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*"To the solid ground*
*Of Nature trusts the mind which builds for aye."*—WORDSWORTH



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NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE.

"*To the solid ground*
*Of Nature trusts the mind which builds for aye.*"—WORDSWORTH.

THURSDAY, NOVEMBER 2, 1893.

## *BRITISH FOREST TREES.*

*British Forest Trees.* By J. Nisbet, D.Œc. (London: Macmillan and Co., 1893.)

WITH the exception of Dr. Schlich's able "Manual of Forestry," of which two volumes are now before the public, the English student of arboriculture has for many years past been almost entirely dependent on French and German works for recent information as regards the progress of that part of the art of forestry which deals with the cultivation of our native and introduced trees. The present work is a praiseworthy attempt to remedy this state of dependence, and to provide British foresters with a text-book which shall give the results of modern experience in an English dress.

The plan of the work is simple and to the point. After briefly summarising the history of British forests—too briefly, perhaps, will be the opinion of some—the author proceeds to enumerate the chief forest-trees of our country. To those who miss any reference to some of the minor and unimportant woody plants growing in our hedges, it should be pointed out that the principal forms met with as underwood or coppice are treated separately at the end of the book; while those who feel any surprise at the introduction of several European (but not British) and American trees, especially conifers, should bear in mind that these have been so much planted in England and Scotland of late years, that no work on British forestry can afford to neglect them. Mr. Nisbet seems to have carefully stated what is necessary in this connection.

The next sections of the book deal with the important and very interesting subjects of forest growth in relation to soil, the growth of timber in general, and comparative considerations regarding the growth of forest trees.

It may perhaps be doubted whether the author has succeeded in stating anything new in this connection, beyond what has already been put forward in other text-books, and it is admitted that the sources of the information are almost entirely continental, especially German. Perhaps the chief merit of these parts of the book is the author's manner of putting the facts; for, on the whole, they read well and consecutively, and no student of sylviculture can fail to profit by them.

Sylviculture—and the same is true of forestry in general—is a subject about which much can be written and said, and the temptation to be prolix is great, with such materials. The author's conscientious acknowledgments of the sources of his quoted tables and experimental data may certainly be put to his credit; and although we may doubt whether any practical forester will accept all the statements unreservedly—for foresters, like farmers, are often somewhat apt to generalise too widely from individual experience in one part of a country—few will deny that Mr. Nisbet has succeeded in putting forward very plainly a large amount of information about the sylvicultural aspects of forests in general. The chief fault to be found with this part of the book is, perhaps, that the experience on which the statements are based is almost entirely German, whereas there is really a great deal to be said about the behaviour and treatment of forests in this climate as well.

The principal, and by far the greater part of the book however, is concerned with the treatment of the several species of forest trees in detail. Here, again, the British cultivator will doubtless raise the objection that the author almost entirely confines himself to the experience of foresters in Germany; but it is more and more borne in upon the reader that there is reason in this, in so far that several really great authorities on the cultivation of trees have arisen in that country, whereas it would be difficult to name any in this country.

Be this as it may, there can be no question that Mr. Nisbet has succeeded in collecting a very large amount of valuable information regarding the experience of foresters as to what trees will grow in certain situations, how fast they may be expected to grow there, and how much timber they may be made to yield if properly treated; as to what trees should preferably be grown together in mixed forests, and why such and such mixtures are undesirable; and, further, to what dangers given

species are exposed when grown in quantity, and so forth.

Some of the sections are notably long, and the author gives signs of the discursive habit incidental to those who read and transcribe much from German text-books; moreover, there are sentences which betray the German method in their construction, and there is a distinctly Teutonic sound about some of the terms and short phrases, such as "soil-improving," "free enjoyment of light and air," "above-sketched method," "equal-aged crops," and so on.

With all its faults of diffuse writing, and a certain amount of repetition, the work is likely to be valuable to students of forestry in this country, as setting forth the experience of German and other continental authorities in the growth and tending of mixed and other forests. One or two misprints have come under our notice, *e.g.* an *f* has dropped on p. 161; and should not "prunosa" (p. 328) be *pruinosa*? Again, why adopt the antiquated term "Scots Pine"?

## ASTRONOMY OF THE NINETEENTH CENTURY.

*A Popular History of Astronomy during the Nineteenth Century.* By Agnes M. Clerke. Third Edition. (London: A. and C. Black, 1893.)

DURING the six years that have elapsed since the publication of the second edition of Miss Clerke's classical history of astronomy, new light has been thrown upon a number of old ideas, and many important discoveries have been made. It became necessary, therefore, for the authoress to revise her work, to add here, and substitute there, and in all cases to incorporate the recently-acquired facts without breach of continuity. There is no suggestion of interpolation, and nothing but praise can be given for the manner in which the selected material has been assimilated.

Attention may be directed with advantage to one or two points. On p. 199 a description is given of the luminous outburst observed upon the sun in September, 1859. The occurrence is supposed to have been followed immediately by a break in the magnetic records at Kew, and every astronomical text-book instances it in evidence of the sun's ability to disturb terrestrial magnetism. Miss Clerke's words with reference to the matter are as follows, the italicised expression being her own:—"*At the very instant* of the solar outburst witnessed by Carrington and Hodgson, the photographic apparatus at Kew registered a marked disturbance of all the three magnetic elements." Now, at a meeting of the Physical Society in 1886, the late Mr. Whipple said that from an examination of the magnetic curves, he believed "the very slight notch in the record, many similar to which have occurred since, was of an accidental nature, and a mere coincidence." (NATURE, vol. xxxiii. p. 621.) Further, in a letter to the writer of this notice, Mr. Whipple remarked "it was merely an insignificant wriggle of the curves that was recorded at the time of the Carrington and Hodgson observation, and the great magnetic storm did not commence for some fifteen hours later." Miss Clerke would do well to mention Mr. Whipple's contention in a future edition, and if she will look at the traces and decide the point—accepting Sabine's interpretation of a magnetic disturbance (*Phil. Trans.* vol. cliii. p. 274), she would do a good work. Possibly the coincidence will be disproved before the appearance of the next edition. Tenets of belief accepted quite as implicitly have had to be given up in the interim between the publication of the second edition and the one before us. Thus, in the former edition we read (p. 437) "the conspicuous bright line of the Draco nebula was found to belong very probably to nitrogen"; whereas the present rendering is "the conspicuous bright line of the Draco nebula, although nearly accordant in position with one belonging to nitrogen, has since proved to be distinct from it." But for the suggestion that the chief nebular line had its origin in magnesium, the nitrogen origin would, in all probability, still be accepted. The search for truth initiated by the suggestion, has thus borne good fruit in disposing of the nitrogen-origin "for ever and for aye." One begins to wonder why the idea remained above suspicion for so many years. It is well known that the green line of nitrogen is double, and it now appears that the magnesium fluting is really nearer the true position of the chief nebular line than the nitrogen double. What is more, the magnesium origin was indicated by laboratory experiments, whereas nitrogen had nothing but an approximate coincidence to support it.

In connection with the spectra of nebulæ it may be pointed out that no mention appears to be made of the observation of the discontinuous character of the spectrum of the Andromeda nebula (*Roy. Soc. Proc.* vol. xlv. p. 216), and of the white nebula in Draco, G.C. 4058 (*Ibid.* vol. xlviii. p. 219). This is to be regretted, for the observations are of importance, and, in all probability, many of the spectra now classified as continuous are only irregularly so; hence a study of these minute differences of brightness may very considerably add to our knowledge of stellar constitution. We also fail to find a description of Prof. Boys' work on the heat of the moon and stars (*Roy. Soc. Proc.* vol. xlvii. p. 480).

There are seventy-two more pages in the third edition than in the previous one, and five plates have been added. An extremely useful set of tables of astronomical data has also been included. The chronological table has, of course, been brought up to date, and it gives an excellent digest of the work that has been done between March 1774 and April 1893. It can hardly be said, however, that the strict impartiality which should characterise a history of astronomy has been exercised when an event of such local interest as a "Lecture by Dr. Huggins, on Nova Aurigæ, at the Royal Institution," is recorded as having taken place on May 13, 1892, while the announcement on February 8, 1892, of the duplex nature of the lines in the spectrum of the same Nova is unmentioned in the table.

The merits of the volume are now so well known that it is quite unnecessary to expatiate upon them. It seems to us, however, that if Miss Clerke were more a historian and less a partisan, her work would be of higher value.

## OUR BOOK SHELF.

*Inorganic Chemistry for Beginners.* By Sir Henry Roscoe, F.R.S., assisted by Joseph Lunt. (London: Macmillan and Co., 1893.)

Everyone recognises the necessity for having works upon elementary science written by men in thorough touch with their subject. It is with some satisfaction, therefore, that we notice this book, in which Sir Henry Roscoe clearly expounds the elementary principles of chemistry, and describes some of the non-metallic elements and their more important compounds. The book differs from the author's well-known "Lessons in Chemistry" in arrangement and in style, and is far better suited to the tyro in chemistry. In fact, it is adapted to suit the requirements of the syllabus of the Department of Science and Art, and both teachers and students under the Department will benefit by its introduction. There are twenty-one lessons in the book, each complete in itself. At the end of each lesson is a brief summary and a set of questions bearing upon the subjects treated. Believing with all educationalists that principles only become apparent when they are reflected by facts, the author illustrates each step with an experiment. One hundred and eight illustrations elucidate the text, and though many of them are of the ordinary stock character (which is, perhaps, unavoidable in a book of this kind) a fair proportion are from new blocks. In every respect the book is a good one, and contains the kind of knowledge that should be imparted to all beginners of science.

*The Chemistry of Fire.* By M. M. Pattison Muir. (London: Methuen and Co., 1893.)

THE fact that this book belongs to a University Extension Series vouches for the popular character of the contents. Extensionists should welcome Mr. Pattison Muir's contribution to their literature, for it represents the work of a practical teacher, and combines accuracy with simplicity. It is now generally conceded that the best way to teach chemistry is to deal first with common occurrences and things, and finally to generalise. Let a student once obtain a correct notion of the changes of composition that happen in the burning of a candle, and he can comprehend all chemical changes. We therefore commend the book before us to the notice of committees and organisers of technical education, for it contains just the kind of knowledge that should be imparted to all students under their guidance. Like the majority of the volumes in the series to which this one belongs, the illustrations are few and very sketchy. On this account it will be difficult for the home-reader to get a clear conception of many of the experiments.

*Solutions of the Exercises in Taylor's Euclid I. to IV.* By W. W. Taylor, M.A. (Cambridge: University Press, 1893.)

BY the publication of these solutions, Mr. Taylor has furthered very considerably the usefulness of the book written by his brother. In the book he has worked out very fully all the problems, and has arranged the text in such a form as to be thoroughly intelligible to any student. Where several problems were of a similar character, it has been thought expedient to adopt a different mode of solution, while in some cases duplicate solutions have been given. Extension of theorems have here and there been inserted, and a few additional exercises will also be found to have been interpolated. By the adoption of a simple notation, reference can be directly made to the problems in the "Pitt Press Euclid." Both teachers and taught will find that they have a very useful companion to the above-mentioned book, while the latter will be very much enlightened in the art of solving many problems.

## LETTERS TO THE EDITOR.

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

### The Recent Glaciation of Tasmania.

IN a paper read before the Royal Society of Tasmania in June last, Mr. R. M. Johnston, F.L.S., gives a sketch of what is known of the glaciation of the island, or rather of the western portion of it, for no indications of glaciers appear to have been discovered in the eastern half. This difference is supposed to be due to the fact that on the western side of the island the rainfall is from 50 to 76 inches annually, while in the central valley it is but little over 20 inches. Indications of glaciation among the western mountains were noticed by Mr. Charles Gould, Government geologist, about forty years ago, and from information received from him through the late Chief Secretary of Tasmania, the Hon. J. R. Scott, Mr. Johnston took up the inquiry, and for many years has made explorations in the western plateaus and mountains. Mr. C. P. Sprent was another explorer who published some account of the glacial phenomena in 1886, while more recently Mr. T. B. Moore and Mr. Dunn have recorded similar observations. Mr. A. Montgomery, the present Government geologist, has also just published a paper on the same subject.

Mr. Johnston tells us that he has personally explored the whole of the western mountains, from the Picton and Craycroft Rivers, southern branches of the Huon, in the extreme south, along the mountain ranges forming the western border of the central plateau, quite through to Emu Bay on the north coast; and that he has found the clearest evidences of glaciation in almost every valley throughout this great extent of country. From the Arthur Range in the south to Mount Bischoff in the north, are numerous moraines, *roches moutonnées*, tarns and lakes in great abundance, polished and striated rock-surfaces, and numbers of true erratics. Near the sources of the Franklin River, under Mount Hugel, and only six or seven miles west of Lake St. Clair, are Lakes Dixon and Undine, of which Mr. Johnston writes:—"The valley of Lake Dixon is *par excellence*, the ideal of a perfect glacier valley. No one, however ignorant of glacial action, could in this neighbourhood gaze upon these beautiful scooped, or rather abraded lakes or tarns, the snow-white, polished, billowy, and cascade-like *roches moutonnées*, composed of quartzites, on the upper margin of Lake Dixon, together with the tumbled moraines and large erratics on the lower banks—at a level of about 2000 feet—without being impressed with the idea that its singularly characteristic features must have been produced by the slow rasping flow of an ancient river of ice."

Further north, the Murchison, Macintosh and Huskisson rivers, all branches of the Pieman River, contain similar glacial markings; and Mr. Dunn has recently described others of the same character about Lake Dora, nearer to the west coast. The latter observer lays special stress on the rounded planed and scored rocks, on hard quartzite and conglomerate rocks rounded and polished, on numerous tarns in rock-basins, on moraines covering hundreds of acres, and on numerous huge erratics and perched blocks. (See Annual Report of the Secretary for Mines, Victoria, 1893, p. 21.)

Mr. T. B. Moore states that he found the rocks polished and striated within 25 feet of the top of Mount Tyndall, or 3850 feet above the sea, a sufficient indication that the great central plateau at an average elevation of nearly 4000 feet must have been buried in ice or *névé* to a considerable depth, and have formed the feeding ground for the glaciers, whose effects are so visible in the adjacent western valleys. The Tasmanian geologists are united in the belief that the glaciers never reached the coast or descended much below the 2000 feet level, and that the ice did not extend to the central valley or the eastern side of the island. They therefore speak of it as a *glacier*, not a *glacial* period, the conditions being somewhat similar to those of the Alps at the present time; but, owing to the great difference in the rainfall, there was a more marked contrast between the western and eastern districts, while the lofty central plateau afforded a much more extensive snow-field than Switzerland now possesses.

The facts here stated on the authority of Mr. Johnston, sup-

ported by those of three other observers, two of them being the Government geologists, render more singular the statements of Messrs. Officer and Spencer (NATURE, June 29, p. 198) as to their not finding any traces of glaciation in the country around Lake St. Clair, which they explored for a month. Lake Dixon, which Mr. Johnston describes as presenting all the evidences of glaciation in their fullest development, appears to be less than ten miles from the lower end of Lake St. Clair, according to the best map I can refer to; while Lake Petrarch, which Mr. Officer describes as seeing from the top of Mount Olympus, lies between the two in the Cuvier valley, and is also mentioned by Mr. Johnston as being within the highly-glaciated region. It is quite possible that the lakes on the great plateau may be due to damming up, owing to movements of the superficial gravels and clays by the ice or *névé* sheet; but there are evidently an abundance of small valley-lakes and tarns in the western valleys so surrounded by all the marks of extensive glaciation as to render it almost certain that they are true ice-eroded rock basins. It is much to be wished that a more detailed account of this interesting district, with a good map showing all the mountains, lakes, and valleys referred to, would be given us by one of the local geologists. ALFRED R. WALLACE.

## The Supposed Glaciation of Brazil.

MR. WALLACE observes in his letter on this subject, published in NATURE (vol. xlviii. p. 589), that "no authoritative disproof has yet been given of the exceedingly strong and positive statement of Agassiz and Hartt."

I confess to my mind the matter had seemed disposed of by the interesting discussion of the subject to be found in the "Notes of a Naturalist in South America" (1887), by the late Mr. John Ball, F.R.S. This experienced and accurate observer arrived at the conclusion from a study of the phenomena on the spot, that they could be sufficiently accounted for by subaërial denudation (see, in particular, pp. 313–8).

In the following passage he rejects the agency of glacial action as definitely as his habitual caution and modesty would allow:—

"I was unfortunately not acquainted at that time with the observations made near Tijuca by Prof. Alexander Agassiz, which appear to him to give evidence of glacial action in this part of Brazil. It would be rash, especially for one who has not been able to examine the deposits referred to, to controvert conclusions resting on such high authority; but I may remark that the evidence is confessedly very imperfect, and that the characteristic striations, either on the live rock or on the transported blocks, which are commonly seen in the theatre of glacial action, have not been observed. I lean to the opinion that the deposits seen near Tijuca are of the same character as those described by M. Liais[1] as frequent in Brazil. The crystalline rocks are of very unequal hardness, and while some portions are rapidly disintegrated, the harder part resist. The disintegrated matter is washed away, and the result is to leave a pile of blocks of unequal dimensions lying in a confused mass." (P. 342.) W. T. THISELTON-DYER.

Royal Gardens, Kew, October 23.

## The Nativity of Rama.

I HAVE been much interested in the letter of "Kanhaiyalal," which appears in your issue of August 31. I fully agree with him in the view taken in regard to the verification of dates by astronomical methods, and it really does seem somewhat singular that the example of Sir William Jones, the pioneer of Orientalism in Europe, should have been entirely neglected by his learned colleagues and successors in this department of research. From many considerations it must be obvious that wherever mention of planetary "yogams" or conjunctions, siderial and lunar positions, &c., are given in the text of any classical work, they are to be preferred to any arguments drawn merely from literary style and other empirical data—so much relied upon by Orientalists and scholars generally—when the question is one of a calendaric date.

I have endeavoured to work out the calculation of Rama's birth figure. In *Ramayana* is the following slokam, or stanza, referring to Rama's birth:—"*Chaitre navamike tithau Nakshatre aditi daivatye sewochha samstheshu panchasu Griheshu karkate lagne.*" From this we learn that Rama was born in the ninth day of the Moon's age, and that five planets were in their exaltation signs, the rising sign (*lagnam*) being Cancer (of the Hindu Zodiac). The planets' places are given in Section 18 of the English translation of *Ramayana*, by Manmatha Nath Dutt, M.A., in the following words:—

"And then, when six seasons had rolled away after the completion of the Sacrifice, in the twelfth month, on the ninth lunar day, under the influence of the Punarvasu asterism, when the Sun, Moon, Saturn, Jupiter, and Venus were at Aries, Capricorn,[1] Libra, Cancer, and Pisces, and when Jupiter had arisen with the Moon at Cancer, Kaushalya gave birth to that lord of the universe, bowed unto by all the worlds, Rama, &c."

It may be well to state for the benefit of those not acquainted with the Hindu zodiac, that an asterism includes 13° 20′ of the ecliptic circle, and consequently there are twenty-seven asterisms in all. Of these, Punarvasu is the seventh. The zodiac commences with the asterism *Aswini*, and the fixed star *Revati* is the point from which enumeration of longitude begins. This star is said to have been coincident with the equinoctial point *To* in the year 3600 of the Kali Yuga, *i.e.* 498 A.D.

The last conjunction of Saturn and Jupiter in the sign Libra was in K.Y. 4224, and the one previous in K.Y. 1344; and from this we must subtract three Signs to bring Jupiter into Cancer (its exaltation). This equation referred to the "period" of Jupiter, *i.e.* twelve years, gives three years to be subtracted. The year K.Y. 1341, therefore, would see Saturn in Libra, and Jupiter in Cancer as required.

The Moon being nine days old at the birth of Rama, and its motion in respect to the Sun being 12° per day, its distance from the place of conjunction must be taken as over 96°. But it is stated in the *Slokam* that the Moon is in Punarvasu, and as this asterism ends at 93° 20′ from the star Revati, it is evident that the conjunction of the luminaries took place in the twenty-sixth degree of *Minam* or Pisces; and that on the ninth day the Moon was in the first degrees of Cancer (Hindu *Kartaka*) and the Sun in the fifth degree of Aries (Hindu *Mesham*).

To determine the date of this planetary epoch we must have recourse to the Ayauámsha, the distance between the fixed star Revati and the Vernal Equinox. The Hindus compute this to be 54″ per year, and in accordance therewith their month of Mesham (Aries) begins on April 11. At the present time Revati is behind the Equinox, but in K.Y. 1341 it was in front of it, regarded by the order of the Signs. The calculation for K.Y. 1341, according to Suryasiddhauta, is:—

$$(3600 - 1341) \times 54'' = 33^\circ\ 53'\ 6''.$$

Referring this to the Equinox, it gives a point corresponding to the twenty-seventh degree of Aquarius in *our* zodiac, which was the point at which the Hindu zodiac began in the year K.Y. 1341; and from this we must take 4° to bring us to the 26th of *Minam*, wherein the Sun and Moon were conjoined at the birth of Rama. The result is the twenty-third degree of Aquarius in our zodiac.

We have already obtained the year K.Y. 1341 from the positions of the planets Jupiter and Saturn, and we may now apply this luni-solar position as a test.

On February 11, 1888, the Sun and Moon were conjoined in the twenty-third degree of Aquarius. This date corresponds to the beginning of the tenth month of the K.Y. year 4989. Applying the Metonic cycle, we find that a conjunction of the luminaries also took place in the twenty-third degree of Aquarius (Hindu twenty-sixth *Minam*) in K.Y. 1341, thus:—

$(4989-1341) \div 19 = 192$ *exactly*. I have not yet made reference to the position of Venus as given in the above *Slokam*, but I think there is strong evidence of this being the correct epoch, and I think it not unlikely that Venus had less than 30° west longitude of the Sun, in which case it would be in the Hindu sign corresponding to our Pisces, *i.e. Minam*, as required by the *Slokam*.

This epoch corresponds to noon (local time) February 10, 1761 B.C., disregarding the change of Style; and, if correct, may be the time of the birth of Rama; but on this point I should not care to judge too hastily, for in view of the recurrence of these positions at some earlier or later date, we have no evidence which should lead us to select one rather than another epoch.

One thing strikes me as sufficiently curious to record in

[1] See his valuable work, "Climats, Géologie, Faune et Géographie Botanique de Brésil."

[1] This should be *Cancer*, not Capricorn, as is seen from the fact of the Moon's rising with Jupiter.

this connection, viz. that in Sáukaravijaya of Vidyáranya, the same positions are given for the planets at the birth of Sáukarácháryа, with the exception of the Moon, which is in Árthra, *i.e.* Gemini, 6° 40′ to 20° 0′ of the Hindu zodiac. These positions of the Sun, Moon, Jupiter, and Saturn took place on the 1st of *Mesham*, Kali Yuga 4221, corresponding to March 30, A.D. 1119, without change of the present style.

I am afraid, however, that these dates will hardly suit my Hindu friends, whose devotion to these great personages gives them a sense of "distance" which is best satisfied when expressed in *years!* I give these notes, however, for what they may be worth.

Adyar, Madras. WALTER R. OLD.

NOTE.—According to the Suryasiddhanta rules for computing the longitudes of the planets, I find that Mars was in Capricorn, its "exaltation" Sign, in the month of *Mesham*, K.Y. 1341, as required by the data given for Rama's epoch, its longitude in the Hindu zodiac being Capricornus 13°.—W. R. O.

## On the Latent Heat of Steam.

SINCE the invention of M. Berthelot's extremely elegant and simple apparatus, described in his "Mécanique Chimique," vol. i. p. 288, the approximate determination of the latent heat of vaporisation of liquids has become comparatively easy. The exact evaluation of the correction due to the heating of the calorimeter from extraneous sources is, however, a matter of considerable difficulty with the original form of apparatus. The correction is necessarily calculated from data supplied by the thermometric observations made previously to, and after, the actual condensation of the liquid has taken place. For this calculation to be as simple and satisfactory as possible, it is essential that during the whole experiment the temperature of the bodies in the immediate neighbourhood of the calorimeter shall remain approximately constant. In M. Berthelot's method of determination this condition is however not strictly fulfilled. For during the "preliminary period," although the flame is lighted over the calorimeter, the liquid in the flask has not yet begun to boil, so that the radiation to the calorimeter varies, and during the "final period" the flame is extinguished and no further heat reaches the calorimeter from this source. Also during the beginning of the "middle period," a considerable amount of liquid which has been volatilised from the flask at a temperature below its boiling-point, reaches the worm and is there condensed. We therefore modified the apparatus in such a way that the flame was at a constant height and the liquid was boiling *during the whole time of the experiment*, including both the preliminary and final periods. We found that under these circumstances, with a rise of 3° or 4° in ten minutes, the Regnault-Pfaundler correction is perfectly accurate. We propose shortly to publish a complete description of our apparatus, and shall not therefore go into details at present. It differs mainly from that of M. Berthelot, by the insertion in the interior of the boiling flask of a glass valve, which is opened when the rise of the thermometer in the calorimeter has become steady, and closed when sufficient liquid has been condensed in the worm. The vapour during both the preliminary and final periods passes into a reversed condenser.

Our main reason for this communication is to record the somewhat remarkable results obtained with water, and to ask if any of your readers can give information as to any accurate work upon the latent heat of steam published since that of Regnault (*Mémoires de l'Académie des Sciences*, t. 21) in 1847.

We give the results of five experiments (done at pressures differing but little from 760 mm.), which are still subject to certain corrections not exceeding ± 1 unit.

| | Wt. of water condensed in grams. | Time of condensation in minutes. | Rise of temp. in calorimeter in deg. C. | Latent heat of steam (L). |
|---|---|---|---|---|
| (1) | 10·122 | 7½ | 3·491 | 525·6 |
| (2) | 12·546 | 15 | 4·416 | 524·7 |
| (3) | 9·278 | 8 | 3·235 | 526·6 |
| (4) | 9·854 | 7 | 3·439 | 525·0 |
| (5) | 2·742 | 6 | ·991 | 523·9 |

It will be noticed that in experiment 5, where the amount of water condensed was purposely reduced, so as to increase as far as possible the experimental error, the result obtained differs but slightly from the mean. This mean, 525·2 (omitting experiment 5, 525·5) is over 2 per cent. lower than that of Regnault. The thermometer used was one divided into fiftieths of a degree, by Baudin, and was compared with a thermometer calibrated at the International Bureau of Weights and Measures. Every precaution was taken to ensure accuracy of reading.

We have sought for confirmation of our results in the indirect determinations of other observers. If we insert the latest values for the specific volume of steam at 99·6° given by Perot (*Ann. Chim. et Phys.* [6] 13, p. 159) and for the mechanical equivalent of heat by Griffiths[1] (NATURE, vol. xlvii. p. 476) in the thermodynamic formula,

$$L = \frac{T}{J}(S - S')\frac{dp}{dt},$$

we find the number 527·43 for the value of L at 99·60° C.[2] The number given by Regnault for 100° C. is 536·7. We have also selected from the numerous results obtained by Joly (*Proc. Roy. Soc.* vol. xli. p. 358) with his steam calorimeter those relating to silver, which is a substance easy to obtain in a state of purity. If we take the number given by Regnault for the specific heat of silver, we find his own determination of the latent heat of steam confirmed. On the other hand the concordant numbers for the specific heat of silver, given independently by Kopp and Bunsen, lead to a result about 1½ per cent. lower than that of Regnault.

The complete discussion of such results, however, is a matter of great difficulty owing to the uncertainty which prevails with regard to the specific heat of water. We have not as yet succeeded in discovering any constant error capable of explaining the discrepancy between our result and that of Regnault, but further experiments are now in progress.

The question, as need hardly be pointed out, is of considerable practical importance in connection with problems relating to the steam engine.

P. J. HARTOG.
J. A. HARKER.

Physical Laboratory, Owens College, October 19.

## Artificial Amœbæ and Protoplasm.

IN No. 1251 of NATURE, Dr. John Berry Haycraft has written a review on Prof. O. Bütschli's investigations of microscopic foams and protoplasm.

The biological parts of the contribution I may leave my colleague, Prof. Butschli, to answer, but as my investigations are also mentioned, and my name several times quoted, though always mis-spelled as "Nuincke," instead of Quincke, I may perhaps be allowed to call attention to the fact that I, not Prof. Bütschli, as the reviewer asserts, was the first who tried to explain the movements of amœbæ and protoplasm by physical laws, by the periodical spreading of a soap solution. In 1879 I explained the voluntary formation of an emulsion observed by Prof. Gad, and the amœboid movements of oil-drops by the periodical spreading of a soap solution upon the common surface of oil and water, and I said "that foam is an emulsion of air instead of oil, and that the durability of foam depended on the same conditions as the durability of an oil emulsion."[3] In a continuation of these investigations I explained in the year 1888 the movements of protoplasm by the same physical principles, making the supposition that it was intermixed with thin oil-films, and in the cells of plants, surrounded by an oil-coat.[4] I there fore believe I was the first to point to the foamy structure of protoplasm, which was later on further investigated by Prof. Bütschli.

Is Dr. John Berry Haycraft acquainted with my investigations, and from whence does he deduce the right of calling them "toys for the physicist"? They form the conclusion of a series of researches on capillarity which I began 37 years ago, and by which I, for the first time, showed that surface-tension is considerably altered by layers of a foreign substance of far less thickness than 1/10 of a light-wave; for the first time, also, the

[1] We understand that Mr. Griffiths' number is still subject to a slight correction, but that this does not amount to 1 part in 1000.

[2] $\frac{dp}{dt}$ was calculated from Roche's formula quoted by Hirn, Théorie Mécanique de la Chaleur, *t.* I. p. 325.

[3] G. Quincke, "Ueber Emulsions bildung und den Einfluss der Galle auf die Verdanung" (*Pflüger's Archiv.* 1879. p. 144).

[4] G. Quincke, "Ueber periodische Ausbreitung an Flüssigkeits oberflächen und dadurch hervorgerufene Bewegungserscheinungen" (*Sitzungsber. der Berliner Akad.* 12, 7, 1888. *Wiedem. Ann.* 35, p. 580-642, 1888). "Ueber Protoplasma bewegungen und verwandte Erscheinungen" (*Tageblatt der 62 Versammlung Deutscher Naturforscher und Aerzte*, Heidelberg, 1889, p. 204-7).

sphere of molecular action was measured exactly. A number of physical problems were treated, with which in England Lord Kelvin, the late Prof. Clerk Maxwell, Prof. Reinold, Prof. Rücker, Lord Rayleigh, and others have also occupied themselves. The criticism therefore seems not justified.

I know very well that in Germany several representatives of the descriptive natural sciences do not agree with my views about the structure and the movement of protoplasm. For instance, Prof. Pfeffer[1] reproached me with "having, without deducing my views from admissible foundation on experience in organism, exclusively constructed them by physical experiments, and thereupon demanded, in an unwarranted manner, a peripheric oil-layer for protoplasm."

Here, too, let me remark, that I concluded the existence of this peripheric oil-layer from the globular form of the surface of protoplasm in plasmolysed cells and that I tried for months to find in living cells the characteristic periodic spreading, suspected by me, on the inner side of the hypothetical oil-layer. I have several times observed this spreading and the destruction of the globular form caused thereby. The observations of living cells have led me to fresh physical experiments, which I published in the year 1888, together with my theory of the structure and movement of protoplasm. These theories I have always found corroborated in the continuation of my researches since 1888. My adversaries, on the contrary, have as yet not given a satisfactory physical explanation for the above stated phenomena, the globular form of protoplasm surface and the movements in the vicinity thereof. Up to the present day I believe my views to be correct and irrefuted.

The facts observed and the physical conclusions inferred by me, may appear extraordinary and not very intelligible to another science, but they are none the less correct and useful. Biological science must, well or ill, take into account the fact that the development of the cell and the life of the organic nature depends on masses and layers which cannot be perceived by the microscope alone.

Heidelberg, October 22. GEORG QUINCKE.

### Human and Comparative Anatomy at Oxford.

IN the article which appeared in your last number under the above heading, expressions occur which may, I think, lead to misconception as to the position of the department of Human Anatomy. It is of such importance in the interest of scientific medical education that the academical teaching of human anatomy should *not* consist merely in "technical training in anthropotomy," that I cannot allow the statement that the teaching of the subject in Oxford is of this nature to pass without comment. Had the writer of the article in question taken the trouble to inquire of the University lecturer here, or of any of the University professors of human anatomy elsewhere, for instance at Cambridge, Edinburgh or Dublin, or had he consulted any of the leading text-books of the subject, he would have found that its scope is much more extended than he supposes. The misstatement having been made, however unintentionally, must be corrected.

Let me add that the department, which was founded in 1885, was not connected in its origin with the department of Comparative Anatomy, and has had no relation whatever with it since. J. BURDON SANDERSON.

### Asymmetrical Frequency Curves.

OWING to the haste with which I looked through the proof of my letter in last week's NATURE (p. 615) two slips escaped me, which I hasten now to correct. The ordinates in the diagram should have been marked $\frac{\alpha p^n}{c}$, $\frac{\alpha n p^{n-1} q}{c}$, $\frac{\alpha n(n-1)p^{n-2}q^2}{1.2.c}$, &c., the factor $\frac{1}{c}$ having been dropped. Further, the value for $c$ should have been

$$c = \frac{\sqrt{2(2\mu_2^2 - \mu_4)\mu_2 + 3\mu_3^2}}{\mu_2 \alpha},$$

my $\alpha$ having been converted into a square power.

The method applied to Dr. Venn's curve fits it with an accuracy only surpassed by the generalised probability curve itself. KARL PEARSON.

University College, October 28.

[1] Pfeffer, "Zur Kenntniss der Plasmahautund der Vacuolen" (*Abhandl. Leipzig, Akad. math. phys. Klasse*, 1890, xvi. p. 279.

### Telegony.

As already stated in my previous letter, I have discussed this subject in my recently published "Examination of Weismannism" more fully than in NATURE. If "M. D. H." (NATURE, October 19) will consult the reference given in that letter to this work, he will find the facts to which he directs my attention are there given, together with certain reasons for concluding that they do not materially affect the point in question.

Hyères, October 26. GEORGE J. ROMANES.

## *AN ORNITHOLOGICAL RETROSPECT.*

DURING the year 1892 there were at least three publications which are of great value to ornithologists, though from somewhat different points of view. They are Prof. St. George Mivart's little work on the "Elements of Ornithology,"[1] Dr. Gadow's "Classification of Birds," published in the Proceedings of the Zoological Society, and Capt. Bendire's "Life-Histories of North American Birds."

To thoroughly appreciate the value of Prof. Mivart's "Elements" one has to be the curator of a museum. Many people, like myself, must have been puzzled by the frequent demand for an elementary, but comprehensive book on birds, such as a man can carry with him on his travels, and many people about to journey abroad have asked me for a small book which would explain to them what certain birds were like. I prophesy that Prof. Mivart's book will make many collectors, and its handy size is one of its best features. There have been many introductory works on ornithology published in this country and America, notably those of Prof. Elliott Coues, but nearly all of them are too bulky, and that is the fault with the most popular works, such as the "Standard Natural History" and Cassell's "Popular Natural History." Commencing in an easy and unconstrained manner, Prof. Mivart in his Introduction leads his pupil on through the various forms of bird-life, his object being not to weight the tyro with too heavy material for study at starting. All the leading Avian types are passed in review and they are illustrated by some admirable woodcuts by Mr. Keulemans, drawn especially for the work. It is, therefore, possible for any one to understand what a particular form of bird is like, the only drawback to this mode of illustration being the impossibility of illustrating the subjects on the same scale, so that some of the smaller forms appear to be larger than they really are in comparison with the bigger birds. This was, however, unavoidable.

Three chapters (pp. 134-234) are devoted to the anatomy and osteology of birds, and a fifth chapter deals with their geological and geographical relations (pp. 235-250). That on the "Classification of Birds" summarises the chief characters for each order, suborder, and family, and lastly there is an enumeration of the genera with the number of species in each. This is of course mainly derived from the British Museum "Catalogue of Birds," and I find that on adding up Prof. Mivart's figures, the number of known species is 11,900. The last time that a computation of the number of birds was made was in 1871, when the late Mr. G. R. Gray finished his "Handlist of Birds," and admitted 11,162 species as then known. This was probably a correct estimate, as I have generally found that the "Handlist" contained about enough false species to counterbalance the number of species described since the work was issued. For similar reasons, Prof. Mivart's estimate of 12,000 species will turn out to be approximately correct, and then by adding the number of species described since his book was published, and others discovered since the issue of the "Catalogue of

[1] St. George Mivart, "Birds: The Elements of Ornithology." 8vo, pp. vi.-329. (London, 1892.)

Birds," we may fairly consider that about 12,500 species of birds are known to exist at the present day.

Dr. Gadow's "Classification of Birds" is based on very careful and exact study, and certainly carries this perplexing subject several steps further as regards the higher groups. There is now a good opportunity for any naturalist, working on the same exhaustive lines, to give us a classification of the Passeries, and it is to be hoped that Dr. Gadow will some day be induced to take up this study. In my address to the Ornithological Congress at Budapest in 1891, I advocated the employment of every external and internal anatomical character, as well as the nesting habits and the geographical distribution, for the achievement of a natural classification. Dr. Gadow has not only worked upon the same lines, but has further personally examined the anatomical features on which his classification is mainly based, and he has selected some forty characters, which he considers to be of essential value in determining the various orders and families. Dr. Shufeldt will doubtless not agree with the author's conclusions regarding the *Macrochires*, and it seems to me somewhat strange to find the Hornbills allowed no higher rank than as a sub-family of the *Upupidæ*, while the position of the *Striges* in the *Coraciformes* will doubtless excite a good deal of criticism. There can, however, be no question that the amount of work which Dr. Gadow has managed to compress into some five-and-twenty pages will be found to contain some highly original ideas, and such as must materially influence the mind of the next worker on the classification of birds.

The third work alluded to above is the "Special Bulletin" of the U.S. National Museum, a goodly 4to volume of 416 pages, with 12 coloured plates of eggs. The figures are beautifully rendered by chromolithography, and the publication is altogether a notable one. The letterpress is the work of Capt. Charles Bendire, who is known to be one of the most practised oologists of the present day. He has described and figured in the present volume the eggs of all the North American game-birds, pigeons, and birds of prey, and he has used his opportunity to the greatest advantage by giving an excellent account of the life-histories of the species, together with the latest information respecting their geographical distribution. Capt. Bendire's work forms one of the most important of the recent contributions to ornithological knowledge, and the succeeding volumes will be awaited with eagerness by ornithologists.

The issue of several good faunistic works on various parts of the British Islands, brings within measureable distance the time when it will be possible to take a detailed review of the ranges and occurrences of the birds which inhabit the above-mentioned area. Some of the books alluded to are of the lighter kind, like Dr. Hamilton's "Riverside Naturalist,"[1] and Mr. John Watson's "Poachers and Poaching,"[2] wherein the authors relate their own personal experiences of animal and plant life. In Dr. Hamilton's book the birds occupy nine chapters (pp. 21–165), and he gives a series of chatty and well-written notes, giving quite a full review of the birds which come under the notice of the fisherman or stroller on the river's bank. The book is a pleasant companion for a holiday outing, and it is a pity that the illustrations are not more up to the mark, for M. Robert's woodcuts are not worthy of insertion in any book which pretends to scientific accuracy, as they are evidently drawn from stuffed birds, and in some cases it is impossible to tell what they are meant for, the illustration of the "redbreast" on p. 105 being equally suggestive of a black redstart, while the sparrow-hawk's head on p. 153 is certainly that of a cuckoo!

Mr. Watson's collection of essays, gathered from several publications, is very good reading, and ranges over a wide field of subjects, with some of which "poaching" has nothing to do. As is inevitable in a series of articles contributed to different publications, the author travels over the same ground more than once in the course of the book, but the latter is always readable, and when Mr. Watson writes from his own first-hand experiences, he tells his story as a field naturalist should. In some of the remarks which he makes, however, we notice that he does not always acknowledge the source of his inspiration.

Some of the faunal works issued during the last year or two have been of special excellence, especially those published by Mr. David Douglas, of Edinburgh, which deal with the Zoology of Northern Britain. One of the most interesting of these is the "Birds of Iona and Mull," edited from the MSS. of the late H. D. Graham by Mr. J. A. Harvie-Brown. The work was originally edited by the late Robert Gray, the well-known author of the "Birds of the West of Scotland," whose appreciative preface is also given in the work; but he did not live to see its publication. The volume consists firstly of letters sent by Graham to Robert Gray, not only from Iona, but from his later home at Littlehampton, in Sussex, where his references to shooting at Pagham must kindle remembrances in a few of us who can still call to mind collecting in that fine old haunt of the naturalist. After some "extracts from diaries," a list of the birds of Iona and Mull is given. The book is enlivened throughout by sketches by the author, illustrating the wild country in which he lived, and the shooting experiences so well related in its pages. These little sketches are spirited and amusing enough, though sometimes the sportsman seems to be firing "in among the crowd" of his companions in the boat. From the usual position of the gun, the little dog—who was Graham's constant companion in his collecting-trips—must have had some narrow escapes, and perhaps that is why the last picture in the book represents the dog's tombstone.

Another of Mr. Douglas' excellent publications is the "Vertebrate Fauna of the Orkney Islands," by Mr. T. E. Buckley and Mr. J. A. Harvie-Brown. The birds occupy the bulk of the volume (pp. 91–264, app. pp. 297–302), and are treated in a very full manner, as might have been expected from the well-known reputation of the authors. The natural history of the Orkneys has been several times chronicled, the best-known works being those of the Rev. George Low, who wrote about 1770, and of Messrs. Baikie and Heddle, in 1848. The list of writings relating to the natural history of the islands, as given by Messrs. Buckley and Harvie-Brown, is considerable, and some excellent photographs of scenery are given, in addition to some spirited pictures of bird-life by Mr. J. G. Millais. The above-named authors have also published, in 1892, a "Vertebrate Fauna of Argyll and the Inner Hebrides," which forms a companion volume to the "Fauna of the Orkneys" and the other works on Scottish Natural History published by Mr. Douglas.

To Mr. R. H. Porter we are indebted for the publication of some very useful contributions to British Ornithology. In 1891 was published Mr. Borrer's "Birds of Sussex,"[1] with six beautiful coloured plates by Keulemans, illustrating the Gyrfalcon, the Honey Buzzard, the Rufous and Aquatic Warblers, the Nutcracker, and the Squacco Heron, all rare visitors to Sussex and the British Islands generally. Mr. Borrer is one of the old school of ornithologists, and has been an esteemed correspondent of

[1] "The Riverside Naturalist. Notes on the various forms of life met with either in, on, or by the water, or in its immediate vicinity," by E. Hamilton. 8vo. pp. i.-xviii. 1-401. (London, 1890.)

[2] "Poachers and Poaching," by John Watson. 8vo. pp. i.-viii. 1-326. (London, 1891.)

[1] "The Birds of Sussex." By William Borrer. 8vo, pp. xviii, 385, pls. i.–vi. with map. (London: R. H. Porter, 1891.)

all the well-known writers on British birds during the past fifty years, from Yarrell downwards. His notes range over a number of years, and, from his long experience as a collector, he has been able to write an exhaustive list of the birds of Sussex, on which he is undoubtedly the best living authority. Mr. Pidsley's "Birds of Devonshire"[1] is also a useful contribution to our local knowledge, and is accompanied by an excellent coloured figure of the Buff-backed Heron in breeding plumage, in which state, however, it does not appear to have been met with as yet in Devonshire. Mr. Pidsley's book, however, is eclipsed in size and importance by another work on the ornithology of the same county by Mr. D'Urban and the Rev. Murray A. Mathew.[2] Both these gentlemen have long been known as workers at the statistics of Devonshire birds, and the accounts of the species are very complete as regards their distribution in the county. A very good notion of the geography and natural features of the district is added, and some photographs of Lundy Island and other noted haunts of birds are given, as well as coloured plates, by Keulemans, of the Black Redstart, Montagu's Harrier, and a dark variety of the Rough-legged Buzzard, as well as the Great Black-backed Gull, which is one of the rarities contained in the Albert Memorial Museum at Exeter. It is a little curious that neither Mr. Pidsley nor the authors of the larger work on the "Birds of Devon" allude to the Montagu specimen of the Gull-billed Tern, which received its name of *Sterna Anglica* from the author of the Ornithological Dictionary. The specimen was taken in Sussex, and is still in the British Museum, having so far survived the decay which has overtaken a considerable portion of the Montagu collection. Several specimens from the latter no longer exist, having no doubt perished in the course of years, as none of them seem to have been properly preserved, and in most cases still have the bones of the trunk inside them. In addition to the list of the British-killed examples of the Gull-billed Tern in summer plumage, we may add to the enumeration given by Messrs. D'Urban and Mathew a beautiful bird in the British Museum from Christchurch, presented by Baron A. von Hügel.

Mr. D'Urban adds some tables showing the lines of migration of birds across Great Britain, opening up a new and fascinating branch of ornithological study to English readers.

The most recent addition to our local Avifaunæ is Mr. Whitlock's "Birds of Derbyshire,"[3] which is on the plan of similar works issued of late years, giving a county map and photographic illustrations of the most salient features of the district treated of. Derbyshire is a most interesting county, as it comprises within its area so many different kinds of country, each with varying characteristics. The notes on the migration of birds are good, as are also the accounts of the Ring Ouzel, Dipper, Pied Fly-catcher, and other birds which frequent the famous peak.

Amongst other books of interest to the student of British Ornithology may be mentioned a popular edition of the St. John classical work, "A Sportsman's and Naturalist's Tour in Sutherlandshire." Mr. Wintringham's "Key to the Classification of British Birds" is a small book, which gives tables of the orders, families, and species of birds inhabiting the British Islands; but it should have been called a "List" not a "Key," as there is not a single character given whereby a species may be distinguished. When a complete analysis has to be made of all the works which deal with British Ornithology, so as to illustrate by statistics the distribution of birds throughout Great Britain, Mr. Miller Christy's little "Catalogue of Local Lists of British Birds" will be found most useful.

A recent reviewer has stated in the columns of a leading London paper, that ornithologists are the only people to whom, in the present day, the "insulting character of Dr. Dryasdust is applicable," that they, as a body, take no interest in any problems connected with the past history or evolution of birds, "like Gallio, caring for nothing of these things, and, like Gallio, acquiring a considerable reputation by their attitude!" No wonder that, to this reviewer, the volumes of the British Museum "Catalogue of Birds" appear "most terrible publications." To understand the latter a man must be an ornithologist, which the writer of the above-quoted nonsense evidently is *not*. A direct contradiction to the sage declarations of the reviewer is given by glancing at the list of ornithological works of the year 1892, when it will be seen that in every branch of the subject considerable progress has been made, and that this country is by no means behind the rest of the world, either in the number or the quality of its productions. Lord Lilford has continued his beautiful coloured figures of British birds, a work now hastening to a successful issue, and accompanied by a series of short but entertaining notes, based upon the author's wide experience as a field naturalist in younger days. On the Continent, some of the results collected from the various stations of observation in the different countries, and summarised by Drs. Meyer and Helm, Dr. von Middendorf, Mr. Winge, and others, are bound to form an important basis for reliable conclusions when a new history of European birds has to be written. One of the most complete of these summaries is to be found in Prof. Giglioli's third and concluding volume on the Italian orins.[1] In this volume Dr. Giglioli summarises the general results of the observations of the corps of auxiliary naturalists who have helped him with statistics, and the migrations of birds are treated of under various headings and according to localities, while the notes on nidification of Italian birds and their food are also classified, a copious index enabling the crowd of facts relating to each species to be easily found. Four parts of the large folio work on the birds of Italy were also published in 1892 by Dr. Giglioli, with coloured figures by Signor A. Manzella.

Dr. Pleske's great work on the ornithology of Russia is making progress, and considerable addition to our knowledge of the Avifauna of Thibet and Mongolia has been achieved by the Russian travellers Grum-Grzimailo and the expedition of Prince Henri of Orleans and M. Bonvalot.

In Ethiopian ornithology there are several interesting events to chronicle. Prof. Barboza du Bocage has published a supplement to his "Ornithologie d'Angola," embodying the results of recent exploration in that province, and bringing the work up to date. The collections made by Señor Francesco Newton, for the Lisbon Museum, in the island of St. Thomas, have also been described by Prof. Bocage, and some interesting new species discovered. The writer has finished the description of Mr. F. J. Jackson's collections, formed during the latter gentleman's journey to Uganda, and Mr. H. H. Johnston, C.B., has sent several consignments from Nyassa Land, where he has an experienced naturalist, Mr. Alexander White, working for him. The visit of the

1 "The Birds of Devonshire." By William E. H. Pidsley. Edited, with an introduction and short memoir of the late John Gatcombe, by W. A. Macpherson. 8vo, pp. xxx. 194. 1 plate and map. (London and Exeter, 1891.)

2 "The Birds of Devon." By W. S. M. D'Urban and Rev. Murray A. Mathew. With an introduction, and some remarks on the migrations of Devonshire birds. Pp. lxxxvii. 459. Plates i-ix. With three maps. (London: R. H. Porter, 1892.)

3 "The Birds of Derbyshire." By F. B. Whitlock. Annotated with numerous additions by A. S. Hutchinson. Pp. vi. 240. (London and Derby, 1893.)

1 Giglioli, E. H. "Primo Resoconto dei risultati della Inchiesta Ornitologia in Italia." Parte Terza ed. Ultima. "Notizie d'Indole Generale, Migrazioni, Nidificazione, Alimentazione, etc." 8vo, pp. vii. 518. (Firenze 1891.)

latter to the Milanji mountains resulted in the discovery of several new species, allied representatives of others inhabiting Kilimanjaro, Elgon, or even the Camaroon peaks. The collections made by Emin Pasha and Dr. Stuhlmann in Uganda resulted in the discovery of some interesting novelties, which have been described by Dr. Reichenow, at Berlin, who has also received some important collections from the Camaroons, from Dr. Preuss, and from Togoland. Mr. Johnston, at the present moment, appears to be the only patriotic Englishman who is taking pains to explore the natural history of the countries under his rule, whereas the Germans seem to have in every one of their "spheres of influence" and protectorates some well-informed naturalist who occupies himself with the natural history of the district.

The Indian region, formerly the scene of so much ornithological activity, seems, during the last few years, to have passed into a quiescent stage, and the principal work is now being done by Mr. Hose and Mr. Everett in Borneo, and Mr. Styan in Southern China. Dr. Modigliani's collections, from the Island of Nias, were described last year by Count Salvadori, and showed that some of the species found by the traveller were akin to those of the Nicobars, while, curiously enough, others were allies of Bornean forms rather than Sumatran, though the latter affinity would have been expected. The death of Mr. Davison, at Singapore, has deprived us of one of the best-known Indian naturalists. His explorations in Tenasserim gained him immortal fame as a collector, and, had his health been stronger, he would no doubt have continued his researches into the natural history of the Malay Peninsula, where much still remains to be done. His last expedition to Pahang resulted in the discovery of a very fine new starling (*Æthiopsar torquatus*).

Dr. A. B. Meyer, who has identified himself with the pursuit of Natural History in New Guinea and the Moluccas for many years, has received some collections from Kaiser Wilhelm's Land in north-eastern Papua, wherein have been some interesting new species, while in the southern portion of the great island Sir William McGregor has discovered some extraordinary new forms of birds, one of which, *Paramythia*, is such a puzzle that no one has been able to define its place in the natural system with any confidence. The completion of Count Salvadori's "Uccelli di Papuasia e delle Molucche" marks an epoch in the history of Austro-Malayan ornithology, and this wonderful work with its appendices will remain for ever a monument to its painstaking and accomplished author.

In Australia the most notable work of recent years has been Mr. A. J. North's description of the nests and eggs of the birds inhabiting that continent.[1] This book not only contains a vast amount of additional material on the nesting-habits of Australian birds, but is accompanied by photographic illustrations of the eggs, while a few coloured copies have been prepared, one of which has been sent to the Natural History Museum. An appendix describes the nests and eggs of the birds inhabiting Lord Howe and Norfolk Island.

In New Zealand Sir Walter Buller has been assiduously collecting additional notes to supplement his recently completed work on the birds of that country, and Prof. Hutton has given some notes on the Moas, which will have to be critically compared with Mr. Lydekker's recent determinations of these struthious birds. By far the most interesting event, however, of recent years has been the discovery by Mr. H. O. Forbes, the celebrated Malayan traveller, of the remains of *Aphanapteryx* in the Chatham Islands. *Aphanapteryx* was previously known only as a former inhabitant of the Island of Mauritius, and the discovery of identical remains in a locality so far distant as the Chatham Islands, has opened up possibilities of speculation of the most intense interest, and Mr. Forbes' recently exploited theory of the former existence of a great Antarctic continent has changed the ideas of many zoologists with regard to the origin and geographical distribution of many forms of animals and plants. It is decidedly the most interesting episode of the year 1892.

Polynesian ornithology has undoubtedly been forcibly brought before our notice by the careful work which has been done by Mr. Wiglesworth, in his "Aves Polynesiæ," and a complete list of the species inhabiting the Pacific Islands, with their synonymy and geographical distribution, has been published in the "Abhundlungen" of the Dresden Museum, under Dr. A. B. Meyer's care. Mr. Scott Wilson, with the help of Mr. Evans, has reached the fourth part of the "Aves Hawaienses,"[1] and with one more part the work will be brought to a conclusion. Mr. Wilson gives some interesting notes on the habits of the species, but it is doubtful whether he has obtained all the material necessary for a monograph of the Hawaian Avifauna, judging by the number of new species which the Hon. Walter Rothschild has been receiving from his collector, Mr. Palmer. These may, of course, be included in the final part of the work, thus bringing it up to date. A visible improvement is to be noticed in the plates of Mr. Frohawk, and the coloured figures of the species look something like the actual birds, instead of being a sort of map, as heretofore.

Except for the splendid paper by Dr. Gadow, before mentioned, on the classification of birds, very little anatomical work has scarcely been done, in England at least; and it is to be hoped that Mr. Beddard, who has before now written some useful ornithological papers, and on whom the mantle of Garrod and Forbes is supposed to have fallen, will give us some further results from the splendid opportunities which he enjoys as prosector at the Zoological Gardens.

R. BOWDLER SHARPE.

## *HENRY OLDENBURG, FIRST SECRETARY OF THE ROYAL SOCIETY.*

"SIR, you will please to remember that we have taken to taske the whole Vniverse, and that we were obliged to doe so by the nature of our Dessein. It will therefore be requisite that we purchase and entertain a commerce in all parts of y^e^ world w^th^ the most philosophicall and curious persons, to be found everywhere." So writes Henry Oldenburg to Governor Winthrop of Connecticut on October 13, 1667. And in these words he briefly expresses what was the chief aim of the best years of his life. It was mainly by his immense correspondence that Oldenburg forwarded the cause of science, or, as it was then called, of the "new experimentall learning," by that and by his assiduous discharge of secretarial and editorial work. Without being a man of brilliant genius, he was just such an intelligent, reliable, energetic, and conscientious worker as was needed at that time to form a centre for the new movement. In the history of literature Henry Oldenburg is a familiar figure as the friend and correspondent of Milton; in the history of philosophy, as the friend and correspondent of Spinoza; but neither literature nor philosophy is indebted to him to the same extent as science.

It is somewhat remarkable that, although the name of Henry Oldenburg is so familiar in the history of the seventeenth century, no complete life of him has ever been written. The only attempt at a con-

[1] North, A. J. "Descriptive Catalogue of the Nests and Eggs found breeding in Australia and Tasmania." (Catalogue No. 12 of the Australian Museum, Sydney, N.S.W.)

[1] Scott B. Wilson, assisted by A. H. Evans. "Aves Hawaienses: the Birds of the Sandwich Islands." Parts iii. iv. 4to. (London: R. W. Potter, 1892, 1893).

nected biography is that of Dr. Althaus, of University College, London, who, in 1888, contributed to the *Allgemeine Zeitung*, published in Munich, a series of very interesting articles upon the life and correspondence of this remarkable man. These he supplemented at a later date by many new facts as to Oldenburg's birth, parentage, education, and early life, the results of researches undertaken at his instance by Dr. von Bippen, Archivist of Bremen. Until these facts were published by Dr. Althaus, we knew nothing whatever of Oldenburg's early life. He appears suddenly upon the scene as the agent for Bremen with the English Commonwealth and a correspondent of Milton's, but who this friend of Milton's was, and from what pit he was digged, no one seems to have taken much trouble to inquire.

We did not, as it now turns out, know so much as the date of his birth, for it is evident from Dr. von Bippen's researches that the date 1626 usually given in biographical dictionaries as the date of Oldenburg's birth is altogether wrong, and that as a matter of fact he must have been born about 1615, a date which puts the whole of his life and correspondence in an entirely new perspective. He was, according to this, only seven years Milton's junior, which accords much better with the tone of their correspondence, and he was seventeen years older than Spinoza, which perhaps partly accounts for the somewhat fatherly manner in which he encouraged that philosopher to publish certain of his works. Equally at sea are the biographical dictionaries (and other works too) as to his descent. The statement copied from book to book that he was descended from the Counts of Oldenburg appears to have been a pure "shot," inferred partly from his name, and partly from the fact that in his matriculation entry at Oxford he is called "nobilis Saxo," which means nothing at all. What we do now know about him is that he was the son of Heinrich Oldenburg (d. 1634), a tutor in the Gymnasium at Bremen, the grandson of another Heinrich Oldenburg (d. 1603), Professor of Mathematics in the same Gymnasium, and great-grandson of Johann Oldenburg, who came from Münster in 1528 to be the first rector of the Evangelical school at Bremen; and that he was one of a large family who lived in somewhat narrow circumstances.

As to Oldenburg's education, we learn that he studied first at the Evangelical school and afterwards at the Gymnasium illustre in Bremen, and that on November 2, 1639, he took there the degree of Master in Theology, the subject of his thesis being "De ministerio ecclesiastico et magistratu politico." Whether, like Gotthold Lessing at a later day, he was intended by his parents for a theologian, we do not know. He did not break with theology so completely as Lessing did, for throughout his life there was a certain theological flavour about him, and, in his interesting "commonplace book" preserved among the archives of the Royal Society, there is an entry of fifteen pages headed "Sensa Animi mei de Deo et ejus cultu naturali"; but he revolted from the *à priori* methods of the current teaching, and in the same MS. we find accordingly many vigorous passages directed against "the vain shadows of scholastic theology and nominalist philosophy." These outbursts, however, belong to a later date. It was as a theologian that he graduated at Bremen, and then, for some unknown reason, he went to England.

In England he lived for eight years, probably in the capacity of a tutor, probably, too, in royalist families. Some evidence, at any rate, exists in the Bremen archives that during this first English residence he took the king's side against the Parliament. Then comes a gap of four years, during which there are hints that he was travelling upon the continent of Europe and cultivating those numerous acquaintances with learned men, which afterwards stood him in such good stead when his life-work was to gather scientific information from all parts of the world.

From June, 1653, however, his life becomes clear. In that month he was, as I have said, appointed agent for Bremen, in which capacity he had audiences with Cromwell, and made the acquaintance of Cromwell's Latin secretary, John Milton. The acquaintanceship ripened into friendship, and an elegant but somewhat ponderous Latin correspondence followed. Oldenburg's political mission came to nothing, and then we find him in a country village in Kent waiting in uncertainty as to public events and as to his own future career. That career was, however, very soon determined, for in 1656 he went to Oxford, and was immediately caught in that current of "experimental learning" which had already begun to flow. Boyle, Wilkins, Wallis, Petty were his constant associates, and his letters at this time show the strong scientific impulse which his mind had received.

The passage in Anthony à Wood's "Fasti Oxonienses," which records Oldenburg's Oxford residence, is as follows:—"1656. In the beginning of this year studied in Ox. in the condition of a sojourner Henry Oldenburg, who wrote himself sometimes Grubendole, and in the month of June he was entred a student by the name and title of Henricus Oldenburg, Bremensis, noblis Saxo; at which time he was tutor to a young Irish nobleman called Henry ô Bryen, then a student also there." Besides Henry O'Brien he had another young nobleman as his pupil during his Oxford residence, namely Richard Jones, son of Catherine Lady Ranelagh and nephew to the Hon. Robert Boyle, and after remaining at Oxford for about eighteen months he accompanied young Ranelagh upon a journey to the Continent. For a year they remained at Saumur, and while there letters continued to pass between him and Milton. It is rather amusing to read that Milton had entrusted to Oldenburg a packet of his latest politico-theological writings for distribution to foreign savants, a task which the cautious Oldenburg did not half like, and which he executed, as he informed Milton, by giving copies of the writings "to no one who did not ask for them." How many asked for them he does not say. It was not in truth with the fierce political and theological controversies of the time that Oldenburg's mind was now engaged. He had gained a new interest and was travelling with a new object. His scientific observations were certainly very mixed, many of them trivial, and some of them superstitious, but they serve to show the direction in which his mind was travelling. From Saumur he sends to Boyle "noteworthy observations concerning the existence and the working of animal poison," and a chemical recipe for an invisible ink, and says that if his travels take him to Italy it will be a satisfaction to give Boyle "news of the industrious Kircher's subterraneous world, his strange Grotta de' Serpi, his story of the growth of pulverised and sowne cockles irrigated by sea-water, his thermometre by a wild-oats-beard, his vegetable phœnix's resurrection out of its owne dust by ye warmth of ye sun, his pretended ocular confutation of Kepler's magnetical motions of ye Planets about the Sun, and of Gilbert's magneticall motion of ye Earth and of twenty other remarquable things."

At a later date he sends Boyle from Paris the recipe of a wonderful oil which he had picked up in the course of his travels, which was supposed to heal "migraines, palsies, lamenesses, crookednesses, and all ricketing diseases." More wonderful even than this wonderful oil is another of his discoveries, for Samuel Hartlib, in a letter dated April, 1659, informs Boyle that Oldenburg has written to him from Paris that he has in that city discovered a "clever, but very secretly acting" physician, who had spoken to him of a method by means of which one can prepare a drink from sunbeams!

Meanwhile Boyle and the other Oxford worthies con-

tinued their pursuit of the "new philosophy," meeting generally at that time in "Dr. Wilkins's lodgings in Wadham College." The London branch of the same movement, too, was now becoming active, meeting usually at Gresham College "at the Wednesday's and Thursday's lectures of Dr. Wren and Mr. Rorke." After the Restoration many of the Oxford professors lost their positions and came to London, and on the 28th November, 1660, at the close of a lecture of Wren's at Gresham College, it was resolved to reconstitute the Society, which had hitherto been somewhat amorphous, as a "Society for promoting the physical-mathematical experimental sciences." Oldenburg, who had just returned from abroad, was elected a member of the first Council, and he and Dr. Wilkins were chosen the first secretaries of the Society. From that moment Oldenburg threw himself heart and soul into the work of the Society. Its interests he regarded as his own, and Prof. Masson gives it as his opinion, and with justice, that without his endeavours and those of Hooke, the Society would scarcely have held together. The great difficulty, of course, was the want of money. Charles II., the so-called "Founder," had promised to endow it, but he broke his promise and only gave it a mace. The Society could not afford to pay its secretary, and yet the secretary must live. In the British Museum is preserved a rough memorandum in Oldenburg's handwriting, quoted, but not very accurately, by Weld in his "History of the Royal Society," which gives a very vivid idea of the secretary's labours and poverty. It runs as follows:—

*The Business of the Secretary of ye R. Soc.*

He attends constantly the meetings both of ye Society and Councill; noteth the observables, said and done there; digesteth $y^m$ in private; takes care to have $y^m$ entered in the Journal and Register-books; reads over and corrects all entrys; sollicites the performances of taskes recommended and undertaken; writes all Letters abroad and answers the returns made to $y^m$, entertaining a corresp. $w^{th}$ at least 30 psons; employes a great deal of time, and takes much pains in satisfying forran demands about philosophicall matters; disperseth farr and near store of directions and inquiries for the Society's purpose, and sees them well recommended, etc.

*Qy.* Whether such a person ought to be left vn-assisted?

In connection with this may be mentioned another memorandum of Oldenburg's. It is preserved in the same MSS. (Birch MSS. 4441), and is headed as follows:—

*Liste of Members $y_t$ are likely to promote ye dessein of ye R. S.*

| | |
|---|---|
| Members $y^t$ will probably both pay and give yearly one entertainment to $y_e$ Society. | Such, as will pay, and procure an entertainment to be made by others. |

In the first column occur among others the names of Boyle, Petty, Wren, Evelyn, Wallis, Croon, Grew, Pell, Mercator, Hook, Collins, Newton, and Smethwick. Against the names of Newton, Grew, Pell, Mercator, Hook, Collins, and Smethwick are written the words "no pay."

The "no pay" element was one main difficulty of the new Society. Even those who promised to pay, frequently neglected to do so. In 1666 the arrears amounted to £600 sterling, and in 1673 to £1957, and this, notwithstanding strenuous efforts on the part of the Secretary to collect the contributions. In fact, at that time, out of 156 Fellows, only 53 paid regularly.

At the beginning of 1664 Oldenburg was authorised to make what he could by publishing the Transactions of the Society, but they were printed at his own risk, and seldom brought him in as much as £40 a year. The very next year the Plague appeared in London and drove away the book-purchasers, and the year after occurred the Great Fire of London, which ruined the booksellers, and made publication still more difficult. Besides all this, the sale of the Latin edition in foreign countries was greatly hindered by the war with Holland. And to crown all, in 1667, the very year after these great disasters, Oldenburg himself, who had stuck to his post through Plague and Fire, was imprisoned in the Tower of London. The warrant, which is signed by the Prime Minister, Lord Arlington, charges him with "dangerous plans and practices"; but the fact appears to be that the immense number of his foreign letters had attracted attention, and since the Government of that time did not understand a man who had, as he wrote in the letter quoted above, "taken to taske the whole Vniverse," this voluminous correspondence excited suspicion. He was kept in prison for two months, "during which comitment," as he afterwards wrote to Boyle, he "learned to know his reall friends." Among these friends was Evelyn, who visited him in the Tower on August 8. After his discharge he waited upon Lord Arlington, and then went down into the country to recruit. "I was so stifled by the prison-air," he writes on September 3, "that, as soon as I had my enlargement from the Tower, I widen'd it, and took it from London into the country, to fann myself for some days in the good air of Craford in Kent. Being now returned, and having recovered my stomack, which I had in a manner quite lost, I intend, if God will, to fall to my old trade, if I have any support to follow it."

He fell to his old trade with his old energy, and how indispensable that energy was to the Royal Society is shown by the fact that during his imprisonment the Society did not meet. Besides his purely official work and his voluminous scientific correspondence, he was ready at all times to do battle for the Society. For in those early days it was far from being plain sailing. The Society had to meet much odium, especially on the score that it was "an enemy of the established religion and destroyer of the ancient well-grounded learning"; and it is with reference to these charges that Oldenburg breaks out in the fifth volume of the *Philosophical Transactions*: "Let envy snarle, it cannot stop the wheels of Active Philosophy, in no part of the known world. Not in France, either in Paris, or at Caen. Not in Italy, either in Rome, Naples, Milan, Florence, Venice, Bononia, or Padua. In none of the Universities, either in this or that side of the seas. Madrid and Lisbon, all the best spirits in Spain and Portugal, and the spacious and remote dominions to them belonging; the Imperial Court, and the Princes of Germany; the Northern Kings and their best luminaries; and even the frozen Muscovite and Russian have all taken the Operative ferment, and it works high, and prevails every way, to the encouragement of all sincere Lovers of Knowledg and Virtue."

Oldenburg died suddenly in September, 1677, at Charlton, in Kent. In the Archives of the Royal Society there are no less than 405 of his autograph letters and drafts, besides ninety-four letters to Robert Boyle in a separate guard-book, and many rough drafts in his own private Liber Epistolaris. One letter in this last-named MS. book, which has not hitherto been published, I cannot forbear to mention in concluding this article, since it shows Oldenburg, even at that early date, as an advocate of the higher education of women. The letter is written to Lady Frances Jones, and is dated August 28, 1660. "I wish heartily," he writes, "that that sexe, which is thus advantaged by Nature with a choyce structure of body, and thereby gives cause to conclude, that the guest thereof must be more than ordinary, would not suffer themselves to be diverted from those nobler improvements they are, to speak the truth, as capable of as men; nor be contented to have their innate capacity in their education stifled or debased to the needle or the making of sweet meats." Many such passages, full of sound sense, might be quoted from his letters did the limits of this article permit, but at present we can only express a

hope that an interesting man who lived in a most interesting period may yet find a biographer who will adequately bring him into the light out of the shadow of the giants who were in the earth in those days—Cromwell, Milton, Newton, Spinoza, Boyle—in the midst of whom he moved, and by whose great names his own has hitherto been too much obscured. HERBERT RIX.

## THE NATURAL HISTORY OF EAST EQUATORIAL AFRICA.

THE geology of East Equatorial Africa has been recorded in a very general way in the maps of the region published by Mr. Jos. Thomson in his "Through Masai Land," and in the more recent one of Prof. Toula; from these it was known that the area consists of a basal plateau of gneiss and schists, covered by a series of lavas in the interior and marked along the coast by patches of Jurassic rocks. My work therefore lay in the main in the examination of the gneisses and schists with a view to the determination of the method of their formation; also to the study of the volcanic rocks—which range from basalts to quartz trachytes—and of the relations of the old lava plateaus and sheets to the craters of various ages which play such a striking part in the scenery of the district. The most interesting part of the work consisted in the examination of the great "Graben" or valley of subsidence which runs north and south across the district; on the floor and on the sides of this are many old lake deposits now buried by lava flows, while the walls are also marked by terraces formed by the existing lakes when at a higher level than at present, or by old ones that have long since disappeared. In some of these terraces are shells with Nilotic affinities, though the localities are now far from the Nile basin. The collections made from the coast Jurassics will allow the age of these beds to be definitely settled, and the fossils—*Ammonites*, *Lytoceras*, *Belemnites*, &c.—suggest that they are probably Callovian. An interesting addition to the geology of tropical Africa has been the discovery of some Palæozoic shales, more than 130 miles from Mombasa, which have yielded a fairly good fauna, though richer in individuals than species.

The evidence collected proves the existence of a former race of men who used obsidian implements, and who lived in a period long prior to any existing tribes; and also, that the glaciers on Mount Kenia once extended several thousand feet further down the mountain than at present; in fact, a regular sheet or cap glaciation preceded the existing valley glaciation.

Zoologically the district is somewhat barren, and in many parts only animals with great powers of migration or hybernation are to be seen. In some of the country most famous for its game, none can be found, as it was killed off by last year's drought Cattle disease is responsible for the disappearance of many species; thus, whereas buffalo used to be extremely common, only three were seen; only one herd of giraffes was met with. Zebra and ostriches are abundant in places, while the commonest antelopes seen were the hartebeest, mpalla, and water buck; topi are numerous on the Tana. The sparseness of dense forest, except on the higher parts of the district, accounts for the rarity of monkeys. *Colobus guerazi* was seen at over 9000 feet on Kenia, and some baboons amid the rocks of one of the ridges of the basin of Lake Kibibi. Hyena and a small bush buck range up into the lower Alpine zones on Kenia, while a small rat, Hyrax, and elephants occur in the woods of *Senecio johnstoni* in the upper Alpine zone. Another high record is the occurrence of fresh water crabs (*Telephusa*) in some swamps on Leikipia at the height of about 8000 feet.

The rarity of limestones doubtless helps to the scarceness of mollusca. As is well known, most of the species live on trees, whether in river valleys, such as the Sabaki, or among the forests of Kenia, where some small delicate species are common from 8000 to 10,000 feet.

Botanically also, the country is somewhat barren and monotonous; vast areas are covered by nothing but low, umbrella-shaped acacias. The country may be roughly divided into seven zones. The first includes the coastal plain and river valleys, characterised by the abundance of palms, such as the Dum palm (*Hyphæne thebaica*) and the Borassus palm (*B. flabelliformis*); the former is abundant along the coast and fringes the rivers, being found up the Tana as far as south of Kenia, and up the Sabaki to Tzavo. The Screw palm (*Pandanus*) is rarer, but has a similar range. The salt marshes and lagoons are bordered by the mangrove, while the she-oak, or *Casuarina*, occurs on the ends of exposed promontories on the coast. These have doubtless grown from cones carried by currents from Australia, just as the Krakatão pumice, which now forms banks along the shore, has floated from Malaysia. This zone is succeeded by great sandy steppes covered with mimosa and acacia scrub, with large baobabs, which occur also on the coast. The most typical plants have large and white flowers, a species of *Convolvulus* being the commonest. Aloes, and especially the species known to the Suahili as "nkonge," are abundant. The two next zones are the steppes and woods of the high plateaus; the most striking feature of the former is the high grass, which, when the seeds are ripe and yellow, reminds one of the great cornfields of Dakota.

In places the forests of the plateaus pass upward gradually into those of the flanks of the higher mountains, such as Kenia and Settima. The prevalence of lofty junipers which replace the trees of lower horizons, and the dense jungles of bamboos, with a carpet of *Selaginellæ* characterise the fifth or bamboo zone.

Above this are the Alpine pasturages. In the lower part there are numerous orchids, *Gladiolus*, &c. With the upper zone there appear species of the "everlasting plants" of the Cape, while the only trees are *Senecio johnstoni*. Beyond this is the zone above the snow line, where except for a few diminutive yellow composites and lichens, we have passed beyond the realms of plant or animal life. J. W. GREGORY.

## NOTES.

DR. POTAIN has been elected a member of the Paris Academy of Sciences (Section of Medicine and Surgery), in the place of the late Prof. Charcot.

WE are sorry to learn of the death of Dr. H. H. Ashdown, on October 10, at the age of thirty-four. He was a Fellow of the Royal Society of Edinburgh, and published several memoirs on his physiological investigations.

WE regret to announce that Mr. T. C. Bain, the Government surveyor and geologist at the Cape, died at Rondebosch, Cape Town, on September 28. He was born in 1830, and his father was the engineer of the well-known Mitchell's Pass Road, at Cape Colony. Mr. Bain was appointed irrigation and geological surveyor in 1888. The British (Natural History) and Cape Museums contain a number of geological specimens collected by him, among which may be mentioned the collection of reptilian remains from the lacustrine beds of the Karoo.

A STATE MUSEUM is now in course of formation at Pretoria. Mr. P. Krantz has been appointed a curator, and he has, with an entomological assistant, just started on a collecting expedition, which may probably occupy a space of two years. Their mode of transit is in a large wagon drawn by twenty donkeys, these animals having been chosen as best able to withstand the

vicissitudes of climate and attacks of "fly" pertaining to some parts of the country proposed to be visited. This wagon has been fitted inside and outside with shelves and other paraphernalia for holding specimens, cork, medicaments, &c. When not travelling, accommodation is found in a large marquee fixed to the side of the wagon, from which step-ladders, dissecting-tables, &c., may be let down. A lighter and rougher wagon, suited to more inaccessible country, also accompanies the party. Everything has been done to favour the success of this expedition, and the Raad has passed a resolution specially exempting those engaged in it from the provisions of the game law. The nucleus of a good general collection should thus surely be obtained, whilst the idea of collecting the Transvaal fauna is highly to be commended.

AN appeal for subscriptions to found a Pasteur Institute for India is about to be made (says the Allahabad *Pioneer*). It is proposed to locate the institution in some convenient place near Simla. There the necessary laboratories, fitted with the best scientific appliances, quarters for the officials, and accommodation for patients will be provided. The expenses will be very considerable, but the Government of India, besides giving their cordial approval to the scheme, have contributed notable help by promising the services of a selected medical officer. India has hitherto taken very little interest in bacteriological work, though almost every European nation, America, and Japan are devoting a large amount of attention to it. It is hoped that in addition to its anti-rabic work, the Indian institute may be put on such a footing as to enable it to carry on original research in this and other directions. The institute should also serve as a training school in practical bacteriology for medical men in India. The scheme is full of promise, and there should be little difficulty in obtaining the funds necessary to carry it out.

AT the Institution of Electrical Engineers, on Thursday, November 9, Prof. George Forbes, F.R.S., will read a paper on "The Electrical Distribution of Power."

ACCORDING to the *Pretoria Press*, and from a Blantyre source, a very large supply of ivory has come down from the Lake, in the Lake Company's possession. Huge 6 feet and even 7 feet tusks were to be seen at Mandala, and several thousand pounds must have been paid the Arabs in exchange for this valuable commodity.

AN International Horticultural Society was founded at the recent congress of horticulturists held at Chicago. The chief object of the society is to facilitate the exchange of plants, seeds, books, &c. The following officers have been nominated:—President, P. J. Berchmans; Vice-President, Henry L. de Vilmorin; Secretary and Treasurer, Mr. George Nicholson, the Curator of Kew Gardens. We are informed, however, that Mr. Nicholson is unable to undertake the work that this office would impose upon him.

AN International Exhibition of Industry, Science, and Art will be opened at Hobart, Tasmania, on November, 1894, and will continue open for a period of about six months. The exhibits will be arranged into twenty-four classes. Class X. is Chemistry, Apparatus and Processes, Philosophical Instruments; XI. is devoted to Electricity; Gas and Lighting, other than Electricity, is the subject of Class XII. The following classes are also of scientific interest: XVI.—Machinery, Machine Tools, Hydraulic Machines, and Machines for raising heavy weights, Elements of Machines, Furnaces; XVII.—Prime Movers, and means of distributing their power, Railway plant; XVIII.—Naval Architecture and Engineering; XIX.—Civil Engineering, Construction, and Architecture, Sanitary Appliances, Aeronautics, &c.; XX.—Mining and Metallurgy, Minerals, Quarrying, and Fuel; XXI.—Agriculture, Horticulture, Arboriculture; XXII.—Fisheries.

A CORRESPONDENT writes: "There seems still little recorded as to the maximum or average size of the flying fish, *Exocœtus* sp. On my voyage to the Cape, on board the R.M.S. *Drummond Castle*, in about the longitude of Greenwich and the latitude 11° S., and on September 9 last, a specimen flew, or was blown, on board, where the bulwarks were 19 feet to 20 feet above the water, which measured 18¾ inches long, with an expanse of 22½ inches across the wings. This was the largest specimen that has ever passed through my hands. It only weighed 1 lb. 6 oz., but a development in weight would clearly be disadvantageous to its power of flight."

IN the notice of Prof. Sylvester's life which appeared in NATURE for January 1889 (vol. xxxix. p. 217), it is mentioned that after coming out at Cambridge as Second Wrangler, "he was incapacitated by the fact of his Jewish origin from taking his degree," and it is added that in "more enlightened times (1872) he had the degrees of B.A. and M.A. by accumulation conferred upon him." The learned librarian of Trinity College, Dublin, Rev. Dr. Abbott, calls our attention to the fact, which should not be overlooked, that though unable to take the degree at Cambridge, he actually passed *ad eundem* to Dublin University, and had the degrees of B.A. and M.A. conferred upon him there (in virtue of his Cambridge qualification) in 1841. The honorary degree of LL.D. was also conferred upon him by Dublin in 1865. It may not be without interest to mention that the first Jew to obtain a degree in the United Kingdom was Nathan Lazarus Benmohel, who graduated B.A. at Dublin in 1836, and M.A. in 1846.

SIX years ago Hofrath Dr. A. B. Meyer, Director of the Natural History Museum at Dresden, published in the *Abhandlungen und Berichte des K. Zool. Museum Zu Dresden*, a series of descriptions and drawings of iron-framed cases, and of other museum fittings and apparatus introduced by him in Dresden. Since then a good deal of attention has been directed to the subject of metal instead of wooden framing in museum cases; and in 1891 Dr. Meyer gave further details as to his experience in a communication to the Museums Association meeting at Cambridge. In the *Abhandlungen* of the Dresden Museum for the year 1892–3, just published, Dr. Meyer returns to the subject of iron-framed cases, on the details of which his recent experience has suggested several improvements. In a series of twenty lithographic and photographic plates, accompanied by elaborate specifications, measurements, &c., he deals with several forms of case, with store cabinets and their fittings, with trays for eggs and nests, sheet iron trays for shells, supports for skeletons and crania, craniometers, and several other varieties of museum appliance and case fittings. In truth Dr. Meyer has, with real German patience and industry, drawn and described in an exhaustive manner a range of museum cases and appliances which every curator more or less works out for himself, and of which, having by rule-of-thumb or otherwise attained his object, he thinks no more. But, as Dr. Meyer points out, museum officials are much given to experimenting at a loss of both time and money, and there is no reason why the results of well-matured experience should not be authoritatively laid down and generally accepted as a basis from which to reach forward to further improvements. The only other means than publication by which museum officials can obtain the results of mutual experiments and experiences is by visits to museums, but by that means alone the observer cannot get the precision of information and the working details which are conveyed by Dr. Meyer's monograph. The publication indeed confers a signal benefit on all interested in museum work, and it is much to be desired that

others having like valuable experience should follow Dr. Meyer's example, and put down with precision what they know and have accomplished for the benefit of the ordinary museum officer.

DR. KARL DOVE, in a letter addressed to the President of the Berlin Gesellschaft für Erdkunde, gives some interesting particulars regarding the climate and vegetation of South Damaraland. The numerous larger rivers, or rather water-courses, of the country contain water almost throughout the year, which in the dry season, however, is found underneath the superficial layer of sand. In August of last year Dr. Dove even found a strongly flowing brook, about ten feet broad, in the hot and dry valley of the lower Swakop. He attributes the permanence of the rivers to the profusion of strong inclines and the scarcity of purely horizontal plains, which has the effect of diminishing evaporation. The great efficiency of the protection afforded by the soil even in that dry country is shown by the fact that in places where moisture could only be due to rain, traces of it were found in samples at the depth of three feet after five months of the dry season. The amount of atmospheric precipitation was abnormally large during the last rainy season, and the sky was clouded very much like a north European rainy sky. During January over 11·8 inches were recorded in the vicinity of the higher mountains of Windhoek and the Sheep River. At Windhoek itself the mean rainfall is estimated at 15·8 inches. The discovery that the rainfall does not show a further increase from lat. S. 22° to 19° is of special importance.

AT a recent meeting of the British Ornithologists' Club, the Hon. Walter Rothschild read some notes on the genus Apteryx, and exhibited a very extraordinary number of living specimens of these "wingless" birds of New Zealand. He recognises the following as a complete list of the species at present known :—*A. australis*, Shaw, from the South Island ; *A. lawryi*,* sp. nov. from Stewart Island ; *A. mantelli*,* Bartl. from North Island ; *A. oweni*,* Gould, the east coast, South Island ; *A. oweni occidentalis*,* sub-sp. n., the North Island, and west coast, South Island ; *A. haasti*,* Potts, central South Island and west of the North Island ; and *A. maximus*, Verr. (sp. dub.), South Island. Males and females of those marked with an asterisk were exhibited, and also a female specimen of the new sub-species. Mr. Rothschild is engaged on a monograph of these strange birds.

DURING the construction of the Puy-de-Dome Observatory in 1872, the ruins of a large temple were discovered (says M. Plumandon in *La Nature*). From a tablet bearing a well-preserved inscription it appeared that the temple was consecrated to Mercury, and, according to historians, it was destroyed towards the end of the third century. Near the middle of the ruins of the temple, in the part that was originally the most highly decorated, there stands a small vertical wall, about one and a half yards high and rather more than two yards long, built of rectangular blocks of stone four inches high and about six inches in length. The blocks are of two different colours, one kind being of light dolomite, while the other is a black lava. The two colours are alternated in each horizontal row, and the rows are arranged so that the vertical joint between any two blocks falls at the middle points of the blocks above and below it. Proceeding, therefore, from the bottom to the top of the wall, or *vice versa*, the faces of the blocks of each colour form a zigzag pattern of which the lines are inclined about 60° to the horizontal lines separating the successive layers of stone. In fact, the mosaic constitutes a system of parallel lines cut by oblique lines of precisely the same kind as that which is frequently figured in illustration of optical illusions. When the wall is viewed from a short distance the horizontal layers seem to lose their parallelism, and appear to converge towards the interior of the angles formed by two consecutive series of obliques. Zöllner first called attention to the apparent loss of parallelism which truly parallel lines undergo when they are cut by oblique lines, but it is possible that the mosaic was designedly constructed to deceive the eye, and played an important part in the ceremonial of the temple on the Puy-de-Dome one thousand seven hundred years ago. *Nihil novum sub sole.*

MR. E. A. ANDREWS describes in the last (October) number of the *Studies from the Biological Laboratory of the Johns Hopkins University* an undescribed Acraniate, *Asymmetron lucayanum*, found in considerable numbers between North and South Bemini, Bahamas, in June and July 1892. They were taken in the tow-net while swimming at or near the surface, most abundantly at the early part of the ebb-tide when it had been high tide about nine o'clock in the evening, rarely in the day-time, or late at night, or on the rising tide. They were also obtained buried in the sand flats, but not very abundantly. The specimens taken in June were larger, often sexually mature, while those taken later were generally immature or larval forms. In captivity their habits were like the European lancelet, the largest was 16 mm. in length and sufficiently translucent to enable one to trace the food or carmine granules to be traced through most of the digestive tracts. The peculiarities of this form, and those which induced the author to venture to refer it to a new genus, are briefly : the gonads being present only on the right, instead of on both sides as in Branchiostoma, the ventral fin having no fin rays, and there being a long caudal process.

A PAPER was read lately by Mr. H. B. Stocks to the Edinburgh Royal Society (Proc. Roy. Soc. Edin. p. 70), "On Certain Concretions from the Lower Coal Measures, and the Fossil Plants which they contain." The interest which attaches to these concretions, or "coal-balls," is the remarkably perfect state of preservation of the fossil contents, in many cases fine plant-cells and fibres being preserved even without complete petrifaction. Chemically analysed, the petrified wood yields mainly carbonate of lime and iron pyrites, each in the proportion of 48 per cent. The late Mr. Binney suggested that the carbonate of lime was dissolved from shells in the marine strata overlying the concretionary beds and re-deposited on the plants, but, as Mr. Stocks points out, this assumes the lapse of a considerable period of time between the beginning of vegetable decay and the process of petrifaction, a period which would be under ordinary conditions fatal to the preservation of the delicate vegetable tissues. Mr. Stocks thinks that decay and petrifaction went on simultaneously, and hopes to prove the following explanation o the mode of petrifaction : by the process of osmosis water con taining the usual quantity of carbon sulphate in solution, passes through the vegetable tissues of the plant, and sets up a series of chemical changes resulting in the formation of carbonate of lime and iron pyrites. The sulphuretted hydrogen combines then with more iron. The spheroidal shape of the nodules is, he believes, merely due to the deposition of calcium carbonate from a solution heavily charged with organic matter.

THE October number of the *Annals of Scottish Natural History* contains several interesting articles, amongst them being one by Mr. Peter Adair, on the disappearance of the short-tailed field vole (*Arvicola agrestis*), and on some of the effects of the vole plague. This destructive rodent began to be observed in the infested area a few years before 1890 ; it multiplied with rapidity until the summer of 1892, when the numbers began to decrease, and by the summer of the present year the pest had disappeared. Mr. Adair finds that the disappearance has been general over the whole infested area. On some farms the normal numbers remain, but on others scarcely a vole is to be seen. Various causes have been suggested to account for the disappearance. The drought of last spring and winter may have had some good effect, for the animal is partial to damp

ground. There is, on the other hand, evidence that an epidemic caused the plague to come to an end. But it is the general opinion of the farmers and shepherds of the district from which Mr. Adair obtained his particulars, that the disappearance is due in a great measure to the work of such natural enemies as the owl, kestrel, rook, blackhead gull, and buzzard, the stoat, and the weasel.

THE Weather Bureau of Washington has published an elaborate discussion of the climate of Chicago, by Prof. H. A. Hazen, being No. 10 of the valuable *Bulletins* now being issued by that department. The city of Chicago is situated at the south-west of Lake Michigan, whose elevation is about 580 feet above the level of the sea. The earliest observations available were made in 1832, and continued until 1836, after which time they were of a very fragmentary character until November, 1859, since which a continuous series of observations has been maintained, at least as far as regards the temperature. The lake has naturally great influence upon the climate, and this has been investigated in great detail for each separate element. With regard to the winds, the tables show that for the year there is a maximum from the south-west, and a secondary maximum from the north-east. During the cold months there is a marked preponderance of land winds, while in the warm months there is a slight preponderance of lake winds. The mean temperature deduced from twenty years' observations is 48°·6, and occurs about the third week in April and October. The highest temperature occurs about the middle of July, and the lowest the third week in January; for 174 days the temperature is rising, and during 191 it is falling. The cold spell about the middle of May, which is generally observed in the northern hemisphere, is well marked in the 5 – day means. The highest temperature observed was 99°·6 on July 17, 1887, and the lowest −23° on December 24, 1872. The maximum temperature was 90° or over on 121 days during 20 years, and a minimum temperature of −15° or below was only reached 16 times. Accurate rainfall observations can scarcely be said to begin at Chicago before 1867. The annual rainfall from this series is 34·4 inches, and is fairly well spread over each month. A fall of 2·5 inches in a day only occurred 15 times in 20 years. The work contains an abstract of the observers' *Journal* since the occupation of the station by the Weather Service, which includes an interesting account of their experience of the great fire of October 8–9, 1871.

WE learn from the report on the administration of the Meteorological Department of the Government of India that the valuable series of meteorological observations which were taken by the late Mr. J. Allan Broun at Trevandrum during the years 1853–64 are being prepared for publication by that department, owing to the action taken by the Royal Societies of London and Edinburgh, and by the Meteorological Council with that view. It is proposed to publish them in three volumes containing (1) hourly observations, (2) comparative observations at various stations on the Travancore Hills, and (3) discussion of the observations. The report shows great activity in the collection of observations from ships entering the Hooghly; these observations are used in the construction of daily charts of the Indian land and sea area, the publication of which began with January this year. The growing usefulness of ordinary weather forecasts is exemplified by the fact that they have been extended to expeditions in the field, and they have been pronounced by the military authorities to have been very successful.

HERR P. CZERMAK publishes, in *Wiedemann's Annalen*, some beautiful photographs of ascending currents in gases and liquids. For the former a box of rectangular section was used, consisting of plate-glass sides firmly cemented together. At the centre of the bottom was placed a flat spiral, the escape spring of a large spindle clock. The spiral could be heated by the passage of an electric current. A glass tube opened into the box at the bottom, directed towards the centre, for the introduction of smoke. A second glass tube led in at the top, for ventilation or the introduction of a light gas. Tobacco smoke blown in through the lower tube was seen to spread out on the bottom in a uniform layer, provided all parts of the box were at the same temperature. The touch of the hand on one side was sufficient to produce an ascending current and a motion of the smoke towards the warmer side. It was therefore necessary to perform the experiments in a room kept at a uniform temperature. On sending a current through the spiral, the mushroom-like figure first described by Vettin was observed to rise in faultless symmetry. This was photographed by flash-light, and the reproductions show the spiral convolutions to great perfection. Since the contours reflected the greatest amount of light, they stand out well from the dark background, and clearly exhibit the interior structure of the stream-figure. In order to imitate more closely the actual condition of the atmosphere during the ascent of warm air currents, the upper part of the box was filled with coal-gas. The stream-figure then ascended in the usual manner until its vertex reached the lighter stratum. It then became stationary, expanded in the diffusion stratum, and part of the smoke trickled back to the bottom. Sometimes it was found possible to obtain a cloud-like structure, with a dome in the centre and wavy outlines. The figures were more easily produced and photographed in the case of liquids, but the general type remained the same.

INVESTIGATIONS are carried on at the Agricultural Experiment Station, Purdue University, Indiana, on much the same lines as at Rothamsted. *Bulletin* 45 of the Station contains information of interest and importance concerning wheat-growing in Indiana. From field experiments extending over ten years it appears that none of the varieties of wheat tried have any tendency to deteriorate or "run out," provided proper care is exercised. No wheat proved to be "rust-proof," but early wheats were generally less injured by rust than later kinds. Eight pecks of seed per acre gave the best returns at the Station, the average yield for nine years being 30·35 bushels per acre. The best results came from sowings made not later than September 20. The value of crop rotation in maintaining yields of grain has been strongly emphasised, for a comparison of rotating crops with constant grain-cropping for seven years showed an average gain of 5·7 bushels per acre in favour of the former. Another important result obtained was that wheat may be harvested at any time from the dough stage to the dead-ripe condition, without appreciably affecting the weight or yield of the grain. Finally, a comparison of forms of nitrogen as fertilisers for wheat indicated that sulphate of ammonia is better than nitrate of soda or dried blood.

IN a former note (June 22, 1893) we have given a short account of the means employed by Signor Augusto Righi to obtain electro-magnetic waves of small wave-lengths (about 8 cm.), and also on p. 299, vol. xlviii. we have described some of the experiments he has performed, using waves of this small wave-length. Since then Righi has continued his researches, and has published in the Proceedings of the Royal Academy of Lincei an account of his experiments on the question as to whether the electric force is perpendicular to, or in the plane of polarisation. Trouton, from his experiments on the reflection of electro-magnetic waves from the surface of non-conductors, such as glass and paraffin, has come to the conclusion that the electric force is perpendicular to the plane of polarisation. The reflection of these waves from paraffin, and also from metals, has been studied by Righi, who finds a marked difference in the two cases. In the

case of paraffin his results agree with those obtained by Trouton; when, however, a metal is used as the reflector he finds that the plane of polarisation is parallel to the electric force. The author has measured the refractive index, for oscillations having a wave length of 7·5 cm. of the paraffin used in his experiments. He employed for this purpose an equilateral prism, each face being 20 cm. high and 37 cm. broad, and found 1·4 for the refractive index. The paraffin employed was not of the highest quality, although it was quite white and homogeneous, and had a melting point of 50°·5 C.

DR. OETTEL has continued his researches on the phenomena of the electrolytic deposition of metals (see NATURE, July 6, 1893). In the present paper, which is published in the *Chemiker Z itung*, he gives the results he has obtained in his investigation of the condition of an auxiliary electrode placed between the two principal electrodes in a copper voltameter. For an auxiliary electrode 86 by 131 mm. in size, being a little smaller than the principal electrodes, he finds that copper is deposited on the side next the anode, and dissolved at the side next the cathode; the quantity dissolved being larger than the quantity deposited in nearly the same proportion as at the principal electrodes. This difference is caused by the electrodes not being composed of pure copper. The deposit on the auxiliary electrode attains as much as 87 per cent. of the deposit on the cathode; but depends on the following conditions:—(1) The relative dimensions of the auxiliary electrode and of the chief electrodes. (2) The absolute size of the electrodes; for, since the copper tends to be deposited chiefly at the edges, the proportion increases when the plates are small.

IN order to ascertain if rifle bullets are capable of carrying infection, Messner (*Münchener med. Wochenschrift*, 1892, No. 23) has been making careful experiments with bullets purposely infected with particular micro-organisms. Bullets thus treated were discharged into tin boxes at a distance of from 225 to 250 metres. These boxes were filled with sterile gelatine peptone, and the channel in the latter made by the passage of the bullet was carefully watched and examined. It was found that in all cases the infected bullets had produced growths of those organisms in the gelatine with which they had originally been brought in contact. In some experiments the boxes, whilst filled with sterile gelatine, were covered over with flannel previously infected with particular bacteria, so that before reaching the gelatine the bullet would first have to pass through the former. Ordinary uninfected bullets were used, but in every instance bacterial growths made their appearance in the subjacent gelatine corresponding to the particular organisms present on the flannel. On the other hand, ordinary bullets, when discharged direct into the gelatine, occasioned only the appearance of moulds and other bacteria usually found in the air. Thus the heat communicated to the bullet during its discharge is not sufficient to destroy any bacteria which may be present upon it; the temperature produced is also wholly inadequate to sterilise any portions of clothing with which the bullet may come in contact, the latter, on the contrary, carrying with it into the wound those bacteria which may be present on the former.

WITH regard to the physiological action of oxygen in asphyxia, more especially in coal mines, a committee of the British Association has arrived at the following conclusions:—(1) In the case of rabbits asphyxiated slowly or rapidly, oxygen is of no greater service than air, whether the recovery be brought about in an atmosphere contaminated by carbonic acid or completely free of carbonic acid, and whether artificial respiration be resorted to in addition or not. (2) Pure oxygen, when inhaled by a healthy man for five minutes, produces no appreciable effect on the respiratory rate and volume, nor on the pulse rate or volume. (3) Oxygen, whether pure or somewhat diluted, produced no effect on one particular patient, who suffered from cardiac dyspnœa of moderately severe type, in the direction of ameliorating the dyspnœa, and, compared with air inhaled under the same conditions, produced no appreciable effect, either on the respiratory rate and volume or on the pulse rate and volume. (4) An animal may be placed in a chamber, the general cavity of which contains about 50 per cent. of carbonic acid, and retained there for a long time without supervention of muscular collapse, provided a gentle stream of a respirable air gas or oxygen, indifferently, be allowed to play upon the nostrils and agitate the surrounding atmosphere.

THE *Quarterly Journal of the Geological Society* (No. 196) has been issued.

MESSRS. DULAU AND CO. have issued a catalogue of works on Lepidoptera, Neuroptera, and Orthoptera.

MESSRS. WHITTAKER AND CO. have published a pamphlet, by Capt. M. P. Nadieine, on a new system of sanitary drainage and treatment of sewage matter.

THE Matabele War has induced Mr. E. P. Mathers to issue a "Map of Mashonaland and Matabeleland." A few facts about the Matabeles and their country give the map additional interest.

WE have received a paper on "Rainmaking," read before the Texas Academy of Science in December 1892, in which Dr. A. Macfarlane discusses professional rain-makers (not the medicine men of the Indians, but their civilised prototypes) and disposes of their theories seriatim.

THOUGH Mr. A. T. Burgess's "First Stage Agriculture" (Joseph Hughes and Co.) is adapted to the Elementary Syllabus of the Department of Science and Art, it should be valuable to all students of agriculture. The author is concise in his statements, so he has been able to give a large amount of information in a small book. A scarcity of illustrations is the book's only fault.

"THE Birds of Michigan," by Mr. A. J. Cook, are described in *Bulletin* No. 94 of the Michigan State Agricultural College. The bulletin is illustrated and contains a bibliography. In the text are recorded the food habits of the birds; so that the economic importance of the various species can be judged. A section is devoted to a statement of the laws that obtain in Michigan for the protection of game. The list is a useful contribution to the ornithology of an interesting region.

A USEFUL book on the "Analysis of Milk and Milk Products," by Prof. Henry Leffmann and Dr. William Beam, has been published by Messrs. P. Blakiston, Son and Co., Philadelphia. The book appeals particularly to American agriculturists, but it may be introduced with profit into the dairy schools springing up in various parts of the country, and professional chemists will be interested in some of the analytical methods described.

MR. HUGH GORDON'S "Elementary Course of Practical Science," part 1, belonging to the series of Science Primers published by Messrs. Macmillan and Co., is worthy of introduction into all elementary and continuation schools. The experiments described are of a very simple nature, and refer to every-day phenomena. The pupil who conscientiously works through the little book will certainly have impressed upon him the importance of exactness, and will thus be given the best foundation of a scientific education.

ANOTHER book on practical physics is "Lessons and Exercises in Heat," by Mr. A. D. Hall (Rivington, Percival and Co.) The book contains a series of lessons and exercises, and is

suitable for use as a supplement to lectures and demonstrations. The experiments described will impress the student with the fact that "science is measurement," hence they are of the right kind, for it is doubtful whether showy experiments are of any educational value. Schools and university classes requiring a good and accurate handbook of heat for the physical laboratory would do well to adopt Mr. Hall's work.

MESSRS. LONGMANS AND CO. have just published, for Dr. F. Clemow, of the English Hospital, Cronstadt, "The Cholera Epidemic of 1892 in the Russian Empire." The author states in his preface that to the English medical world Russia is almost a closed book. The reason of this is that, in consequence of the difficulties of the Russian language, medical news from that country is rarely taken from the original source. Dr. Clemow, therefore, having a knowledge of Russian, set himself to give a plain, unvarnished account of the epidemic of cholera which last summer swept over the Russian Empire, and to bring together information bearing upon the subject *directly* from the most authentic Russian sources. He seems to have spared no pains to get the statistics as full and trustworthy as possible, and was assured by the authorities that, notwithstanding the difficulties attending their efforts to obtain proper returns from regions such as Central Asia and Siberia, in no case did the error exceed 10 per cent.

CARBIDE of silicon, SiC, the beautifully crystalline sapphire-like substance whose preparation by M. Moissan with the aid of the electric furnace was described in our note of October 12, p. 572, forms the subject of a communication to the current publication of the *Zeitschrift für Anorganische Chemie*, by Dr. Mühlhäuser, of Chicago, whose preparation of the carbide of boron formed the subject of our last week's chemical note. It appears that Dr. Mühlhäuser had already completed a long and very elaborate research upon the preparation of this interesting compound upon a scale of considerable magnitude, for the ultimate purpose of its manufacture, before the communication of M. Moissan appeared. The mode by which it may be obtained in large quantities was perfected some time ago by Mr. Acheson, and Dr. Mühlhäuser now gives details of the process, together with considerable additions to our knowledge of its chemical and physical nature. The process essentially consists in heating a mixture of silica and carbon to the temperature of 3500° by means of the electric furnace, when carbon monoxide escapes and silicon carbide is produced.

$$SiO_2 + 3C = SiC + 2CO.$$

Silicate of alumina may be employed instead of silica with equally good results. The crystals obtained possess many of the properties, particularly the hardness, of the diamond. According to the purity of the materials employed in their manufacture they are colourless, or coloured yellowish green, bluish green, or pale blue. The name carborundum is suggested for the substance. Upon the large scale the cheaper materials sand and coke are employed, with the addition of common salt as a flux. The latter acts mechanically, causing the unattacked portion of the ingredients to bake together, thus facilitating the separation of the crystals; it also prevents loss of carbon by surface oxidation. One hundred parts of the powdered coke are mixed with one hundred parts of sand and twenty-five parts of salt. The mixture is placed in an electric furnace built of highly refractory fireclay. The electrodes are inserted through apertures at the ends of the furnace, and are connected with a central bar of carbon, the high resistance, round which the mixture is closely packed. The electrodes are in immediate connection with a powerful current transformer, which is connected in turn with an alternating current dynamo. The carbon high resistance bar is raised by the current to an intense white heat, which is in turn communicated to the mixture. Gas is rapidly evolved from the mass, and yellow and blue flames dart out in all directions. As the heat increases the flame concentrates about one position until the fused salt rises to the surface, when an energetic action occurs, the gases eventually forcing their way through the liquid crust and heaping it up in the form of a crater, from which a high flame shoots up surrounded at its base by dense white clouds of vapour of salt, and eventually the remainder of the salt wells forth from the crater like veritable lava, carrying the dark impurities along with it. The interior of the crater, where the reaction is proceeding, is now seen to be white hot. The eruption soon commences to subside, the flames cease to appear, the outer crust hardens, and the reaction is complete.

THE product of this remarkable reaction is an ellipsoidal hardened mass, surrounding the carbon high resistance, and is found upon making a section to consist of six distinct layers. The first, close against the carbon bar, is a zone of graphite, which occurs in the form of hollowed hexagonal plates, pseudomorphs of silicon carbide, from which they are produced by dissociation at the extremely high temperature in the neighbourhood of the bar, silicon escaping as vapour. The second and by far the largest zone consists of the crystals of silicon carbide. They are largely found in elongated aggregates, radiating in all directions from the axis of the ellipsoid; the individuals forming the aggregates are bluish or yellowish-green, and of all sizes up to crystals a centimetre in diameter. Numerous isolated and highly perfect crystals of considerable size and great beauty are likewise found between the aggregates. Surrounding this zone of crystals is a narrow zone of amorphous carbide of silicon, outside which is found a layer of nodules of minerals produced from the impurities during the reaction; the fifth layer consists of the remains of uncombined mixture, and the sixth the crust of common salt. The crystals obtained by employing silicate of alumina are usually colourless or pale blue, and have been employed by M. Nikola Tesla in his new lamp for the transformation of electrical waves into waves of light. The powdered crystals explode violently when heated with potassium and lead chromates, but burn quietly with chromate of lead alone, forming dioxides of carbon and silicon. The powder exhibits a vivid greenish-yellow luminosity when heated in a platinum crucible. It is only very slightly attacked by the oxygen of the air under these circumstances, only 0·5 per cent. uniting in an hour. The fine powder, moreover, remains suspended in water for months without subsiding, although the specific gravity of the carbide at 15° is 3·22.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*, ♂) from India, presented by Mr. Robert Gallon; a Chestnut-eared Finch (*Amadina castanotus*) from Australia, a De Filippi's Meadow Starling (*Sturnella defilippi*) from South America, presented by Mrs. Kemp-Welch; two Laughing Kingfishers (*Dacelo gigantea*) from Australia, presented by the Executors of the late Mr. Fred Burgess; a Punctured Salamander (*Amblystoma punctatum*) from North America, presented by Mr. J. H. Thomson, C.M.Z.S.; four Common Toads (*Bufo vulgaris*) from Jersey, presented by Mr. J. Stanton; two White-handed Gibbons (*Hylobates lar.* ♂ ♂), a —— Bulbul (*Hypsipetes* ——) from the Malay Peninsula, a Red and Yellow Macaw (*Ara chloroptera*) from South America, five Green Lizards (*Lacerta viridis*), three Black-spotted Toads (*Bufo melanostictus*), four Schlagintweit's Frogs (*Rana cyanophlyctis*) from Ceylon, two Slow-worms (*Anguis fragilis*), three Fire-bellied Toads (*Bombinator igneus*) European, deposited; a Bar-tailed Godwit (*Limosa lapponica*), two Dunlins (*Tringa alpina*) British, purchased.

## OUR ASTRONOMICAL COLUMN.

BROOKS' COMET.—Dr. F. Bidschof has computed the following elements and ephemeris for the comet discovered by Mr. W. R. Brooks, on October 16 :—

$T$ = 1893 September 19·6929 Berlin mean time.
$\Omega$ = 175° 1·0 } Mean
$\omega$ = 348 30·7 } eq.
$i$ = 129 54·6 } 1893·0
log $q$ = 9·91335

*Ephemeris for Berlin Midnight.*

| 1893. | R.A. app. h. m. s. | Decl. app. ° ′ | log $r$ | log $\Delta$ | Brightness |
|---|---|---|---|---|---|
| November 2 | 12 45 59 | +24 35 9 | 0·0600 | 0·1913 | 0·88 |
| 6 | 12 53 13 | 27 51 8 | 0·0782 | 0·1788 | 0·85 |
| 10 | 13 1 12 | 31 21·1 | 0·0961 | 0·1662 | 0·83 |
| 14 | 13 10 2 | +35 4·6 | 0·1137 | 0·1539 | 0·81 |

The brightness of the comet on October 18 has been taken as unity.

THE PLANET JUPITER.—At the present time Jupiter is a fine object for observation, his declination being between 18° and 19° north of the equator. Coming into opposition on November 18, telescopes of moderate power can be used effectively for observing the belts, small spots, and other fine details. Large instruments—that is, those having an aperture of 15 or 16 inches or more—may be used also for observations of the 5th satellite. Assuming the period of this satellite to be 11h. 57m. 21·88s. with a probable error of about a second of time according to Mr. Marth, the following are the approximate times of elongation :—

*Greenwich Time.*

| | East. h. m. | | West. h. m. |
|---|---|---|---|
| Nov. 2 ... | 0 9 p.m. | ... | 3 8 a.m. |
| 6 ... | 8 47 | ... | 2 46 |
| 10 ... | 8 24 | ... | 2 23 |
| 14 ... | 8 2 | ... | 2 1 |
| 18 ... | 7 40 | ... | 1 39 |
| 22 ... | 7 18 | ... | 1 17 |
| 26 ... | 6 56 | ... | 12 55 |
| 30 ... | 6 34 | .. | 12 33 |

THE WAVE LENGTHS OF THE NEBULAR LINES.—Last week we referred to Prof. Keeler's paper, read at the congress of Astronomy and Astro-Physics at Chicago, and we may add here a few words with regard to the results it included, as they are of importance. This paper, on "The Wave-lengths of the two Brightest Lines in the Spectrum of the Nebulæ" is the outcome of a series of measurements made with the 36-inch refractor and the large spectroscope of the Lick Observatory, the dispersion employed being equivalent to twenty-four 60° flint prism. The "normal position" of a nebular line is defined as the position of the line in the spectrum of a nebula at rest relatively to the observer. The results with respect to the two chief nebular lines are—

Normal position of the chief nebular line on Rowland's scale ... ... λ 5007·05 ± ·03
Normal position of the second nebular line on Rowland's scale ... ... λ 4959·02 ± ·04

Prof. Keeler considers the greater part of this probable error to be due to comparisons with the third line, which could not be observed so accurately. From all the observations he finds that the motion of the Orion nebula referred to the sun is + 11·0 ± 0·8 miles per second, and the wave-length of the chief line in this nebula, corrected for the earth's orbital motion, is 5007·34 ± ·013.

## GEOGRAPHICAL NOTES.

YET another plan for polar exploration is announced with no definite purpose of pushing on to the pole, although that may incidentally be reached. Mr. Robert Stein, of the U.S. Geological Survey, proposes establishing a station at the south end of Ellesmere Land, which will be kept in touch with the outer world by the whalers hunting in Baffin Bay. Here a number of observers will live gaining experience in Arctic travel, and from this base "a fan of secondary stations" will be pushed out a hundred miles or so further north, where comfortable houses will be built and frequent communication kept up with headquarters. From each secondary station the staff of five hardy observers will travel northwards, combining science with sport, and even when tracking the musk-ox or white bear each explorer will carry his "four-pound aluminium theodolite" and "make game of the heights and bearings of the mountain peaks." We fear that if this expedition, or rather system of exploration, is really set on foot, its difficulties will become much more real than they now appear. In any case it would be wise to postpone work on so large a scale until the two well-equipped expeditions already in the field have added their contribution to our knowledge of Arctic conditions.

M. E. DE PONCINS, who is travelling in Central Asia, has written some interesting letters to the Paris Geographical Society. In the latest, dated from Chajan, in the Pamirs, on July 9, he mentions the curious fact that while in Europe he has repeatedly suffered from mountain sickness on Mont Blanc and Monte Rosa, he eats and sleeps at 4500 metres in the Pamirs just the same as at sea-level. In crossing snow-passes at 5750 metres his horses caused some trouble, but with this exception he found the Pamirs a pleasant region where it was easy to get about in summer.

THE Russian Government has organised a new province in Siberia under the name of Anadyr. It occupies the extreme north-east of Asia, and is very thinly peopled, mainly by natives, Koriaks, Kamchadales, Chuchis, &c., the last named being the most numerous and the least uncivilised.

DR. E. V. DRYGALSKI, who has spent eighteen months in North-West Greenland studying the phenomena of Arctic glaciers, has returned to Europe, and his report of the work done by his expedition will be expected with much interest.

A NOVELTY in political boundary lines is reported in *La Géographie*, which states that the frontier between Turkey and Servia is to be marked throughout its length by a wire fence.

THE November number of the *Geographical Journal* is rich in new contributions to geography and exploration. The Earl of Dunmore's paper on the Pamirs and Central Asia occupies the first place.—The Rev. J. A. Wylie gives an account of a journey through Central Manchuria, with many interesting notes on places and people, and a detailed itinerary which must prove valuable to subsequent travellers.—Lieut. B. L. Sclater writes a detailed report on routes and districts in Southern Nysaland, illustrated by a new map of the district east of the Shire as far as the Milanji Mountains, largely compiled from his own prismatic compass surveys.—Mr. Theodore Bent communicates a letter from Mr. Swan, who is now in Mashonaland, giving an account of fresh ruins recently visited on the Lotsani and Lundi Rivers, the "orientation" of which to the setting solstitial sun he believes he has established.—Mr. W. S. Bruce and Dr. C. W. Donald publish a preliminary report of their observations during a voyage toward the Antarctic Sea, and Dr. Schlichter gives his paper on the determination of geographical latitudes by photography.

## INSTITUTION OF MECHANICAL ENGINEERS

ON Wednesday and Thursday of last week, October 25 and 26, a general meeting of the Institution of Mechanical Engineers was held in the theatre of the Institution of Civil Engineers, in Great George-street, Westminster; the President, Dr. William Anderson, occupying the chair. Dr. Anderson retires in rotation this year, and Prof. Alexander B. W. Kennedy, F.R.S., is proposed as his successor. There were two papers down for reading, as follows :—"On the Artificial Lighting of Workshops," by Mr. Benjamin A. Dobson, of Bolton; and "On the Working of Steam Pumps on the Russian South-Western Railways," by Mr. Alexander Borodin, Engineer-Director.

Mr. Dobson's contribution was an interesting and valuable paper, in which he described the results of inquiries he had made with a view to obtaining the best mode of artificial illumination for the large workshops of his engineering establishment at Bolton. Mr. Dobson's works are engaged in producing textile machinery, more especially that for cotton-spinning. Many parts of such machinery require to be finished

in the highest manner, and with mathematical accuracy. In order to accomplish this a good light is necessary, but unfortunately that is a thing Mr. Dobson can seldom get from natural sources at his works. We do not as a rule expect to find engineers and manufacturers exclaiming against the smoke nuisance; we rather look to hear such things from those who cultivate the gentler arts. It is therefore, perhaps, worth while to quote a few passages from Mr. Dobson's paper, in which he speaks of the state of the atmosphere in Lancashire:—

"Although Lancashire coal has a number of excellent qualities, yet it is one that makes the most smoke of any. A large portion of the Lancashire manufacturing industries, great and small, date from a number of years back, when smoke-consuming and smoke-preventing apparatus had not yet been devised; and many of the factories are working at the present day under pretty much the same conditions as when they started. Hence the atmosphere in all manufacturing towns in Lancashire is heavily charged with unconsumed carbon, producing an excess of cloud and fog, which, while inducing an excess of rain, acts also as a screen against the rays of the sun, and thus does a double injury to the neighbouring agriculturist, the producer of the country's native wealth. A circle of thirty miles radius around Manchester is said to include a larger population than an equal circle around any other place in the world; and within this circle, about twelve miles north-west of Manchester, lies Bolton, the town with which the author is best acquainted, where all winds, except the west and north-west, bring the surcharged atmosphere from other manufacturing districts, producing at any season of the year, if the wind happens to be slight, a sky ranging from dull lead to dark brown. For four years in succession it has occurred at the writer's works, that on June 21, the longest day, the gas in every room, amounting to nearly 7500 jets, has had to be lighted by eleven o'clock in the morning, and has remained lighted until work ceased; and this has occurred also in other towns, in weather that ought to have secured abundant sunshine. To such an extent does gloom prevail that in clear weather the effect of bright sunlight becomes even distressing to the eye-sight, simply from the rarity of the contrast."

In endeavouring to improve the lighting of his shops, Mr. Dobson naturally turned to electricity. Incandescent lamps were tried, but these were not a very great improvement in illuminating power over gas; whilst with the arc lamp the shadows were so hard and strongly defined that the workmen preferred a very much weaker illumination, if more diffused. When travelling on the Continent, Mr. Dobson visited some cotton mills, and here he found what seemed a very perfect system of illumination. Arc lamps were used, but they were placed in an inverted position to that which is usual, the negative carbon being above, and the positive carbon below. This, of course, threw the greater part of the light rays upwards, as most of the illuminating power proceeds from the crater of the positive carbon. The ceiling is kept well whitewashed, so that the light thrown up is again reflected downwards. The sides of the rooms are also whitewashed, in order that a reflection may come from them. The result is that, without any definite source of illumination being observable, the whole room is flooded with a well-diffused light. Mr. Dobson had very kindly arranged to have one of these lamps in the large visitors' room of the Institution of Civil Engineers, so that members were able to judge of its efficiency for themselves. The result was very perfect in regard to absence of shadows. One could stand in any part of the room, facing any way, and read a book or paper without any very perceptible shadow being thrown; indeed, the diffusion of light appeared to us as good as in the open air. Such a result is of the greatest importance, and it is to be hoped that libraries and reading-rooms especially will in future largely adopt this system; or at any rate, that it will be introduced to the exclusion of the direct arc lighting, like that adopted with such unpleasant results in the reading-room of the British Museum. In regard to the cost, Mr. Dobson cannot speak positively on the subject, not having yet sufficient data to go upon, but he anticipates that it will be higher than gas at 2*s.* 8*d.* per thousand, which is the price in Bolton. There will, however, be a much larger volume of light than when the gas was used, and the advantages of the system, in his opinion, altogether outweigh any possible additional cost. In the discussion which followed, Mr. A. P. Trotter gave a good popular explanation of the advantages of a dead white surface for reflecting light, as compared to that of a looking-glass or bright surface. Good white blotting-paper, he said, reflects back 82 per cent. of the light cast upon it. Many persons are under the impression that looking-glass must be a better reflector than paper or a whitewashed surface, because, with looking-glass, a strong shadow can be cast, while from a dead surface no heavy shadow is obtained. The reason, of course, is not so much that the reflected light is less from the dead surface, but that the reflection is concentrated in the case of the looking-glass; with paper or whitewash it proceeds from a vast number of points.

A modification of this system of reflected light, which is of interest, has been adopted by Mr. Aspinall, the chief engineer of the Lancashire and Yorkshire Railway, at the Horwich shops, where the rolling-stock for the line is produced. In these shops the roof is not adapted for putting in large whitewashed reflectors above the lamps, the jibs of travelling cranes, belting, shafting, &c., being in the way; but Mr. Aspinall, having seen the very perfect illumination obtained by Mr. Dobson at Bolton, determined to see if he could not obtain a modified result. He therefore inverted his arc lamps so as to get the positive carbon below, as in the case of the Bolton installation, and the major part of the light would be thrown towards the ceiling. Above the lamp, and therefore not shielding it from view, was a whitewashed screen of boards, acting as a reflector. The effect was far superior to that of the ordinary method of arc lighting, where the dazzling stream of light pours upon the spectator to the derangement of his eyesight, and at the same time casting heavy and impenetrable shadows. This arrangement, however, is inferior to the complete system, as described by Mr. Dobson, but may be taken as a very good substitute where, from local causes, the entirely reflected principle cannot be adopted.

Mr. Borodin's paper on Steam Pumps was read on the second day of the meeting, and led to a fairly long discussion. The author gives details of a number of pumps tested in order to find their efficiency under ordinary working conditions. The paper has a commercial rather than a scientific interest, to this extent—that it shows the manufacturers how badly machinery may work; for instance, a pump manufactured by an English firm of very good repute only gave 2953 foot lbs. of work done per lb. of steam, when pumping against a head of 33 ft. and the steam pressure being 90 lbs. Supposing the trial conditions to be properly observed—which there is no reason to doubt they were in the present instance—such a result could only be due to the pump being in extremely bad condition, owing to neglect or ill-usage. It had been in use for a number of years. One meets with the same thing—perhaps to a greater extent—in steam engines where the fuel consumption of 30 or even 40 lbs. per one horse-power per hour has been recorded. Mr. Borodin's paper is useful as supplying awful examples for pump users, and at the same time it opens up the very wide question of the value of trial trip efficiencies. To take another instance, that of war ships, a very high speed may be obtained on trial with picked coal, picked stokers, engines thoroughly overhauled, and, in fact, every possible precaution taken to procure efficiency. Naval captains are apt to say, "We would like to know what our ship will do under fair working conditions in action, rather than what she may be made capable of by tuning her up to concert pitch." That is a very good argument for the captains, but where are we to draw the line? It is impossible to lay down what are the fair conditions of ordinary service for any class of vessels—how bad the coal should be, how inefficient the stokers, how rough the weather. Our only course is to get the highest possible result in every case, and then make such allowance as experience, or common sense, would dictate. The same thing may be said with regard to the pumping machinery dealt with by the author. For instance, a pulsometer referred to in the paper was stated to require 860 lbs. of steam per hour for a certain duty; whilst experiments made by Prof. T. Hudson Beere, with a pulsometer in good order, gave the pounds of steam required for a similar duty as 147·6. Now, it will be obvious that if a contractor requires a convenient pump like the pulsometer, and is prepared to pay somewhat for the suitability in the matter of economy, he need not take 860 as his figure of merit, when 147·6 is the trial trip efficiency, although he may undoubtedly have to make some allowance upon the latter figure.

The paper was favourably received by the meeting, and will no doubt add to the attractiveness of the volume of Transactions in which it will appear.

The meeting concluded with the usual votes of thanks.

## THE ARBUTHNOT MUSEUM, PETERHEAD.

THE visitor to Peterhead in past years may have had his or her attention directed to the Arbuthnot Museum, and may have ventured into the hall which then contained the very interesting but well-mixed collection.

The founder of this museum, Mr. Adam Arbuthnot, was born in September 1773. During his years of business as a merchant in Peterhead, and after he retired, he kept gathering at objects of antiquity and natural history, and amassed an immense and valuable collection, all of which he bequeathed to the town at his death in 1850. Some years later the museum of antiquities, minerals, &c. collected by the members of the Peterhead Institute, was added. This last contained a very fine and extensive collection of local shells by the late Mr. Dawson, who was a schoolmaster in Cruden. Since then many smaller but important donations have been made, notably by whaling captains. The Rev. Mr. Yuill, late Free Church minister of Peterhead, contributed the large majority of the invertebrate fauna.

It had become apparent that better accommodation was required, and a complete revisal of the whole collection. There is no necessity here of detailing how this was gradually arrived at. With bazaars, and by means of a handsome contribution made by Mr. Carnegie, Peterhead was enabled to adopt the Free Library Act, and on a site obtained, a very handsome and suitable building was erected, with provision for a free library and reading-room, museum, and art gallery. The two rooms devoted to the museum are large and well-lighted, and the collection has been completely rearranged. The whole building was opened on Wednesday, October 11.

The museum is now in a very different condition. One of the rooms contains the antiquities and ethnographical exhibits, the other the natural history collection. Local and foreign objects have been separated in both rooms as far as was possible. And now the visitor may begin in the antiquities room and see the stone implements, the urns, and the mediæval finds of a local character, and the curiosities from different parts of the world, all placed in a rational order. The rich collection of domestic and other articles from Greenland are all together at the far end of the room. A very valuable collection of coins is also arranged in excellent order in this room. It may be interesting to note that the British coins are so arranged in movable glass panels that the visitor can see both sides by turning the panels round. The ancient swords, African spears, and the like have been grouped on the walls. Not only is the room in the manner of its arrangement worthy a visit, but many of the objects are of considerable value and interest.

The same is true of the larger natural history room. There is a very good collection of minerals, polished granites from many localities, local seaweeds, lichens, mosses, and the invertebrate division of the zoological collection is also rich in many of the orders. These specimens are all arranged in large double-floor cases, a feature in which is the upright middle case. Spirit and branching specimens are thus shown to an immense advantage from both sides. Lightness of effect is secured by using plate-glass shelves.

It may be interesting, moreover, to point out that one or two of the Sertularians and a Ray's bream have been obtained, prepared, and presented by Mr. C. W. Peach.

The fishes are arranged in a wall case, and surmounted by a group of the "saws" of the saw-fish. The amphibia and reptiles are arranged in a corresponding case, which is surmounted by turtle shields. The crocodiles, &c., are arranged on the wall near this, above the very handsome case of birds. In this last case, as in the rest of the museum, all the foreign specimens are made to keep company. The mammals are arranged in one of the old cases, and near them all the Greenland specimens are grouped together. Plate-glass shelves have been used throughout.

Very many valuable objects claim the attention in this section. There is a group, for instance, of deers' horns (mostly red deers') over the door, which have been picked up in the mosses around Peterhead, and which measure more in diameter than the recent ones. Among the fishes are many that could be mentioned as occurring at Peterhead. There are several fœtuses of whales, walruses and seals, including a large one of the Greenland whale. Two very nice cases, exhibiting the characteristics of foxes and badgers, are the work of the Aberdeen naturalist Mr. Sim. A similar case of sea birds was made by a local naturalist, Mr. McBoyle, from whom, too, many of the local birds have been procured. It is to be hoped that some of the groups, such as the Crustacea, will not be lost sight of by the members of the Buchan Field Club, whose interest in the museum should be a direct and helpful one.

This is not the only collection in Aberdeenshire. It has been my pleasure to meet some enthusiasts who have more or less exhaustive collections of antiquities, insects, birds, &c.; but it is to be regretted that there is no good public museum in Aberdeen itself; its situation is one that would be unequalled almost in interesting such collectors in a very large district. Moreover such a museum, if ever formed, would require to provide for a good technical display illustrating agricultural, fishery, and granitic industry. ALEXANDER MEEK.

## THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

THIRTY years ago Dr. William Barton Rogers, the then Director of the Geological Survey of Virginia, and a Professor in the University of that State, founded the Massachusetts Institute of Technology, Boston. Dr. Rogers has since died, but the Institute has grown, and is now the largest scientific and technical school in the United States, and one of the largest in the world. By the catalogue of 1892–93, the number of students was 1060, and the number of teachers 125.

An account of the character, equipment, and work of the Institute has recently been published, and from it the following facts have been obtained. The prospectus is illustrated by a number of fine pictures, three of which have been sent to us for publication.

The Institute is remarkable for the great variety of its courses. In it are taught the sciences and their applications to the arts, the studies being divided into thirteen four-year courses, as follows:—(1) Civil engineering, including railroad engineering, highway engineering, bridge building, and hydraulic engineering; (2) mechanical engineering, including steam engineering, mill and locomotive engineering; (3) mining engineering and metallurgy; (4) architecture; (5) chemistry; (6) electrical engineering; (7) biology; (8) physics; (9) general studies; (10) chemical engineering; (11) sanitary engineering; (12) geology; (13) naval architecture. Agriculture is not included in this list, on account of its being provided for in a State College at Amherst.

In the four years required for graduation, it is sought:—

(1) To make the pupil observant, discriminating, and exact.

(2) To develop in him a taste for research and experimentation on the one side, and for active exertion on the other.

(3) To give him the mastery of the fundamental principles of mathematics, chemistry, and physics, which underlie the practice of all the scientific professions.

(4) To equip him with such an amount of practical and technical knowledge, and to make him so familiar with the special problems of the particular scientific profession at which he individually aims, as to qualify him immediately upon graduation to take a place in the industrial order.

The chief and dominating feature of the Institute, from the material point of view, consists of its numerous large and well-equipped laboratories. The buildings of the Institute, in addition to drawing, recitation, and lecture rooms and libraries, comprise eight laboratories, or groups of laboratories. The Rogers Laboratory of Physics comprises seventeen separate rooms. It includes a laboratory of general physics devoted to instruction in the principles of physical measurement, a laboratory of electrical measurements, devoted chiefly to advanced electrical work; a laboratory of acoustics, one for optical work, and another for photography. In addition to these, there is a dynamo-room and several laboratories of electrical engineering.

The dynamo-room (Fig. 1) is provided with a Westinghouse engine of 75 horse-power, the sole use of which is to furnish the power to drive the plant of dynamos. This plant, besides a number of smaller machines, comprises a 500 light alternating current Thomson-Houston dynamo, with transformers, a 150 light Edison dynamo, a 200 light Thomson-Houston direct current dynamo, a 60 light Weston dynamo, a 3 arc-light Brush dynamo, a United States 300 ampere low voltage dynamo for electrolytic work, and a Siemens' alternating arc-light dynamo. From time to time other large machines are temporarily placed here for purposes of study by the students. The wires from

this room are carried to all parts of the building for experimental purposes, as well as for use in illumination.

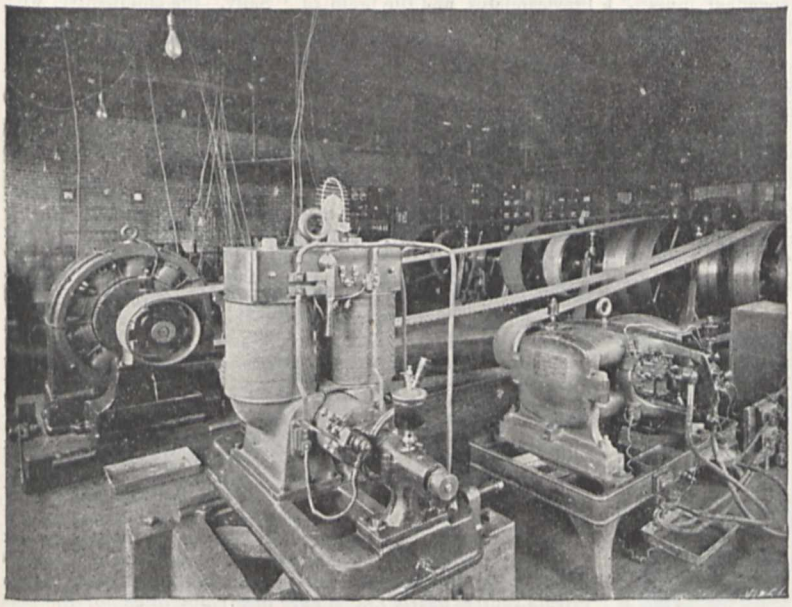

FIG. 1.—Dynamo Room.

The Kidder Chemical Laboratories are just as well-equipped as the Rogers Laboratory of Physics. They comprise eighteen laboratories, four lecture-rooms, a library and reading-room, balance-rooms, &c.; in all, thirty rooms. There is a laboratory of general chemistry with 133 working tables, each of which has under it three complete sets of drawers and cupboards; a laboratory of analytical chemistry, with 108 benches; an organic laboratory having benches for twenty-six students; two laboratories of sanitary chemistry, in which, since 1887, 10,000 samples of water have been analysed for the Massachusetts Board of Health; a laboratory for gas analysis, and three for industrial chemistry, besides a number of smaller ones.

The John Cummings Laboratory of Mining Engineering and Metallurgy comprises laboratories for milling, for concentrating, and for smelting ores, as well as for testing them by an assay and by the blowpipe, and a library comprising the most important literature of the subject.

The engineering laboratories comprise laboratories of steam engineering, of hydraulics, a laboratory for testing the strength of materials, and a room containing cotton machinery.

The most prominent feature of the steam laboratory (Fig. 2) is an Allis triple-expansion engine, having a capacity of about 150 horse-power when running triple, with 150 lbs. initial pressure in the high-pressure cylinder.

The laboratory also contains a 16 horse-power Harris-Corliss engine, and an 8 horse-power engine used for giving instruction in valve-setting. In addition to these, there is a great variety of apparatus, including condensers, calorimeters, injectors and ejectors, steam pumps, &c., directly connected with studies in steam, also apparatus for testing the efficiency of transmission of power and for measuring the power transmitted.

The hydraulic laboratory (Fig. 3) contains a closed tank, 5 feet in diameter and 27 feet high, extending from the basement under the lower floor to the upper part of the room on the second floor. This is connected with a stand-pipe, 10 inches in diameter and over 70 feet high, so arranged that the water may be maintained at any desired point, glass gauges along the stand-pipe serving to measure the height. The stand-pipe is connected with a steam pump, with a rotatory pump, and with the city supply. On the sides of the large tank are the connections for the various hydraulic apparatus, including apparatus for measuring the flow over weirs; through various sizes and shapes of orifices; through hose-nozzles; through different sizes of pipe, with the several varieties of obstructions that occur—namely, diaphragms, couplings, elbows, T's, bends, valves, &c. Also connected with the tank, or with a centrifugal pump, is a Swain turbine, so arranged that measurements can be made of the power transmitted under various heads and with different openings of gate.

The most important feature of the biological laboratory of the Institute is the opportunity of studying ferments, fungi, algæ, bacteria, and other low forms of life. Courses are also provided in general biology, microscopy, comparative anatomy and embryology, physiology and histology.

The Institute possesses a laboratory of mineralogy, lithology, structural geology, and economic geology, but it is neither so extensive nor so well equipped as most of the laboratories already named.

A praiseworthy feature of the Institute's curriculum is that during the last term of his course every student who is a candidate for a degree spends a large portion of his time in the preparation of a thesis upon some chosen subject. This is always of the nature of an experimental research, and may be either purely scientific or technical in its nature. In many cases the results of this work have been of such a character as to merit

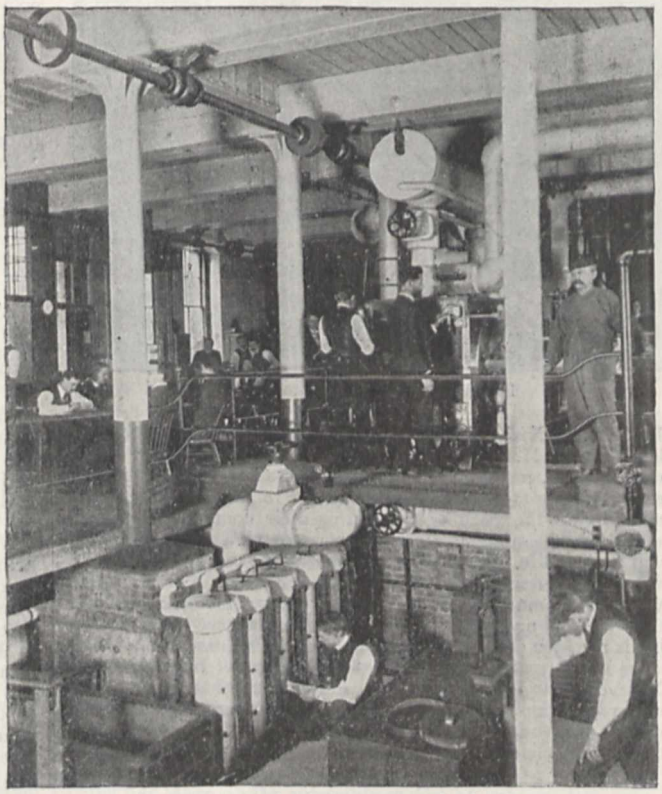

FIG. 2.—Engineering Laboratory: an Engine Test.

publication, and a considerable number of such papers have appeared in scientific and technical journals.

A high value is attached to the thesis work; and rightly. In it the student is placed in the attitude of an independent investigator. He is thrown to a large extent upon his own resources in devising methods of investigation and in finding means of overcoming the difficulties that always arise in original work. Such individual aid is given to each student as is necessary to keep him from too great loss of time from using wrong methods of procedure, without, on the other hand, giving him such specific directions as would entirely deprive his work of originality. He thus acquires a knowledge of the patience, care, and time which it is usually necessary to spend upon the experimental solution of any new and untried problem. This early training of investigators has produced excellent results. A register of the publications of the Institute and of its officers, students, and alumni, between 1862 and 1882, was compiled by

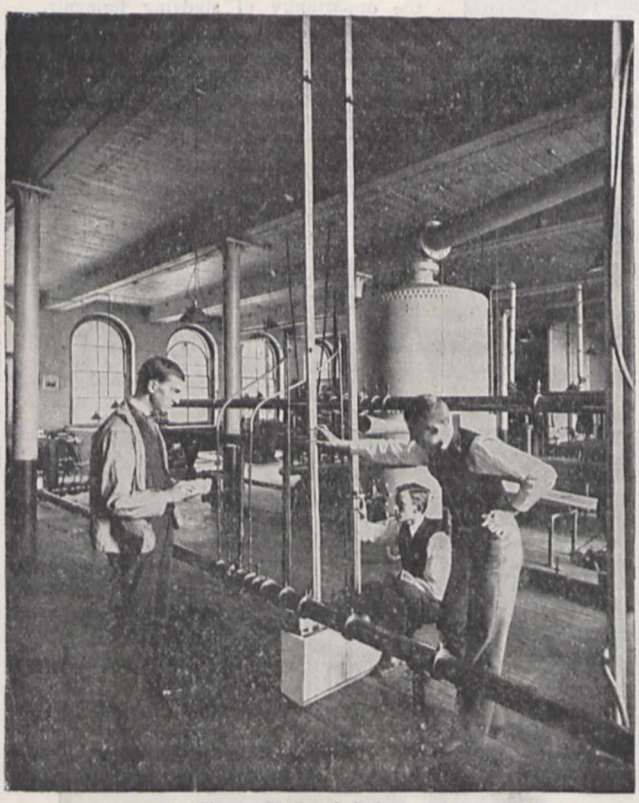

Fig. 3.—Hydraulic Laboratory.

Prof. W. R. Nichols, and has been brought up to date by the late Prof. L. M. Norton and Prof. A. H. Gill. The list includes books, pamphlets, reports, contributions to periodicals—everything, in fact, except contributions to daily newspapers—made by the the teaching staff during their connection with the school, and by students during their connection with the school and in after life. As Prof. Gill remarks, no truer index of the value of an educational institution can be found than the work which its alumni have done and are doing, and when we say that the total number of titles of communications given in the list is nearly 2,900, thirteen hundred of which have been added since 1888, it will be agreed that the system of training at the Massachusetts Institute of Technology is one that gives a love of investigation to the students; and to the man of science this desire to extend natural knowledge should be the end and aim of all scientific education.

## *UNIVERSITY AND EDUCATIONAL INTELLIGENCE.*

OXFORD.—At a meeting of the Junior Scientific Club, on Friday, October 27, Mr. M. D. Hill, of New College, was elected President for the current term. Mr. E. S. Goodrich exhibited some recent additions to the University Museum, including a specimen of Palæospondylus, a specimen of Indrisbrevicandatus, and the brain of "Sally," the chimpanzee, who was so well known at the Zoological Gardens. Mr. Wynne-Finch, of New College, read a paper on mining; and Mr. Gordon, of Keble College, read a paper on the effects of temperature on the incubation of eggs.

The Ashmolean Society held a meeting on Monday, October 30, when Mr. A. G. Vernon Harcourt read a paper on the properties of ferrous chloride, and Dr. W. B. Benham one on the effects of sedentary life on certain annelids.

The Junior Scientific Club seems to have ousted the older and more senior Ashmolean Society almost completely. At the meetings of the latter, which offers communications of at least equal, perhaps of greater, interest than the Junior Society, the attendance seldom reaches a dozen, and of these a large proportion consists of ladies who are more or less directly interested in the lecturer. The attendance at the Junior Scientific Club, on the other hand, is always large, and frequently exceeds fifty. The reason of this disparity is not easily found. Some people attribute it to the lesser formality of the proceedings of the younger society, and to the fact that smoking is permitted during the meetings.

The Sherardian Professor of Botany announces a course of six lectures on forestry, to be given by Dr. J. Nisbet, at the Botanic Garden, daily from Monday, November 6, to Saturday, November 11, inclusive.

CAMBRIDGE.—The Engineering Laboratory Syndicate ask for a grant of £1000 to enable them to complete the buildings required for the accommodation of the department. From private sources nearly £5000 have been subscribed for the purpose, but this is insufficient for the whole of the work in contemplation. Prof. Ewing reports that no less than seventy-four students have entered for courses in engineering during the present term; and it is very desirable that their work should not be hampered by delay in providing the necessary rooms for their accommodation. It had been hoped that subscriptions towards so valuable an extension of the scientific equipment of the University would flow in liberally, but the stream of benefaction seems for the present to have dried up.

The scheme for examinations in agricultural science will come before the Senate for decision on November 9. Already a note of dissent has been sounded by a well-known theological graduate.

Mr. R. A. Sampson, Fellow of St. John's, has been appointed Professor of Mathematics at the Newcastle College of Science.

## *SCIENTIFIC SERIALS.*

*L'Anthropologie*, tome iv. No. 3.—The current number contains four papers of much interest. Dr. R. Collignon contributes an article on the proportions of the trunk among the French, whom he divides into three classes: (1) the Celts, in the sense in which Broca used that term, that is to say, a short, dark, brachycephalic and mesorhine people, such as those found in Auvergne, Limosin, and the centre of France generally; (2) the tall, fair, dolichocephalic Kymris, found in the north-eastern or Belgic departments of France; and (3) those who are really cross-breeds. The measures of the trunk are five in number:—(1) The total height, in the sitting position, from the interclavicular notch to the seat; (2) the maximum bi-acromial diameter; (3) the maximum bi-humeral diameter; (4) the maximum bi-iliac diameter; (5) the maximum bi-trochanteric diameter. The following measures of the thorax are also taken: (1) the distance from the superior border of the clavicle to the inferior border of the false ribs, measured on a perpendicular line passing over the nipple; (2) the transverse width, and (3) the antero-posterior width, at the height of the nipples; (4) the circumference just below the nipples; (5) the circumference about 3 c.m. below the nipples. Observations were made on sixty Celts, seventy Kymris, and eighty Celto-Kymris. It appears that there is a regular gradation between the three classes. Among the brachycephalic Celts, the trunk and thorax are shorter than amongst the dolichocephalic Kymri, whereas in all other respects the measurements of the Celt exceed those of the Kymri. The people of mixed blood occupy an intermediate position. When the total height or the length of the

trunk is taken as a standard, the same general results are obtained, but the length of the thorax as compared with that of the trunk is greater in the Celts than in the Kymri. A comparison with similar measurements of various races of Tunis, negroes of the Soudan, and a single bushman, leads the author to the conclusion that in any given race all the measures of the body increase in absolute length and diminish in relative length as the stature increases, and *vice versâ*.—In a paper on the Matriarchate in the Caucasus, Maxime Kovalevsky adduces facts which tend to prove that the ancestors of the mountaineers who live in the high valleys of the Caucasus at the present time practised what Morgan and Fison have called "group marriage."—Dr. H. Ten Kate gives an account of his researches in Malaysia and Polynesia during a scientific mission promoted by the Royal Geographical Society of the Netherlands, in the course of which he examined 999 Malaysians of different races, and 314 Polynesians. The predominant colour of the skin among the Malaysians is brown and dark brown, while among the Polynesians it is light brown and yellow. The Malaysians have generally wavy or curly hair, but straight hair is a characteristic of the Polynesians. The Malaysians are mesocephalic; the Polynesians brachycephalic. Among the Malaysians the nose is concave or *retroussé*, while the Polynesian noses are straight and aquiline in about equal proportions. As regards stature, the Malaysians are below middle height and the Polynesians tall.—Dr. P. Topinard gives an interesting account of Anthropology in the United States, where the subject has received so much attention during the last few years. The question of the antiquity of man in North America is discussed at some length, and the general conclusion arrived at is that it does not exceed 15,000 years. Dr. Topinard proposes to continue the examination of American questions in future numbers of *L'Anthropologie*.

*Bulletin de l'Académie des Sciences de St. Pétersbourg*, New Series, vol. iii. No. 3.—Preliminary report on the results of the archæological expedition to the Orkhon River, by W. Radloff. The ruins of Khara-Calgasun, the old city of the Uigurs, close by which lie the ruins of a palace of the Mongol Khans, have been explored, as also the Tüküe monuments in the valley of Tsaidamin-nor. In the monastery of Erdeni-dsu, about 27 miles south-east of Kosho-tsaidam, and 20 miles south of Kharabalgasun, the expedition has discovered several stones, covered with Mongolian, Tibetan, and Persian inscriptions which, in Prof. Radloff's opinion, prove that the old town of Karakorum stood at this spot. This position would agree with the Chinese indications which give to Karakorum a position of 100 *li* south of Ughei-nor. Many maps, plans, photographs, and casts of inscriptions have been brought in by the expedition.—Reports of MM. Clements, Dudin, Yadrintseff, and Lewin, relative to the same expedition.—Photographic spectrum of Nova Aurigæ, 1892, observed at Pulkova, by A. Belopolsky. Full details of the observations and measurements made on the photographs are given. In his conclusions the author considers an eruption of the star as not probable, and concludes in favour of a superposition of the spectra of two or more bodies in the spectrum of the Nova.—On a group of peculiar rocks brought from the Taimyr-Land by A. Middendorff, by Dr. K. Chrustschoff.—On a new species, *Felis pallida*, from China, by Eug. Büchner. The species is near to *Felis chaus*, Güld., but partially differs in coloration, as also in the length of the tail. The specimens described were brought in by Przewalski in 1884 from the south Tetung ridge in Gan-su.—On the state of the basin of the Black Sea during the Pliocene Age, by N. Andrusoff. The following conclusions are arrived at: The now deep part of the Black Sea remained submerged since the Sarmatian epoch, and was covered with brackish lakes of the Caspian type; however, it was separated from the Mediterranean by a continent which occupied the place of the Archipelago and the Ægean Sea. This continent was submerged, and a communication between the Mediterranean and the Black Sea was established at a very recent epoch, when the Black Sea already had its present shape.—On the differential equation of Lamé-Hermite, by F. Brioschi.—On the Perseids observed in Russia in 1892, by Th. Bredikhin. Observations, with the view of determining the decrease of the inclination of the orbits of the meteors, in proportion to the time-interval from August 10·5, have been made throughout the duration of the shower at Moscow, Pulkova, and a place in the district of Kineshma. All observations, including 339 meteors, are embodied in seven lists, or charts, published in full. The radiant has been deduced from each chart separately, and given for eight different dates, from July 29 to August 29. The surface of radiation has a circular form, its diameter having a length of nearly 45°, and the radiant point really suffered displacement.—On the embryonal development of the birch, preliminary communication, by S. Nawaschin. It has two phases in common with the development of the Casuarinæ, which therefore cannot be separated from other Angiosperms. They are evidently connected, through the birch, with the lower Angiosperms (Apetales).—On the representation of the daily change in the temperature of the air by means of Bessel's interpolation formula, by H. Wild. Critics of conclusions, opposed to those of the author, and arrived at by Dr. Paul Schreiber, director of the Chemnitz Meteorological Institute.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Entomological Society**, October 18.—Henry John Elwes, President, in the chair.—Mr. R. Adkin exhibited two *Leucania vitellina* and one *L. extranea*, taken in the Scilly Islands, in August 1893.—Mr. R. South exhibited a specimen of *Polyommatus bœticus*, and a number of varieties of *Chrysophanus phlæas*, captured in Kent, in September last, by Mr. Sabine; also a curious variety of *Argynnis euphrosyne*, taken in Lancashire in May 1893; a pallid variety of *Vanessa urticæ*, taken in Monmouthshire, in July 1893; and a *Triphæna pronuba*, the right wings of which were typical, and the left wings resembled the variety *innuba*, caught at sugar, in Dovedale, Derbyshire, in July 1893.—Mr. G. H. Verrall exhibited a specimen of the Tsetse (*Glossina morsitans*), and also one of the common European allied species (*Stomoxys calcitrans*). He also exhibited a specimen of *Hæmatobia serrata*, Dsv., which hes tated was not uncommon on cattle in England, but believed to be harmless; while in North America the dreaded "horn-fly" is said to be the same species.—Mr. Elwes exhibited a larva which he had found three days previously under stones on a moraine, apparently quite destitute of vegetation, in the Austrian Tyrol, at an elevation of about 7000 feet. He remarked on the number of Alpine butterflies, some of them in fresh condition, which he had seen whilst chamois-hunting in the Austrian Tyrol during the last week, and he suggested that in such a fine autumn as the present one collectors might find more novelties among the larvæ of Alpine species than in the summer.—Col. Swinhoe read a paper entitled "A List of the Lepidoptera of the Khasia Hills" (pt. 2). The President said he thought all entomologists would be grateful to Col. Swinhoe, Mr. Hampson, Mr. Meyrick, and others for the work they had recently been doing in describing the moths of India; but as the district of the Khasia Hills was probably richer in species than any other part of India, except Sikkim, and new species were being received almost daily, it was impossible to make any list complete. Mr. Jacoby, Mr. McLachlan, Mr. Jenner Weir, and Col. Swinhoe continued the discussion.—Mr. E. Meyrick communicated a paper entitled "On a Collection of Lepidoptera from Upper Burma." The author stated that the species enumerated in the paper were collected by Surgeon-Captain Manders whilst on active service in the Shan States and their neighbourhood, shortly after the British annexation of the territory. A discussion followed, in which the President, Surgeon-Captain Manders, and Col. Swinhoe took part.

### PARIS.

**Academy of Sciences**, October 23.—M. de Lacaze-Duthiers in the chair.—Observations of Brooks' Comet (1893, October 16), made at the great equatorial of the Bordeaux Observatory, by MM. G. Rayet and L. Picard.—On the movements of the surface of the heart, by M. Potain. The object of this investigation was to obtain the interpretation of the cardio-pulmonary sounds resulting from the movements communicated to the lung by the heart, and the local inspiration phenomena produced by these movements. The movements were recorded by an instrument capable of tracing simultaneously at several points of the surface the displacements in all directions. From these traces the actual trajectories of the points were constructed, the points being five taken on the accessible surface of the ventricle of an animal with an open chest. The general movement thus indicated is, during systole, a rapid retreat of the surface and an equally rapid translation to the right; this is, in fact, the well-known torsional motion. At the end of the ventricle, the retreat is only effected towards the end of the systole. At the beginning

of diastole, the whole wall rapidly collapses; it then rises, slowly at first, as the blood gradually enters the ventricle, and then rapidly, when the systole of the auricle takes place. On comparing these trajectories with the sounds heard in man and sometimes also in animals, it is found that their amplitude is greatest where these sounds are most intense and frequent, that their direction is that calculated to produce upon the lung a rapid aspiration during systole, and that the rhythm of the sound is itself in correspondence with the variations of speed of the movement. The relation thus discovered solves a complex problem of auscultation.—Observations of the new comet Brooks (1893, October 16), made at the Paris Observatory (west equatorial), by M. G. Bigourdan.—On certain families of gauche cubics, by M. Lelieuvre.—On the kinetic interpretation of the function of dissipation, by M. Ladislas Natanson.—Determination of the velocity of propagation of an electric disturbance along a copper wire, by means of a method independent of any theory, by M. R. Blondlot.—Analysis of a vanadiferous oil, by M. A. Mourlot. This oil, of slight density varying between 1·15 and 1·20, is of a fatty appearance, and contains 51·52 per cent. of volatile matter. The percentage of hydrogen is much lower than that of the vanadiferous oil recently discovered in Argentina by Mr. Kyle, and carbon and nitrogen show a larger percentage. The most interesting feature of this oil is the presence, in the ashes, of a large proportion of vanadic acid in the shape of alkaline and metallic vanadates. It also occurs free in this oil, and may be extracted by washing with ammoniacal water. A quantitative analysis gave a percentage of 0·24 of vanadic acid in the oil, and 38·5 per cent. in the ashes. As the oil is abundant, some important applications of vanadium may be looked for if the properties of the metal are found to be commercially valuable.—On the perfume of the violet, by MM. Ferd. Tiemann and P. Krüger. This is an account of the success so far obtained in the analysis of the perfume-oil contained in the fresh flower of the violet or the dry root of the iris, and its synthesis from lemon-juice.—New synthesis of erythrite, and synthesis of an isomeric erythrite, by M. G. Griner.—Influence of organic solvents upon rotatory power, by M. P. Freundler.—On certain chemical conditions of the activity of brewers' yeast, by M. J. Effront. It was found by a series of experiments that various kinds of yeast, after treatment with gradually increasing quantities of ammonium fluoride, acquired a very considerable fermenting power, estimated at about ten times that developed before this treatment. It also imparted properties which some physiologists had up to now considered as the privilege of certain species.—On the propagation of the *Pourridié de la Vigne* by slips and graft-slips placed in sand "in stratification," by M. A. Prunet. The storage of grafting slips in moist sand for the next season encourages the growth of small fungi upon them, which give rise to a fatal disease of the vine.—On a dislocation in the shape of a mushroom in the Alps of Haute-Savoie, by M. Maurice Lugeon.—On a halo observed at Créteil, on October 22, 1893, by M. Georges Pouchet.

GÖTTINGEN.

Royal Society of Sciences.—The following papers of scientific interest appear in the *Nachrichten* of July to September 1893:—

July 26.—E. Ehlers: On the morphology of the Bryozoa. W. Nernst: Dielectric coefficients and chemical equilibrium. W. Holtz: On direct impressions of magnitude in artificially induced optical illusions. W. C. Röntgen: On the influence of pressure on the electric conductivity of electrolytes.

August 2.—O. Wallach: On compounds of the camphor series. W. Voigt: Observations on rigidity under homogeneous deformation. Also, on an apparently necessary extension of the theory of elasticity. W. Meyer: G. F. Grotefend's first announcement of his decipherment of the cuneiform character.

AMSTERDAM.

Academy of Sciences, September 30.—Prof. van de Sande Bakhuysen in the chair.—Mr. Bakhuis Roozeboom described the method for the determination of oxygen dissolved in water studied by Dr. Romyn. This method unites simplicity and accuracy, and can be executed outside the laboratory. Its use in hygiene was indicated by two series of researches, the first aiming at the determination of the quantity of pure water necessary to improve that of the canals of Leyden, whilst the other concerned the analysis of the oxygen in different parts of the water-conducts in Arnhem, in view of the corrosion of the iron tubes.—Prof. Schoute treated on sections and projections of tessaract and hexadecatessaract.—Prof. Korteweg dealt with the classification of the curves of the third class or the third order, and a graphical representation of the totality of these curves and their division in three tribes by the points of a plane, every point representing all the projective and reciprocal transformations of the same curve.

Netherland Zoological Society, September 30.—M. Hubrecht in the chair.—M. van Wyhe contributed a paper on the ventral nerves (ventral roots) of Amphioxus. With the help of Golgi's method the author was able to state that the ventral nerves are furnished with true terminal organs, Retzius not having succeeded to observe them. The author then discussed the question as to why the ventral part of the motor nerves lies within the myotome, and not, as with the dorsal part is the case, at its medial side. Finally, the same author pointed out that in Amphioxus the ventral nerves contain sensory nerves also.—M. J. T. Oudemans exhibited specimens of *Alytes obstetricans*, taken by him for the first time in the Netherlands, viz. near Valkenburg (Limburg).—M. Horst exhibited a new gigantic European earthworm, obtained near Arcachon (France), and which he referred to a new species (*Allolobophora Savignyi*). The same author observed the larva of a dipterous insect within the mouth of a Perichæta from Java.—M. Hoek made remarks on the spawning of the Anchovy in the Zuiderzee. Another communication from the same author contained an account of trawling experiments in the North Sea.

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