers by Kessels and Bröcking.

The weather during the winter and certain other circumstances have to some extent affected the astronomical observations, so that for the determination of time only a few meridian passages have been observed; but this circumstance is of no consequence whatever, as the station is independent of local determination of the time for ascertaining the absolute time, viz. the common mean time of Göttingen, which has been adopted at all the Polar stations as the common time, and which we receive from the observatory at Christiania through the telegraph office, about ten minutes distant, twice a week, at 9 a.m. on Sundays and 8 a.m. on Wednesdays, Greenwich time.

We have, however, a few meridian passages and observations of time with corresponding sun altitudes, which may be used for the verification of the longitude of the place. The Polar altitude has been verified by the measuring of circummeridian altitudes of the sun and Polaris. The universal instrument has also been employed for the determination of azimuth for the observations of the aurora borealis and the magnetic declination.

Of magnetical instruments we have a set for the determination of the elements of the terrestrial current, viz. a unifilar magnetometer by Elliott Brothers of London, and a Dover inclinatorium, both verified at Kew. The variation instruments, which are constructed on Lamont's principle by Prof. Mohn, and executed by Herr C. Olsen, optician, of Christiania, consist of a variation instrument, a unifilar apparatus with two fixed deflectors for the observation of the variations of the horizontal intensity, and a unifilar apparatus with vertical bars of soft iron as deflectors, whose magnetic moment varies accord-

ing to the changes in the vertical intensity. We have two sets of these instruments exactly similar in construction, of which one is kept in reserve. All the magnetical instruments are erected in the magnetic observatory in the manner shown in the diagram (Fig. 1). This observatory is divided into three sections, and arranged as follows:—Furthest to the east is the variation chamber, which has, in order to make room for both sets of instruments, been made rather large, viz. 7·5 m. long, 5 m. wide, and 2·8 m. high. It has been constructed partly under the earth's surface, the ground having been hollowed to a depth of about 1 m., where the floor has been laid, and the mould cast up along the outer sides of the hut, which have first been covered with birch bark, and in turn by turf. The roof has first been covered with fireproof paper, and then with turf and mould, which gives to the observatory the appearance of a subterranean chamber. The object of this is, of course, to keep the temperature in the room as constant as possible, which we have in fact fully succeeded in doing, as the diurnal variations have seldom exceeded 5° to 6° C., while averagely the temperature during twenty-four hours has only varied from 2° to 3°. The lowest temperature registered in the chamber during the winter was — 3° C. during a high wind, while the highest during the summer was 23° C. Of windows there are none; but lighting is effected by means of four petroleum lamps, which are kept

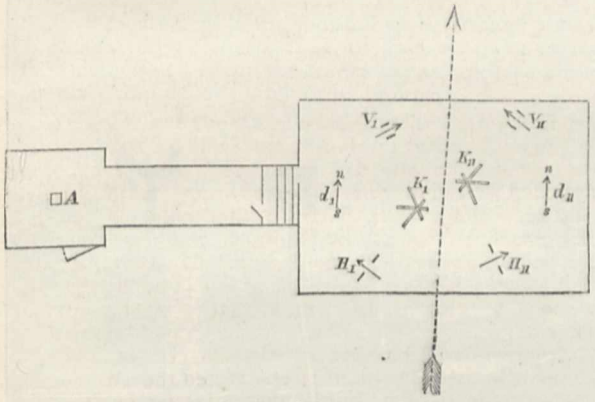

FIG. 1.—Diagram showing the plan of the Magnetic Observatory. d_I d_{II}, variation instruments for the declination; H_I H_{II}, variation instruments for the horizontal intensity; V_I V_{II}, variation instruments for the vertical intensity; K_I K_{II}, the reading telescopes; *A*, pillar for absolute measurements; ⟶, magnetic meridian.

burning day and night, and to the faint heat emitted by these I ascribe the circumstance that the average temperature during the winter was several degrees above freezing-point, and this under an open-air temperature of — 20° C. From the great variation chamber a small ladder leads through an aperture in the western cross wall up into a narrow corridor 5 m. by 1·5 m., which opens into the chamber for the absolute measurements. This is 2·5 m. in length, width, and height, and from this a door leads out into the open, while it is also provided with a small window in the western wall. In the corridor is a partition with a door, in order to prevent as much as possible any change in the temperature in the variation chamber. The building is constructed of rough deals, while the use of iron has, of course, been carefully avoided. The whole has been joined by means of wooden pegs, and the roof-paper fastened with copper nails. The lamps have been hung on brass wire or placed on wooden tripods; while the hinges of the doors are of brass, and the handles of wood.

In the variation chamber eight pillars have been raised of iron-free bricks and cement. These pillars rest on large slates, which have been laid at a depth of about 7 decimetres below the floor, and run free through openings in the floor. The tops of the pillars have a marble slab attached to them, on which the instruments are placed, viz. one on each of the six pillars, and a reading telescope on each one of the remainder.

The needles in the six instruments are exactly alike in size as well as in magnetic moment. They are made of lamellar watch-spring, separated by three small bits of brass, and are about 9 cm. in length. Above the needle, and parallel with the same, a mirror is affixed, from which the image of the scale (paper on spruce wood), placed perpendicularly on the reading telescope, is reflected in the focus of the telescope. Each scale is one metre in length, but even this comparatively great length has, as regards the intensity instruments, been found insufficient during great perturbation, and we have been compelled to lengthen the scale on the side most exposed by adding an auxiliary scale. The scale is divided into millimetres, the distance between mirror and scale being exactly 1719 mm., making the value of the angle of one part of the scale exactly 1′. The reading telescopes of the two sets are fixed on a common vertical axis, the one for horizontal intensity being highest, the one for declination in the centre, and the one for vertical intensity lowest. This is also the order in which the instruments are read, a reading of all three being easily effected in fifteen to twenty seconds.

The regular magnetic variation observations are, as previously stated, effected every hour, seven readings being taken of each instrument. At fixed terms, viz. on the 1st and the 15th of the month, readings are effected every fifth minute, while, during a certain hour of these two days, the variations of the declination and the horizontal intensity are read every 20th second. Magnetic disturbances, some even of great violence, have during the twelve months been the order of the day here. Thus when perusing our "log," one will hardly find five days in average in each month during which the needle has remained completely at rest throughout twenty-four hours. Little jerks or oscillations have constantly occurred, particularly during the night, when the disturbance has generally been greatest, and it has not been an uncommon occurrence that the readings have fallen out on the auxiliary scale, oftenest, however, as regards the vertical intensity.

The zero of the variation instruments is partly controlled by direct simultaneous observations of both systems, compared once a week, and partly by absolute measurements of the three terrestrial magnetic elements effected several times during the month. The unifilar magnetometer is employed for determining the declination as well as the horizontal intensity, the latter embracing both vibratory motions and deflections with the magnet deflector at two different distances. The effect of the torsion on the position of the declination needle is also determined by deflections in the manner advocated by Lamont in his "Handbuch der Erdmagnetismus," § 91. The inclinometer is provided with four needles, of which three are in use, and during the last half year all three have been used during inclinatory observations, which have given results with a pretty uniform difference. As a matter of course, every reading during absolute measurements has been accompanied by a stringent and simultaneous reading of the corresponding variation instruments.

For the study of the aurora borealis we have employed a theodolite which has been constructed by Prof. Mohn, and finished by Herr C. Olsen. The theodolite has an excentrically attached conic tube, which serves as drop. The small ocular end is closed by a disk in which is a circular hole a little larger than the pupil of the eye. The objective end, which forms the basis of the conus, is completely open, with a cross of thin steel wire suspended therein. The one half of the curved surface of the tube, the ocular part, is a solid brass pipe, while the

other half, the objective part, is constructed in open trellis work, partly in order that the wire cross may easily be seen when a lantern is held at its side, and partly on account of the balance. The horizontal as well as the vertical circle, is provided with noninus, whereby 10′ is read directly and 1′ may easily be ascertained. To the horizontal axis belongs a libella, on which each part represents 1′. A massive base of cast-iron—a vertical column with three projectors at the foot, each one with a foot-screw—gives the instrument an exceedingly solid rest, and keeps the due level for weeks when the instrument is not subjected to gales or other violent exterior influences. Our station possesses two such theodolites, while the Swedes at Spitzbergen have three, the Dutch on board the *Varna* two, and Dr. Sophus Tromholt, at Kautokeino, one.

Auroræ have been seen here during the winter almost every night, and during all weathers, thus, even behind cumulo-stratus clouds, oscillating waves of the aurora borealis have at times been observed. Proper measurements have, however, of course only been effected on clear nights. With Dr. Sophus Tromholt, who has, as the readers of NATURE know, from his communications to this journal, during the winter sojourned at Kautokeino specially for his researches on the aurora borealis, we have arranged to measure at agreed periods the elevation of the aurora in the common plane Kautokeino-Bossekop. We have effected a number of such measurements here, which will, I believe, give important results as regards this phenomenon, when compared with those made by Dr. Tromholt. A closer auxiliary station for parallax measurements was also contemplated here, and to this end I had a pillar raised in an open place for a theodolite, about seven kilometres south of our station, but the want of telephonic connection and assistants, I regret to say, prevented this project from being carried out.

The auroral forms or types which have appeared here have been those generally known, from the grand corona to the modest pulsating little luminous cloud, but as a characteristic feature attending them all I must mention

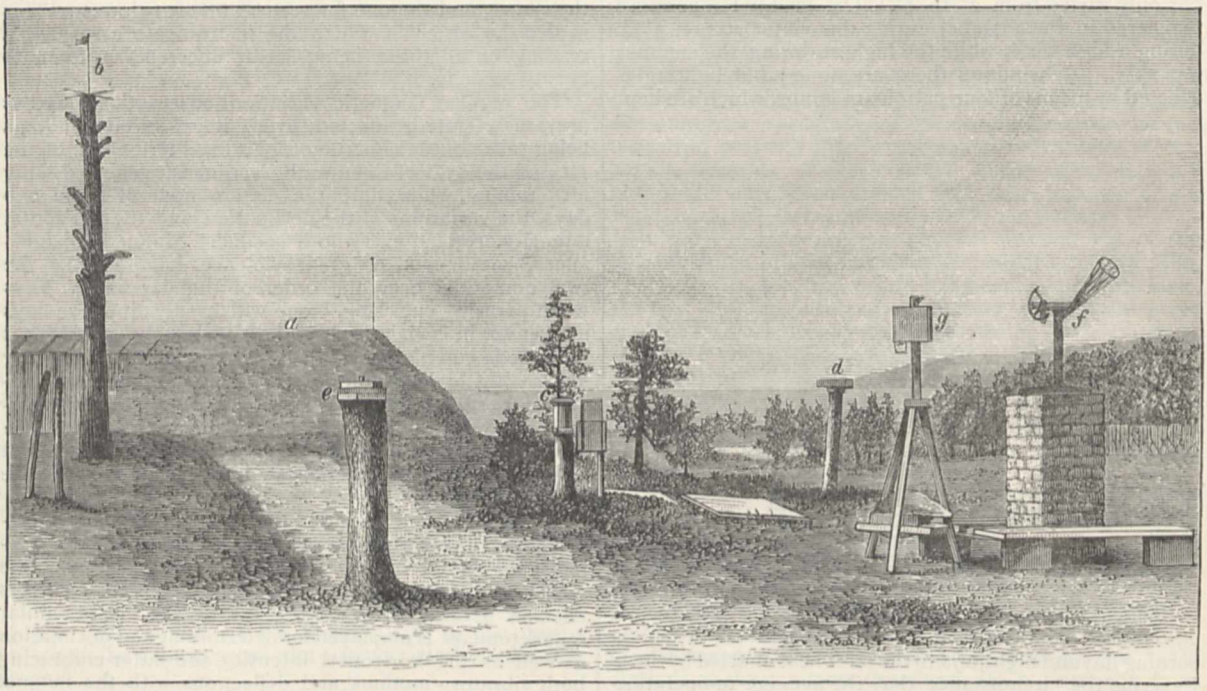

FIG. 2.—The Norwegian Circumpolar Station at Bossekop. *a*, magnetic observatory; *b*, vane; *c*, rain-gauge; *d*, black-ball thermometer; *e*, transit instrument; *f*, auroral theodolite; *g*, instrument for recording the auroral observations.

the absence of stability in the types. Thus only on a few occasions has there been an opportunity of watching the quiet stationary arc, but in general the auroræ have represented wafting draperies and shining streamers with ever-changing position and intensity.

As often as there has been an opportunity, spectroscopic researches have been effected with a Wrede's spectroscope. The well-known yellow-green auroral line has always been observed, and on one occasion also the red, the position of which we succeeded in fixing approximately in the spectroscope.

The meteorological instruments with which we have been furnished are similar to those in use at the meteorological observatory in Christiania. A Kew station-barometer (Adie) is employed at the hourly observations, while a Fortin barometer (Secretan) serves as normal and control barometer. Generally a few times a week both barometers, which hang parallel in the office of the station, are compared. As a reserve instrument we have an aneroid, but this we have fortunately had no need of using.

For the protection of the thermometers we have erected a wooden cage on four poles facing the north, with blinds, a double back wall and a roof, exactly in conformity with Wild's model. In the centre of the cage is the actual thermometer box placed, of sheet iron and with a free circulation for the air, in which is to be found dry and wet thermometers (divided into 0°·2 C.), as well as maximum and minimum ones. All the thermometers, which were manufactured by Aderman of Stockholm, have several times during the winter been examined as to the stability of zero, which has always been found perfectly correct. Besides these a black-ball thermometer has during the summer been erected, and read several times a day. Psychrometer readings have on some occasions been controlled at low temperatures by observations with Allnard's modified form of Regnault's hygrometer (Golaz, Paris), while absolute determinations of moisture

through weighing have been attempted by Dr. Krafft with a chemical weight (Bunge), however without result, caused chiefly by the circumstance that he was unable to give the instrument the proper rest. The observations of the directions of the wind have been made by a weather-cock fixed on the top of a stripped fir tree, the force being registered by Beaufort's scale, and the velocity partly by Mohn's hand thermometer, which are used during the hourly observations, and partly by means of a Robinson anemometer placed on the roof of the dwelling-house, which is read once in twenty-four hours. Further, one of Hageman's anemometers is erected in the office, from which the conductor, made of indiarubber and lead pipes, is carried outside the house and along the flagstaff in such a manner that the absorbing point or tube is situated a couple of centimetres above the knob of the same. The observations with this anemometer have, however, not given so satisfactory results as might have been expected from my experiences in other places. The cause of this is no doubt the circumstance that the instrument used was not a new one, and consequently, perhaps, not very sensitive, while the position was, we found, not the most advantageous. On the bare ground we have placed two rain-gauges—the one square and the other round—with a receiving surface of 225 square cm. each. The rainfall here is very small, averaging only 267 mm. per year, but during the past twelve months it has been rather less.

The measurement of the snowfall we have found almost an impossibility, on account of the frequent gales during the winter, which sweep the snow away as quicksand from one place and deposit large drifts in others.

Every month measurements of the temperature of the sea have been effected, in the Alten Fjord, with one of Negretti and Zambra's deep-sea thermometers. The depth is 100 English fathoms, and the temperature read at every tenth fathom. We have during these researches discovered that from the bottom and 10 to 20 fathoms upwards the temperature keeps constant throughout the year, whereas in the layers above this depth some very interesting variations occur with the seasons.

Last winter here has been milder than we anticipated, the lowest temperature registered being $-21°{\cdot}7$ C., which was read by the minimum thermometer at 8 a.m. on December 31, 1882. Under high wind such a temperature is unpleasant enough, and with gales we have several times been favoured. Thus, on October 5 the velocity of the wind under a storm from the north-west was 26 metres per second, and on later occasions the anemometer has not seldom shown a velocity of from 10 to 20 metres per second.

Our labours at this station are now approaching their completion, and it is satisfactory to me to be able to state that no accident has occurred to our instruments, the accuracy of which has been controlled throughout in various manners, and that the scientific researches have been continued during the entire year without a single interruption.

What the ultimate results of our researches during our sojourn here will be it is of course at the present moment an impossibility for me to state, but I feel confident that, when all the materials of research have been collected from the various circumpolar stations and compared, it will be found that the Norwegian station at Bossekop has formed an important link in the chain of international meteorological research around the Pole. AKSEL S. STEEN

Bossekop, Finmarken, Norway, August

A NATIONAL LABORATORY OF MARINE ZOOLOGY

IT is pretty well understood that the Executive Committee of the London International Fisheries Exhibition of 1883 will have a sum of money in hand when all expenses connected with the Exhibition are paid, amounting to some thousands of pounds. The gentlemen who have organised and carried through this very successful enterprise are to be congratulated on the popularity which has attended the Exhibition and on the amount of interest which they have excited in all classes of the community in matters relating to our national fisheries. Not only this, but the Committee deserves hearty thanks for the valuable series of pamphlets on subjects connected with fisheries which it has printed and circulated far and wide. These pamphlets are for the most part reports of lectures delivered by highly competent specialists at the "Conferences" inaugurated by Prof. Huxley under the presidency of the Prince of Wales, and amongst them are such important essays as that of Prof. Hubrecht on oyster culture, of Dr. Day on the food of fishes, of Prof. Brown Goode on the fishery industries of the United States, and of Mr. Duff on the herring fisheries of Scotland.

It is not surprising that at the present moment suggestions should be offered from various sides to the Exhibition Committee with reference to the best use of the surplus funds in its hands. No one will pretend for a moment that the Committee has not the full right to make what use of those funds it may deem most fitting; and the public has every reason to feel confidence that the ultimate decision of the Committee will be made with the intention of doing what is best for the national interests bound up with our fishery industries. At the same time it is a legitimate thing for men of public position and responsibility to place before the Committee suggestions as to useful modes of employing the surplus funds in its hands. Accordingly we note with satisfaction that a number of our leading biologists, whose opinion upon this matter is certainly entitled to very great weight, have placed before the Committee a suggestion for the foundation of a laboratory upon the British coast, which shall be devoted to the study of marine animals and plants in relation to fisheries. A similar proposal has also been independently placed before the Exhibition Committee by the executive of the British Association for the Advancement of Science.

It is a very striking fact that the one point in which all speakers at the Conferences held during the past summer at the Exhibition were agreed was this: that our knowledge of the habits, time, and place of spawning, food, peculiarities of the young, migrations, &c., of the fish which form the basis of British fisheries, is lamentably deficient, and that without further knowledge any legislation or attempts to improve our fisheries by better modes of fishing, or by protection or culture, must be dangerous, and indeed unreasonable. Prof. Brown Goode, the United States Commissioner, declared at the Conference on July 20 that "the spread of actual scientific knowledge concerning fish and fisheries was one of the things which, above all others, would be the most profitable and satisfactory outcome of this Exhibition." At the same Conference Prof. Hubrecht, the Netherlands Commissioner, said that "he endorsed from the bottom of his heart the principle that there must be inquiry, and still further inquiry, before legislation based on scientific and accurate principles could be carried out. They must take as a motto, more knowledge, more science, more zoology." On the same occasion the Duke of Argyll referred to the suggestion which had been submitted to the Conference to the effect that the foundation of a laboratory of marine zoology might well be undertaken by those who had organised and carried out the International Fisheries Exhibition. Speaking with the authority of one well acquainted with the Scotch herring fisheries, as well as with the knowledge of an accomplished naturalist, he stated that in his judgment this suggestion was a most important one, which he hoped would be brought forward in the proper quarter, and that he should give all the help he could in the matter.

The memorandum which we print below briefly sets forth the proposal as now submitted to the Executive Committee of the Fisheries Exhibition. It has been signed by the following naturalists:—Sir John Lubbock, Mr. P. L. Sclater, Prof. Jeffrey Bell, Prof. Michael Foster, Prof. Burdon Sanderson, Prof. Flower, Prof. Allman, Prof. Richard Owen, Dr. G. J. Romanes, Prof. Lankester, Prof. Moseley, Dr. Carpenter, Mr. John Murray, Mr. Thiselton Dyer, Prof. Milnes Marshall, and Mr. Adam Sedgwick. The absence of the names of one or two influential zoologists from this list is explained by their official connection with the Exhibition, which has rendered it undesirable to ask them to commit themselves in reference to a question in the consideration of which they will ultimately have the greatest responsibility and weight.

The memorandum runs as follows:—

Proposal for the Foundation of an Observatory on the British Coast for the Study of Marine Animals and Plants in relation to Fish and Fisheries.

The value to the fish industry of an increased knowledge of the habits and life-history of fishes has been proved by the experience of the American and French Commissions. Without such knowledge we cannot improve our fisheries commercially; with it, there is every probability that a great deal may be done in the way of controlling and extending them. In order to gain accurate knowledge as to the circumstances which affect the life of fishes, and the various mollusks, shell-fishes, corals, and sponges, which are important commercially as well as interesting from the scientific point of view, it is necessary that continuous observations should be made upon their growth from the egg onwards, upon their food and its natural history, as well as upon their enemies and the conditions favouring, or injurious to, their life. Such observations can only be successfully carried out by persons resident on the sea-coast. In order to enable competent observers to spend such time as they can afford for these studies to the greatest advantage, zoological observatories have been established on the sea-coast of foreign countries, but at present there is no such observatory on the British coast. The first observatory of the kind is the "zoological station" established by Dr. Dohrn at Naples, which is frequented by naturalists from all parts of Europe. Its buildings and aquaria represent an expenditure of 20,000*l.*, and its annual expenditure is over 4000*l.* Similar observatories have been established by the Austrian Government at Trieste, and by the French Government at Concarneau, Roscoff, and Villefranche. It has been for some years the desire of English naturalists to establish a zoological observatory on the British coast, which would be in charge of a competent resident superintendent, and fitted with aquaria, laboratories, and apparatus, and possessed of boats and dredging apparatus. Two or three fishermen would be kept in the pay of the observatory. The institution thus organised would be frequented at all times of the year by naturalists desirous of carrying on original investigations relative to the life-history and structure of marine organisms. Accommodation for as many as six such naturalists might be provided. The affairs of the observatory and the granting of permission to make use of its appliances might be intrusted to a small committee, consisting (for example) in the first place of the Warden of the Fishmongers' Company, the professors of zoology, botany, and physiology in the universities of Great Britain, and in the London colleges, and the secretaries of the Linnæan and Zoological Societies of London. Were such an observatory once established, there is every reason to believe that funds could be raised annually for the purpose of extending its operations, and of carrying on special work in it by grants from scientific societies, the universities, and such sources. The obstacle hitherto to the establishment of a British zoological observatory has been the difficulty of obtaining the large sum necessary to launch the institution. It is calculated that 8,000*l.* would be sufficient to secure a site and erect and furnish a suitable building—whilst 500*l.* a year should be secured as a minimum income for the purpose of paying a salary of 250*l.* a year to a resident superintendent, minor salaries to fishermen and attendants, and of meeting the small current expenses. The income of the institution might be materially aided by the payment of a fee (say 5*l.* a month) on the part of those naturalists making use of its resources. The opportunity for securing the 20,000*l.* necessary for the inauguration of such a zoological observatory has presented itself in connection with the International Fisheries Exhibition. Should there be, as there is reason to hope, a large surplus fund in the hands of the Committee of the Exhibition at its close, it is proposed to bring the suggestion of the establishment of a Marine Zoological Observatory before the Committee, and to endeavour to obtain the support of that body for the scheme. It is proposed that a deputation of scientific men should interview the committee of the Fisheries Exhibition, in order to explain the importance of a marine observatory and the close relationship of the work done in such an institution to the interests of our fisheries; and the Committee would then be asked to consider the propriety of handing over the sum of 20,000*l.* (or if possible a larger sum, this being a minimum) to trustees, for the purpose of building and endowing such an observatory, provision being made as to the future government and occupation of the observatory, as above suggested.

NOTES

At the opening of the London Hospital Medical School, Prof. Huxley gave an address on the relations of the State to the medical profession. He considers the present relations on the whole satisfactory, and that it is not desirable that the State should do more than it does to protect the public against incompetent persons and quacks. He thinks that no license should be granted except for the three qualifications, and that the course of study should be extended somewhat backwards, by insisting, instead of the general education test, upon some knowledge of elementary physics, chemistry, and so forth, by the young man desirous of entering upon a course of medical studies. In conclusion, he referred to the want of organisation for the advancement of the science of medicine considered as a pure science.

Prof. Michael Foster gave the introductory address at the School of Pharmacy last week; the subject was "Cramming," and the address will be found reported in full in the *Pharmaceutical Journal* of October 6.

The remains of William Harvey are about to be removed to a new sarcophagus in Hemel Hempstead Church.

An amusing incident is related in our contemporary *L'Électricien*, showing that the knowledge of electrical terminology is yet far from perfect amongst patrons of the latest applications of the science. One of the most eminent and old-established firms who supply incandescent lamps had lately fulfilled an order for a certain number of lamps, specified to be of twenty candle-power at forty-five volts. They received, three days after despatching the goods, the following memorandum:—"We have received your lamps as per invoice, together with the supports, but we were unable to find amongst the goods consigned the forty-five volts invoiced with the lamps . . . "!

As the papers often refer to Chinese telegrams sent to and from Europe in connection with the Franco-Chinese negotiations, it may not be useless to state that a special code of telegraphy has been devised for the use of the Chinese. All the characters of the Chinese language have been numbered, and these numbers are sent by telegraph as secret messages. On arriving in China they are translated into Chinese numbers for the use of Chinese officials.

In carrying out an Act passed by Congress, President Arthur has invited the various countries to send representatives to an International Conference at Washington, the date of which is unfixed, to establish a common prime meridian. The Governments of Austria, Norway, and Sweden have declined, but the two latter approve of the object. Spain is favourable, but has deferred its reply. Belgium is uncertain, but Denmark and Portugal have accepted the invitation conditionally. Switzerland, Venezuela, Mexico, Turkey, Greece, China, Japan, Hawaii, Hayti, Liberia, Holland, Canada, Guatemala, Rou-

mania, Nicaragua, and Honduras have accepted. Replies are expected from Italy, Great Britain, Russia, France, Chili, Brazil, and Germany.

UNIVERSITY COLLEGE, DUNDEE, the munificent gift of Miss Baxter, was duly "inaugurated" on Friday, Prof. Stewart of Cambridge giving an able address on higher education. The college starts with a clear endowment of 100,000*l.*, and a well-selected staff of professors.

THE Photographic Society's Exhibition has been opened at the rooms of the Royal Society of Painters in Water Colours.

WE notice in the *Izvestia* of the Russian Geographical Society an interesting paper by Dr. Woeikof, on the velocity of the wind in Russia. In addition to the important works of MM. Hann and Koeppen, Dr. Woeikof has calculated for fifty Russian and Siberian stations the ratio between the velocity of the wind at 1 p.m. and that in the morning and evening. These calculations have been made in order to show the increase of the force of the wind towards midday and to verify Herr Koeppen's hypothesis as to the dependency of this increase upon the differences of velocities of air in its upper and lower strata, which strata are mixed together by the ascending currents occasioned by the heating of the surface of the soil. The Russian and Siberian stations displaying a great variety of local conditions, M. Woeikof points out the influence of these conditions, but arrives, in their broad features, at the following conclusions:—Throughout Northern and Middle Russia, where the heating of the surface of the soil is very small during the winter, and the ascending current is feeble, the force of the wind increases but slowly as the sun rises above the horizon. The increase is much more during the spring and summer, and at some places the wind at midday blows with a force on an average nearly double what it was in the morning and will be in the evening. In Southern and South-Eastern Russia the increase of the force of the wind during the day is felt even in the winter, owing to the greater heating of the steppes in these lower latitudes. In the Ural region the same increase becomes obvious after February, and the ratio between the forces of the wind at 1 p.m. and at 7 a.m. and 9 p.m. becomes more than 2 to 1 in the summer. In Siberia and Mongolia the relations become more complicated on account of the anticyclones, but the same explanation of the phenomena holds good if the local circumstances be taken into account.

IN his recent work on "Jade and Nephrite Articles in the Dresden Museum," Dr. A. B. Meyer expressed the opinion that there must be other sources of the raw material than those of raw nephrite found in North Germany, Turkestan, New Zealand, and New Caledonia, and of raw jade in Burmah and Montevideo, in order to account for the diffusion of articles wrought from these materials. This view has been so far confirmed that four pieces of raw nephrite of the specific weight of 3·01 have since been found in Suckow, Uckermark, a boulder of the same material in Steiermark, and raw jade in large masses, generally in the form of boulders, in Alaska. He further was of opinion that China could not draw all its nephrite from Turkestan. It had already been shown that the large masses of raw material transported by sea from Burmah to China consisted of jade with the specific weight of nephrite, and Dr. Meyer remarked that by far the largest number of Chinese articles seemed to be of nephrite. Out of the stone hatchets, as they were thought to be, brought by Mr. Anderson from Yunnan, there were but three which had the specific weight of nephrite, and Dr. Meyer conjectured that they were of jade. A piece of the only "indubitable" hatchet out of the three, having been forwarded by Mr. Anderson to Dr. Meyer, was on examination found to be genuine nephrite. The fact is therefore established that genuine nephrite as well as jade exists in the region of Further India, though their exact locality has yet to be discovered.

MESSRS. CROSBY LOCKWOOD AND CO. announce the following new and forthcoming publications:—"British Mining; a Practical Treatise on the Metalliferous Mines and Minerals of the United Kingdom, dealing comprehensively with the theories of Mineral Deposits, the History of Mines, their Practical Working, and the Future Prospects of British Mining Industry," fully illustrated, by Robert Hunt, F.R.S., late Keeper of Mining Records, editor of Ure's "Dictionary of Arts, Manufactures, and Mines, author of "Researches on Light," &c., formerly Professor of Physics, Royal School of Mines; "Earthy and other Minerals and Mining," with numerous illustrations, by D. C. Davies, F.G.S., Mining Engineer, &c., uniform with and forming a companion volume to the same author's "Metalliferous Minerals and Mining"; "Graphic and Analytic Statics in Theory and Comparison, their Practical Application to the Treatment of Stresses in Roofs, Solid Girders, Lattice, Bowstring and Suspension Bridges, Braced Iron Arches and Piers, and other Frameworks, to which is added a chapter on Wind Pressures," by R. Hudson Graham, C.E., containing diagrams and plates to scale, with numerous examples, many taken from existing structures; "A Handbook of the Art of Soap-making, including the Manufacture of Hard and Soft Soaps, Toilet Soaps, Medicated and Special Soaps, Bleaching and Purifying Oils and Fats, Recovery of Glycerine, &c., &c.," with a series of engravings, by Alexander Watt, author of "Electro-Metallurgy Practically Treated," &c.; "The Engineers' and Shipowners' Coal Tables," by Nelson Foley, author of "The Engineer's Office Book of Boiler Construction."

MESSRS. SIEMENS AND HALSKE have brought out an instrument called a torsion galvanometer to be used for large currents. It consists of a magnet suspended between two coils, so as to be affected by both, but to which is attached a torsion spring so arranged that the amount of torsion necessary to bring the needle back to its normal position can easily be determined. These instruments are made in two forms, a vertical and a horizontal form. In the vertical form the needle is suspended by a cocoon silk, and the reading is taken from above; this is the more delicate form. In the horizontal form, which is meant for more practical work, the needle is balanced on knife-edges, and carries at one end a light pointer which passes behind a scale. The amount of torsion required to bring the needle back to zero is indicated by another pointer attached to a handle, and which moves in front of the scale. These instruments can be used either in main circuit or shunt; in the latter case they are often used in conjunction with a resistance box so arranged as to reduce the fall of potential between the terminals of the instrument in a known ratio. It is necessary, however, to use a table of calibrations which are subject to very little change with time.

A COURSE of elementary lectures upon Recent Astronomy and Sidereal Astronomy will be delivered in Gresham College, at six o'clock p.m. on October 16, 17, 18, and 19, by the Rev. Edmund Ledger.

THE President of the Aristotelian Society, Mr. Shadworth H. Hodgson, M.A., LL.D., will open the ensuing session with an address, on Monday evening, October 15, 1883, and the society will then meet fortnightly as usual. The chief work of the session will be a study of Berkeley's "New Theory of Vision" and "Principles of Human Knowledge," and Hume's "Treatise of Human Nature."

THE recent *soirée* of the Chester Society of Natural Science was marked by the publication of a useful programme or descriptive catalogue, which gave to the objects exhibited a teaching value, which may be well imitated, and which forms a permanent reference to those who had the opportunity of being present. The sixty microscopes shown were classified, according to the

subject under the lens, into groups, exemplifying the intimate structure of each of the classes into which animals and plants have been divided, the chief points of structure being briefly described under each head in the "programme," which thus formed a biological text-book of twenty pages with real objects for illustration. This society, founded by Canon Kingsley, is doing exceedingly good work in limiting its operations to the natural history and geology of its own district, scrupulously defined on an ordnance map. The study of local biology is encouraged by the annual grant of 10*l.*, known as the Kingsley Memorial Prize, open to any resident within the Society's district; that of next year is offered for the best collection of "Slides of the Freshwater Algæ of the Society's District, omitting the Diatoms." The Kingsley Memorial Medal this year was awarded to Mr. Shrubsole, F.G.S.

THE report on the progress and condition of the Botanic Garden and Government Plantations in South Australia for 1882, by the Director, Dr. Schomburgk, contains the usual amount of information on the introduction and cultivation of useful and ornamental plants. Dr. Schomburgk draws attention to the small rainfall for the year. He says that during 1881 it amounted to 18·192 inches, but during 1882 it only amounted to 15·742 inches, which was 5·469 inches below the general average (21 inches odd) of the previous forty-three years, the only years during which the rainfall was less than that of last year. During May and June severe frosts prevailed. The temperature was on several nights as low as 29° and 30°. These frosts had, of course, a disastrous effect upon plants in the gardens. "The tropical and subtropical trees and shrubs which had scarcely recovered from the frosts of 1881, especially the tropical *Ficus*, constituted the chief bulk of the sufferers; they have suffered materially, and they have been sadly reduced—from 30 feet and 40 feet in height, to 6 feet and 10 feet." As early as the latter end of September some very hot days were experienced, the thermometer showing 96° in the shade, and 120° in the sun, the highest temperature experienced in any former September. During December and January three slight showers of rain alone fell. Notwithstanding these checks to vegetation a considerable amount of work seems to have been done of a varied character. In the matter of useful plants we quote the following paragraph as an example:—"The demand by invalids for medical herbs becomes more frequent, and it is gratifying to be able to supply them. Inquiries are especially made for the following, viz.: the common English broom (*Cytisus scoparius*), of which a decoction is used in dropsy; the leaves of the mullein or shepherd's club (*Verbascum thapsus*), a decoction of the leaves being recommended by some of the American papers as a remedy against consumption; the globular sponge (*Euphorbia pilulifera*), a native of the tropical regions of the New and Old World. It is found growing in Queensland, and a decoction of the plant is said to be used with the best results in asthmatic complaints."

MR. F. S. MOSELEY, F.Z.S., writes to the *Times* to state that a Marmoset (*Hapale jacchus*) in his possession gave birth to two young ones on the 4th inst.; Mr. Moseley supposes this to be the first case of the kind in Europe.

A TELEGRAM received at Paris on Tuesday night from Algiers states that a strong shock of earthquake was felt at Philippeville at half-past one o'clock that morning. The oscillation was in the direction from north to south. At Jammasses the church and barrack walls were cracked; at Stora a house was also damaged.

A CORRESPONDENT residing at Accra, West Coast of Africa, sends some particulars of the recent earthquake at that place:—"It was at 2.30 a.m. on the morning of Sunday, August 12, that several shocks of earthquake were experienced. The evening previous had been cool, with alternate periods of thick, hot air, which rather presaged a thunderstorm, it being the season of the year when tornadoes pass over the coast. On the night in question it was observed that the surf was particularly violent until half an hour prior to the first shock, when the water seemed to subside and become comparatively calm. The first shock was followed by a second and more violent shock, shaking the foundations. In each case the shock was preceded by an explosion resembling in a great degree the sound usually caused by the discharge of a gun from ships lying in the roadstead. Christiansborg Castle, which in 1863 was wrecked by an earthquake at the same time of year, felt the force of the disturbance severely. Several of the castle walls and those of the neighbouring European houses were found to be cracked the next day. The critical phase lasted, as far as could be calculated, from thirty to forty seconds. During the period—2.30 a.m. to 3.30 a.m.—there was a variation of temperature of 3°—viz. from 71° to 74°, and *vice versâ*. In this interval the wind had completely died away, the atmosphere being hot and almost stifling. It was very difficult to trace the direction of the earthquake, but my own opinion is that it travelled from the south-west, and this is somewhat confirmed by the reports since received from that quarter. Small shocks were repeated at intervals of one hour till seven o'clock in the morning, and on two days since the 12th slight tremors have been felt, but not of sufficient power to do much damage. Since the event the weather has become remarkably cool, considering our proximity to the Equator, the average temperatures being, night and morning, 72°, sun 97°, shade 56°."

THE additions to the Zoological Society's Gardens during the past week include a Bubaline Antelope (*Alcelaphus bubalis* ♀), a Domestic Goat (*Capra hircus*) from Algeria, presented by Mr. Robert Pitcairn; a Black Hornbill (*Buceros atratus*) from West Africa, presented by Mr. J. T. Carrington; two Grey Monitors (*Varanus griseus*) from Arabia, presented by Capt. J. S. Sanderson; four Ural Phrynocephales (*Phrynocephalus helioscopus*) from the east coast of the Caspian, presented by Dr. A. Strauch, F.M.Z.S.; twelve European Tree Frogs (*Hyla arborea*), European, presented by Mr. Carl Schorlemmer; a Cape Hyrax (*Hyrax capensis*) from South Africa, a Great Bustard (*Otis tarda*), European, deposited; an Ocelot (*Felis pardalis*), a King Vulture (*Gypagus papa*), a Brazilian Caracara (*Polyborus brasiliensis*), an Anaconda (*Eunectes murinus*), a Common Boa (*Boa constrictor*) from Brazil, purchased; two Mandarin Ducks (*Æx galericulata*), two Cockatoos (*Calopsitta novæ-hollandiæ*), bred in the Gardens.

GEOGRAPHICAL NOTES

A LETTER from Mr. H. M. Stanley, dated July 14 has been published in New York, in which he reports the discovery of a new lake called Mantumba. He has also explored the river marked in the maps as the Ikelembu, but which is really the Malundu, and finds it to be a deep, broad, navigable stream. Stanley expresses his increasing surprise at the density of the population in the equatorial portions of the Congo basin, and says if what he has seen may be taken as representing the state of things generally, there is a population in this river basin of forty-nine millions. Extensive commercial openings are offering themselves.

A TELEGRAM from New York, October 9, states that exploring parties who had just descended the Yukon River, in Alaska, say that they travelled down the stream for two thousand miles. They report the river to be one of the largest in the world, discharging 50 per cent. more water than the Mississippi. Its breadth in some places is seven miles.

THE Austrian African explorer, Dr. Stecker, after five years' absence in the service of the German African Society, has just returned home. For the most part he travelled in company with Herr Gerhard Rohlfs, but Stecker has himself discovered about a dozen countries east and south of Abyssinia, which

before him, no European had ever entered. He was imprisoned as a spy by King Melelek, of Shoa, but was eventually released through the intercession of Marquis Antinori. He has brought back with him numerous valuable maps and a large collection of the fauna, flora, minerals, and other objects connected with the regions he explored.

LIEUT. WISSMANN is preparing to set out on a new expedition to the Upper Congo.

THE United States observing party at Point Barrow have returned to Alaska, *en route* for San Franscisco.

THE French war steamer, which was sent out last year with the French scientific mission to Cape Horn, is daily expected with the party, who have spent their winter in this remote part of the world. These observations have been carried on in connection with the Polar observations as organised by the International Conference, and have been made from August, 1882, to August, 1883.

"THE Yearly Report of the Swiss Alpine Club" for 1882, the eighteenth volume of the series, contains many and various contributions towards a fuller knowledge of the Alps. Besides valuable letterpress we are treated to excellent panoramas after original drawings, coloured views, woodcuts, and cartographical sketches.

IN one of a collection of lectures published at Heidelberg, 1883, by the house of Carl Winter, A. von Lasaulx, the well-known geologist, draws an ingenious parallel between Ireland and Sicily, and attempts to explain the backward state of the inhabitants of these two islands and the disorders of which they have been the theatre by the nature of their geological strata, the formation of their coasts and their positions.

THE last number of the *Izvestia* of the Russian Geographical Society, contains, besides minutes of proceedings, two papers by Dr. Woeikof, on the diurnal period of the velocity of the wind in Russia, and on the distribution of heat in the oceans; a paper by Prof. Lenz, on the periodicity of auroras; the annual reports of the western and eastern Siberian branches of the Society; the end of M. Polyakoff's letters from Sakhalin, wherein he describes his journey on boat down the Tym River and on the eastern coast of Sakhalin; and several notes. We notice among these latter a list of forty-two places in Persia, Attak, and Akhal-Tekke, the positions of which were determined by Capt. Gladysheff.

THE EVOLUTIONARY POSITION[1]

I HAVE been requested by the Subjects Committee of the Congress to place before you a brief statement of some of the advances which have recently been made in natural science, with a view to open a discussion upon their relations, real or supposed, to religious belief. The particular advances which, as I am given to understand, were especially in the minds of the Committee in proposing this question, are those which have resulted in the more or less general adoption by scientific men of the view of the sequence of events which have taken place, and are still taking place, in the universe, to which the term "evolution" is now commonly applied.

All that is embraced by this term, the various realms of nature in which its manifestations are traced, the various shades of meaning attached to it by different persons, would constitute far too large and complex a subject to be treated of in the time to which addresses to this meeting are wisely restricted. I will therefore select for special consideration the only point in the application of the theory upon which I can speak with any practical knowledge; one which is, however, in the eyes of many of very vital interest. It is the one, at all events, which at the present moment attracts most attention; the new ideas upon it being received with enthusiasm by some, and with distrust, if not with abhorrence, by others.

The doctrine of continuity, or of direct relation of an event to some preceding event according to a natural and orderly sequence is now generally recognised in the inorganic world; and although the modern expansion of this doctrine as applied to the living inhabitants of the earth appears to many so startling, and has met with so much opposition, it is, in a more restricted application, a very old and widespread article of scientific as well as of popular faith.

Putting aside, as quite immaterial to the present discussion, the still controverted question of the evidences of the production of the lowest and most rudimentary forms of life from inorganic matter, it may be stated as certain that there is no rational and educated person, whatever his religious beliefs or philosophical views, who is not convinced that every individual animal or plant, sufficiently highly organised to deserve such distinctive appellation, now existing upon the world, has been produced from pre-existing parents by the operation of a series of processes of the order to which the term natural is commonly applied; processes also fundamentally the same throughout the whole range of living beings, however much modified in detail to suit the various manifestations under which those beings are presented to us. We feel absolutely certain, when we see a horse, a bird, a butterfly, or an oak tree, that each was derived from pre-existing parents more or less closely resembling itself. Though we have no direct evidence of the fact in each individual case, the knowledge derived from the combined observations of an overwhelming number of analogous cases is of such a positive character, that we should entirely refuse to credit any one who made the contrary assertion, and should feel satisfied that he had been deluded by some error of observation. We cannot, indeed, conceive of the sudden beginning of any such creatures, either from nothing, from inorganic matter, or even from other animals or plants totally unlike themselves.

To persons whose opportunities of observation of animal and plant life are limited to a comparatively few kinds, existing under comparatively similar circumstances, and which observations moreover only extend over a comparatively limited period of time, it appears that in each kind of animal or plant, such as those just mentioned, individuals of various succeeding generations present a very close resemblance to each other. That they often vary a little cannot escape careful observation, but the deviations from the common characters of the kind to be noticed by persons whose range of vision is thus limited are not striking, and usually appear not to pass beyond certain bounds. Hence arose the common idea, natural enough under such circumstances, but which gradually developed itself, not only into a scientific hypothesis, but even, it would appear, almost into an article of religious belief, that the different kinds or "species," as they are technically called, of animals and plants, had each its separate origin, its fixed limits of variation, and could not under any circumstances become modified or changed into any other form.

This idea became deeply rooted in the human mind, in consequence of the very long period during which it prevailed, the horizon of observation having remained practically stationary from the time man first began to observe and record the phenomena of nature until little more than a century ago, when commenced that sudden expansion of knowledge of the facts of the animal and vegetable world which has been steadily widening ever since. Now it is important to observe that it is strictly *pari passu* with the growth of knowledge of the facts, that the theoretical views of nature have changed, and the older hypothesis of species to which I have referred has gradually given way to a new and different one.

The expansion of the special branches of knowledge affecting our views upon this subject has taken place in many different directions, of which I can here only indicate the most striking.

1. The discovery of enormous numbers of forms of life, the existence of which was entirely unknown a hundred years ago. The increase of knowledge in this respect is something inconceivable to those who have not followed its progress. Not only has the number of well defined species known multiplied prodigiously, but infinite series of gradations between what were formerly supposed to be distinct species are being constantly brought to light. The difficulty of giving any satisfactory definition of what is meant by the term "species" is increasingly felt day by day by practical zoologists, as evidenced by the introduction of such terms as "sub-species," "permanent local variety," &c., into general use, and especially by the wide differences of opinion as to the number or limits of the species included in any given group of animals or plants among naturalists who have made such group their special study.

2. Vast increase in the knowledge of the intimate structure of organic bodies, both as revealed by ordinary dissection and by microscopic examination, a method of investigation only brought to perfection in very recent years. By the knowledge thus acquired has been demonstrated the unity of plan pervading, under diverse modifications, the different members of each

[1] The following address by Prof. Flower, F.R.S., President of the Zoological Society, was given at the recent Church Congress as introductory to a discussion on "Recent Advances in Natural Science in their Relation to the Christian Faith." The address has been revised by the author.

natural group of organisms at one time attributed to "conformity to type," a so-called explanation which explained nothing, but for which a *vera causa* may be found in descent from a common ancestor. Wonderful gradations in the perfection to which different structures have attained in the progress of their adaptation to their respective purposes have also been shown, and of still greater importance and interest, the numerous cases of apparently useless or rudimentary organs in both animals and plants, which were absolutely unaccounted for under the older hypothesis.

3. The comparatively new study of the geographical distribution of living things, which has only become possible since the prosecution of the systematic and scientific explorations of the earth's surface which have distinguished the present century. The results of this branch of inquiry alone have been sufficient to convince many naturalists of the unsoundness of the old view of the distinct origin of species, whether created each in the region of the globe to which it is now confined, or, as many still imagine, all in one spot, from which they have spread themselves unchanged in form, colour, or other essential attributes to their present abodes, however diverse in climate and other environments or conditions of existence.

4. Lastly, though most important of all, must be mentioned the entirely new science of palæontology, opening up worlds of organic life before unknown, also showing infinite gradations of structure, but mainly important as increasing our horizon of observation to an extent not previously dreamt of in the direction of time. Powers of observation formerly limited to the brief space of a few generations are now extended over ages, which the concurrent testimony of various branches of knowledge, of astronomy, cosmogony, and geology, show are immeasurable compared with any periods of which we hitherto had cognisance. We are enabled to trace, and every year, as discovery succeeds discovery, with increasing distinctness, numerous cases of sequences of modification running through groups of animals in successive periods of time, such as the gradual progress in the development and perfection of the antlers of deer, from their entire absence in the earliest known representatives of the type, through the simple conical or bifurcated form, increasing in complexity as time advanced to the magnificent many-branched appendages which adorn the heads of some species of recent stags; such also as the progressive modifications, so often described, beginning in the short-necked, heavy-limbed, many-toed tapir-like animal of the Eocene period, and ending in the graceful, long-necked, light-limbed, single-toed horse of our own age, and numerous others which time will not allow me even to mention.

It would be impossible here to trace the history of the effect of this enormous influx of knowledge upon the doctrine of the separate origin and fixed characters of species; to narrate the scattered efforts of philosophical minds, discontented with the former views, but not yet clearly seeing the light; to describe the slow and struggling growth of the new views, amid difficulties arising from imperfections of knowledge, and the opposition of prejudice, or to apportion to each of those who by their labours have contributed to the final result his exact share in bringing it about. How much, for instance, is due to the work and the writings of our illustrious countryman Darwin? and how much to those who have preceded or followed him? All this forms an episode in the history of the progress of human knowledge which has been abundantly chronicled elsewhere.

The result may, however, be briefly stated to be that the opinion now almost, if not quite, universal among skilled and thoughtful naturalists of all countries, and whatever their beliefs upon other subjects, is that the various forms of life which we see around us, and the existence of which we know from their fossil remains, are the product, not of independent creations, but of descent, with gradual modification from pre-existing forms. In short, the law of the natural descent of individuals, of varieties, races, or breeds (which, being within the limits of the previous powers of observation, was already universally admitted) has been extended to the still greater modifications constituting what we call species, and consequently to the higher groups called genera, families, and orders. The barrier fancied to exist between so-called varieties and so-called species has broken down.

Any one commencing the study of the subject at the present time without prejudice, and carefully investigating the evidence upon which to form his conclusions, bearing in mind that he must look for his proofs, not so much in direct experiments or absolute demonstrations, which from the nature of the case are impossible, but in the convergence of the indications furnished by the interpretations of multitudinous facts of most diverse kinds, must find it extremely difficult to place himself in the position of those who held the older view, so much more reasonable, so much more in accordance with all that we know of the general phenomena of nature, does this new one seem. In fact the *onus probandi* now appears entirely to lie with those who make the assertion that species have been separately created. Where, it may be asked, is the shadow of a scientific proof that the first individual of any species has come into being without pre-existing parents? Has any competent observer at any time witnessed such an occurrence? The apparent advent of a new species in geological history, a common event enough, has certainly been cited as such. As well might the presence of a horse in a field, with no sign of other animals of the same kind near it, be quoted as evidence of the fallacy of the common view of the descent of individuals. Ordinary observation tells us of the numerous causes which may have isolated that horse from its parents and kindred. Geologists know equally well how slight the chances of more than a stray individual or fragment of an individual here and there being first preserved and afterwards discovered to give any indication of the existence of the race. Those who object to the new view complain sometimes of the frequency with which its advocates take refuge, as they call it, in the "imperfection of the geological record." I think, on the contrary, the difficulty is always to allow sufficiently for this imperfection. When we contrast the present knowledge of palæontology with what it was fifty or even ten years ago; when we see by what mere accident, as it were, a railway driven through a new country, a quarry worked for commercial purposes, a city newly fortified, all the most important discoveries of extinct animals have been made, we must be convinced that all arguments drawn from the absence of the required links are utterly valueless. The study of palæontology is as yet in its merest infancy; the wonder is that it has already furnished so much, not so little, corroboration of the doctrine of transmutation of species.

Direct proof is, then, equally absent from both theories. For the old view it may be said that it has been held for a very long time by persons whose knowledge of the facts of nature which bear upon it was extremely limited. On the other hand, the new view is continually receiving more support as that knowledge increases, and furnishes a key to a vast number of otherwise inexplicable facts in every branch of natural history, in geological and geographical distribution, in the habits of animals, in their development and growth, and especially in their structure. Allow me to take one instance from the last named—the anatomy of the whale. How is it possible, upon any other supposition than that it is the descendant of some land animal, with completely developed limbs and teeth, which has become gradually modified to suit an aquatic mode of existence, to explain the presence of the numerous rudimentary, and to their present possessors absolutely useless, structures found in its body. Amongst others, a complete set of teeth, existing only in embryonic life, entirely disappearing even before birth, and rudimentary hind legs, with their various bones, joints, and muscles, of which no trace is seen externally. It may be asserted that the whale was originally created so, as it was asserted, and long maintained, that fossil shells and bones were originally created as such in the rocks in which they are found. It took more than two centuries of continuous and most acrimonious discussion to convince the world, especially the theological world, that these were the actual remains of animals which had once lived in a former period of the earth's history. Their evidence is now, however, universally admitted as supplying knowledge of the changed conditions of the surface of the earth, and with equal clearness do these rudimentary organs, hidden in the secret recesses of the whale's body, furnish, to those who inquire, indications that the animal has passed through phases of existence unlike those in which we now see it.

I do not for a moment assert that the new view explains everything that we students of nature are longing to know, or that we do not everywhere meet with obscure problems and perplexing difficulties, facts that we cannot account for, and breaks in the chain of evidence. As to the details and mode of operation of the secondary laws by which variation and modification have been brought about, we are far from being in accord. Happy for us that it is so, or our work would be at an end. I only maintain that the transmutation view removes more difficulties, requires fewer assumptions, and presents so much more consistency with observed facts than that which it seeks to supersede, and is, therefore, so generally accepted, that there is no

more probability of its being abandoned, and the old doctrine of the fixity of species revived, than that we should revert to the old astronomical theories which placed the earth in the centre of the universe, and limited the date of its creation to six ordinary days.

The question of the fixity or the transmutation of species is a purely scientific one, only to be discussed and decided on scientific grounds. To the naturalist, it is clearly one of extreme importance, as it gives him for the first time a key to the interpretation of the phenomena with which he has to deal. It may seem to many that a question like this is entirely beside the business of a Church Congress, as it is one with which only those expert in the ways of scientific investigation, and deeply imbued with knowledge of scientific facts, could be called upon to deal. This would certainly have been my view, if it had not been that some who, from their capacities and education, should have been onlookers in such a controversy, awaiting the issues of the conflict while the lists are being fought out by the trained knights, have rushed into the fray, and by their unskilful interposition have only confused the issues, casting about dust instead of light. In the hope of clearing away some of this dust the present discussion has been decided upon.

It is self-evident that a solid advance of any branch of knowledge must, in some way or other, and to a greater or less degree, influence many others, even those not directly connected with it, and therefore the rapid simultaneous strides of so many branches of knowledge as may be embraced under the term of "Recent Advances in Natural Science," will be very likely to have some bearing upon theological beliefs. Whether in the direction of expanding, improving, purifying, elevating, or in the direction of contracting, hardening, or destroying, depends not upon those engaged in contributing to the advance of science, but upon those whose special duty it is to show the bearing of these advances upon hitherto received theological dogmas. The scientific questions themselves may well be left to experts. If the new doctrines are not true, there are plenty of keen critics among men of science ready to sift the sound from the unsound. Error in scientific subjects has its day, but it is certain not long to survive the ordeal, yearly increasing in severity, to which it is subjected by those devoted to its cultivation. On the other hand, the advances of truth, though they may be retarded, will never be stopped by the opposition of those who are incompetent by the nature of their education to deal with the evidence on which it rests. There is no position so fraught with danger to religion as that which binds it up essentially with this or that scientific doctrine, with which it must either stand or fall. The history of the reception of the greatest discoveries in astronomy and geology, the passionate clinging to the exploded pseudo-scientific views on those subjects supposed to be bound up with rellgious faith, the fierce denunciations of the advocates of the then new, but now universally accepted, ideas, are well-worn subjects, and would not be alluded to but for the repetition, almost literal repetion in some cases, of that reception which has been accorded to the new views of biology.

Ought not the history of those discoveries and the controversies to which they gave rise to be both a warning and an encouragement? Those who hoped and those who feared that faith would be destroyed by them have been equally mistaken; and is not probable that the same result will follow the great biological discoveries and controversies of the present day?

In stating thus briefly what is the issue of these discoveries, as generally understood and accepted by men of science, I have done all that I promised, and must leave in far more competent hands the part of the subject especially appropriate for discussion at this meeting. I may, however, perhaps be allowed to put a few plain and simple considerations before you, which may have some bearing upon the subject, and which have no pretensions to novelty, though, being often lost sight of, their repetition may do no harm.

I said at the commencement of this paper that it has long been admitted by all educated persons, whatever their religious faith may be, that that very universal but still most wonderful process, the commencement and gradual development of a new individual of whatever living form, whether plant, animal, or man, takes place according to definite and regularly acting laws, without miraculous interposition. Further than this, I believe that every one will admit that the production of the various races or breeds of domestic animals is brought about by similar means. We do not think it necessary to call in any special intervention of creative power to produce a short-horned race of cattle, or to account for the difference between a bulldog and a greyhound, a Dorking and a Cochin China fowl. The gradual modifications by which these races were produced, having taken place under our own eyes as it were, we are satisfied that they are the consequence of what we call natural laws, modified and directed in these particular cases by man's agency. We have even gone further, having long admitted, without the slightest fear of producing a collision with religious faith, that variation has taken place among animals in a wild state, producing local races of more or less stable and permanent character, and brought about by the influence of food, climate, and other surrounding circumstances.

The evidences of the Divine government of the world, and of the Christian faith, have been sufficient for us, notwithstanding our knowledge that the individual was created according to law, and that the race or variety was also created according to law. In what way then can they be affected by the knowledge that the somewhat greater modifications, which we call species, were also created according to law? The difficulties, which to some minds seem insuperable, remain exactly as they were; the proofs, which to others are so convincing, are entirely unaffected by this widening of scientific knowledge.

Even to what is to many the supreme difficulty of all, the origin of man, the same considerations are applicable. Believe everything you will about man in his highest intellectual and moral development, about the nature, origin, existence, and destiny of the human soul—you have long been able to reconcile all this with the knowledge of his individual material origin according to law, in no whit different in principle from that of the beasts of the field, passing through all the phases they go through, and existing long before possessing, except potentially, any of the special attributes of humanity. At what exact period and by what means the great transformation takes place no one can tell. If the most Godlike of men have passed through the stages which physiologists recognise in human development without prejudice to the noblest, highest, most divine part of their nature, why should not the race of mankind, as a whole, have had a similar origin, followed by similar progress and development, equally without prejudice to its present condition and future destiny? Can it be of real consequence at the present time, either to our faith or our practice, whether the first man had such an extremely lowly beginning as the dust of the earth, in the literal sense of the words, or whether he was formed through the intervention of various progressive stages of animal life?

The reign of order and law in the government of the world has been so far admitted that all these questions have really become questions of a little more or a little less order and law. Science may well be left to work out the details as it may. It has thrown some light, little enough at present, but ever increasing, and for which we should all be thankful, upon the processes or methods by which the world in which we dwell has been brought into its present condition. The wonder and mystery of creation remains as wonderful and mysterious as before. Of the origin of the whole, science tells us nothing. It is still as impossible as ever to conceive that such a world, governed by laws, the operations of which have led to such mighty results, and are attended by such future promise, could have originated without the intervention of some power external to itself. If the succession of small miracles, formerly supposed to regulate the operations of nature, no longer satisfies us, have we not substituted for them one of immeasurable greatness and grandeur?

A GREEN SUN IN INDIA

WE have received the following communications on this phenomenon. At the same time we may refer to a passage in one of Mr. Norman Lockyer's papers on "Physical Science for Artists," in which he speaks of the marked effects of aqueous vapour in the atmosphere on the character of the sun's light. He states that he asked Dr. Schuster to test his theory while in India. "Theory," he states, "had led me to expect that with the enormous thickness of air available there, absorption at the red end of the spectrum by aqueous vapour would be seen as well as the absorption at the blue, which is so common with us. Seeing the sun a vivid green through the steam of the little paddle-boat on Windermere first led me to inquire into the possibility of aqueous vapour following the same law as that which I think we may now accept in the cases of the vapours of metals. As in these experiments with vapours absorption of the red end alone was seen, as well as absorption at the blue end alone, the

assumption that these two absorptions existed in aqueous vapour at once accounted for the green sun." In the sequel it will be found that Dr. Schuster's observations quite confirmed Mr. Lockyer's theory.

By my friend Major A. T. Fraser, R.E., I have just been favoured with a copy, which I now inclose to you, of a Madras paper, dated September 12, giving not only the frightened comments of a dozen different, unpractised observers on the *green* sun, seen morning and evening over the south-east of India during the two or three previous days, but also the spectroscopic explanation thereof by Rev. Prof. Michie Smith, which is so good that you may perhaps think well to introduce it into your columns.

The case too is further worth notice here, as an example of the occasional powers of the rain-band spectroscope over and above the wet and dry bulb thermometers, to tell us what is in the upper air now and will visit us soon below. For on those days when the greenness of the sun was undoubtedly due to being seen through strata of atmosphere inordinately charged with watery vapour (much as I set forth in vol. xiv. of "Edinburgh Astronomical Observations," was the case so eminently at Palermo in 1872), the air in contact with the dwellings of man was dry.

It has been so too for a considerable time, as testified by Mr. Pogson at the Madras Observatory, both by his daily hygrometric observations, and by his record of rainfall for the year being behind the usual quantity by about a third of the whole. From this circumstance apparently, "some of the learned old men," but knowing nothing of spectroscopy, in that locality, needlessly afflicted themselves and their neighbours also, by proclaiming that the *green* sun, in place of being a sign of good times coming, "was a bad omen for the country, and would bring a famine this year."

But though there was still a drought at Madras, the same paper involuntarily reports that abundant rain had begun to fall further away to the south and west, or to the extent, at Travancore, of 5·91 inches, and at Malabar of 10·14 inches, in one week.

C. PIAZZI SMYTH

15, Royal Terrace, Edinburgh, October 9

We have just been having the curious phenomenon of a greenish colour in the light of the sun. Letters to the Madras papers show that the same thing has been noticed in many other parts of Southern India. It is new to me, and to every one else who has seen it, so far as I have heard. The native astronomers say that there is a planet wholly absorbed in the sun, and that if it leaves the sun a green light will appear. Or, according to others, if Venus comes in contact with the sun, which, according to their calendars, is the case now, a green light will be seen. Both agree, however, in portending evil to the inhabitants of this planet; consequently there has been no little curiosity and speculation awakened by this singular appearance, and more or less of uneasiness in the minds of the ignorant and superstitious natives. As I am principal of the High School in this place, and teacher in a small way of science, they apply to me for the scientific solution of the mystery; but, farther than a mere conjecture, I have to confess myself quite as much in the dark as the rest.

Doubtless others of your correspondents have noticed the same thing, and my description may be superfluous; yet I venture to give it, as it may at least corroborate the statements of other observers.

My attention was first called to the matter by one of my teachers about four o'clock on the afternoon of September 10, but I learn that the same thing was noticed elsewhere the day before. At the time of which I speak I noticed that the light from the sun shining into the room through an open western door threw a curious pale blue colour on the floor. I also noticed that it had something of the effect upon colours that is commonly seen in coloured lights. On looking out I saw that the sun, which was somewhat dimmed by a haze, had a decidedly greenish-blue tinge. The same thing was observed on the 11th and 12th, both morning and evening; but my observations were confined to the evenings. About four o'clock (at least I did not notice it earlier) an indistinct bluish tinge appeared in the light. This gradually passed into a greenish colour, and this in turn became tinged with yellow as the sun approached the horizon. As the sun sank, bands of smoky haze drifted across its disk. After the sun was down, bright yellow, orange, and red appeared in the west, a very deep red remaining for more than an hour after sunset; whereas under ordinary conditions all traces of colour leave the sky in this latitude within half an hour after the sun disappears. At night the moon, just past the first quarter was surrounded by a pale greenish halo some thirty degrees in breadth.

After sunset I observed a peculiar appearance in the haze which covered the sky. It was not of sufficient density to be at all visible, except where it reflected the direct rays of the sun. There it had a singular mottled appearance, with a smoky look along the borders of the denser portions, suggesting clouds of smoke or dust in the upper regions of the atmosphere.

Of course the question which every one is asking now is, What caused the green light? very few, so far as I have learned, having noticed anything else. The succession of colours which I have mentioned, occurring exactly in the order of the solar spectrum, would seem to indicate beyond a doubt the presence of some highly refracting substance in the atmosphere which resolved the sun's rays into primary colours and gave us in succession, according to the angle of the sun to the horizon, blue, green, yellow, orange, and red, the two latter only appearing as reflected from the under surface of the haze. On the evening of the 13th the sun appeared to be perfectly clear, but after it was below the horizon the western sky was seen to be covered with a smoky haze of a singular appearance, which became brilliantly illuminated with yellow, orange, and red in the order I have mentioned, counting upward from the horizon. These sank one after the other, leaving at last an arc of brilliant red along the west, the inner portion of the segment contained by the arc being composed of orange. This disappeared in turn, and the whole western sky became yellow again without any distinct outlines, and this gradually deepened into red, which remained for an hour or more after sunset. The latter phenomenon was not unlike an ordinary sunset, except in brightness and duration.

But what could the refracting medium be? The air itself has refracting power, and so have the minute particles of moisture or ice which constitute the ordinary hazy clouds in the upper regions of the atmosphere; but it would be difficult to say why the effects which I have described should not be of more frequent occurrence if produced by either or both of these causes, since they are always present in a greater or less degree, and especially as there was apparently nothing unusual in the state of the weather at the time. Neither would clouds of smoke alone produce such effects as I have mentioned. In my native place in the United States, where vast tracts of prairie, and often of woodland, are burned over every autumn, a smoky haze is a common thing at that season of the year. Sometimes for days together the haze is so dense as almost to hide the sun, yet I never heard of any other effect upon the light than this obscuring of it, while the sunsets were especially dull and colourless. Nor do I see how these phenomena could be referred to unusual electrical conditions, for in that case they should be more common, as electrical storms are by no means unusual. I have been led, therefore, to wonder if the phenomena may not be the result of some fine transparent or semi-transparent dust particles in the upper regions of the atmosphere, which form the singular looking haze, and refract the light in the manner I have described, and whether the whole may not be traceable to the recent volcanic eruptions in Java.

According to the telegrams, the city of Batavia was darkened for thirty-six hours by clouds of dust from the volcano. True, we are a long distance from Java here, Ongole being in latitude 15° 30′ N., and longitude 80° 6′ E. But it is well known that the smoke and ashes from volcanoes are often carried to immense distances, and in this case, if acted upon by the trade winds, they would be carried away to the westward, and rising with the upward currents might enter the return trades, and so be swept over Southern India in a north easterly direction—the direction of our prevailing winds at this season of the year. However, I only venture this solution of the problem as a timid conjecture, the truth or falsity of which I have no means of demonstrating.

Will not some of the readers of NATURE who are better informed in regard to such matters kindly give me their opinions of the phenomena? I should be glad also to know if such effects upon the light as I have described have ever been noticed as the result of the smoke or dust or gases emitted by volcanoes.

Another thing which awakened about as much curiosity and speculation in the minds of the natives as the coloured light was the large spot now crossing the sun's disk. Ordinarily the atmosphere is so clear that even at sunset the sun cannot be

viewed with the naked eye; but, being obscured as it was by the haze, the spot was distinctly visible to all.

Ongole, India, September 14 W. R. MANLEY

[Mr. Manley sends us several letters from the *Madras Mail* on the phenomenon; from these we give the following extract, dated September 10:—]

A. T. M. writes:—"Unlike his usual custom the sun rose this morning clothed as it were in bright blue colour, rendering the whole horizon and all beneath it of the same hue. The pure, colourless river water looked as if it was just let out of an indigo vat. Even the green fields with grass and trees about looked blue. Our whitewashed house also had a temporary change of colour. This phenomenon lasted from 6 to 10 a.m."

The same phenomenon seems to have been observed in Trinidad on the afternoon of Sunday, September 2. Mr. J. Arnold, writing to the *Times*, gives the following extract from a correspondent's letter from Port of Spain:—

"We have been having very curious weather; last Sunday, about five o'clock, the sun looked like a blue globe, and with the aid of a small telescope I saw plainly three dark spots on it. After dark we thought there was a fire in the town from the bright redness of the heavens." Mr. Arnold adds: "All my correspondents agree as to the blue colour, and several seem to have noticed the spots. This occurrence, which was held to foretell bad weather, took place three days before the cyclone that swept Martinique."

THE JAVA ERUPTION

THE following details concerning this catastrophe have been sent by Lloyd's agents at Batavia, under date of Sept. 1:—

"The past week is memorable as having witnessed one of the most disastrous and severe volcanic eruptions ever known in the Malay Archipelago. Krakatoa has again been the origin of the disturbance. On Sunday last, about 4 p.m., a series of detonations were heard proceeding apparently from the south-west. Towards night these grew louder, till in the early morning the reports and concussions were simply deafening, not to say alarming. When day broke the atmosphere to the west had a sulphurous and lurid appearance, and a thin layer of fine white ash covered the ground. Towards 9 a.m. the reports died away, but about an hour later dark clouds quite obscured the sky and the sun. A heavy rain of ashes, sulphur, and dust commenced to fall, and at 11 a.m. this town was in pitch darkness and business totally suspended. About twelve o'clock (midday) a large wave about seventeen feet in height swept in from the sea, causing many prows and small craft to be driven ashore, but doing but little damage to the shipping in harbour. This being the dry monsoon, the rivers are low at present. The wave, however, drove an immense volume of water up our rivers, which suddenly rose so high that the banks at the river mouth were flooded and many small crafts stranded. Happily the wave subsided again suddenly, leaving the rivers almost dry, and about one o'clock the rain of ashes subsided and the atmosphere grew lighter. Shortly after 2 p.m., however, another wave, larger than the first, came rolling in from the sea. A few native fishermen were drowned by this wave, and two Europeans at Onrust also lost their lives. At Tandjong Priok the *Princess Wilhelmina* was within an ace of stranding, while some small crafts and prows were cast high up on land. No further damage, however, occurred in Batavia. The eruption, however, so far as we can learn, has had most fatal and disastrous effects all along the south-west coast of Java, and also on the south coast of Sumatra. We shall not probably be in possession of full particulars for some days yet, as telegraph lines are damaged and roads destroyed, but so far we can give the following particulars. The Island of Krakatoa, the summit of which peak was 2600 feet above water level, has totally disappeared below the sea, and the neighbouring Island of Dwaisindeweg is split in five parts. Sixteen new volcanic islands have been formed between Krakatoa and Sibesie, and the sea bottom in the Straits of Sunda has completely changed. In fact the Admiral Commanding-in-Chief has issued a circular stating that till new soundings have been taken the navigation of the Straits of Sunda is likely to be extremely dangerous. Anjer and lighthouse and the other lights of south-west Java have all been destroyed. The subsidences and upheavals we have alluded to caused a large wave about 100 feet in height to sweep down on the south-west coast of Java and south of Sumatra. This wave swept inland for a great distance, thereby doing great injury both to life and property. We are here only twelve miles away from one of the points on which the wave spent its fury. The whole coastline to the south-west has changed its configuration. The inhabitants of the Island of Onrust were only saved from the flood which swept over the island by taking refuge on board two steamers. At Merak Government establishment the inhabitants took refuge on the knoll, 50 feet high, but were all swept off and drowned, with the exception of one European and two Malays, who were saved. Mauk and Kramat, west side of Batavia Roads, have been laid waste, and about 300 lives lost. In Tjeringin only one house has been left standing. Both the native and European officials have perished. A rain of mud also fell at the above place, which is situated opposite to where Krakatoa Island once lay. Anjer seems to have been completely destroyed. Lloyd's sub-agent there wires from Serang: 'All gone. Plenty lives lost.' The dry dock at Amsterdam Island was carried away by the waves, but has since been found stranded in Middleberg Island. The Padang steamer, which left here on Sunday, returned next day to Anjer, only to find the place in ruins. The captain reports that his vessel was in great danger, owing to the eruption from Krakatoa. On his arrival at Telok Betong, his first port of call, the place was found completely destroyed. We understand that it has been submerged, but are not yet in possession of full particulars. We hear that on Monday the whole of West Java, as far as Banding, was shrouded in darkness and covered by ash rains. A telegram just in informs us that the explosions from Krakatoa were heard at Deli (Sumatra), which place is opposite Penang. The Government here, we understand, in the interest of shipping, are sending out steamers to cruise at either end of the Straits of Sunda, to warn vessels to observe caution while passing the Straits, as charts are no longer reliable. According to latest telegram from Serang we learn that in the residence of Tjeringin alone 10,000 lives were calculated to be lost. The Padang steamer just in reports that it is impossible to approach to the place where Telok Betong once was situated, owing to the sea being filled with pumice stone and mud. In some parts of Sumatra Straits the pumice stone is seven to eight feet deep."

THE BRITISH ASSOCIATION

SECTION C—GEOLOGY

On some Fossil Fish Remains found in the Upper Beds of the Yoredale Series at Leyburn, in Yorkshire, by James W. Davis, F.G.S.—The red limestone forms the upper part of the main limestone of Phillips, being separated from it by only one foot of shale or plate. It is about 100 feet below the millstone grits, the intermediate beds being composed of grits and shales with one bed of limestone about 16 or 18 feet thick. A peculiar aggregation of fish remains has been discovered in the red beds by Mr. Wm. Horne of Leyburn. They comprise nearly forty species, the majority of which are peculiar to the beds; others like *Cladodus* and *Petalodus* are common to the Mountain Limestone, and do not appear to differ either in size or otherwise from those of the lower massive limestone. The representatives of the genera *Psamodus*, *Cochliodus*, and *Polyrhizodus*, which are found abundantly in the lower limestone, and are of great size and importance, are in this locality comparatively small and rare, and appear to indicate that the fishes they represent were gradually becoming extinct. Their representatives are not known to occur in the superimposed Millstone Grits either in this locality or any other. There are in addition species of *Megalichthys* and *Pleurodus*, which are characteristic of the coal measures. The presence of so varied a fauna naturally leads to the inference that the circumstances under which they existed were not those usually characteristic of the aggregation of limestones, but rather indicate a shallow or shore deposit with occasional influxes of fresh water. *Megalichthys* and *Pleurodus* are fishes which in the coal measures probably lived in fresh or brackish water; and though they may have been adapted to exist in marine conditions, the occurrence of beds of sand and shale intercalated with the thin limestones of the Yoredales evidently shows the proximity of land, and it is probable that they were carried to their present position by rivers, and there deposited with the marine forms with which they are associated. The supposition that the water was brackish may account for the small size of some of the genera already mentioned and their final extinction in the grits and shales which succeed the limestone The great fishes whose remains are found in the lower lime

stone, represented by *Ctenacanthus*, *Orthacanthus*, and others, are absent, the only species hitherto found being those of the curious *Cladacanthus* and *Physonemus*.

On the Occurrence of the Remains of Labyrinthodonts in the Yoredale Rocks of Wensleydale, by James W. Davis, F.S.A., F.G.S.—Some bones of the leg of a Labyrinthodont were discovered by Mr. Horne and described by Prof. L. C. Miall in the *Quarterly Journal of the Geological Society*, vol. xxx. p. 775. They were found in a dark-coloured flagrock above the Harmby Quarry, which also extends with an easterly dip to the Harmby railway cutting. The same flagrock is also found behind Leyburn and the Shawl, and in that locality it has been extensively quarried. In addition to the leg-bones already mentioned, others have been found in the same flagrock, but separated by considerable distances, so that it is not probable that they belonged to the same Labyrinthodont. In the railway cutting a portion of a cranium was found. It is 1·9 inch in length and 1·4 in breadth. A number of sutures, not very well defined, seem to indicate that the bone constituted the back part of the skull. The third specimen was found in the quarries beyond the Shawl north-west of Leyburn, and exhibits casts of the jaws of another Labyrinthodont. Each ramus is about three inches in length; they have been disturbed and displaced. The external surface of the jaws was ornamented with a reticulated arrangement of tubercles, an impression of which is preserved in the specimen. Along the margin of the impression of the alveolar portion of one of the rami there is a series of impressions which appear to have been caused by small pointed teeth.

Section across the Trias recently exposed by a Railway Excavation in Liverpool, by G. H. Morton, F.G.S.—During the last eight years a very important section of the Triassic strata has been exposed in Liverpool, by excavations for widening the line of the London and North-Western Railway Company. The section presents a solid mass of sandstone on both sides of the new railway cutting from Lime Street Station to Edge Hill Station, a distance of 2300 yards from east to west. The height of the rock on each side varies. The strata exposed belong to the Keuper and Bunter formations. The Pebble Beds of the Bunter crop out for 914 yards along the east of the cutting, but do not contain any marl partings, and not a single pebble of any kind has been noticed. Only two faults occur along the whole length of the Pebble Beds exposed, and they are of very little importance. The subdivision ends at Smithdown Lane, where there is a fault with a downthrow to the west, which brings in the upper mottled sandstone, the highest member of the Bunter formation, where it is not represented on the map of the Geological Survey, or the fault recorded. The Upper Mottled is a fine-grained, soft, bright red sandstone with grey streaks, and as it readily crumbles into sand is never hard enough for building purposes. It crops out to the west from Smithdown Lane to University College, when a fault throws down the strata about 600 feet and brings in the Keuper sandstone, which is 400 feet thick, and interstratified with thin beds of marl. The highest beds of the Keuper are at the College; lower strata containing the beds of marl crop out from beneath, and are thrown down to the west by faults three times in succession, when the basement beds crop up in Lime Street Station. The section shows that all the faults throw down the strata to the west and bring in higher beds in that direction. It also shows the exact position of the fault between the Bunter and Keuper formations, which was not known before. The position of the Keuper, as a wedge-shaped mass of sandstone, with the Bunter formation faulted against it on the east and west, is of great local interest, and it is easy to understand how the succession of the strata has not been satisfactorily explained before in the absence of any such a continuous section as that described. The remarkable absence of faults in the pebble-beds has an important bearing on the construction of the Mersey Tunnel, which will have to be carried through these beds along its entire length. The section shows that while faults are numerous in the Keuper sandstone, which was frequently fractured during subsidence into a depression, the pebble-beds are very little faulted. A few days ago, when under the Mersey, I did not find a single fault either in the tunnel or in the heading beneath.

Recent Opinions on the Loess Deposits of the Valley of the Rhine as Evidence of a "Great Post-Glacial Flood," by Mark Stirrup, F.G.S., adversely criticises recent opinions of Mr. H. H. Howorth, F.S.A., as to the mammoth in several of the superficial deposits proving a "great Post-Glacial flood." The facts connected with the loess deposits of the Rhine Valley are not consistent with the interpretation given to them by Mr. Howorth, nor is the assumption that the materials of the loess were derived from volcanic mud-streams borne out by the evidence. The author considers Mr. Howorth has failed to prove his postulate that not only the extinction of the mammoth but the existence of several superficial or Post-Glacial deposits were due "to a sudden catastrophe involving a great diluvial movement which extended over the larger part of the northern hemisphere, and accompanied by an equally sudden and violent change of climate," and the author considers the whole of the evidence adduced by Mr. Howorth as unsound and inconclusive. He regards Mr. Howorth's attempt to resuscitate some of the obsolete doctrines of Cuvier and Buckland as a retrograde movement in the history of geology.

Master Divisions of the Tertiary Period, by Prof. Boyd Dawkins.—The classification of the Tertiary rocks sketched out some fifty years ago and since then altered in no important degree is out of harmony with our present knowledge, and the definitions of the series of events which took place in it has been greatly modified by the process of discovery in various parts of the world. The terms Eocene, Miocene, and Pliocene no longer express the idea of percentages of living species of fossil mollusca upon which they were founded, and Post-Tertiary, Quaternary, and Recent are founded on the assumed existence of a great break comparable to that separating the Secondary from the Primary or Tertiary periods which is now known not to exist. The author proposed a classification of the Tertiary period in Europe, by an appeal to the land mammalia, and since that time his definition has been found to apply equally well to the Tertiaries of Asia and the Americas and to the late Tertiaries of Australia. He stated that the forms of life in the rocks have changed at a very variable rate, and in direct proportion to their complexity of organisation, the lower and simpler having an enormous range, while the higher and more complex have a much narrower range and are more easily affected by the change in their environment.

On a Boulder from the Chloritic Marl of Ashwell, Herts, by H. G. Fordham.—Boulders found in these marls, in the so-called coprolite workings in Cambridgeshire and the neighbouring counties, are usually little more than pebbles. The boulder now described measures 12 × 9½ × 5½ inches. It is somewhat triangular in general form, and is much rounded and worn. The material, according to Prof. Bonney, is a quartz-felsite. The author attributes its origin to its being brought to its present position by floating ice.

Preliminary Note on the Further Discovery of Vertebrate Footprints in the Penrith Sandstone, by G. V. Smith.—The specimens were obtained from a quarry opened out by the Settle and Carlisle Railway, situated on the slope of the hill, north of the highway from Penrith to Alston, and about three and a half miles from Penrith, the sandstone is strongly current bedded, and is largely used for building purposes; these sandstones are older than the magnesian limestone. The impressions indicate several distinct forms of vertebrates.

On a Supposed Case of Metamorphism in an Alpine Rock of Carboniferous Age, by Prof. T. G. Bonney, M.A., F.R.S.—At the base of the Carboniferous series in some parts of the Western Alps is a conglomerate called the *Poudingue de Val Orsine*, the matrix of which abounds in mica, and is supposed by some geologists to exhibit true foliation. In the Alps there is always an abrupt transition from the comparatively unmetamorphosed rocks of known geological age to the true schists and gneisses of unknown but certainly far greater antiquity, and nothing short of the clearest proof would justify us in considering any of these crystallised foliated rocks as altered Devonian or Silurian, even though the latter term be used in its most extended sense.

On the Geological Age of the North Atlantic Ocean, by Prof. Edward Hull, LL.D., F.R.S., &c., Director of the Geological Survey of Ireland.—In this paper the author made use of three leading formations as factors in his inquiry, viz. the Archæan (or Laurentian), the Silurian (chiefly the Lower Silurian), and the Carboniferous. He considers that throughout the Archæan, or Laurentian, the Lower Silurian, and the Carboniferous epochs, the regions of North America, on the one hand, and of the British Isles and Western Europe were submerged, while a large part of the North Atlantic area existed as dry land, from the waste of which these great formations had been built up; and he urged that if such were the case, the doctrine of the permanency of oceans and continents, as tested by the case of the North Atlantic, falls to the ground.

Dyas versus Permian, by Rev. A. Irving, B.Sc., F.A.,

F.G.S.—This subject is brought forward for discussion both as having a special local interest, and on account of the international importance of the subject in view of the Berlin Congress next year, and the progress of the geological map of Europe. The author, referring to previous papers in the *Geological Magazine* during the year 1882, in which strong reasons were given for abandoning the threefold division of the so-called Permian system, and to the discussions raised in the same periodical, maintains that the "Permian system" of Murchison, which represents the group of strata as marked by three stages, is inapplicable to the English rocks of Post-Carboniferous age. The term "Permian" has only a local and subordinate value, and scarcely applies even to the whole Russian area in which these strata are developed. He considers that the application of the "Permian system," as propounded by Murchison, to the Post-Carboniferous rocks of Central Europe is no longer tenable, any more than is its application to the British series, as the author has shown elsewhere.

On the Coloration of some Sands, and the Cementation of Siliceous Sandstones. By the Rev. A. Irving, B.A.—In the first part of this paper attention is drawn to the occurrence of certain green-coloured sands which are frequently met with below the peaty layers, at the heads of the small valleys, in the Upper Bagshot sands. The local and exceptional nature of these green deposits, and their relation to the decomposing vegetal matter which has overlain them for a long period of time, suggest the connection of the green colour with the decomposition of vegetation. Chemical analysis of these sands shows that the green colour is in no way connected with any of the ordinary green minerals which enter into the formation of rocks, but reveals the *organic* origin of the colouring matter. In the second part of the paper attention is drawn to some recent investigations by the author of the origin of the siliceous cementing material of the sarsen stones.

Note on the Nagel Flue of the Rigi and Rossberg. By Prof. T. G. Bonney, M.A., F.R.S.—The author called attention to the following points in regard to the conglomerate of these mountains:—(1) That the pebbles were not seldom indented by mutual pressure; (2) that the pebbles in this district consisted mainly of grits and limestones from the Secondary and perhaps early Tertiary series of the Alps, with a variable amount of a reddish granite (of whose locality he was ignorant). He considers there was a close analogy between the Bunter conglomerate and the nagel flue, the former also resembling the British Old Red Sandstone, and a part of the Calciferous sandstone series in Scotland. As these three were admittedly freshwater deposits, he argued that the Bunter series (the parts of which had some resemblance to the ordinary molasse) should be reckoned among the true fluviatile or fluvio-lacustrine deposits.

Notes on Geological Sections within Forty Miles' Radius of Southport. By C. E. De Rance, F.G.S.—The sections in Silurian works of the Lake District and North Wales within the radius are described, also those in the Carboniferous limestone, coal measures, Permian, and the Triassic rocks, especially the Keuper sandstones and worls around Southport. The sections in the glacial drift of West Lancashire and Cheshire are mentioned, and the sequence and character of the overlying postglacial beds. Southport is built upon blown sand resting on peat, which is 79 feet below the surface at the sea-coast, rising inland to the surface; the whole series rests on the Keuper marls, which have been bored into to a depth of 187 yards at the Palace Hotel, Birkdale, without finding the base. Fragments of gypsum and pseudomorphous crystals of salt occurred in the boring. The section in the Mersey tunnel, now in course of erection, was alluded to.

On the Pre-Cambrian Igneous Rocks of St. David's, by Prof. J. F. Blake, M.A., F.G.S.—The rocks below the Cambrian conglomerate have been described by Dr. Hicks as bedded rocks belonging to three distinct periods. The same rocks have been recently asserted by Dr. Geikie to be partly Cambrian and partly intrusive. The author contends that they are Pre-Cambrian in age, but form a very complete volcanic series, which may well be designated the Dimetian. The basis of the series is the Dimetian granite, serving as the core. This is surrounded by the more acid rocks, as the quartz-felsites and the felspar porphyries (the so-called Arvonian), and the more outlying portions consist of very varying materials, chiefly rough ashes or agglomerate breccias—on the east side finely bedded "halleflintas," and on the north side many basic lava flows. These are the so-called "Pebidian." The arrangement of these rocks shows the characteristic irregularity of volcanic rocks, and though many portions are bedded, they have no dominant strike over the whole district. The Cambrian series commencing with the conglomerates is quite independent and hangs together as a whole. In no case can a continuous passage be proved from the one series to the other; the junction is in most cases a faulted one, and at the places where this is not so, the conglomerate lies on different beds of the volcanic series.

On a Coral Atoll on the Shore Line at Arvigland, near Dumfries, Scotland, by James Thomson, describes a band of Carboniferous limestone, with corals of several genera, which form seventeen coral reefs, extending through a depth of 400 feet of strata.

On the Former Physical Condition of Glendale, Northumberland, by G. P. Hughes, describes the River Till, as once filling this valley, and forming a lake, on the site of which occurs peat, forest beds, grey clays, with *Bos urus*, *Cervus megaceros*, and red stag, and gravels, resting on boulder clay.

Additional Notes on Anthracosaurus Edgei, by W. H. Baily, describes a large Sauro-Batrachian from the lower coal measures, Jarrow Colliery, near Castlecomer, co. Kilkenny.

On Basalt apparently overlying Post-Glacial Beds, co. Antrim, by W. T. Knowles, describes a mass of basalt twenty yards in length, lying on sands and gravels; probably is a glacial erratic.

On the Geological Relatives and Mode of Preservation of Eozoon Canadense, by Principal Dawson.—The oldest known formation in Canada is the Ottawa gneiss, or fundamental gneiss, a mass of great but unknown thickness and of vast area, consisting entirely of orthoclase gneiss imperfectly bedded, and destitute of limestones, quartzites, or other rocks, which might be supposed to indicate the presence of land surfaces and ordinary aqueous deposition. It constitutes the Lower Laurentian of Logan, and may be regarded either as a portion of the earth's original crust, or as a deposit thereon by aqueo-igneous agency, and without any evidence of derivative deposits. Succeeding it is a formation of very different character, though still belonging to the Lower Laurentian of Logan. It may be named the Glenville series, and includes beds of limestone, quartzite, tin ore, graphitic and hornblendic schists, with local beds of pebbles; it is in one of these great limestones that Eozoon occurs. The Grenville series give distinct evidence of ordinary atmospheric erosion of the older rocks, and of ordinary aqueous as well as organic deposition. The author hopes to exhibit specimens, now in the McGill University, to the Association.

On the Topography and Geology of the Troad, by T. S. Diller.—The Liparites are older than the Andesites, rocks that are probably pre-Cambrian from the base of the older sedimentary rocks, which are much altered and often highly crystalline. The more sedimentary rocks are also partially crystalline; they are less important in determining the physical geography. Positions of streams have varied much, but the coast-line has probably changed little since the days of Troy. Mount Ida is an anticlinal with a very short axis, and is almost a dome, the summit of which has been denuded.

SECTION D—Biology

Department of Zoology and Botany

On the Origin and Development of the Rhinoceros Group, by Messrs. Scott and Osborne.—The very extensive series of Tertiary lake deposits in the north-western United States have afforded these gentlemen material for some generalisations on this subject. Their conclusions are as follows:—That from the Rhinoceros group of the Middle Eocene there diverge three distinct lines, one represented by the forms still living in the Old World, the other two exclusively American and extinct. The first of these lines is continued into the Upper Eocene formation by the genus Amynodon. In this form the rhinocerotic features of the skull are slightly more marked; the lower canines are somewhat more procumbent and have caused the atrophy of the lower incisors. The digits are four in the manus and three in the pes. In the Lower Miocene follows the genus Aceratherium, which, retaining the number of digits found in Amynodon and many lophidont skeletal characters, is yet an unmistakable rhinoceros. From Aceratherium, again, we get two diverging lines, one belonging to the Old World, the other to the New. These authors think that very probably Aceratherium originated in America, and migrated to Asia in early Miocene times. In the Old World it gave rise to the horned series of genera, probably beginning, as suggested by Cope, with

Ceratorhinus. In America are found a number of large rhinoceroses in the Loup Fork deposits of the River Platte, which are variously designated as Uppermost Miocene and Oldest Pliocene. These have left no successors unless *R. inenius* of Le Gros should turn out to be an Aphelops. In brief, the rhinoceros line branched off from the Lophiodontidæ in America during the Middle Eocene, in early Miocene times the genus Aceratherium migrated to the Old World, and there gave rise to the horned genera, which still live there, as well as the larger species which became extinct in the Post-Pliocene. The second line mentioned is represented by the curious genus Diceratherium. The third line is that of Hyracodon, small hornless animals of the Miocene. This retains the full set of incisors and canines in both jaws, but with rhinoceros-like premolars and molars. Many lophidont characters are still retained.

The Polymorphism of Alcyonaria, by Prof. Marshall.—The author directed attention to the occurrence of tentaculato-zooids in two members of the group Pennatulidæ—the first the variety of *Pennatula phosphorea*, known as aculeata, and the second a new species of Umbellula, *U. gracilis*, obtained in the Faroe Channel during the *Triton* dredging expedition in 1882. In the first case the tentacles, which vary from one to five in number, are fused together to form a conical spine strengthened by very stout calcareous spicules, and projecting a considerable distance beyond the mouth. In the case of *U. gracilis* the tentacle is single, and differs from that of all other pennatulid zooids in presenting a fringe of pinnules along each side identical with those of the typical polyps. The morphological importance of this unitentacular condition was discussed at some length, the single tentacle being shown to have constant anatomical relations and to correspond to the single tentacle present in the young embryos of *Actinia mesembryanthemum*. In conclusion, arguments were adduced against Prof. Kölliker's statement that Umbellula is one of the more primitive genera of Pennatulidæ.

The Differences between the Males and Females of the Pearly Nautilus, by Mr. A. G. Bourne, B.Sc.—The author bases his observations upon the dissection of two specimens, male and female respectively—both adult and well preserved—of *N. pompilius* obtained by Prof. Lankester for the museum at University College, and a specimen of *N. macromphalus* placed in his hands for examination by Prof. Hubrecht, of Utrecht University. The author regards the tentacular lobes as homologous with the arms of a Dibranch, while the tentacles probably represent the suckers, this view, which has already gained considerable ground, receiving very strong support from the hectocotylised condition which the author describes. Eight tentacular lobes may be recognised, four internal, two superior, and two inferior, the latter two being fused together, and four external, the two superior being fused to form the "hood," and the two inferior completing the external ring. In the male four tentacles of the left superior internal lobe become hectocotylised, while the corresponding four upon the opposite side exhibit an exactly similar modified condition, though in a very slight degree, forming a most interesting example of a "rudimentary organ." In the male the inferior internal lobes are present in a very much reduced condition.

Budding in Polyzoa, by Prof. Haddon.—This author asserted that according to most observers the buds in ectoproctous Polyzoa are derived solely from the endocyst, or according to Joliet, from the endosarc (funicular tissue). It is possible that a combination of these views may be the more correct, since the development of the bud itself appears to prove that several distinct tissues are implicated, and that as a matter of fact all the three embryological layers are concerned in this process.

On a Young Specimen of the Grey Seal (H. gryphus) from Boscastle, Cornwall, by Prof. Lankester.—Prof. Lankester had the good fortune to find a specimen of this seal at the above place about a fortnight ago. He carried it about a quarter of a mile to a more sheltered place, but found it in the original place the next morning. As the specimen was not more than twenty-four hours old, was very weak, and could not swim, it is very probable that the mother had carried it during the night. The animal was taken and fed on milk; he was sent to the Zoological Gardens, and when last heard of was doing well. Mr. Cordeaux said it was extremely interesting that this specimen had been found, as previously it had not been seen so far south. Prof. Moseley remarked that the dislike of young seals to the water had probably some connection with their descent from ancestors which inhabited the land quite as much as the water.

On Wool Plugs and Fertilised Fluid, by Mr. Duncan Matthews.—This paper describes in detail a series of experiments undertaken with the object of testing the filtering action of cotton wool plugs upon the atmosphere, and the consequent possibility of permanently preserving fluids sterilised in flasks plugged with wool. The author found, after a long series of experiments, that sprayed water carrying germs could pass through wool plugs as well as between it and the glass, when an inward current was produced by the cooling of the flask. He therefore sees no reason why air should not in the same manner carry germs through or alongside the wool. As an experimental fact, he found this to be so in a very large percentage of his experiments. All the experiments related to one kind of bacterium, the hay-bacillus.

The President then introduced the next four papers, which all related to various phases of the germ-theory, by a few remarks on bacteria. Micrococcus, bacillus, spirœchœte, spirillum, and leptothrix were briefly spoken of, and the terms saprogenous, cromogenous, and pathogenous explained; the first of these papers was then read.

On the Germ Theory of Disease from a Natural History Point of View, by Dr. Carpenter.—Dr. Carpenter stated that many of the existing genera and species of animals and plants were altogether uncertain, that as fresh knowledge was gained, so it was found necessary to modify our accepted views; this especially holds good with genera which have great power of adapting themselves to various circumstances, and which consequently produce numerous variations. This power of modification, the author stated, was much more marked in the lower than in the higher forms of either kingdom, and was especially found in bacteria. The author then cited the case of the germ producing smallpox, in which he stated the germ had undergone such a modification, that whereas two centuries ago the disease was very severe, and known as "black-pox," it now existed only as a mild disease. During the last siege of Paris, however, the conditions were such that the germ reverted to its original form, and produced the same severe disease as two centuries ago. Many facts were brought forward to confirm this view.

On some Cell Contents in Coffee and other Plants, by Marshall Ward.—The author has for some time past been engaged in researches among the fungi, particularly those which attack living plants; and his attention was necessarily directed to cell contents of the host plants; among others the cells of *Coffea*, *Cinchona*, *Pavetta*, and *Canthium*, and one or two cryptogams have received special attention. The present paper refers particularly to one class of bodies found in the cells of the cultivated species of *Coffea—C. arabica*, *C. liberica*, &c. Certain fatty bodies, mixed with proteids, found in the endosperm, are traced into the embryo and seedling, and their reactions and changes noticed. In the leaves, cortex, and other soft parts of the mature plant are found "fat-bodies," under circumstances which compel the author to conclude that they are the result of constructive activity, and not products of destructive metabolism. These "fat-bodies" consist of varying mixtures of fats and other substances, probably, in part, proteid, and show considerable similarity to the fatty masses of the endosperm. Details are given of their reactions and changes, and the author believes that they represent temporary stores, to be worked up further in the construction of higher bodies.

On the Closed Condition of the Seed Vessel in Angiosperms, by Alexander S. Wilson, M.A., B.Sc.—Flowering plants may be divided into two classes, according as their seeds are contained within a closed seed vessel, or are exposed without any such covering. The former, having their seeds included in a pod or pistil, are called Angiosperms or cover-seeded; and the latter, on account of their naked seeds, Gymnosperms. The Angiosperms, which form by far the more important division, embrace most of the common plants which make up the bulk of our flora, and are universally regarded as the more highly organised of the two. Corresponding to the lower degree of organisation, Gymnosperms (yew, cypress, fir, &c.) appear earlier in the geological strata, and are largely represented in a fossil state. The pod of an Angiosperm, such as that of a wall-flower, is composed of metamorphosed leaves termed carpels. In nearly every instance these leaves are so united as to form a completely closed case enveloping the young seeds. At first sight it would seem as if the presence of such a covering were a disadvantage, for before the young seeds or ovules can develop to maturity they require to be fertilised. The process of fertilisation is effected by the agency of pollen dust, which is brought to the flower either by the wind or by insects visiting the flower in search of honey. Now in the case of Gymnosperms, where the seeds are exposed uncovered, this pollen dust,

if blown by the wind, simply alights on the surface of the seed and fertilises it directly. In plants with covered seeds, on the other hand, the pollen cannot gain direct access to the ovules, but can only fall on the surface of the envelope formed by the carpellary leaves. This covering has to be penetrated before fertilisation of the seeds can be effected. For this purpose several adaptations of tissues, modifications of structures, and changes in the position of the ovules are rendered necessary, all of which might easily be dispensed with were the seeds exposed as they are in Gymnosperms. It can hardly be supposed that all this specialisation, whereby the process of fertilisation so simply performed in Gymnosperms becomes complicated by being broken up into numerous subsidiary processes, should be called into play unless some very important end were to be attained by the presence of a completely closed pistil. What then is the *rôle* of the pistil? The young seeds are the most vital parts of the vegetable organism. Composed of delicate cells, containing much nitrogen and phosphorus, they may be said to constitute the chemical and physiological wealth of the plant. On this account they must be carefully guarded from any external influence that would degrade their chemical constitution or lead to a misappropriation of the nutritious matters they contain. Now it is well known that the leaves and stems of nearly all plants are subject to the attacks of parasitic fungi. The spores of these parasites germinate on the leaves of the plant on which they alight, and appropriate its juices to their own use, as, for example, in the case of the fungus which occasions the potato disease. All kinds of moulds, putrefaction, and fermentation are in like manner produced by the development of spores falling frsm the atmosphere which have found a favourable soil for their growth. Now a more suitable pabulum or nidus for the growth of mould germs can hardly be imagined than that which would be afforded by the immature ovules, seeing that in them is collected a large amount of easily assimilable matter destined for the nutrition of the embryonic plant. There can be little doubt then that the disadvantages which the pistil brings with it, and the higher organisation thereby entailed, are more than compensated for by the security which it gives against the entrance of fungus spores. The pea pod is in fact the counterpart of the hermetically sealed or stoppered flasks, in which Tyndal and Pasteur performed their well known experiments on the preservation of organic fluids against putrefactive changes. These observers found that it was possible to preserve beef tea or other organic infusion for any length of time, provided no air was admitted to the flask, or if care were taken to filter the air from all organic germs by passing it through cotton wool, &c., before allowing it to have access to the infusion. The pistil of a flower then may be regarded as analogous to the flask in these experiments. The loose cellular substance of the style, and the acid secretion on the stigma, may in like manner serve to filter the air before it reaches the ovules contained within the ovary. At any rate the air must pass through the substance of the carpels before it can reach the ovules.[1] When this fact is viewed in connection with the experiments of Van Tieghem, which show how difficult it is to effect the direct fertilisation of ovules with pollen, owing to the constant appearance of microscopic fungi, a new light is thrown on a vast number of vegetable and animal structures. The same principle operates not only among phanerogams, but even among the cryptogams; nor could a principle of such general application in the vegetable world have failed to play an important part in the animal kingdom. It is remarkable then to find that within the cup of the commonest wild flower we have the results of recent scientific research anticipated, the benefits of the antiseptic system as completely secured as by modern surgery, and a parallel between nature and art which agrees even to the minutest detail.

Protoplasmic Continuity in the Florideæ, by Thomas Hick, B.A., B.Sc.—The author has made an extensive series of observations on a large number of species belonging to the more important genera of Florideæ, with special reference to the question of protoplasmic continuity. He finds in all the species examined that there is such a continuity, and that of the clearest and most definite character. In the simpler filamentous types, such as *Petrocelis cruenta* and *Callithamnion Rothii*, the protoplasm of each cell is united with the protoplasm of contiguous cells by means of a fine protoplasmic thread. This obtains throughout the whole plant. In the more complex types, such as *Callithamnion roseum*, *C. arbuscula*, and *C. tetragonum*, the arrangements for continuity are of a more elaborate character. The contents of the axial cells are not only united with one another, but also with those of the cortical cells, however numerous these may be. The cortical cells also display continuity *inter se*. *Ptilota elegans* is a most instructive form, as here the connective threads may be easily traced from the tips of the ultimate branchlets to the base of the stipes of the frond. As the threads become older, they increase in thickness, thus showing that they are not merely temporary or effete structures. On the stouter connecting cords a sort of ring or collar is developed at about the middle point, and over this is stretched, *in some cases*, a delicate diaphragm. The behaviour of both ring and diaphragm when treated with microchemical reagents, is similar to that of the ordinary protoplasm.

On Peripatus, by Adam Sedgwick.—Mr. Sedgwick showed living specimens of this animal, and briefly described them.

Some newly-discovered Localities of the Rare Slug Testacella haliotoidea, by E. J. Lowe, F.R.S.—This rare and hitherto extremely local nest-eating slug has recently been found in various places in Monmouthshire and South Wales. Shirecester Hall, Shirenewton Village, Tatton Court, Hardwick, Chepstow, Cardiff, and various other places, were mentioned as producing more or less abundant quantities of this interesting creature.

Department of Anatomy and Physiology

On the Relations of Protoplasm and Cell-wall in the Vegetable Cell, by F. O. Bower.—After tracing the history of this subject, it was concluded that it has now been demonstrated with as much certainty as is possible by the use of microchemical and staining reagents, that in certain cases, the number of which is now constantly being increased, there is a direct connection between the protoplasmic bodies on opposite sides of cell-walls, and that this connection is established by means of fine strings of protoplasm which, in the cases observed, run nearly transversely through the walls. The question remains whether this is the *only* mode of permeation of the cell-wall by protoplasm. The author could not accept it as proved as yet that any further permeation of the cell-wall by protoplasm, as a reticulum or otherwise, really exists, but he brought forward certain grounds for regarding such a permeation as possible or even probable, taking into account chiefly those phenomena observed in *free cell-walls*, in order thereby to avoid any confusion with connecting strings, such as those already proved to exist:—1. The strings already observed vary greatly in thickness, from the well marked to the indistinguishable; thus we have evidence of the existence of strings which would probably not have been recognised were it not for comparison with other examples. Further, it has been shown, in the author's paper on plasmolysis, that protoplasm may be drawn out into strings so fine as to defy definition even by high powers of the microscope; thus there can be no objection on the ground of the small size of the hypothetical strings or reticulum. 2. Those cases in which a perforation of cell-walls has been demonstrated are those very cases in which a most efficient physiological connection is required. There is no reason why a less obvious permeation should be denied where the requirements are less, but by no means absent. 3. There is *a priori* probability of some form of permeation of cell-wall by protoplasm if Strasburger's account of the growth of cell-walls be correct. 4. A strong argument in favour of such general permeation of walls by protoplasm is found in the existence of important chemical changes in the substance of certain cell-walls *at points at a considerable distance from the main protoplasmic body*, *e.g.* formation of cuticular substance, wax, &c., which differ fundamentally from cellulose, are insoluble in water, and are apparently formed *in the wall itself*. The tendency of recent observations is to show more and more clearly how close the connection of protoplasm with the important chemical changes in the plant is; thus it appears probable that protoplasm is present in some form or other in the cell-wall. Reasons were also given for thinking that the exposure to air is not an important factor in the above changes. These and other considerations show that though this permeation of the wall cannot be accepted as proved as yet in any one case, still the subject deserves more close attention than it has yet received, while it may be expected that the application of new methods may produce definite results bearing on this very important question.

On the Occurrence of Chlorophyll in Animals, by C. A. MacMunn, M.D., F.C.S.—The difficulties attending the recog-

[1] This view of the function of the carpels is corroborated by the fact observed in the case of Reseda, the carpels of which open soon after fertilisation. After dry weather an accumulation of sand and dust frequently takes place within the ovary of Reseda.

nition of chlorophyll in animals was first referred to, and the writer stated that he had based his conclusions as to the identity of animal and vegetable chlorophyll on the fact that the wave-lengths of the centres of the bands of the same solutions of animal and vegetable chlorophyll are the same, and that the wave-lengths of the centres of the bands are the same when the same reagent is added to the respective solutions. Without committing himself to accepting the views of Kraus or Sorby, he applied the term chlorophyll to that colouring matter, or mixture of colouring matters, which can be extracted out of green leaves, such as those of *Primula*, by means of alcohol or alcohol and ether. The colouring matter, to which the writer has given the name "enterochlorophyll" (*Proc. Roy. Soc.* 226, 1883), and which can be extracted from the liver or other appendage of the enteron of invertebrates, was shown to be probably produced by, and in, the body of the animal, and for certain reasons (detailed at length) not food chlorophyll. The absence of parasitic algæ in sections of the livers of certain mollusks which yield enterochlorophyll shows that this pigment cannot be due to their presence. The writer further showed that Pocklington's opservations, published in the *Pharmaceutical Journal* (1873), on the presence of chlorophyll in the wing-cases of Cantharides beetles, could be verified, and he had succeeded not only in verifying the presence of the principal chlorophyll band in the ethereal, chloroformic, and alcoholic solutions of the wing-cases, but the changes produced in the spectra of these solutions on the addition of certain reagents showed the presence of a body indistinguishable from vegetable chlorophyll. Hence Leydig's conclusion as to the presence of that colouring matter in insects was proved to be correct. However, in the case of green larvæ the mere occurrence of a band in red when a strong light is concentrated on the integument may be merely due to the presence of food chlorophyll in the intestine, for, on squeezing out the contents of the latter, the green colour and the band both disappear. The function of chlorophyll was then referred to: it was shown that it could hardly be of much use in respiration, as oxidising and reducing agents do not affect it; that for protective purposes or in mimicry a body of less complex chemical composition might answer equally well, except that the eyes of some invertebrates may be more susceptible to rays of light of a certain wave-length than our own, especially as Sir J. Lubbock has shown that ants perceive the ultra-violet rays of the spectrum which are invisible to us. It may possibly be the persistence of a pigment which was once useful in a remote ancestor in some cases, perhaps at a time when the atmosphere contained much more carbon dioxide than at present. Or again, it may be of use in absorbing the chemically active rays of the spectrum when occurring on the surface of an animal, especially as Zimiriazeff had shown that Langley's observations with the bolometer have proved that the point of maximum energy of the solar spectrum corresponds with the principal chlorophyll band between B and C. In the case of enterochlorophyll this colouring matter may be of use in furnishing material for the construction of other colouring matters, especially as this body and hæmochromogen exist side by side in the bile of some mollusks; and in the bile of the sheep and ox a body exists which fluoresces red and resembles chlorophyll closely, but possesses at the same time some properties which show that it is a hæmoglobin derivative, as proved by the writer (*Proc. Roy. Soc.* No. 208, 1880, and *loc. cit.*). The conclusions which had been arrived at gave support to the view which Prof. Lankester had maintained, namely, that chlorophyll may occur quite independently of the presence of parasitic algæ, as in *Spongilla* and *Hydra*, and that it is in some cases produced synthetically by and in the bodies of animals.

On the Intercellular Connection of Protoplasts, by Prof. W. Hillhouse.—In this paper the author gives the results of a large number of observations to prove the intercellular connection of protoplasm. Out of twenty-two plants examined, these connections were only found in the cortical tissue of *Ilex aquifolium* and *Æsculus hippocastanum*, the pulvinus of *Prunus laurocerasus*, and the winter bud pith of *Acer pseudoplatanus;* he, however, points out that these connections are easily broken in preparation, and that a single connection between a number of cells would be sufficient to produce a perfect unity of action. His conclusions are:—1. That protoplasmic threads connecting neighbouring protoplasts are present in such widely different and diffused structures as sieve-tubes, cortical parenchyma, leaf-pulvinus, pith of resting leaf-bud, and endosperm of seeds. 2. That in the contraction of the protoplast in natural plasmolysis these threads would normally remain unbroken. 3. That they *may* serve to transmit impulses from one cell to another, acting in this way somewhat like a nervous system. 4. That besides the perforating threads, equally widely spread and much more numerous, are threads which attach the protoplast to the cell-wall, whether at the base of pits or otherwise, and that these threads are often opposite each other. 5. That the closing membrane separating two threads often shows differentiation, which suggests permeability, if not "sieve perforation." 6. That in the contraction of the protoplast in natural plasmolysis these threads would naturally be unbroken. 7. That these threads may, when in extension, act upon the cell-wall and put it in a state of slight positive tension. 8. That the presence of minute perforations communicating from cavity to cavity of living cells *would* not, and when communicating with the intercellular spaces *need* not, be a hindrance to the turgipotence of the cells.

On the Continuity of Protoplasm through the Walls of Vegetable Cells, by Walter Gardiner.—The author, after briefly reviewing the work which has already been done in this department, goes on to describe his own experiments with Mimosa, Robinia, Dionæa, and other sensitive plants, and with thickened endosperms in general. In all organs of movement examined, the freely pitted parenchymatous cells were found to communicate with one another by means of delicate protoplasmic threads, which perforate the closing membranes of the pits. The author remarks that the existence of a communication between adjacent cells appears to be very wide, if not of universal occurrence. His own observations, extending over a series of fifteen species of palms and representatives of some thirteen orders, were all found to bear out the above researches, as in all cases definite and well pronounced continuity existed.

On the Muscular Movements that are associated with certain Complex Motions, by R. J. Anderson, M.A., M.D.—When a muscle contracts, one extremity or both extremities may move. When one extremity moves whilst the other is fixed, the fibre may describe a plane surface, as when the moving end lies in a right line or a cone, as when the moving extremity lies in the circumference of a circle or other plane curve. If the fibre lie in the plane of the circle, the cone will be reduced to a plane. Where both extremities move, the fibre may describe a plane, or a cylinder, or a ruled surface of a high order. It frequently happens that when one extremity of a fibre is fixed the other extremity moves in a circle, which itself experiences a movement of translation. The moving point then describes a trochoid, examples in pronator teres and pectoralis major. Muscle fibre may describe curves of a complex nature, although the muscles themselves form a simple surface, as in the two muscles already cited.

SECTION G—Mechanical Science

A Comparison of Morecambe Bay, Barrow-in-Furness, North Lancashire, West Cumberland, &c., in 1836 *and* 1883, by Hyde Clarke.—The writer gave an account of his plans and surveys in 1836 for forming a through line of railway from Lancaster, through Furness and West Cumberland, across the Solway to Dumfries, and thence to Glasgow, by the course now adopted by the Glasgow and South-Western Railway. The chief feature was the passage and embankment of the large estuaries called Morecambe Bay. The history of this undertaking was given, with details of the plans of Messrs. Hyde Clarke, George Stevenson, Hayne, Rastrick, &c., and the works carried out by Mr. James Brunlees. The plans of the Warton Land Company were described. The effect of the undertaking in the development of Barrow or Foudrey and the iron manufacture of Furness was illustrated. There were still 40,000 acres to be reclaimed, and capable of becoming good agricultural ground. If reclaimed it would enable a railway to be carried across the bottom of the Bay. There was now a population of 50,000 in Barrow, and although there had been great depression there were elements which pointed to a probable increase of from 100,000 to 200,000 persons.

The Term "Stability," as used in the Literature of Naval Architecture, by Prof. Osborne Reynolds.—The author explained that the origin of the paper had been the report and discussion which had taken place in regard to the lamentable disaster which happened to the *Daphne*. Stability meant a state of being able to maintain a particular position against any forces which tend to upset; or another way of expressing the same thing was a state of ability to maintain a position after being disturbed and allowed to go free to recover itself again. It appeared from

the report of Sir E. J. Reed on the *Daphne* disaster, and the discussion which resulted, that naval architects were using the term stability both in its proper sense, as meaning a tendency to hold a particular position, and also as meaning a tendency to change position in a particular direction. The writer of the paper proceeded to urge the desirability of using two terms, the one to express the greatest angle of di turbance from which a vessel would return to her normal position, and to limit the quantitative meaning of the term "stability" to the measure of that angle, using the term "stiffness" to express the moment of the upsetting forces necessary to produce any particular angle of disturbance. The adoption of that system, which was consistent and definite, would prevent the confusion into which it appeared naval architects had fallen, and it would then be seen that what were ill-called curves of stability would be well-called curves of stiffness.

On the Construction and Working of Alpine Railways, by J. B. Fell, C.E.—There are three Alpine railways in existence at the present time—the Mont Cenis and St. Gothard Railways, which have been made with long summit tunnels and with ordinary gradients, and the Brenner Railway, that has been made with similar gradients but without a long tunnel. The important question has now arisen, and has been taken into serious consideration by the Governments and local authorities interested, as to how far it may be possible to make other trans-Alpine railways, some of which are urgently needed, at a cost that would render them financially practicable; and to accomplish this object it has been proposed to effect a reduction of one-half or more of the cost, by carrying these railways over the mountain passes by means of steep gradients and the use of the centre rail system, as it was adopted on the Mont Cenis Railway. Upon these improved summit railways the same weight and number of trains could be run that are now running on the Mont Cenis Tunnel Railway, and with the protection of avalanche galleries and covered ways the regularity of the service would be maintained at all seasons of the year. The extra cost of working expenses caused by working over a higher level than that of a tunnel line would, if capitalised and added to the cost of construction, still leave a clear net saving of more than one-half in the cost of construction as compared with the cost of a tunnel railway. The result of the experiences of the last twenty-five years seems to point to the conclusion that a method of constructing Alpine railways with long, non-paying tunnels is a thing of the past. The future belongs to the best system that can be devised for overcoming the difficulties of trans-Alpine railways rather by adding to the powers of the locomotive engine and by other mechanical appliances for reducing the cost of traction on steep inclines, which methods are capable of indefinite improvement, than by burying in gigantic tunnels enormous sums of unproductive capital that, when once expended, are irrecoverably lost.

The Euphrates Valley Railway as an Alternative Route to India, by J. B. Fell.—The author described the proposed route, and gave the total cost as 8,500,000*l*. He stated that, when not only its commercial but also its strategical and political advantages were taken into account, it must be admitted that the Euphrates Valley Railway certainly has the prospect of being one of the most successful enterprises in the world. Canon Tristram detailed his experience in the Tigris and Euphrates valleys, and stated that he believed the former to be the preferable route.

On Injector Hydrants, by J. H. Greathead.—This paper described the method proposed for the author for meeting the serious increase of fires in the metropolis. A separate system of water supply at very high pressure would be laid under the footway with hydrants at short distances apart. The high pressure water would be used in conjunction with the ordinary water supply in the mains, and jets of water would thus be enabled to be raised to sufficient heights without the aid of fire-engines. The paper was illustrated by numerous diagrams, and elicited an interesting discussion, generally favourable to the author's views.

Nest Gearing, by Prof. Fleeming Jenkin.—This paper contained an account of a new friction gearing, the chief novelty being in the mode of obtaining any required amount of pressure between the wheels which roll upon each other. As many as thirty-two modifications have already suggested themselves, and the opinions expressed in the discussion were unanimously in favour of the invention as being a very valuable one.

Electric Launches, by A. Reckenzaun.—The paper commenced with a description of the launch *Electricity*, which made her first trip in September, 1882. The *Electricity* is 25 feet long, with a 5 feet beam, and draws 21 inches forward and 30 inches aft. Her speed is 8·3 miles per hour with ten passengers on board. Forty-five Sellon-Volckmar accumulators stored under the seats and decks forward and aft supplied the current to two Siemens D_3 Series dynamos placed side by side on the floor of the boat, with their axes parallel to the propeller shaft. A Carliss-Browne two bladed propeller of 20 inches diameter and 3 feet pitch was employed in these first experiments; straps and pulleys were resorted to in order to reduce the speed of the screw to 350 revolutions, whilst the motors revolved at 950 revolutions per minute. The two motors were coupled in parallel circuit, whereas the cells formed one series. Each machine had its own switch and ammeter, and the starboard machine could be stopped mechanically by means of a friction clutch on the countershaft. Both machines were tested with a Prony brake, and they gave 1·86 horse-power on the brake at 950 revolutions, consuming a current of 21 amperes and 100 volts. At 694 revolutions, 100 volts and 33·25 amperes, the brake horse-power rose to 2·78. With 47 cells on board, the current used by both motors running together was 46 amperes, and the propeller made 360 revolutions; when disconnecting one of the motors the current passing through the other was 33 amperes, and the speed of the propeller shaft fell to 250. Messrs. Siemens' dynamos lend themselves very readily to the purposes under consideration; the height of a D_3 machine is only 10 inches, length 28 inches, and width 23 inches. The two machines weigh together 632 lbs., countershaft, supports, and pulleys 180 lbs., total for the driving apparatus 812 lbs.

Electric Launches, by J. Clark.—This paper contained a very brief account of advances in this subject.

The Fire Risks of Electric Lighting, by Killingworth Hedges.—The author first drew attention to the great difference between the electric currents which have been in constant use for telegraphic purposes and those which are to be supplied by the undertakers under the Electric Lighting Act. The latter can only be said to be free from danger when the heat generated by the current is utilised in its right place, and not developed in the conductors or wires which lead the electricity to the incandescent lamps. The Fire Risk Committee have already issued rules for guidance of users of electric light; these can hardly be said to embrace all the salient points of the new subject, which can only be arrived at after years of practical work. The necessity of proper regulations has already been recognised by the insurance offices, both in the United States and Germany, and some of their special rules are given in this paper. The conductors must be properly proportioned for the current they have to carry; whatever resistance there is in the conductor will cause a corresponding development of heat, which will vary with the amount of electricity passing, and inversely as the sectional area. As the temperature in Dr. Matthiessen's experiments upon the subject was not increased over 100° C., the author has made some further experiments—heating the wires by the electric current from a secondary battery to within a few degrees of their melting-point. Various materials were tried—the wires and foils having such sectional area, and so arranged that, on the current being increased by 20 per cent., they were immediately fused. The total length of each experiment was twenty-four hours, during which time the current passing through varied slightly. The results of the experiments were then given.

SCIENTIFIC SERIALS

Archives of the Physical and Natural Sciences, Geneva, September 13.—Verification of some atomic weights (second memoir); zinc and magnesium, by M. C. Marignac. The atomic weight of zinc, fixed by Erdmann at 65·05 and by Favre and Jacquelain raised to 66, is approximately determined at 65·33, a figure which further analysis may show to be slightly too low. For magnesium, calculated by MM. Marchand and Scheerer at 24 and by others at 24·5, the number 24·37 results from the author's fresh experiments.—Essay on the protistology of Sardinia, with a description of some new or little-known lower animal organisms, by Prof. Corrado Parona. In the fresh and marine waters of Sardinia the presence is determined of as many as 228 species belonging to the families of Bacteria—Monera, Flagellata, Lobosa, Diatomea, Heliozoa, Ciliata, Acineta, and Catallacta. The paper is accompanied by seven illustrations.—Memoir on earthquakes and volcanoes (continued), by Prof. F. Cordenons. In this second and concluding part the

author expounds his own views, and argues against the generally accepted theory that underground disturbances of all sorts have their source, not in the upper but in the lowest regions of the earth's crust.—On a case of commensalism between a fish (*Caranx melampygus*) and a medusa (*Crambessa palmipes*), with two illustrations, by M. Godefroy Lunel. In this instance the fish appears as the parasite or guest of the medusa, taking up its abode in one of its cavities, which it enters and leaves at pleasure without apparent injury to the gelatinous substance of the sea-nettle. This circumstance, which has been fully verified, seems to throw a new light on the relations of a species of *Schedophilus* to the medusa, on which it is supposed to feed, and has accordingly, by Prof. Cocco, been named *Schedophilus medusophagus*. One of these is described by Günther in the *Transactions of the London Zoological Society*, October, 1882.—Meteorological observations with tables of temperature and barometric pressure made at the Observatory of Geneva and on the Great Saint Bernard during the month of August.

Rivista Scientifico-Industriale e Giornale del Naturalista, July 15 and 31.—On the measurement of altitudes by means of the barometer, by S. Paolo Busin.—Further remarks on a new experiment in electrolysis, by Prof. Eugenio Semmola.—On the comparative electric resistance of fixed and vibrating metal wires, by Prof. Angelo Emo.—An essay on some new applications of the hyperbolic functions to pseudo-spherical surfaces, with a description of Gronau's tables for all kinds of trigonometrical functions of cyclic and hyperbolic sectors, by Prof. Angelo Forti.—On the language of birds, by Prof. Luigi Paolucci.

SOCIETIES AND ACADEMIES

LONDON

Entomological Society, October 3.—Mr. R. McLachlan, F.R.S., vice-president, in the chair.—Two new members were elected.—Mr. F. P. Pascoe exhibited several interesting British *Hemiptera*, and Mr. T. Wood exhibited a supposed new British species of *Malthodes*.—Mr. W. F. Kirby (on behalf of M. Wailly, who was present as a visitor) exhibited a large box of bred specimens of various *Saturniidæ*, &c., and some living larvæ of *Telea Polyphemus*, and *Hyperchiria Io*.—Mr. Billups exhibited specimens of the celery fly (*Tephritis onopordinis*), and a small larva of *Meloe* (?).—Dr. D. Sharp communicated some proposed alterations of names in the genus *Batrisus*.—Mr. W. F. Kirby read notes on the Diptera of New Zealand, supplementary to Prof. Hutton's list of 1881.

SYDNEY

Royal Society of New South Wales, July 4.—The Hon. J. Smith, C.M.G., M.D., president, in the chair.—Ten new members were elected and sixty-three donations received. The following papers were read:—By the Rev. J. E. Tenison-Woods, F.G.S., &c, on the Waianamatta shales.—By R. Etheridge, jun., further remarks on Australian Strophalosiæ; and description of a new species of Aucella from the Cretaceous rocks of North-East Australia.—Prof. Liversidge, F.R.S., &c., exhibited specimens of tin ore; he explained that most of the tin worked in this colony was alluvial tin, though occasionally thin veins of crystallised tin had been met with. Those shown, however, were from a vein which had already proved to be of a width of ten feet, and the full width had not yet been reached. The tin, as could be seen, was disseminated through the felspar, and the specimen, which came from the Stannifer Bischoff Mine in New England, closely resembled the ore found in the St. Agnes Mine, in Cornwall, England.

August 1.—The Hon. J. Smith, C.M.G., M.D., president, in the chair.—Three new members were elected, and sixty-seven donations received. The following paper was read:—On plants used by the natives of North Queensland, &c., for food and medicine, by E. Palmer.—Mr. J. Trevor Jones, City Engineer, exhibited and explained the MacGeorge test, an instrument for determining the deviation in diamond drill bores.

PARIS

Academy of Sciences, October 1.—M. Blanchard, president, in the chair.—On the slow upheavals and subsidences of the ground, by M. Faye. In reply to M. Issel of Genoa, the author revives the old theories of Élie de Beaumont, Cordier, and many others, and argues that the progressive cooling of the earth's crust goes on at a more rapid rate under water than on dry land. There is nothing hypothetic in this view, which might have been deduced from the thermometric soundings taken fifty years ago by the *Venus* in deep seas, and repeated with similar results in recent times. It follows that the solidified crust is much thicker under the oceans than on the continents. Hence also the liquid mass in the interior of the globe is subjected to far greater pressure under the seas than on the main land; and as this excess of pressure is diffused more or less rapidly in every direction, the less dense continental crust must yield to the pressure exercised on it from within. It is thus being everywhere continually upheaved, while the submarine crust, becoming denser and denser, is slowly subsiding.—Note on the recent attempts made by M. Delauney and others to foretell seismic disturbances, by M. Daubrée. The author concludes that the hitherto collected statistical data are insufficient to justify any theorising for the present on the future recurrence of earthquakes.—Separation of gallium (continued); separation from tantalic acid, by M. Lecoq de Boisbaudran.—Researches on the encephaloid cancer, by M. C. Sappey.—On the destruction and utilisation of the carcasses of animals dying of contagious diseases, and especially of charbon, by M. Aimé Girard.—Observations made at the Observatory of Marseilles, by M. Coggia.—On the calculus of perturbations, by M. A. de Gasparis.—On the approximate evaluation of integers, by M. Stieltjes.—On the interpretation of some phenomena of the solar spectra, by M. L. Thollon.—On the transport and distribution of electric force; experiments made at Grenoble by M. Marcel Deprez, by M. Boulanger.—On the presence of arsenic in certain wines in the absence of all foreign colouring matter, by M. A. Barthélemy.—Quantitative analysis of the chloroform in the blood of an animal treated with this anæsthetic, by MM. Gréhant and Quinquaud.—Researches on parasitic infusoria, with an account of fifteen new species of protozoa, by M. G. Kunstler.—On the marine lamprey, by M. L. Ferry.—On the caterpillar that feeds on the citron blossom, by M. Laugier.—On the position of a fœtus found in a *Pontoporia Blainvillei*, by M. H. P. Gervais.—On a meteor observed at Evreux on the night of September 23, by M. H. Dubus.

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