THURSDAY, MAY 19, 1881

"A BOOK OF THE BEGINNINGS"

A Book of the Beginnings. By Gerald Massey. Two Vols. (London: Williams and Norgate, 1881.)

IN two large volumes Mr. Gerald Massey has collected together all the principal facts known about Egypt, with a view to trace the origin of mankind. Some portions of his theories are undoubtedly correct, especially those which go to prove that the Egyptians are the oldest known historical race, that they are an African people of a peculiar type, and by no means an Asiatic tribe filtered through the Isthmus of Suez, and in course of time building up a Semitic population in Africa; that evidence of their primitive development is to be found in their physical type; for Mr. Massey is a decided evolutionist, and regards man as evolved from some of the anthropoid apes, especially the black races, whose colour he considers marks their animal descent; that flint and stone weapons, principally of the Neolithic period, have been found in Egypt at different points is undoubted; and that the aboriginal inhabitants of the Nile Valley gradually rose to a higher state of civilisation, and that without a foreign predisposing them, is probably true. When however the author leaves the realms of ethnology and dashes into philology his results are startling, and his deductions so weird and transcendental that they fail to command acquiescence. It is the rash seizing of any word in any dialect which is totally inadmissible, as from such arbitrary selections any absurdity may be perpetrated.

Still more extraordinary is the separation, arbitrary as it appears, of dissyllable words into syllables, and comparing each syllable with any Egyptian one that will give such a meaning as the inquirer wishes. To such proceedings there are no limits, and some of the results are grotesque. The first requirement in the study of a language is to separate the original from the introduced words, and to apply to each a distinct etymology. In all languages nouns are of uncertain origin, verbs and original inflections, affixes and prefixes are more typical. Such derivations, for example, as butter and butterfly from the Egyptian *Put*, "food," and *Ter*, "entire" or "total," and moth from the Egyptian *Mut*, "death," and cooper from the Egyptian *Kheper*, "a bottle," are too far-fetched to entitle them to the designation of philological deductions. But with all this straining at gnats the number of English words, whether original or derivative, which can be tortured into supposed Egyptian origin, is remarkably small. Objecting, as is imperative, to all such vain delusions, it must be admitted that the author has a full right to oppose that system of comparative philology which has been built up from the Sanskrit, the supposed oldest representation of the Aryan languages, to the utter neglect of the older Egyptian, Sumerian, Babylonian, and Chinese. The stately edifice built upon the sand of Sanscritism already shows signs of subsidence, and will ultimately vanish like the baseless fabric of a vision. For by it not the study of the general laws of speech, but only of a comparatively recent development is exhibited. The weakness of the author is however equally manifest here, as he deals with languages which he does not understand, and institutes comparisons on imperfect data, nor does he seem to be aware of the knowledge recently acquired of a prehistoric Chinese. He is however right when he points out that such a Hebrew, not British, name as Adam is more likely to be derived from *Tem* or *Atem*, the Egyptian word for "creator" and "created" being, than the Sanscrit Adima, proposed by Max Müller, the more so that the Pentateuch abounds in Egyptian words, and Sanscrit philology is vainly and ridiculously applied to it. But in treating of the Egyptian word for cat and its vocative form pussy, although the different forms cited may amuse those interested in the "great cat question," the learning expended is not on an original, but an introduced word. The cat was doubtless an African and Chinese animal unknown to the Greeks till a very late period, not introduced till late into the houses of the Romans, and not seen on Egyptian sculptures as a pet till about 1500 B.C. The immense deal of reading and the fanciful comparisons of the section of the Egyptian names of personages are too daring and startling. No doubt there is a peculiar fascination in playing with words, and if the combinations are neither correct nor harmonious, they are at all events amusing, as to find that the Chinese expression *fieng yue* is the same as the word fiend, after all only the Egyptian *fenti*, and "old Bendy," the English nick-name for the devil. The same remarks may also be applied to the attempts to refer British symbolical customs to Egyptian names, and the identification of the Egyptian deities in the British Isles, although a great deal of reading has been wasted. In the wriggling over the word Tasc on British coins, the well-known abridgment of Tasciovanus, the father of Cunobelinus, or Cymbelin, there is an unusual degree of floundering. It is referred to the Egyptian word *tes* and the English *tas*, a reaper, and this example will give an idea of the manner in which the subject is treated. At some spot in Herefordshire certain services were performed over "old Tom"—not the spirit, but as the departed year was called; and this is supposed to be part of the myth or legend of the Egyptian god Atum, or the Creator, Tom in the game of noughts and crosses, and so is Tommy Dodd. The only difficulty is to conceive how such a transformation can have got into any English head, for the word Tom suggests a vulgar familiarity and a contracted form of Thomas; and in the same strain run on the consideration of the types, names, and similar subjects, all on the same plan. From the consideration of Egyptian origins in Britain, a more than doubtful thesis, Mr. Massey however goes into deeper water when he ventures on Egyptian analogies in the Hebrew scriptures, although the subject is by no means novel, and has been mentioned by various Egyptologists, Chabas, De Rouge, Ebers, Brugsch, and others, besides the extensive use of Egyptology made by German theologians. The identification of biblical personages is another of the attempts of the author to grasp at faint analogies with Egyptian words that might possibly be compounded into the Hebrew syllables forming the Hebrew names; the slightest probability is grasped at as if an absolute proof, with the undaunted boldness of a preconceived theory. Such researches may dazzle those unacquainted either with Egyptian or Hebrew, but it is more than doubtful

if such averments will commend themselves either to Egyptologists or Hebraists; they are so transcendental that they do not belong to the domain of pure or comparative philology, but appertain rather to the province of comparative mythology, and the interpretations so liberally accorded of the myths of one nation by the philology of another. They resemble the labours of the school of Bryant, which expended so much learning, obtained such few results, and established no important fact. So with an immense amount of Egyptian reading and learning the real amount of new facts acquired by ingenious comparisons is small, not to say of the most doubtful character. Amongst one of the most startling ideas is that the Arsu, who ruled during the anarchy which preceded the reign of Setnethk or Nekhtset, is no other than Moses. The search for Moses amongst Egyptologists has been most exhaustive, and Prof. Lanth, who also belongs to the imaginative rather than the critical school, has long ago thought that he identified not only the Jewish lawgiver, but all the members of his family, on an Egyptian sepulchral tablet. It is needless to remark that no other Egyptologist recognises in the polytheistic worshipper of Apis the monotheistic leader of Israel.

No doubt many identical verbal roots occur in Egyptian, Assyrian, and Accadian; those of Hebrew and Coptic have already been pointed out and alluded to; still the languages are essentially distinct in their constructions, and belong to different families. The Assyrian may be classed as the oldest form of the Semitic family, at all events the Babylonian must be considered so. Greater difficulty indeed exists about the Accadian, which has been referred with probability by some to the Ugrian family of languages, and with doubtful success by others to the oldest Chinese, as the theory is based on the comparison of few words, some of which are of uncertain meaning, and they cannot be historically traced as the descendants of one another. Some of the Accadian nouns, indeed, resemble the Finnish, but the verbs are totally dissimilar. Many Egyptian words, however, it would appear from the comparative table of Mr. Massey, resemble Accadian, and this may be considered a new departure, and one perfectly legitimate, as the two languages may have started from a common origin; indeed by some linguists the origin of the Semitic has been referred to Africa; but as already clearly pointed out, although certain phases of construction ally the Egyptian with the Semitic languages, there is not the most remote similarity with the Accadian, which is not only of a totally different family from the Semitic, but also the Egyptian or Hamitic tongues. When however Mr. Massey claims to trace Egyptian words in the Maori, he has no doubt been more fascinated by the theory of the Egyptians belonging to a primitive continent subsequently broken into the islands of the Polynesian group than the actual coincidences of the two tongues or the similar words in the two languages. It must always be remembered that, like the Chinese, the Egyptian is a very poor language, and expresses a great variety of ideas by a single monosyllable: no wonder, then, if coincidences occur. The African origin of the Maoris of course demands further consideration. Ethnologically and philologically they were formerly classed as a probable offset of the Malay race, but how Egyptian words passed to them is another question. Some words certainly look like Egyptian; but that is not sufficient, as some Egyptian words resemble those in all other languages.

More in accordance with probability is the hypothesis that Egyptian words may be found in all the African languages, although their structures differ. This has been long recognised as a fact in the Berber, and also in some of the other African stems, but again the great difference of structure and the doubt how and when the Egyptian words were introduced cloud the inquiry in investigating languages that have had no inscriptions or written literature. Yet the old Egyptian must have been a development of one of the old African languages which subsequently became extinct.

Notwithstanding the difference of opinion about the results and the methods by which they have been obtained, great credit is due to Mr. Massey for the ingenuity with which he has endeavoured to build up his theory and, to his mind, discoveries. He has read through all the principal works on the subjects he treats, and his collection of words, legends, and data is enormous. He has produced a work which will be read with pleasure by some, with amazement by others, and incredulity by specialists. He has taken all reasonable care to insure a fair and correct list of words and facts: yet for all that the embroidery of his particoloured threads has produced a weird and grotesque pattern of strange and fantastic conceptions such as might have been planned by elves or fairies to dazzle and bewilder mortal imagination as much as to amuse and delight themselves. It is too warm and rosy for the chill glance of science.

THE SCOTTISH CELTIC REVIEW

The Scottish Celtic Review. No. 1, March, 1881; pp. 80, 8vo. (Glasgow: James Maclehose.)

THIS is a quarterly review of which the first number has just appeared, published by Mr. Maclehose of Glasgow; but the name of the editor is not given, nor of the writers of the articles. The work however is done in a way which shows that there are at least a few persons in the North who feel a deep interest in Celtic philology and the language and literature of the Scotch Highlands. The programme is an excellent one, and embraces among other things the application to the study of Gaelic of those methods of investigation which have been so fruitful in the fields of English and German philology. It is intended also to help, by means of translations, to make English readers better acquainted with Gaelic literature, and to collect for publication all fragments of unwritten literature which still may happen to linger in the Highlands, as well as to afford room for the discussion of questions relating to Gaelic grammar and orthography. This last, it seems to us, is a subject with which the Gaelic scholars of the Highlands trouble themselves a great deal too much. Modern Gaelic orthography, whether in Ireland or in Alban, is simply incorrigible, and had better be left alone for the rest of the natural lives of the surviving dialects. This involves no great inconvenience; for no scholar who wants to understand the history of a Gaelic word ever thinks of being guided by any of the modern spellings which may be in use, but goes back to the Irish of the Middle Ages, or farther still,

to what is technically known as Old Irish. It is some consolation to Englishmen to know that English orthography is not quite the worst in the world, and that Tonald seldom writes, but that when he does he spells more outrageously than the most wayward spelling-book ever known in the land of the Southron.

The philological articles in this review are very well done, and will be found very instructive, and specially adapted for beginners in the study of Celtic; but what we presume would most attract the readers of NATURE in this number is the tale which it contains, published for the first time. It was taken down some years ago in the Island of Tiree, the Terra Ethica of Adamnan's "Life of St. Columba." This is a summary of it :—The King of Ireland's heir was returning from hunting towards the evening, when he was overtaken by a shower, out of which came a big fellow with a fine steed and a marvellously handsome woman. The big fellow challenged the prince to play with him; he did so, and the big fellow was beaten, whereupon the prince took away his lady companion. He met the same big fellow another day and beat him again; according to the woman's advice he asked this time for the steed, which he took away with him home. The woman told him he would be beaten the next time, and how he was to act under his defeat. It happened just as she had told him, the big fellow laying him under charms, that he should have no rest or peace until he discovered how the Tuairisgeul Mor met with his death. He in his turn laid the big fellow under a charm not to leave the spot until he should return from the difficult expedition which was before him, and in which ever so many kings' sons had perished in former times. With the aid of the counsel of the woman he had taken from the big fellow, and with the assistance of her three wonderful brothers, to whom she recommended him, he managed to execute the first part of his business. On his way back on his horse, just as he had ridden through a wide loch and cut it into two, he was met by a youth who made unheard-of offers for the horse; according to previous advice he was to accept none of them, but to give away the horse only for a grey old man the youth had at home. The hero of the tale carries the grey old man on his shoulders and is guided by him, but is always to do the reverse of what he says. Each time this happened the old man would say, "That gives longer life to you and shorter life to me." At last they sat down in a house, and the old man had to relate the tale of his life, which was to yield the prince the information he was in quest of. He said that he was one of the three sons of a king, who were turned into wolves by their stepmother with her mallet of Druidism. They avenged themselves on her by killing her hens, until she got all the sportsmen in the land assembled to destroy them, when they were driven to shelter themselves under a big rock near the sea. There two died, and the surviving one, seeing a ship not far off, swam so near it that the captain ordered him to be picked up. By and by he became a pet of the captain's, who took him home to his wife. Some time afterwards she was confined of a boy, and the midwives, after dressing the baby, went to sleep, while the wolf lay quietly below the bed; ere long he saw a big fist coming in through the roof and snatching the baby away. When the midwives woke they smeared blood on the animal, and laid the blame on it of having devoured the child, in order to clear themselves of neglect. The captain was loath to kill his pet wolf. The same thing happened another year; but the third time the beast watched, and beheld the fist coming in through the roof, when he seized hold of it, and tore it off at the shoulder; however, the other hand seized the child, but the wolf gave chase, and made its way into a little island with a cave in it where he found that the robber was a giant. The baby was under his arm, and the children previously stolen were playing in the cave. The giant being asleep, he got at his throat, and so the Tuairisgeul Mor found his death. After relating how the three children were brought home to their father, the captain, and how he himself recovered his human form, the old man said: "I am not to live any longer; throw me into yonder cauldron." The King of Erin's son now returned to the hill, where the big fellow who used to challenge him to play, lay with his bones by this time bleached by the wind and the rain; but when the prince told him how the Tuairisgeul Mor had been put to death he was gathered together, and rose from the hillock alive and well, while the young prince went home to marry the beautiful maiden who had enabled him to overcome all the difficulties which had met him.

We have read various tales at different times containing similar incidents, but the only one we shall mention here is that of Pwyll, Prince of Dyved, in Lady Charlotte Guest's "Mabinogion," where it is related how he lost his first-born the night he was born; and how another prince of South Wales used to lose the colts of a remarkable mare he had about the same time. At last the latter watched, and cut off the hand that was in the act of seizing a colt through a window; but what we wished to come to was this—the time is specified in the Welsh tale, namely the first day of May every year. Possibly this may suggest to somebody who has made a study of such legends what they really mean; but we abstain from giving any crude theories of our own on the matter.

OUR BOOK SHELF

Zwangsmässige Lichtempfindungen durch Schall und verwandte Erscheinungen auf dem Gebiete der anderen Sinnesempfindungen (Sensations of Light generated by Sound, and related Phenomena in the Sensations of other Organs of Sense). By E. Bleuler and K. Lehmann 8vo, pp. 96. (Leipzig: Fues's Verlag, 1881.)

As the authors (two medical students of Zürich) were conversing on chemistry in the autumn of 1878, Bleuler being asked what was the appearance of *cetones* (substances of which *acetone* or naphtha is the type), got out of the difficulty at once by saying, "They are yellow, because their name contains an *o*." Lehmann, astonished, inquired what such an apparently absurd answer meant, and then found that from childhood Bleuler, on hearing, or even thinking of any vowel or word, immediately saw a colour, and that many of his relatives were in the same condition. Such was the origin of this investigation, and it is remarkable for having been carried on by one who always saw the colours (Bleuler) and one who never saw them (Lehmann). Such appearances of colour generated by sound are here called *photisms*, while sensations of sound generated by colour are termed *phonisms*, and both are called "secondary sensations or perceptions,"

the authors not knowing exactly in which category to place them. The authors have examined 596 persons (383 men and 213 women), and found among them 76 "positive" (that is, capable of seeing photisms), and 520 "negative" (that is, incapable of seeing photisms). This proportion is about 1 to 7. Particulars of the examinations of all are given. The photisms for the same sounds differ much from individual to individual, but remain constant for the same individual, as shown by receiving identical answers to thousands of questions after intervals of more than a year. The photisms are not always distinct or of definite forms, but are projected on to the spot whence the sounds arise. Other senses produce sensations of colour as well as hearing; thus there are taste and smell photisms. There are also emotional photisms. The authors are unable to give any explanation, but they are clear that simple association does not suffice, and they examine a number of suggestions made to them, showing that they do not account for cases observed. They themselves think that the solution of the difficulty is to be sought in the nature of nervous processes, but they do not admit that "secondary sensations" are psychopathological. This little book is full of curious and interesting details evidently connected with Francis Galton's "mental images," and localisation and sometimes colouring of numbers in the mind's eye. The following account of the general conclusions obtained, given on the last page of the book, will show what a curious page of nervous physiology is here opened out.

1. *Bright photisms* are excited by musically high sounds, severe pain, sharply-defined sensations of taste, small forms, pointed forms. *Dark photisms* by the contrary.

2. *Musically high phonisms* are excited by bright light, clear definition, small forms, pointed forms. *Deep phonisms* by the contrary.

3. Photisms with sharply defined forms, small photisms and pointed photisms, are all excited by the sensations of musically high sounds.

4. Red, yellow, and blue are common colours of photisms; violet and green are rare, blue is of medium frequency.

5. Thorough agreement of the separate assertions of different individuals does not occur.

6. Unpleasant primary sensations may excite pleasant secondary sensations, and conversely.

7. Secondary sensations are scarcely more influenced by psychical circumstances than are primary sensations; and they are inalterable.

8. The disposition to have secondary sensations is hereditary.

9. Traces of secondary sensations are widely spread. Well-developed secondary sensations could be established to exist for one in eight persons examined.

10. Secondary sensations are not more frequently met with in psychopathically afflicted persons than in those of a normal condition.

A List of European Birds. By Henry E. Dresser. (London: Published by the Author, 1881.)

THIS "List of European Birds," including all the species found in the Western Palæarctic region, has been very carefully revised by Mr. Dresser, and appears opportunely on the completion of his great work on the "Birds of Europe." It will be most useful as a check list for labelling, or for reference in making exchanges of birds and birds' eggs. The classification is the same as that adopted in the "Birds of Europe," and follows that of Prof. Huxley, which still appears to Mr. Dresser to be the best as yet elaborated. The species are numbered consecutively, in order to facilitate reference. A very few alterations in the nomenclature have been made: 623 species are enumerated, and the list is published at the low price of one shilling.

The Seals and Whales of the British Seas. By Thomas Southwell, F.Z.S. (with Illustrations). (London: Jarrold and Sons, 1881.)

THIS neat little volume, though it adds little if anything to our scientific knowledge of the British seals and whales, will be welcome to many as telling a good deal about these interesting mammals which could only be found after a prolonged search through many of our scientific periodicals. It will form a pleasant addition to sea-side libraries, and, telling what is known about these creatures, it may thus be the means of indicating what is not known about them, and so do something towards advancing knowledge. A good deal of the information in this little volume appeared originally in the pages of *Science Gossip*; it has however not only been carefully revised, but several additional woodcuts have been added. It has also had the supervision of Mr. J. W. Clark and of the late E. R. Alston.

The more advanced student would have liked a short chapter on the literature relating to our British marine mammalia, which perhaps in a future edition might be given, and an analytic key to the species of British cetacea would be a great help to those living in suitable localities who would venture to take up the study of these very interesting but not easily preserved creatures.

A Sequel to the First Six Books of the Elements of Euclid, containing an Easy Introduction to Modern Geometry, with numerous Examples. By John Casey, LL.D., F.R.S. (Dublin University Press Series, 1881.)

THERE are many geometrical results which are not directly formulated or stated in Euclid's Elements, which are yet constantly turning up in the solution of geometrical problems, and it is very desirable to have a handy book of reference, the propositions in which may be cited, so obviating the necessity of a lengthy proof. The "Exercises on Euclid and in Modern Geometry" of Mr. McDowell is a useful book for this purpose, as all the propositions are fully worked out. Dr. Casey, in the course of teaching, has frequently had to contend against the defect above referred to, and had to interrupt the course of the demonstration of an advanced proposition by turning on one side to prove some well-known result, because he could not cite Euclid as an authority for it. This handy little book, which appears to us quite up to the level of the author's reputation as a geometer, is intended to meet this felt want, and paves the way to a deeper study of the modern geometry contained in the exhaustive works by Chasles, Townsend, Mulcaby, and many Continental writers. A great number of classical problems are led up to, and they themselves discussed and established. The size and style of the book fit it for use in the higher forms of our schools, and more advanced students will find it a convenient book for citation.

Accented Four-Figure Logarithms and other Tables for Arithmetical and Trigonometrical Purposes and for Correcting Altitudes and Lunar Distances, with Formulæ and Examples. Arranged and accented by Louis D'A. Jackson. (London: W. H. Allen, 1881.)

MR. JACKSON is an experienced editor and computer of logarithmic tables, having already published "Accented Five-Figure Logarithms," "Pocket Logarithms and other Tables," &c. Different calculations require different degrees of approximations, and the computer learns by experience which kind of tables are best suited for the end he has in view. In his Introduction our author carefully discusses the question, and states to what extent the present tables are efficacious. His system of accentuation appears to be a good one. Certainly it insures a much closer degree of accuracy than is to be got from ordinary four-figure tables. Each logarithm, on its face, shows whether it is in excess or in defect of the true value (obtained by taking a greater number of figures), or equal thereto. The range of error seems to be reduced to a

minimum. The worked-out exercises show that the mode of working is easy of apprehension and leads to correct results. A merit of the book, for frequent use, is that it is handy in form and very clearly printed.

LETTERS TO THE EDITOR

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

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

The so-called "Bunsen-Pump"

PROF. ROSCOE, *President* of the Chemical Society of London, in enumerating the works of his friend Prof. Bunsen, says, in NATURE of the 28th ult. ("Scientific Worthies," vol. xxiii. p. 600):—

"To him we are also indebted for the apparatus for accelerating filtration, the 'Bunsen-pump,' together with all its appliances, now employed in every laboratory."

This assertion requires correction. The pump used by Prof. Bunsen for accelerating filtration was invented by me, and not by Prof. Bunsen, as would appear from the use of his name in connection with it. I described the construction of the "WATER-air-pump" distinctly and plainly in the *Journal* of the Chemical Society of London for January, 1865, under the title, "Researches on the Vacuum: I. The Instruments" (not the instrument, as some will read), and I sent a copy of this paper to Prof. Bunsen, inscribed with a suitable allusion to our former relationship as pupil and teacher, during the spring of 1865. Three years later Prof. Bunsen published his paper, "On the Washing of Precipitates," in which he described again my pump, *but unfortunately omitted to quote my paper of* 1865.

The following is a translation of Prof. Bunsen's own words:—

"To create the difference of pressure for filtration one cannot employ any of the air-pumps commonly used, especially not the mercury-air-pump, as the liquids to be filtered contain not unfrequently chlorine, sulphurous acid, sulphuretted hydrogen, and other substances, which would destroy the metallic portions of the apparatus. I therefore employ a water-air-pump constructed of glass on the principle of Sprengel's mercury-air-pump, which for all chemical purposes is, as I believe, preferable to every other apparatus for air rarefaction, where it suffices to push the rarefaction no further than to a pressure of mercury from 6 to 12 millimetres" (*Ann. Chem. Pharm.*, 1868, vol. cxlviii. p. 277).

The peculiar stress laid here on the uselessness of mercury-air-pumps, and on the fact that chlorine attacks mercury, combined with the omission of all reference to my paper, where both *water and glass* are mentioned, gave to Prof. Bunsen's description of the instrument a colour of originality which Prof. Roscoe (and with him many others) thinks right to support and to perpetuate by calling it the "Bunsen-pump."

As this misnomer has been already the subject of a disclaimer from Prof. Bunsen (NATURE, vol. vii. p. 241), of remonstrances both from myself (vol. vii. p. 241), from Prof. Frankland (vol. xiv. p. 74), and from others, I am sorry to see that Prof. Roscoe should continue to use this designation, which is intended to honour an "*employer*" of the instrument, which hurts the feelings of its inventor and deprives him of his only reward—the satisfaction of being credited with having placed a useful servant at the disposal of science and industry.

If any other inventor less eminent than Prof. Bunsen had made the omission which I have pointed out with much reluctance, no one would persist in giving his name to my child, nor (reversing the case) would anybody speak of a pump as "Sprengel's pump," if I had received from Prof. Bunsen the paper of 1865 and said in 1868, "I therefore employ a water-air-pump constructed of glass on the principle of Bunsen's mercury-air-pump."

H. SPRENGEL

Savile Club, London, May 7

[I have read the foregoing note of expostulation from Dr. Sprengel, and I regret that I have hurt his susceptibilities. That Dr. Sprengel first enunciated the principle both of the water- and of the mercury-air-pump no one can doubt. But that Bunsen devised a water-pump suitable for filtration there can be as little doubt. Hence in speaking of a "filter-pump"—as every chemist knew I was doing—as contradistinguished from an "air-pump," I conceive that I am justified in using the words "Bunsen-pump."—H. E. ROSCOE.]

Tide-Predicting Machines

THE recent discussions respecting tide-predicting machines have called to mind a very old invention of my own, which, although originally designed for a different purpose, seems to me capable of solving the required problems with all attainable accuracy.

I communicated to the British Association at Cambridge in 1845 "A description of a Machine for finding the Numerical roots of Equations and Tracing a variety of useful Curves." An abstract of that paper may be found at pages 3, 4, of the *Transactions* of the sections. About the same time I lithographed for private distribution a more detailed account of the proposed machine, illustrated by diagrams. It begins with the remark that "Persons engaged in testing theory by experiment have frequently derived great assistance from mechanical contrivances, which give rapid and near approximations without the trouble, in every separate case, of going through tedious multiplications and additions. The proposed machine would be capable of giving values of $\Sigma\{b\cos(n\theta+\alpha)\}$, or of tracing the curve $\rho=\Sigma\{b\cos(n\theta+\alpha)\}$."

At page 2 it is shown how it was proposed to trace the curve $\rho=a+b\cos(n\theta+\alpha)$. It is then remarked that, in the same way, it would be possible to trace the curve $\rho=a+b\cos(n\theta+\alpha)+b_1\cos(n_1\theta+\alpha_1)+b_2\cos(n_2\theta+\alpha_2)$, &c. Then follow a variety of suggestions for the practical use of the instrument, and at page 7 there are the following suggestions for the construction of a machine:—

"As toothed wheels cannot be employed to turn the circles (A_1), (A_2), &c., I have made use of a combination of the endless screw and toothed wheels so that the error of the wheels is almost destroyed. H (Fig.) represents a handle attached to an axis on which are mounted toothed wheels t_1 t_2 t_3 . . . which gear with the wheels T_1 T_2, &c., mounted on separate axes, each having a portion of a very accurate screw. These act on the circumferences of the circles (A_1) (A_2), &c., and cause them to revolve uniformly, as in Ramsden's dividing engine, &c." The large diagram shows four of these (A) circles, each of which gives one term, $b\cos(n\theta+\alpha)$, and these terms are summed by the help of a chain, such as is used to wind up watches, passing over pulleys carried by frames free to oscillate in parallel directions. I inclose copies of the lithographed description of the instrument.

May 9 F. BASHFORTH

Sound of the Aurora

IN NATURE, vol. xxiii. p. 484, one of your correspondents speaks of the sound of the aurora as "crackling," or as that of "the flickering of blazing fire," while another describes it as like the "rustling or switching of silk." On Monday, April 12 last, there was an electric storm here, and at 7 p.m. when I walked home (the blazing lightning leaving but *momentary intervals* of darkness), I heard all round me the constant crackling or rustling of blazing flames. Towards the north-west across a low arc near the horizon pale sheet lightning swayed quickly to and fro. There was no rain at the time, that came heavily afterwards. The sound of flames was close round me, and others had the same experience. No one I can find has ever seen lightning so completely fill the air or heard such strange sounds.

F. C. CONSTABLE

Karachi, April 25

Meteorological Bibliography

I AM compiling a classified bibliography of meteorological science, and being desirous of rendering it as full as possible, I should feel much obliged if you would intimate to meteorologists that by sending copies of their papers to me they would do much towards helping on the work. The publication of this bibliography has already commenced in "The Scientific Roll."

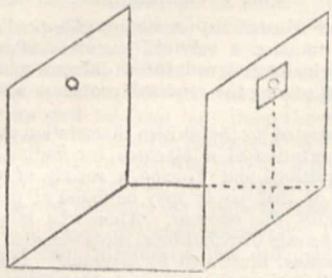
6, Kent Gardens, Ealing, W. A. RAMSAY

An Optical Illusion

THERE is an exquisite optical phenomenon of which I (and doubtless many others too) would be glad to see a really scientific

and physiological explanation. Cannot some one of your numerous scientific contributors favour us with one?

It is this: Take a slip of thin card about three inches long and one wide. Bend up the two end inches at right angles. Perforate one of these vertical ends with a pin-hole, and the other directly and concentrically opposite with a square hole



Observe.—The pin may be placed horizontally, or in any position, with the same result.

about one-eighth of an inch square. Place a small pin in this end, so that the head may be nearly in the middle of the square hole. Now apply this end to your eye and look through both holes at the sky, and you will see the pin apparently beyond the round hole and reversed in position! WILLIAM WILSON

Eirene, Chester, May 4

[This very pretty experiment seems novel. The explanation is, of course, excessively simple. What is seen is the *shadow* of the pin, thrown on the retina by the light diverging from the small hole. As the shadow is erect on the retina, it produces vision of an inverted pin. This appears to be situated about the distance of most distinct vision (ten inches or so), and therefore behind the hole.—ED.]

LAURENCE HARGRAVE, Sydney, should refer to the letter of the Rev. R. Abbay on the "Rayons de Crépuscule" in vol. xviii. p. 329, and the articles and correspondence therein referred to.

SCIENCE IN CHINA[1]

II.

IT is a generally received opinion that the Chinese language presents extraordinary difficulties, both in its acquisition by Europeans and in its use for the expression of the more exalted ideas of Western learning. The attempt to translate modern scientific or technical books into a language so ancient, so crude, and so unchanging is regarded by many who have not given careful attention to the matter as almost absurd. It is readily granted by them that such subjects as the doctrines of Christianity or affairs of a political nature might be expressed easily in the language of a people among whom religion and diplomacy have for ages been carried to a considerable state of advancement. But from the almost total absence of native scientific literature and pursuits there is necessarily a paucity of scientific terms, and this appears at first sight to form an almost impassable barrier to the use of Chinese for scientific purposes. A little investigation however will show that this opinion is without foundation; and that from the time the early Jesuit missionaries commenced their compilations up to the present day no serious difficulties have been experienced by foreign translators.

The question of nomenclature, however, is one that naturally has to be met at the outset. If it were necessary to use only such terms as are to be found in standard Chinese dictionaries, or if it were forbidden to give any new shades of meaning to existing characters the task of translation could never be accomplished. But it must be borne in mind that the Chinese, like other languages, is capable of growth. The increasing intercourse of China with Western nations is undoubtedly making vast additions to the number of words in current use. The Emperor, it is true, has the power of deciding the exact manner in which characters are to be written, and in various instances certain characters have been forbidden to be written in certain ways; but he is powerless to check the changes and additions that are now fast taking place in the language all over the Empire. Where it has become necessary to express a new idea, or to give a name to a new object in Chinese, there has always been found a way of managing the matter more or less satisfactorily; and hence some very clumsy specimens of nomenclature are gradually becoming current, especially among such natives as have much intercourse with foreigners. Of course all such new terms have to stand or fall on their own merits, and if radically wrong or misleading they are pretty certain eventually to be supplanted by better ones. This is merely what naturally happens in the growth of all languages, and although many inconveniences necessarily occur when terms have to be changed, yet there seems to be no help for it. It will be remembered that when the English language began to borrow largely from Greek and Latin, many scientific and technical terms were coined which have since fallen into disuse or been supplanted by others. So it must necessarily be in Chinese with regard to the words borrowed from the English or other languages.

It ought, however, to be possible for the pioneers of modern sciences and arts in China, by exercising great care and by working in harmony, to establish such a system of nomenclature that no very extensive alterations need be made in future years. A Chinaman of ordinary intelligence ought to be able to take up the translation of a work on such a subject as chemistry, for instance, and understand the nomenclature quite as well as a European of similar capacity, and, knowing nothing of chemistry, would understand the original when placed in his hands for the first time. Every new term being explained or defined only when first used, it would of course be useless for an ordinary Chinaman to begin in the middle of such a work and expect to understand everything he read. And yet not only Chinese but foreigners have been known to treat the translations published at the Arsenal in this way. Finding the nomenclature unintelligible to themselves or their Chinese friends, or their teachers or writers, they have condemned all such attempts to express the higher branches of Western learning in Chinese as useless, and have come to the conclusion that the study of European languages is the only way in which satisfactory progress will ever be made in China.

Before commencing the work of the Translation Department it was seen to be necessary to establish a system by which the nomenclature to be employed should be determined. After considerable discussion the following plan was agreed upon by those who organised the department:—

1. *Existing Nomenclature.*—Where it is probable a term exists in Chinese, though not to be found in dictionaries—

a. To search in the principal native works on the arts and sciences, as well as those by the Jesuit missionaries and recent Protestant missionaries;

b. To inquire of such Chinese merchants, manufacturers, mechanics, &c., &c., as would be likely to have the term in current use.

2. *Coining of New Terms.*—Where it becomes necessary to invent a new term, there is a choice of three methods:—

a. Make a new character, the sound of which can easily be known from the phonetic portion, or use an existing but uncommon character giving it a new meaning.

b. Invent a descriptive term, using as few characters as possible.

c. Phoneticise the foreign term, using the sounds of the

[1] By Mr. John Fryer, Chief Translator to the Chinese Arsenal. Continued from p. 11.

Mandarin dialect, and always endeavouring to employ the same character for the same sound as far as possible, giving preference to characters most used by previous translators or compilers.

All such invented terms to be regarded merely as provisional and to be discarded if previously existing ones are discovered or better ones can be obtained before the works are published.

3. *Construction of a General Vocabulary of Terms and List of Proper Names.*—During the translation of every book it is necessary that a list of all unusual terms or proper names employed should be carefully kept. These various lists should be gradually collected and formed into a complete volume for general use, as well as with a view to publication.

Unfortunately the above plan has not been thoroughly or consistently carried out, and hence there exists a certain amount of confusion in the works of the different translators already published, and which can only be partially rectified in future editions. This is greatly to be regretted, because the labour that would have been involved would have been trifling compared with the great advantages to be derived. It is to be hoped that the Chinese as well as the foreign members of the department will in time appreciate the necessity of using the same terms invariably throughout the whole series of publications. It is manifest that the practical utility of each one's work depends greatly upon the extent to which the above rules have been observed.

Next to nomenclature it may be well to consider the selection and arrangement of the various works compiled or translated at the Kiangnan Arsenal. The original idea was, as before stated, to prepare an encyclopædia that should bear some resemblance to the "Encyclopædia Britannica." It was soon found, however, that many of the treatises in the eighth edition of that valuable work were too elementary and too far behind the time. It became necessary, therefore, to translate from more modern and complete publications. Various high officials asked to have books translated for them on special subjects. Several treatises not considered sufficiently complete had to be supplemented by larger ones, and hence the idea of an encyclopædia has gradually been almost lost; while a miscellaneous collection of translations and compilations has been the result, and the range of subjects is comparatively limited. In most cases each translator or Chinese writer seems merely to have selected such subjects as suited him best, without regard to the symmetry or harmony of the entire collection. There are thus several important subjects, such as natural history, biography, &c., not yet noticed, while there are various treatises on others of comparatively little importance. As might be expected, military and naval science is one of the subjects that has received a large share of attention.

The general defect about most of the publications is that they are far too elaborate and profound, and consequently can only be understood by a few, while the masses can never master them. It was to remedy this defect that the *Chinese Scientific Magazine* was commenced, although it has no direct connection with this department. Recently some of the English "Science Primers" have been translated by Dr. Allen, and will no doubt help to supply the want. The "School and Textbook Series," however, will probably be the chief means by which a lower and an intermediate grade of books on scientific subjects will be furnished; and although the series owes its origin to the Missionary Conference held in Shanghai in 1877, it has the two European members of the Translation Department on its managing committee. To some extent this series, when completed, will therefore be supplementary to the publications from the Kiangnan Arsenal, and it is arranged that a part, at least, of the series shall be printed at that place.

Next as to the manner in which the work of translation or compilation is carried on. The foreign translator, having first mastered his subject, sits down with the Chinese writer and dictates to him sentence by sentence, consulting with him whenever a difficulty arises as to the way the ideas ought to be expressed in Chinese, or explaining to him any point that happens to be beyond his comprehension. The manuscript is then revised by the Chinese writer, and any errors in style, &c., are corrected by him. In a few cases the translations have been carefully gone over again with the foreign translator, but in most instances such an amount of trouble has been avoided by the native writers, who, as a rule, are able to detect errors of any importance themselves, and who, it must be acknowledged, take great pains to make the style as clear and the information as accurate as possible. A fair copy having been made, the work is placed in the hands of the foreman of the printing department, who causes it to be written out on sheets of thin transparent paper in the large bold book-characters of the "Sung" pattern, and pasted on blocks ready for the engraver. All illustrations, diagrams, &c., are drawn on the same paper by an experienced draughtsman, and cut at the same time and on the same kind of blocks as the characters with which they are interspersed, as in foreign books. In case of steel engravings, such as those accompanying the last edition of Herschel's "Outlines of Astronomy," translated by Mr. Wylie, the illustrations have been printed in England from the original plates. The various charts have been printed from copper plates engraved at the Arsenal.

It may seem strange that with such facilities for printing in Chinese by metal type as exist in Shanghai, and with a complete fount of such type as well as a good cylinder press on the premises, these books are nevertheless cut on wooden blocks and printed by hand, in the old-fashioned way that existed in China for so many ages before printing was known in Europe. The fact is, however, that as a matter of economy and convenience the old system is preferable. The blocks are all of the same size, about eight inches by twelve inches, and about half an inch thick. Each block represents two leaves or four pages of the book, being engraved on both sides. The blocks for a complete work can thus be stowed away in a very small compass. The cost of engraving a page of these wooden blocks is said to be but little more than the expense of setting up a page of Chinese type and preparing it for the press. An edition of one copy can be printed if no more are required, and thus the expense of keeping a large stock of printed books on hand, some of which might eventually have to be sold as waste paper when they grew out of date or revisions had to be made, as is the case among ourselves, is entirely avoided. Any errors or misprints that may be discovered can as a rule be corrected on the blocks with but very little trouble. A skilful printer can print by hand five thousand leaves of two pages each in a day, using no press or machinery whatever. He supplies his own tools and receives as wages about twenty-five dollar cents. a day. The paper ordinarily used is white and of the best quality, although a yellowish kind is also made use of at a reduction of 20 per cent. on the selling price. The books are bound in the usual Chinese style and fastened with white silk thread. They present an appearance which satisfies the taste of the most fastidious native.

To those who regard the Chinese language as incapable of expressing modern Western learning, and who consider European languages to be the only medium by means of which the Chinese can become proficient in the Arts and Sciences, the establishment of the Translation Department necessarily appears to be a useless waste of time and money. To those again who grant the possibility of carrying on the work, but suppose that English is destined to become the universal language at no very distant

period, or even before the close of the present century, this attempt to supply Chinese literature with the results of modern discoveries in science and art must of course appear to be conferring a mere transient advantage.

But it is no difficult matter to see that the translation and publication of books in Chinese as it is carried on at the Kiangnan Arsenal and other places is the great means by which the intellectual stagnation of China is to be broken up. This work must necessarily go on and increase rapidly now that a current of thought has begun to set in. As long as foreigners have any knowledge to impart that is of real advantage to the Chinese, so long will the Chinese make efforts to obtain it; for the more the celestial mind drinks at this fountain the greater will become its thirst for further supplies.

The fact that this Translation Department has been established and kept up so long by the Government argues well for the future prospects of China, as it shows that whatever may be the national pride in her antiquated literature, or whatever may be her attitude towards the diplomatists of foreign powers, or the missionaries of foreign religions, she recognises the fact that knowledge is confined to no nation or country. She is therefore willing to be taught even by the "foreign barbarians" such useful things as she feels she is ignorant of. But she must do this of her own accord and in her own way, or not at all. It is a matter in which she is not to be dictated to, as in the case of treaties or missionary rights. She has freely availed herself of what she has considered beneficial, and has not been sparing in funds to enable knowledge to be disseminated throughout the Empire. This willingness to be taught and to pay for being taught is one of the most hopeful features that has occurred in her intercourse with foreign countries, and is deserving of the highest commendation.

The work at the Translation Department is at present only in its infancy; but enough has been done to establish a foundation upon which a large and important structure will eventually arise. Having been commenced and carried on only in obedience to a natural and instinctive desire for knowledge, it ought to go on harmoniously with the course of events, and prove a powerful lever in the regeneration of China. The large number of copies of works already sold at cost price without any attempt to bring them before the public notice evinces the appreciation of the masses of the people; for a Chinaman is very slow in parting with his dollars for what he does not value or admire, or derive benefit from in some way or other. It would be strange if the knowledge that has only been acquired by such vast expenditure of thought and labour by Western nations did not make its value felt among the Chinese; for by means of these books they can in some things place themselves on a level with foreigners without going through the difficulties attending discoverers and inventors.

It is gratifying to find that some of these translations have already found their way as text-books in the Peking University and in higher kinds of mission schools. For example, the work on Trigonometry has been used to advantage in Mr. Mateer's school at Tangchow, in the Shantung province.

Another cheering feature in connection with the Translation Department is, that it is not the only undertaking of the kind in China. Even before it had fairly commenced, Dr. Martin, the learned president of the Peking University, had begun to publish works on natural science and international law. Both he and his fellow-helpers have since published various works on scientific and diplomatic subjects, which have become very popular and have proved of great utility to the Government. Their translations are of a high standard, and are conducted in a style which renders them acceptable to literary men and officials of the highest grade. It is to be regretted that no detailed account of this important work that has been carried on in Peking for so many years appears to have yet been given to the public. Various other Protestant missionaries have done a great service to the country by their long list of published translations in Chinese. The names of at least half a dozen of them will be handed down to future generations as the foremost pioneers of the spread of Western arts and sciences in the "Flowery Land."

The establishment of Chinese legations at the courts of all the great treaty powers, and the creation of Chinese professorships at the Oxford, London, Paris, and Harvard Universities, are events which show the increasing importance of the study of the Chinese language. It is therefore not in vain to hope that in foreign countries, as well as in China, the work of supplying useful knowledge to the Chinese by means of their own language will eventually be carried on to an extent which may bear some reasonable proportion to the size and needs of the "Middle kingdom."

One of the latest and most promising of the schemes which have a similar object in view to the Translation Department is that previously alluded to, namely, the supplying a series of text-books chiefly for use in mission schools, but still of a character suitable to the wants of the nation at large. The practical working of this scheme was placed in the hands of a committee of six gentlemen, all of whom have already had considerable experience in this kind of labour. A series of fifty-five works has been determined on, which embraces several books of an elementary kind that will, no doubt, do well as introductions to the more elaborate treatises on similar subjects already in existence.

It is, however, to the future that we must look for the chief part of the practical utility of all this translation work. Such a vast nation as the Chinese is not to be started into motion and made to follow in the wake of Western civilisation all at once. Generation after generation will have to come and go before the complete transformation will be effected, and the intellectual as well as the physical resources of the country will be turned to the best account. Hereditary tendencies in a wrong direction are not to be eradicated without a long series of struggles. The system of ignoring everything but the "Four Books" and the "Five Classics" at the Government examinations, which are the passports to the highest offices in the State, is not destined to last for ever. By patiently working, on even the present generation of foreigners engaged in this laborious task of spreading intellectual light may hope to see much good resulting from their efforts. If they do not live to see Western learning occupying the position it ought to do in Government examinations they may yet see it holding a prominent place.

The work of translating and compiling scientific books is for the time being perhaps about as dull and unthankful a task as any foreigner could engage in, especially in such a secluded place as the Kiangnan Arsenal, and under the depressing influences of the climate of this part of China. Nothing but a strong sense of duty and a firm belief that this kind of labour is one of the most effective means, under the Divine guidance, for bringing about the intellectual and moral regeneration of this great country, has sufficed to render endurable the long and weary years and weary hours of close and continuous application which it has involved.

4. *List of Books and Statistics.*—The Translation Department, although established in the year 1868, did not commence the publication of books till the year 1871, when a treatise on Practical Geometry and another on Coal and Coal Mining made their appearance. Up to the present year the number of works published amounts to ninety-eight. These works are contained in 236 volumes, a Chinese volume generally consisting of 120 to 200 pages and representing perhaps on an average about

the same number of pages of an ordinary English work in octavo, with small pica type. Of course the style of the original as well as the style of translation may be such as to render this approximate number rather wide of the mark.

The number of copies of works sold up to the end of June, 1879, amounts to 31,111, representing 83,454 volumes. The number of maps and charts published amounts to twenty-seven sheets. Most of them are adaptations of the charts of the British Admiralty, and were printed from copper plates engraved at the Kiangnan Arsenal. The number already sold is 4,774 sheets.

The sum realised by the sale of books and charts may be estimated at about 17,500 dollars, or roughly 3,500*l.*

The numbers sold up to the present time, though considerable, are nothing compared with what might have been expected among such an extensive population. But with no regular means of communication, no postal or railway arrangements, no agencies, and no advertisements or other means of bringing them into general notice or distributing them, it is easy to understand why more have not already been disposed of.

The various periodicals, such as summaries of foreign news, political essays, &c., are not reckoned in the above numbers. From three to five hundred copies of these books are published and distributed gratuitously to various officials both in the vicinity of Shanghai and in distant provinces.

Forty-four works, representing about 142 volumes, have been translated, and are in various stages of preparation, but the publication is not yet commenced.

Thirteen works which are now in the course of translation and of which thirty-one volumes are already completed.

Forty-three books are to be published by the Committee of the "School and Text-book Series." Most of these works are nearly ready to be placed in the printer's hands.

Various treatises on scientific subjects have been published by Protestant missionaries; but about them it has been impossible to obtain statistics as to the numbers printed and sold.

The following list will give some idea of the number and class of scientific works that have been translated:—

Subjects.	Published.		Translated.		In course of translation.	
	works	vols.	works	vols.	works	vols.
Mathematics, Surveying, &c.	22	52	2	8	3	5
Engineering, &c.	7	17	3	6	1	2
Chemistry, &c.	5	19	1	1	1	4
Geography, &c.	8	12	—		—	
,, ,,	27 maps		—		2	9
Geology, Mining, &c.	5	20	—		—	
Astronomy, Navigation, &c.	9	27	3	4	—	
Physical Science	6	14	4	5	1	1
Medicine	2	8	1	6	2	10
Arts and Manufactures	13	15	9	26	—	
Naval and Military Science	15	41	9	26	2	2
Chronology, News, Periodicals, &c.	6	10	1	1	—	
Naval Architecture	—		3	13	1	1
History	—		5	18	—	
International Law	—		2	26	—	
Miscellaneous	—		2	2	—	
	98	235	45	142	13	34

THE WILLUGHBY SOCIETY[1]

IT was a happy thought to found an association under the name of Francis Willughby, having for its object the reprinting of scarce ornithological works, thus keeping the name of the writer of "Ornithologiæ Libri Tres" in remembrance and doing a service to the working ornithologist. It is nearly nine years over two centuries since Willughby died (July 3, 1672). About seven years younger than John Ray, he studied at Trinity College, Cambridge, under Ray; but though at first the pupil, he was soon the friend and afterwards the patron of our great English botanist. Belonging to a family of wealth and influence, Willughby soon married (1668), and settled at Middleton Hall, Warwickshire. How hard he must have worked the materials for his great work left at the time of his untimely death amply prove. His second son (the elder died) was created a peer by Queen Anne (Viscount Middleton). An annuity was left to Ray, who edited "The Ornithology," which was printed in London (1676) at the expense of Willughby's widow. Willughby has been called the "father of systematic zoology in this country." The new Willughby Society seems determined to follow in his footsteps.

The reprint in fac-simile of M. Desfontaines's "Mémoire" will be no doubt welcomed by the members, and it is only by members that these reprints can be obtained. Honoured by botanists in the beautiful genus Desfontainea, this account of the birds met by him at Barbary is very rare; and we agree with Prof. Newton that few papers are less accessible to ornithologists than those published by the late Sir A. Smith in the *South African Quarterly Journal*. We trust the Willughby Society will meet with the support it deserves from the members of *Ibis* and from bird-lovers in general.

[1] Desfontaines's "Mémoire sur quelques Nouvelles Espèces d'Oiseaux des Côtes de Barbarie" (1787). II. "Ornithological Papers," by Sir Andrew Smith (1830–34).

ZOOLOGY OF THE DUTCH ARCTIC EXPEDITION[1]

A SUPPLEMENTARY number of the *Niederländisches Archiv für Zoologie* just issued is composed of an instalment of five papers describing certain of the animals collected or dredged during the two Arctic voyages of the schooner *William Barents*, together with a list of all the places dredged at, and a map with these and the track marked on it. The ship visited the north of Spitzbergen and the west coast of Novaia Zemlia, and stretched northwards thence almost to Franz-Josef Land. All the dredgings, except two off the north coast of Spitzbergen, were made in the Barents Sea, between Novaia Zemlia and the north of Norway and Bear Island. Dr. R. Horst reports on the Annelids. He found no new species amongst the fifty-one obtained in the Barents Sea. Hjalmar Theel found in the Kara Sea, on the east side of Novaia Zemlia, ninety species. There can be little doubt that the fauna of the two seas, which join in several places, must be nearly identical, yet amongst the thirty-one species from the Barents Sea are fourteen not yet collected in the Kara Sea. The Annelid collection seems to have been rather a meagre one, and must not be taken as representative. The Pycnogonids are described by Dr. P. P. C. Hoek. Examples of these were obtained on fourteen out of the entire thirty dredgings made. They are of eight species, one of which is new. Amongst them is one species of the genus Colossendeis, numerous forms of which were obtained by the *Challenger* in southern latitudes, some attaining there gigantic proportions. The Lamellibranchiata are described by Dr. van Haren Noman, who appends to his paper an important memoir, illustrated by three plates, on the anatomy of the eyes, gills, and other parts of *Pecten Grœnlandicus* and other forms; Dr. A. A. W. Hubrecht contributes a list of the fishes; and Dr. F. A. Jentink a few notes on the field-mouse of Novaia Zemlia, *Curriculus torquatus*, which, unlike all of its allies, turns white in winter. The animal ranges over the whole of Arctic America, Europe, and Asia, and in late geological periods extended as far south as England, Germany, and the basin of the Loire.

[1] "Zoological Results of the two *William Barents* Arctic Expeditions in 1878 and 1879."

DR. HOLUB'S AFRICAN TRAVELS[1]

II.

DR. HOLUB'S third and longest expedition was commenced in March, 1875, and with an account of it the second volume opens. He now proposed to explore Southern Central Africa, and having acquired a great deal of experience during his two previous journeys, was justly in great hopes of success. The route this time selected was first to the Molapo River. As usual great herds of game were from time to time met with, wherever the bush cover was good; then on to his old quarters at Shoshong, where a few days for rest were spent; from Shoshong he journeyed to the great salt-lakes. Elands were now met with, and furnished many a hearty meal. The first salt lake was met on the morning of April the 18th. Away to the west it extended as far as the eye could see, and it took two hours to travel the length of its eastern coast. There was a uniform depth of barely two feet, and it presented a light grey surface edged with stiff arrow-grass and surrounded by dense bush-forest, whilst around about it, in the very thickest of the grass, were considerable numbers of miniature salt-pans; indeed every depression in the soil contained salt. The evaporation appeared to be most rapid. This salt-lake was called Tsitane, the same name being also given to the adjoining river. Here the first Baobab tree was seen; it was a fine specimen, some twenty-five feet in height and nearly fifty-two feet in circumference. Another larger and deeper lake was called by the natives Karri-karri. Here baobabs abounded. The third of the great salt-lakes, called Soa, is the largest; it extends westward beyond Lake N'gami; it is also very shallow, being only four feet in depth. Travelling on to the banks of the Nata and to Tamasetze with the object of getting to the Zambesi before the middle of the month, he encountered one of Mr. Anderson's servants called Saul. He was out on an ostrich hunt, and though an uncommonly bad shot, managed in the following manner to get more than his fair share of birds and eggs:—"I always," he told Dr. Holub, "take a man with me, and we look about till we discover a nest, and then we dig a hole pretty close to it in which we hide. The birds come to sit, and it doesn't want a very good shot to knock over an ostrich when it is just at hand. Well, having made sure of one bird, we stick up its skin on a pole near the nest, and except we are seen, and so scare the birds away, a second ostrich is soon decoyed, and I get another chance." Such "hunting" as this is very likely to destroy the flocks of ostriches in the country around the Klamaklenyana Springs. The country of the Madenassanas was now entered. These people would seem to be serfs to the Bamangwatos. They are a fierce race, tall, and strongly built, the men generally with repulsive countenances, though occasionally some of the women were even nice looking. Their skin is almost black, and their stiff woolly hair hangs down for more than an inch over their temples, while it is either quite short or is kept quite short over the rest of the skull. Many elephant-hunting parties were met with. One trader had in his two waggons not less than 7000 lbs. of ivory, procured mostly in the district between the Victoria Falls and the mouth of the Chobe. A very short *détour* off the beaten waggon-track revealed herds of buffaloes, striped gnus, Zulu hartebeests, and zebras, or showed evident tracks of these and lions. Great trees with trunks of sixty feet in height were also met with, and a great many orchids with *red* blossoms. What a pity that Dr. Holub did not bring home some of these! Passing over an account of a rather exciting lion-hunt, in which both lion and lioness got decidedly the better of it, the Jamasetze wood was left on July 20. The author was much struck by the peculiar way in which some of the leguminous trees shed their seeds, the heat of the sun causing the pods to burst with a loud explosion and to cast the seeds to a considerable distance all about. The air near this wood was full of myriads of tiny bees that crept into one's clothes, hair, and ears, making even one's nose tingle with great discomfort. About August the 10th the watershed of the Zambesi district was reached, and, gazing down into the valleys of the Chobe and the Zambesi, the author saw the realisation of some of the dreams of his youth. At Impalera, the Lower Chobe and the Zambesi rivers were calculated to have a depth of between thirty and forty feet, but the reaches and the rapids make all navigation impracticable.

Having obtained permission from the king, the Marutze kingdom was visited. Hippopotami and crocodiles were found abundant in the rivers, but all such creatures had to be for the moment overlooked because King Sepopo was waiting to receive the white man. At the banquet fish of many sorts seems to have been the principal food;

FIG. 4.—Ladle and Calabashes.

but at a supper also given, boiled eland flesh was served with a sauce made of meal, and the drink was impote (honey beer). The king demanded no present, though, such being usual, Holub presented him with a Snider breech-loader and 200 cartridges. A good deal of interesting details are given about the kingdom of Marutze, which now extends along both sides of the Zambesi, from Sekhose, to about 150 miles south of the confluence of the Kabompo and the Liba. It is a most productive portion of Africa, as well adapted for agriculture as for cattle breeding, abounds in game, and seems prolific in vegetable products, of which indiarubber is not the least important.

Not at once getting the king's permission to pursue his journey to the source of the Zambesi, Dr. Holub returns to Panda Ma Tenka, and then accompanied his friends Westbeech and Francis on a visit to the Victoria Falls, which were about fifty miles off, which are declared to be, so far as the author's experience goes, the most imposing

[1] "Seven Years in South Africa. Travels, Researches, and Hunting Adventures between the Diamond Fields and the Zambesi." By Dr. Emil Holub (translated by Ellen E. Frewer). With about 200 original illustrations and a map. In two volumes. (London: Sampson Low, Marston, Searle, and Rivington, 1881.) Continued from p. 38.

phenomena in the world. Staying there three days, after the amusement of a lion hunt and several adventures, they returned on September 24 to Panda Ma Tenka. With somewhat failing health our author once again turned his face to the sources of the Zambesi; but when he got to Sesheke the king told him he had been too long in coming, that it was too late to go now, and he had not kept the guides waiting for him. The king declared it would take him over four months to reach the Zambesi sources in the kingdom of the Iwanyoe. An elephant hunt on a grand scale took place about this time, but ended in a panic, during which the whole herd of elephants escaped; but a lion hunt was more successful. Dr. Holub says he heard that one of the days during another great elephant hunt a herd of over a hundred elephants had been seen, but although at least 10,000 bullets had been fired off, only four elephants had been killed. At last leave was given to the author to accompany some of the queens who had come from the Barotse country, and on December 1 he was off. Three royal canoes were placed at his disposal, but he had to ask for a fourth, and even then his servants had to proceed on foot along the banks. The Barotse rapids were safely ascended, but at the rapids known as Mutshila Aumsinga one of the canoes, that which carried all his provisions, gunpowder, medicines, and natural history collections, was capsized, and this ended all his schemes of penetrating far into the country; and thus the preparations of seven previous years proved fruitless. The severe wetting and the extreme disappointment, brought on a dangerous attack of fever, and, growing worse and worse, there was finally no alternative but to return. After a long delay at Sesheke in hopes of recovery he was compelled, after some weeks, to revisit Panda Ma Tenka. An interesting account is given of the manners and customs of the Marutze tribes. They seem to believe in a Supreme Being in good and evil spirits, in the continued existence after death; they are fair agriculturists and good cattle breeders, having a fertile soil, a genial climate, and abundance of water; though the tsetse fly is met with, game abounds; Kaffir corn, maize, beans, cotton, and tobacco are cultivated; salt is expensive; beer from corn is usually drunk at meals; they have also a cider-like drink and the honey beer. The people are cleanly in their persons and keep their food material in well-washed wooden or earthenware bowls or in suitable baskets or calabashes. Some of these are very tastefully decorated, and in the accompanying figures (Fig. 4) one will be seen with animal designs. The medical knowledge of the Marutze would appear to be in advance of many of the South African tribes; they know the properties of a number of medicinal or poisonous plants; the treatment of fever, coughs, and wounds. Bleeding was a common operation among them, and was employed in cases of neuralgia or to reduce inflammation.

FIG. 5.—Rock caves and inscriptions of Bushmen.

After many troubles and trials Panda Ma Tenka was

left, and the return journey was made by the way of the Makalaka and West Matabele countries, and a hearty welcome was given to the traveller on his arriving at Shoshong by the Mackenzies. While here the news arrived that war had broken out in the Transvaal between the Boers and Sekokuni. The journey to the Diamond Fields was made by Limpopo, and shortly Kimberley was for the fourth time reached. Settling at Bullfontein, the doctor with indefatigable energy soon got into large practice, and during two years, surrounded by the various animals and birds he had collected in this journey, his establishment was quite a menagerie. One holiday he paid a visit to the Orange Free State. When he viewed the Rocky Caves used by the Bushmen, he was particularly attracted by the remarkable carvings on the rocks done by the Bushmen to adorn their primitive abodes. A sketch of some of these is represented in the adjoining woodcut (Fig. 5). The rock is chiefly a sandstone, and the drawings are frequently executed in coloured ochres.

After a considerable period spent at Bullfontein, at Grahamstown, at Port Elizabeth, and at Cape Town, he embarked on board the *Germania* for Europe in August, 1879, bringing with him large ethnological and natural history collections. While the author's travels have added something to our previous knowledge of the geography of the portions of Africa he traversed, his account of them is really pleasant reading, and will be found of special interest to the naturalist and sportsman.

ELECTRIC LIGHTING[1]

III.

DECIDEDLY the most successful application of the electric light in London is at the Cannon Street station of the South Eastern Railway. The Charing Cross station of that Company has been lit up by the Brush system, and the Bricklayers' Arms goods-yards and sheds by Mr. Crompton's system, so that the South Eastern Railway officials have an admirable competitive trial proceeding within easy reach of inspection. The Cannon Street station is lit up by the British Electric Light Company with Gramme machines and Brockie lamps.

The engine—one of Marshall's semi-portable type—is of 14 horse-power nominal, and has a double cylinder on a locomotive boiler. The power is transferred by countershafting to the dynamo-machines by a system specially designed for the purpose, which is shown in the following sketch (Fig. 2). Large heavy fly-wheel pulleys give a second motion to the fly-wheel, which secures great steadiness—an essential feature of electric lighting. The engine is controlled by Hartnell's automatic governor, which regulates the expansion-gear of the engine and secures great uniformity of action.

The dynamo-machines are of a new class of Gramme, of high electromotive force, and they generate currents powerful enough to work five lamps. The current produced is of 26 vebers strength, and works a circuit of about 8 ohms resistance, thus giving an electromotive force of 208 volts. There are two machines at work, working ten lamps—eight being inside the station and two outside. The dynamos are fed by smaller Grammes, as shown in Fig. 2.

The lamps are Brockie's, the mechanism of which is extremely simple, consisting only of one magnet with a clutch, which, by means of a branch circuit, periodically interrupted by the commutator, readjusts the arc by letting the clutch fall, which releases the carbons and brings them momentarily together, and then picks them up again very smartly, so as to separate them the required distance. This gives the lamp a blinking habit,

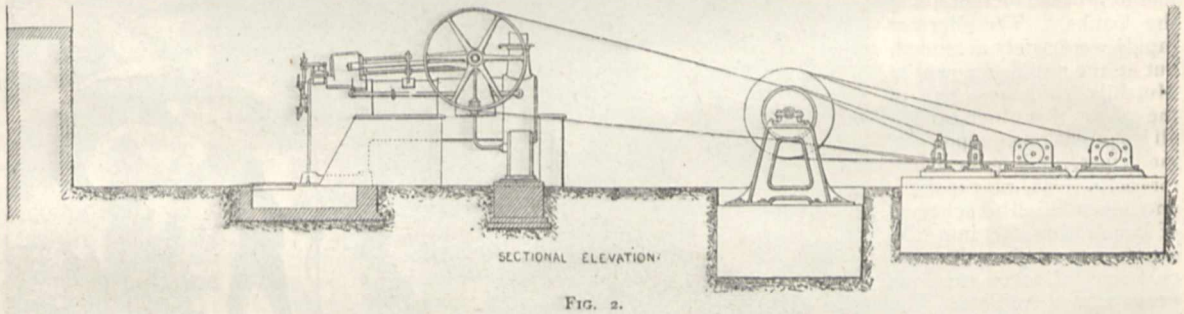


FIG. 2.

which at first is peculiar, but which one soon gets accustomed to and ignores. The diagram (Fig. 3) clearly illustrates how this is done. The magnets are fixed on shunts, two lamps being on two shunts and one lamp on the other. The shunts are of smaller wire than that of the main circuit, but they do not interfere with the main current, which passes through the carbons—in fact the shunts reduce the total resistance of the circuit. The lamps burn for four and a half hours, but it is intended to introduce a double set of carbons, which will of course duplicate this time.

Mr. Brockie has introduced quite a new principle into electric lighting, and certainly, to judge from the effect at Cannon Street, his success is unqualified. It remains to be seen how far this success is repeated at the General Post Office, at Victoria Street, Manchester, at Prince's Dock, Liverpool, and in the town of Liverpool itself. We certainly would like to see a good west-end street, say Piccadilly, Regent Street, or the Haymarket, lit up by this system.

Another system, not yet extensively employed, is Joel's improved incandescent electric lamp. In the latter part of 1878 considerable interest was excited in both scientific and commercial circles by the announcement that M. Werdermann had succeeded in the so-called division of the electric light by an invention based on the incandescent principle. His system was exhibited on an experimental scale only for some time, and then suddenly disappeared from public notice.

This incandescent principle has recently been revived, with many and ingenious improvements in the mechanism of the lamp, by Mr. Joel. An illustration of the hanging lamp is shown in Fig. 4. The light is reproduced, as was the case in M. Werdermann's system, by the heating to incandescence of the end of a small rod or pencil of carbon forming one electrode, which protrudes through a pair of contact jaws and abuts upon a fixed cylinder of copper forming the other electrode. The carbon pencil consumes at the rate of 2½ to 3 inches per hour for lights of 100 candle-power and upwards, and is fed forward according to the consumption. The length of carbon in circuit between the contact jaws and the fixed electrode is about three-quarters of an inch, and this, by the passage of the

[1] Continued from p. 35.

current, is rendered highly incandescent, chiefly however at that part near the copper electrode, where the pencil becomes pointed, and therefore more intensely heated. There is also, in addition to this, a glow or flame-like appearance from the sides of the consuming carbon to the copper electrode, the light thus apparently taking an intermediate position between the purely incandescent system and that of the arc. The heated point of carbon becomes curled at the tip in a peculiar manner, as though it were viscous in shape, somewhat like a mushroom where it wastes away, and is replaced by the gradual forward motion of the pencil.

The fixed electrode, which may be entirely of copper or with a graphite insertion, remains intact without any appreciable wear.

The chief improvements in this lamp consist in the simplification and certainty of action of the mechanism in connection with the contact jaws for clamping the carbon pencil, by which means the lateral pressure of the jaws and the feeding of the carbon are attained by the combined action of one actuating weight, as shown in the diagram, Fig. 5. It will be seen from this that the lateral pressure is thus always proportional to the downward pressure, and may be varied to suit any conditions. The details devised for rendering the lamps in the same circuit independent of each other, and its general adaptability for interior and domestic lighting, constitute an important advance on anything which has gone before.

On referring to the sectional view of the lamp, Fig. 5, E is the fixed copper electrode upon which abuts the point

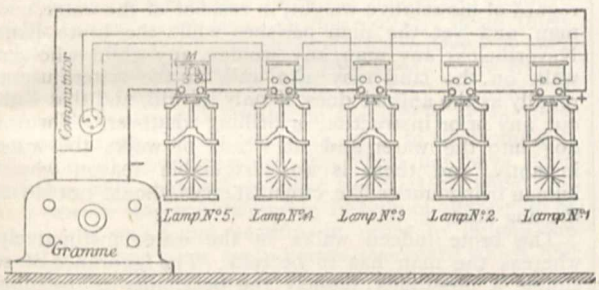


FIG. 3.

of the carbon *e*, which is rendered intensely incandescent by the passage of the current between the jaws and the copper cylinder. The jaws are shown at J clamping the carbon pencil. The actuating weight, W, which gives both the feeding motion to the pencil as it consumes, and the lateral pressure to the jaws, is suspended by continuous cords to the top of the lamp B, the cords then passing down through the weight and under one of the rollers at R, up again through a roller attached to the carbon holder, then back again through another roller at R, and ending at the weight. The rollers R are attached to a light tube, P, which passes down through a nipple, N, and terminates in a flange under the horizontal arms of the jaws and lifts them according to the leverage, thus producing the lateral pressure on the pencil. The top of this tube has also attached to it the armature, A, of an electro-magnet S, wound with fine wire and arranged in a shunted circuit in such a manner that as long as the normal condition of the light is maintained it is neutral; but if an arc should be accidentally formed between the carbon *e* and the copper E, the electro-magnet comes into action in opposition to the controlling weight, and frees the jaws from lateral pressure, thereby allowing the carbon pencil to descend freely and establish contact.

The carbon-holder is also arranged (Fig. 6) so that when the pencil is very nearly consumed the lamp is automatically short-circuited by the lever at L making contact with the arm carrying the copper electrode.

The stem or body of the lamp forms an important part of the whole, being formed of metal tubing in two semi-circular halves, each half forming part of the electrical circuit, the current traversing one side, of which the jaws form part, passing through the carbon pencil to the copper electrode, and returning by the other side of the lamp.

The two sides are kept closed mechanically (but insulated electrically from each other) by the latch and knob T, Fig. 5, which also automatically short-circuits the lamp when opened for the purpose of putting in fresh carbon, thus rendering it perfectly safe in handling. There are

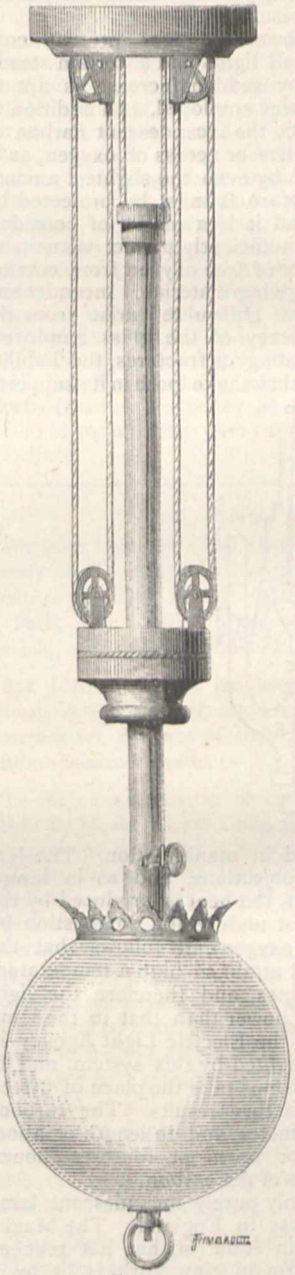


FIG. 4.

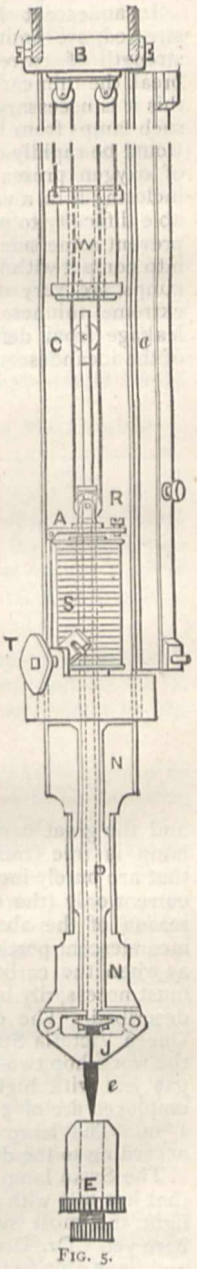


FIG. 5.

ingenious arrangements attached to this system for switching a lamp on or off, with resistances equivalent to that of the lamp; but upon these it is unnecessary to dwell, these adjuncts being common to many systems.

Prof. Adams stated at the Society of Arts that with this system an illuminating power of 715 candles per horse-power could be obtained.

If incandescent lighting is more expensive than the

arc system, which it necessarily is when the current has to traverse a number of small lights, it has the great advantage of possessing perfect steadiness, which an arc lamp can never rival, and for interior lighting this is of great importance. The cost of carbons constitutes an important item in the expenses attached to electric lighting as now employed, and if we consider that in some incandescent systems the consumption of material is for a considerable period nothing at all, we may still work economically even though using considerably more horse-power to obtain our results.

Incandescent lamps, however, as at present constructed, are limited to small lights and a certain steady strength of current, as any sudden increase is apt to break the thin carbon filament employed. In addition to this it is necessary to protect the incandescent carbon of such lamps from the influence or access of oxygen, as it would be rapidly consumed by even the slightest amount of oxygen present. Therefore it must be protected by inclosing it in a vacuum, and it is a matter of considerable difficulty to produce a sufficiently perfect vacuum to prevent some small quantity of free oxygen from coming into contact with the light-giving material. Incandescent lamps are very capricious. Difficulties arise from the extreme thinness and delicacy of the glass employed, leakage from defective sealing or fractures, the liability of the incandescent material to shake loose in its supports,

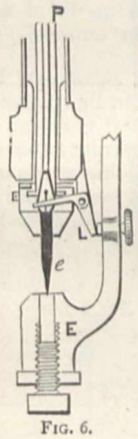


FIG. 6.

and the great care required in manipulation. The Joel lamp is free from these objections, and as in lamps that are purely incandescent, the heat is produced by the current only (the carbon not undergoing combustion by reason of the absence of oxygen), it follows that the incandescent portion cannot attain so high a temperature as when the carbon consumes, and therefore the light must necessarily be of less power than that in the lamp described. The offices of the Electric Light Agency in Queen Victoria Street are lighted by this system, and in the workshop two of these lamps take the place of fifteen gas jets with highly satisfactory results. The carbons employed are of 5 mm. diameter, and in length of about 1 m. The lamp burns for seven or fourteen hours, according to the dimensions of the carbon.

The Swan lamp is the only purely incandescent lamp that has met with any success in England. The Maxim light, the most successful in America, has not reached here yet. Dr. Draper's house in New York is lit by it, and he is able to manipulate his lamps with all the ease and comfort of gas-fittings. Sir William Armstrong, at Craigside, near Newcastle, has utilised a brook to run a dynamo-machine by means of a turbine, and he is able to maintain thirty-seven Swan-lights in his house. Mr. Spottiswoode occasionally gratifies his friends by illuminating his rooms with Swan-lights, and the rooms of the Royal Society were so lit at their last *soirée*. But such lamps remain luxuries, and nothing more.

Wherever the electric light has been introduced for internal illumination it has met with considerable favour. It not only lowers the temperature of a gas-lit room within reasonable bounds, but it clears the atmosphere of vitiations, and men work more cheerfully and better. In fact the extra amount of work got out of men is said in some instances to pay for the change. Moreover, since it renders the illumination comparable with that of daylight, it enables the aged and the weak-sighted to read and work without spectacles.

Electric lighting has however passed the experimental, it has now reached the practical stage.

HOW TO PREVENT DROWNING

I WISH to show how drowning might, under ordinary circumstances, be avoided even in the case of persons otherwise wholly ignorant of what is called the art of swimming. The numerous frightful casualties render every working suggestion of importance, and that which I here offer I venture to think is entirely available.

When one of the inferior animals takes the water, falls, or is thrown in, it instantly begins to walk as it does when out of the water. But when a man who cannot "swim" falls into the water, he makes a few spasmodic struggles, throws up his arms, and drowns. The brute, on the other hand, treads water, remains on the surface, and is virtually insubmergible. In order then to escape drowning it is only necessary to do as the brute does, and that is to tread or walk the water. The brute has no advantage in regard of his relative weight, in respect of the water, over man, and yet the man perishes while the brute lives. Nevertheless any man, any woman, any child who can walk on the land may also walk in the water just as readily as the animal does, if only he will, and that without any prior instruction or drilling whatever. Throw a dog into the water and he treads or walks the water instantly, and there is no imaginable reason why a human being under like circumstances should not do as the dog does.

The brute indeed walks in the water instinctively, whereas the man has to be told. The ignorance of so simple a possibility, namely the possibility of treading water, strikes me as one of the most singular things in the history of man, and speaks very little indeed for his intelligence. He is, in fact, as ignorant on the subject as is the newborn babe. Perhaps something is to be ascribed to the vague meaning which is attached to the word swim. When a man swims it means one thing, when a dog swims it means another and quite a different act. The dog is wholly incapable of swimming as a man swims, but nothing is more certain than that a man is capable of swimming, and on the instant, too as a dog swims, without any previous training or instruction, and that by so doing without fear or hesitancy, he will be just as safe in the water as the dog is.

The brute in the water continues to go on all fours, and the man who wishes to save his life and cannot otherwise swim, must do so too, striking alternately, one two, one two, but without hurry or precipitation, with hand and foot, exactly as the brute does. Whether he be provided with paw or hoof, the brute swims with the greatest ease and buoyancy. The human being, if he will, can do so too, with the further immense advantage of having a paddle-formed hand, and of being able to rest himself when tired, by floating, a thing of which the animal has no conception. Bridget Money, a poor Irish emigrant, saved her own life and her three children's lives, when the steamer conveying them took fire on Lake Erie, by floating herself, and making them float, which simply consists in lying quite still, with the mouth shut and the head thrown well back in the water. The dog, the horse, the cow, the swine, the deer, and even the cat, all take to the water on occasion, and sustain themselves perfectly

without any prior experience whatever. Nothing is less difficult, whether for man or brute, than to tread water, even for the first time. I have done so often, using the feet alone or the hands alone, or the whole four, many times, with perhaps one of my children on my back. Once I recollect being carried a good way out to sea by the receding tide at Boulogne, but regained the shore without difficulty. A drop of water once passed through the rima of the glottis, and on another occasion I experienced such sudden indisposition that if I had been unable to float, it must, I think, have gone hard with me.

Men and animals are able to sustain themselves for long distances in the water, and would do so much oftener were they not incapacitated, in regard of the former at least, by sheer terror, as well as complete ignorance of their real powers. Webb's wonderful endurance will never be forgotten. But there are other instances only less remarkable. Some years since, the second mate of a ship fell overboard while in the act of fisting a sail. It was blowing fresh; the time was night, and the place some miles out in the stormy German Ocean. The hardy fellow nevertheless managed to gain the English coast. Brock, with a dozen other pilots, was plying for fares by Yarmouth; and as the main-sheet was belayed, a sudden puff of wind upset the boat, when presently all perished except Brock himself, who, from four in the afternoon of an October evening to one the next morning, swam thirteen miles before he was able to hail a vessel at anchor in the offing. Animals themselves are capable of swimming immense distances, although unable to rest by the way. A dog recently swam thirty miles in America in order to rejoin his master. A mule and a dog washed overboard during a gale in the Bay of Biscay have been known to make their way to shore. A dog swam ashore with a letter in his mouth at the Cape of Good Hope. The crew of the ship to which the dog belonged all perished, which they need not have done had they only ventured to tread water as the dog did. As a certain ship was labouring heavily in the trough of the sea, it was found needful, in order to lighten the vessel, to throw some troop-horses overboard which had been taken in at Corunna. The poor things, my informant, a staff-surgeon, told me, when they found themselves abandoned, faced round and swam for miles after the vessel. A man on the east coast of Lincolnshire saved quite a number of lives by swimming out on horseback to vessels in distress. He commonly rode an old grey mare, but when the mare was not to hand he took the first horse that offered.

The loss of life from shipwreck, boating, bathing, skating, fishing, and accidental immersion is so disastrously great, that every feasible procedure calculated to avert it ought to be had recourse to. People will not consent to wear life-preservers, but if they only knew that in their own limbs, properly used, they possessed the most efficient of life-preservers, they would most likely avail themselves of them. In every school, every house, there ought to be a slate tank of sufficient depth, with a trickle of water at one end and a syphon at the other, in order to keep the contents pure. A pail or two of hot water would at any time render the contents sufficiently warm. In such a tank every child from the time it could walk ought to be made to tread water daily. Every adult, when the opportunity presents itself, should do so. The printed injunction should be pasted up on all boat-houses, on every boat, at every bathing place, and in every school. "Tread water when you find yourself out of your depth" is all that need be said, unless indeed we add, "Float when you are tired." Every one, of whatever age or sex, or however encumbered with clothing, might tread water with at least as much facility, even in a breaking sea, as a four-footed animal does. The position of a person who treads water is, in other respects, very much safer and better than is the sprawling attitude which we assume in ordinary swimming. And then the beauty of it is that we can tread water without any preliminary teaching, whereas "to swim" involves time and pains, entails considerable fatigue, and is very seldom adequately acquired after all.

The Indians on the Missouri River, when they have occasion to traverse that impetuous stream, invariably tread water just as the dog treads it. The natives of Joanna, an island on the coast of Madagascar, young persons of both sexes, walk the water carrying fruit and vegetables to ships becalmed, or it may be lying-to, in the offing miles away. Some Croomen whose canoe upset before my eyes in the seaway on the coast of Africa walked the water, to the safe-keeping of their lives, with the utmost facility; and I witnessed negro children on other occasions doing so at a very tender age. At Madras, watching their opportunity, messengers, with letters secured in an oilskin cap, plunge into the boiling surf, and make their way, treading the water, to the vessels outside, through a sea in which an ordinary European boat will not live. At the Cape of Good Hope men used to proceed to the vessels in the offing through the mountain billows, treading the water as they went with the utmost security. And yet here, on our own shores, and amid smooth waters, men, women, and children perish like flies annually, when a little properly-directed effort—treading the water as I have said—would haply suffice to rescue them every one.

Belfast HENRY MACCORMAC

NOTES

WE learn from the *Times* that at the meeting of the Royal Society on Thursday last the vacancies in the list of foreign members were filled by the election of Gabriel Auguste Daubrée of Paris, Jean Charles Marignac of Geneva, Carl Nägeli of Munich, and Carl Weierstrass of Berlin.

SIR JOHN LUBBOCK has been nominated to succeed Prof. Allman as president of the Linnean Society, and Mr. G. J. Romanes for the post of zoological secretary, vacant by Mr. Alston's lamented death.

IN the current number of the *Revue Scientifique* there is an article by M. de Lacaze-Duthiers descriptive of an interesting enterprise on which he is engaged, viz. the construction of a zoological laboratory at Port Vendres. Backed by the recommendation of the Academy of Sciences, he obtained a liberal offer from the municipal authorities of the place, which among other considerations determined him in the selection of the site. Altogether he is provided with 32,000 francs as a capital sum, 750 francs per annum as a fixed income, with the gift of building ground and a boat. It will thus be seen that the municipal authorities deserve all credit for the substantial encouragement which they have extended to the undertaking. In a few months the laboratory will be completed, and is then to be thrown open to workers of all nationalities. As its situation on the coast of the Mediterranean is an admirable one for the procuring of fauna, the institution is in every way favourably circumstanced, and we cordially wish it all success.

THE English Transit of Venus Commission having expressed a desire for an understanding with the French Commission, so as to secure a uniform method of observation, M. d'Abbadie and M. Tisserand are coming to London to compare notes with the English Commission.

A LETTER from M. Mascart, director of the French Central Meteorological Bureau, read at last week's meeting of the Paris Academy of Sciences, stated that the French Government intend to establish an observatory for terrestrial magnetism at Cape Horn. The expedition will set out in the same vessel as will

take the astronomers who are to observe the approaching transit of Venus. This is intended as the contribution of France to the international scheme of polar observations, to which England has as yet made no sign of lending her aid.

MESSRS. SIEMENS AND HALSKE gave a public trial last week of their new electric railway, which runs between Lichterfelde and the Cadettenhaus, about six miles from Berlin. The trial is stated to have been most successful. It was in a simple tram-car, with an electric battery totally concealed between the wheels, in connection, through the rails it ran on, with the principal battery at the station. The rails are three feet three inches apart, and exactly resemble those of an ordinary railroad, only the gauge being narrower. The greatest speed obtained on a distance of about one and a half mile was eighteen English miles an hour. Dr. Siemens has proved that if necessary a far greater speed could be obtained, but this is not allowed by the German police authorities. It will not be allowed to proceed at more than nine miles per hour. The railway was opened to the public on Monday.

M. POUCHET with two assistants are about to proceed to Vadsö, on the east coast of Finmark, to collect natural history specimens for the Paris Museum of Natural History.

AN interesting paper on recent earthquakes in Japan has lately been published by Prof. John Milne, vice-president of the Seismological Society of Japan. To get an arrangement which will cause a clock to stop at exactly the same tremor during an earthquake as another similar clock is stopped at, to get a complete time record of the tremors at any place, and to find accurately the direction of the transmission of earth vibrations, these are the questions which Mr. Milne and his friends have been trying to surmount with the help of a grant of money from the British Association and the help of the Japanese Telegraph Department. A result of the work hitherto done is that there is a chronic centre of disturbance within a radius of a few miles from Yokohama, and Mr. Milne felicitates the inhabitants of that seaport on the advantages which their position gives them for seismological observation. The Society has also issued useful forms in which to record earthquake observations, which might supply hints to European observers.

AT the Victoria (Philosophical) Institute, on Monday, a paper on "The Rainfall and Climate of India" was read by Sir Joseph Fayrer, K.C.S.I., F.R.S. He reviewed the causes and effects of those climatic changes which obtain in that country at the present time, and many of which once operated in Palestine and Egypt, not to mention England and other parts of the world, and threw light on questions involving the denudation theory, the variation of river deposits, and other matters affecting the uniformitarian theory of geology. Sir Joseph Fayrer spoke at some length in regard to the climate of India, and showed that, if what science had taught us in regard to the effects of cultivation, the preservation of the forests, drainage, &c., were carefully attended to by the powers that be, the importance of the results could not be estimated, as they involved the health and prosperity of that great country.

IN connection with the subject of "Fascination," Dr. Otto of Schemnitz, Hungary, writes us of a case which came under his notice. In 1859, when the use of firearms was under stringent regulations in Hungary, peasants often killed hares on the Danubian island Creppel in the following way:—Two peasants would drive in a cart over the reaped fields. On spying a hare (say at two to three hundred paces) they proceeded to drive round it some five or six times in succession. One peasant carrying a long stick at length sprang out, at the moment the cart was behind the hare (the cart continuing its course), and coming up to the animal slowly, killed it without difficulty. It was not uncommon to kill thus as many as six or seven hares in one morning.

THE following instance of animal intelligence is sent to us by Dr. John Rae, F.R.S., who states that the Mr. William Sinclair mentioned is respectable and trustworthy. The anecdote is taken from the *Orkney Herald* of May 11:—"A well-authenticated and extraordinary case of the sagacity of the Shetland pony has just come under our notice. A year or two ago Mr. William Sinclair, pupil teacher, Holm, imported one of these little animals from Shetland on which to ride to and from school, his residence being at a considerable distance from the school buildings. Up to that time the animal had been unshod, but some time afterwards Mr. Sinclair had it shod by Mr. Pratt, the parish blacksmith. The other day Mr. Pratt, whose smithy is a long distance from Mr. Sinclair's house, saw the pony, without halter or anything upon it, walking up to where he was working. Thinking the animal had strayed from home, he drove it off, throwing stones after the beast to make it run homewards. This had the desired effect for a short time; but Mr. Pratt had only got fairly at work once more in the smithy when the pony's head again made its appearance at the door. On proceeding a second time outside, to drive the pony away, Mr. Pratt, with a blacksmith's instinct, took a look at the pony's feet, when he observed that one of its shoes had been lost. Having made a shoe he put it on, and then waited to see what the animal would do. For a moment it looked at the blacksmith as if asking whether he was done, then pawed once or twice to see if the newly-shod foot was comfortable, and finally gave a pleased neigh, erected its head, and started homewards at a brisk trot. The owner was also exceedingly surprised to find the animal at home completely shod the same evening, and it was only on calling at the smithy some days afterwards that he learned the full extent of his pony's sagacity."

M. J. PLATEAU has issued a second supplement to the "Bibliographie Analytique des Principaux Phènomenés Subjectifs de la Vision," comprising the years 1878-79. It is reprinted in a separate form from the *Memoirs* of the Belgian Academy.

WE have received the first three parts of the *Zeitschrift für Instrumentenkunde*, a monthly journal intended to bring together all novelties in scientific apparatus. It is edited by Dr. George Schwiskus, assisted by a large staff, and published by Julius Springer of Berlin. It is amply illustrated and its utility is obvious.

M. CARNOT, the grandson of the celebrated War Minister of the First Republic, has taken an important step in his capacity of Minister of French Public Works. He sent to the Lower House a *projet de loi* asking for a credit of 280,000*l.* in order to introduce at once into all the French lighthouses magneto-electric generators and acoustical signals with steam blower. This proposal is sure to be accepted with enthusiasm, and executed with the utmost rapidity.

THE General Council of the Seine have granted the credits asked by the Préfet for establishing in the Morgue a refrigerating machine by MM. Mignon and Rouard. Ammonia is the substance which has been considered as the most powerful and cheapest by a special commission appointed by the Council of Hygiene. Laboratories will be annexed to the establishment. The work will begin as soon as Parliament has voted a small sum for contributing to the expense.

M. BARTHÉLEMY ST. HILAIRE, French Minister of Foreign Affairs, has recommended to M. Cochéry a suggestion of M. W. de Fonvielle's advising the appointment of a commission on the state of international law relating to ocean telegraphic cables, and the means of improving it. M. St. Hilaire states that in

case the Congress of Electricians comes to any conclusion relating to this most important object, he is ready to send a circular to the several Governments on the opening of an international conference on the matter. This official correspondence will be published in full in the next number of *L'Électricité*.

WE take the following from the *Colonies and India*:—"To say that a train had been stopped by caterpillars would sound like a Yankee yarn, yet such a thing (according to the *Rangitikei Advocate*) actually took place on the local railway a few days ago. In the neighbourhood of Turakina, New Zealand, an army of caterpillars, hundreds of thousands strong, was marching across the line, bound for a new field of oats, when the train came along. Thousands of the creeping vermin were crushed by the wheels of the engine, and suddenly the train came to a dead stop. On examination it was found that the wheels of the engine had become so greasy that they kept on revolving without advancing—they could not grip the rails. The guard and the engine-driver procured sand and strewed it on the rails, and the train made a fresh start, but it was found that during the stoppage caterpillars in thousands had crawled all over the engine, and over all the carriages inside and out."

A SHOCK of earthquake is reported from Möttling (Carniola) on April 26, at 4.55 p.m., direction from north to south. At Tüffers (Styria) a smart shock was felt on May 6, at 7.41 p.m., duration three seconds, direction north-east to south-west.

ON Tuesday last week, the Princess Christian of Schleswig-Holstein presented the prizes and certificates adjudged to candidates in a competitive examination on "Domestic Sanitation," following a course of lectures delivered on the subject by Dr. B. W. Richardson. With regard to the course of lectures he had given at the request of the Ladies' Sanitary Association, Dr. Richardson stated that nearly 300 pupils attended, of whom seventy-five competed for the prizes offered by Mr. Edwin Chadwick and others. Of the papers sent in, he could say that all the writers showed a sound knowledge of four subjects, viz. the relative values of the substances used as foods, the circulation of the blood, the process of breathing, with the conditions which produce a pure and healthy dwelling, and the management of a sick room. Dr. Richardson announced that, by desire of the Ladies' Sanitary Association, he should deliver another course of lectures, beginning in October next, on the nervous system. This would raise questions concerning education and other interesting and, at present, debatable matters.

IN the *Revue Scientifique* for May 14 is the conclusion of a long paper on the Physiological Immunities enjoyed by the Jewish race, in which the nature of these immunities is examined and the probable reasons for them given.

THE additions to the Zoological Society's Gardens during the past week include an Indian Fruit Bat (*Pteropus medius*) from India, presented by Mr. Edwin H. Maskell; a Wood Brocket (*Cariacus nemorivagus*) from South America, presented by Capt. Mackenzie, s.s. *Severn*; an Egyptian Gazelle (*Gazella dorcas*) from Egypt, presented by Mrs. J. J. Jones; a Common Hare (*Lepus europæus*), British, presented by Mr. Wormald, F.Z.S.; two Hawfinches (*Coccothraustes vulgaris*), British, presented by Dr. Bree; three Viperine Snakes (*Tropidonotus viperinus*) from North Africa, presented by Mr. J. C. Church; a Common Adder (*Vipera berus*), British, presented by Mr. G. H. King; a Three-striped Paradoxure (*Paradoxurus trivirgatus*) from India, a Javan Adjutant (*Leptoptilus javanicus*) from Java, received in exchange; six Rose-coloured Pastors (*Pastor roseus*) from India, two Mandarin Ducks (*Aix galericulata*) from China, purchased; a Blue and Yellow Macaw (*Ara ararauna*) from South America, deposited; a Geoffroy's Dove (*Peristera geoffroii*), three Red-crested Whistling Ducks (*Fuligula rufina*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN

VARIABLE STARS.—Mira Ceti, which was at its minimum on March 20, according to Prof. Schönfeld's formula in his second catalogue of variables, will attain a maximum by the same on July 8, and may therefore be observed as it approaches that phase. The next maximum takes place on April 1, 1882, and will not be observable.

χ Cygni, by the recent observations of Prof. Julius Schmidt, may also be expected to reach its maximum about July 10, perhaps a few days later: the last maximum occurred on May 30, 1880, when the star was 6m.; it has occasionally attained 4m. at maximum. The perturbations in this case appear to be considerable.

The position of the variable usually designated *Nova* 1848 may be identified by means of Prof. Schmidt's observations of neighbouring stars. In *Astron. Nach.*, No. 1708, he gives the following places for 1855·0:—

Mag.	R.A. h. m. s.	Decl. ° ′ ″	
11 ...	16 50 53·3 ...	−12 43 57	
13 ...	— 51 18·1 ...	12 42 0	
13·12 ...	— 51 22·5 ...	12 40 3	*Nova* 1848
11 ...	— 51 44·8 ...	12 47 8	
11 ...	— 51 51·9 ...	12 31 57	
10·11 ...	16 53 9·2 ...	−12 47 2	

Further, the variable follows the star, Lalande's star 30,853 a ninth magnitude, 14·8s., and is north of it 18′ 21″.

Prof. Winnecke's star of the twelfth magnitude, in close proximity to the place of Kepler's *Nova* 1604, deduced from the observations of Fabricius, and apparently in the position of a star marked 10m. by Chacornac, but not since observed of that brightness, well deserves watching, and it would be interesting to possess a carefully-formed map of all stars visible in the vicinity of Kepler's celebrated star, with the aid of one of our most powerful telescopes—similar to that prepared by D'Arrest with the Copenhagen refractor for the vicinity of Tycho's *Nova* 1572 in Cassiopea. Prof. Winnecke's star precedes the 9m., No. 16872 in Oeltzen's Argelander 33·2s., and is 2′ north of it.

THE SATELLITES OF SATURN.—Observations of these satellites are still followed up at the Observatory of Toulouse, and M. Baillaud has communicated a series made about the last opposition of the planet to the Paris Academy of Sciences. Amongst them are a number of observations of *Mimas*, consisting mainly of elongations, but with several attempts to fix the moments when the satellite was on the tangent to the extremity of the ring. M. Baillaud does not appear to regard the latter observation with favour, on account of the difficulty attending it, but proposes to gain further experience of the degree of precision of which it admits. The later observations of *Mimas* are as follows:—

1880		h. m. s.	1880		h. m. s.
Nov. 1 ...	W. ...	6 59 40	Nov. 25 ...	N.E. ...	10 23 50
13 ...	W. ...	12 58 17	Dec. 18 ...	W. ...	10 1 7
23 ...	E. ...	10 33 13	19 ...	W. ...	8 42 33

The times are mean times at Toulouse, 3m. 29·9s. west of the Observatory of Paris. The observation of November 25 relates to the passage of the satellite by the tangent to the extremity of the ring.

Dr. M. W. Meyer of Geneva publishes elements of *Enceladus*, *Tethys*, *Dione* and *Rhea*, obtained on a new method, from observations made with the 10-inch Geneva refractor. By the way he terms the second of these satellites *Thetis*, not the only time that Sir John Herschel's proposed designation has been mistaken of late. *Thetis*, as is well known, is appropriated for one of the minor planets discovered by Dr. R. Luther.

SWIFT'S COMET (1881 *a*).—M. Bigourdan has calculated the following elements of this comet, from the Dun Echt observation on May 2 and observations made at Paris on May 5 and 7:—

Perihelion passage 1881, May 21·0613, Paris M.T.

	° ′ ″	
Longitude of perihelion	297 54 43	M. Eq. 1881·0
,, ,, ascending node	119 24 5	
Inclination	81 40 56	
Log. distance in perihelion	9·75568	

Motion—direct.

Though observations will not be longer practicable in these latitudes the comet may perhaps be observed in the southern

hemisphere, it being understood that telegrams have been sent to the Cape and to Australia (by Lord Crawford) with this object. According to the above orbit, on July 9 the comet will have one-fifth of the intensity of light on the night of discovery. There is no close resemblance of elements to those of any comet previously calculated.

THE "ASTRONOMISCHE NACHRICHTEN."—It is announced that after the termination of the current volume, by authority of the Prussian Government a new arrangement for the management of this journal will take effect. It will be edited by Prof. A. Krueger, the director of the Observatory at Kiel, in co-operation with the president of the "Astronomische Gesellschaft," of which association it will become a recognised organ.

BIOLOGICAL NOTES

LIMULUS POLYPHEMUS.—A paper on the anatomy, histology, and embryology of *Limulus polyphemus*, by A. S. Packard, jun., M.D. (*Anniversary Mem.* Boston Soc. Nat. Hist. 1880), may be regarded as a continuation of the author's former series on the development and affinities of the king-crab. He discusses fully the question of the affinities of that puzzling animal, and combating the position of those zoologists who connect Limulus with the Arachnida, he sums up the facts which point to the crustacean nature of Limulus as follows :—(1) The nature of the branchiæ, those of Limulus being developed in numerous plates overlapping each other on the second abdominal limbs (those of the Eutrypterida being, according to H. Woodward, attached side by side like the teeth of a rake), while the mode of respiration is truly crustacean ; (2) the resemblance of the cephalothorax of Limulus to that of Apus ; (3) the general resemblance of the gnathopods to the feet of Nauplius or larva of the cirrhipedia and copepoda ; (4) the digestive tract is homologous throughout with that of Crustacea, particularly the Decapoda, there being no urinary tubes as in Tracheata ; (5) the heart is on the crustacean type as much as on the tracheate type, and the internal reproductive organs (ovaries and testes) open externally, at the base of and in the limbs, much as in Crustacea. The paper is illustrated by seven plates showing the circulation of Limulus, sections of the adult and of embryos, and details of the structure of the eyes with comparison of these with those of Trilobites, with which group the author, as in his first memoir, allies the Merostomata.

THE NUMMULITIC ECHINIDS OF EGYPT.—A monograph of the Echinids contained in the Nummulitic strata of Egypt, by M. P. de Loriol, is published in the *Mem.* Soc. Phys. et d'Hist. Nat. de Genève (tom. xxvii. 1880, 1ere pe.). The specimens described by M. de Loriol were obtained mostly near Cairo and Thebes. The fauna of the Nummulitic strata of Egypt has been found by him as far as yet explored to contain forty-two species of Echinids, or about the same number as that of the Nummulitic strata of India ; that of the Canton of Schwytz has only thirty-four, the Eocene fauna of the Antilles only eighteen ; but the Eocene fauna of the Pyrenees has as many as ninety-three. In the present memoir, which is illustrated by ten plates, twenty new species are described. The author does not concur in Prof. Jeffrey Bell's reasons for the formation of his new genus Paleolampas, considering that there are not sufficient grounds for separating it from Echinolampas. Only four of the forty-two species composing the Egyptian Nummulitic fauna are regular Echinids, all the rest are irregular. Of the whole number all but eight are peculiar to Egypt. Of the eight exceptions four occur in the lower part of the Nummulitic formation at San Giovanni Harione, in the Vicentin, three in that of the Pyrenees, whilst the remaining one, *Hemispatangus depressus*, has been found in the Crimea in the same beds as *Echinolampas subcylindricus*, which also occurs at San Giovanni Harione.

SPONGES OF LAKE BAIKAL.—In a recent note to the St. Petersburg Academy, Dr. Dybowski says sponges occur in Lake Baikal wherever the bottom is rocky or large blocks of stone or wood are lying about. Close to the border of the lake, at a depth of 2 to 6 metres, they have a sod or cushion-like form, clinging to the stones, blocks, and (more largely) to decaying wood. In a depth of 6 to 25 metres they become tree- or shrub-like, with a height rarely exceeding 60 ctm. ; while from 25 to 100 m. depth the sod or cushion-like form recurs, and only that is met with. The colour of the sponges is generally more or less dark grass-green, sometimes olive-green or brown. But those got from depths of 60 to 100 m., or found under stones, are nearly quite white.

MICROSCOPICAL EXAMINATION OF FARINA.—In examining any given kind of farina with the microscope to find whether a less nutritive farina has been mixed with it, it has been common to confine attention to the starch granules (which one may easily be mistaken about) : Dr. Cattaneo holds (*Re. Ist. Lomb. Rend.* vol. xiv. fasc. v.) that greater importance should be attached to the character of the bran-particles, some of which are never wanting even in the most carefully-bolted flour. These (as he shows) differ in a marked way according to species.

THE HYPOPHYSIS IN ASCIDIANS.—While the hypophysis, or pituitary gland, found in the cranial cavity of adult vertebrates seems to be a rudimentary body without function, it is, in its earlier development, furnished, like all active glands, with an excretory passage into the alimentary canal. On the instance of M. van Beneden, M. Julin has lately studied an enigmatical organ in ascidians, a glandular apparatus under the brain (discovered by Hankow), which, it was thought, might be homologous with the pituitary gland of vertebrates. M. Julin examined the gland, the so-called anterior tubercle or vibratile organ, and various connected organs, in four species of ascidians at Leewik, on the Norwegian coast, and his researches (lately described to the Belgian Academy) appear to confirm M. van Beneden's conjecture. M. Julin is unable to regard the vibratile organ as an olfactory organ (the ordinary view) ; it receives no nerve-branch, and no olfactory cells can be found in its vibratile cylindrical epithelium. It is (he considers) merely the enlarged mouth of the excretory canal of the gland below the brain, leading into the buccal region, while the gland itself represents, in permanent state and functional activity, the embryonic hypophysis which becomes rudimentary in vertebrates. The *rôle* of the gland remains in obscurity. (Anatomical details will be found in the Academy's *Bulletin*, No. 2.)

PHYSICAL NOTES

AN extremely ingenious explanation of the peculiar green phosphorescence observed by Crookes in his researches on high vacua has recently been given by Mr. J. J. Thomson of Cambridge. This phosphorescence appears on the inner surfaces of the exhausted glass tubes whenever they are exposed to the so-called molecular bombardment of particles projected from the negative electrode. Mr. Thomson points out firstly that, as predicted by Clerk-Maxwell and verified by Rowland, a moving electrified particle acts as a current of electricity and possesses an (electro-magnetic) vector-potential. Now where such an electrified particle strikes a glass surface and rebounds, its change of velocity is accompanied by a change of vector-potential, and the glass against which it impinges and rebounds will be subjected to a rapid change in electromotive force. But by Clerk-Maxwell's electro-magnetic theory of light this is precisely what happens when a ray of light falls upon it. And therefore it phosphoresces as it would under the impact of an actual ray of light. It would be interesting to inquire whether all phosphorescent and fluorescent phenomena are capable of an analogous explanation in accordance with Clerk-Maxwell's theory.

MR. E. H. COOK proposes (*Phil. Mag.*) the term *sonorescence* as suitable to apply to the phenomena discovered by Graham Bell and investigated by Mercadier, Tyndall, and others, of the direct conversion of intermittent radiations into sound. The new name is obviously suggested by analogy with fluorescence and calorescence, but does not seem quite a happy one. Stokes gave the name of *fluorescence* to the phenomenon of the change of non-luminous ultra-violet rays into luminous ones. Akin gave the name of *calcescence* to the phenomenon of the change of non-luminous heat-rays into luminous ones (as in the lime-light), but the term has been superseded by Tyndall's term *calorescence*, which is etymologically unfortunate, seeing that the Latin verb is *calesco*, not *caloresco*. By strict analogy the term *sonorescence* should mean the conversion of sound into luminous rays, not the reverse change, to which Mr. Cook applies it.

THE researches of Edlund, Joubert, and others have left no doubt that the voltaic arc possesses an electromotive force of its own acting in a direction opposite to that of the current which sustains the arc. The principal work of maintaining the arc appears indeed to be spent in overcoming this opposing force, and is not occasioned by the resistance of the arc itself, which is small. M. Alfred Niaudet has lately announced the observation

of an important fact in connection with this subject, namely, that when the arc begins to emit the well-known *hissing sound* there is an abrupt change in the opposing electromotive force, which is greater while the arc is silent than when it is hissing.

MM. NACCARI AND PAGLIANI have lately determined the vapour tensions of a number of liquids in the laboratory of the University of Turin. Their method consisted of a modification of that of Regnault, reduction of pressure being effected by an aspirating pump. The tensions of toluene, propylic and isobutylic alcohol, and of several of the ethers of the fatty acids were determined at different temperatures with great exactitude and their empirical formulæ calculated.

FROM a study of the electromotive force of inconstant couples MM. Naccari and Guglielmo conclude that in couples containing one fluid the electromotive force is influenced by the nature of that pole to which the hydrogen goes, and that the change in the strength of the current varies always in the opposite sense to that of the electromotive force, the sense depending upon the manner in which the liberated oxygen enters into secondary chemical actions.

AT the Observatory of Campidoglio, Prof. Respighi has been lately conducting a series of experiments for the determination of gravity. The data are not as yet fully reduced, but the author has described his method (*Atti della R. Acc. dei Lincei*, vol. v. fasc. 5), which consists in the use of a pendulm with a lead ball about 9½ kg. in weight, and a steel wire 0·6 mm. in diameter; a sharp iron point at the extremity, dips in mercury each oscillation, so as to give passage to the current of a chronograph. Five different lengths of pendulum were used, between 7·90 m. and 5·16 m.; and with all these lengths the pendulum, on account of its weight, the fineness of the wire, and the convenient mode of suspension, proved independent of the rotatory motion of the earth, presenting Foucault's well-known phenomenon (an essential condition, in the author's opinion, but not verified in Borda's or Bessel's apparatus). The number and duration of the oscillations were registered by the chronograph with greater exactness than is attainable by the method of coincidences.

AN arrangement for rendering Volta's pile constant and depolarised is described by Count Mocenigo in a recent number of the *Rivista Scientifico-Industriale*. Twelve couples with their elements are fixed on a horizontal axis; a trough of acidulated water having twelve compartments is brought up by a lever motion, so as to cover a good third of the surface of the pile, and a rotatory movement is communicated to the axis.

THE velocity of sound in chlorine has been determined lately by Prof. Tito Martini (*Riv. Sci. Ind.*, No. 6), no physicist having previously, to his knowledge, done so. His method was suggested by an experiment of Tyndall. A glass tube 40 ctm. long and 2 ctm. internal diameter, and fixed in vertical position, was connected below, by means of a gutta-percha tube, to another glass tube holding sulphuric acid, and capable of being raised or lowered so as to vary the level of the liquid entering the fixed tube, in order to obtain the column of gas which would strengthen a certain tone. The fixed tube was graduated in centimetres and millimetres. Having first verified the accuracy of the method by experiments with carbonic acid and protoxide of nitrogen, the author proceeded to chlorine, and obtained 206·4 m. as mean value of the velocity of sound in it for zero temperature.

THE mode of decomposition of water by discharge of Leyden jars through platinum electrodes has been studied by Dr. Streintz (Vienna Acad. *Anz.*). Riess attributed this phenomena to heating of the electrodes. Using a quadrant-electrometer, &c., Dr. Streintz found that with very small electrodes giving passage to a series of discharge-currents in one direction, then left to themselves, a remarkable reversal of electromotive force occurred, but only when the discharges did not exceed a certain number. The author was led to examine the change of electromotive force by short galvanic currents, which also produce, in a few minutes, a reversal in the electric behaviour of the electrode covered with H_2; and he explains this by saying that platinum containing no free, but only occluded, hydrogen is electromotively negative to pure platinum. The further observation that a fully-polarised cell, one of whose electrodes was covered by a very brief galvanic current with H_2 the other with O_2, did not show a reversal of the difference of potential, led to the conclusion that the decomposition through battery discharges is to be regarded as the product of a galvanic polarisation and a connected (thermal?) development of oxyhydrogen gas on the two electrodes.

IN a recent note to the Vienna Academy Prof. Reitlinger and Dr. Wächter distinguish three varieties of Lichtenberg figures: (1) the positive radiating figure (*Strahlenfigur*); (2) the positive disk-figure; (3) the negative disk-figure. The (2) was lately added by Herr Holtz. The conditions of production in each case are investigated. The positive radiating figure is produced (according to the authors) by dust particles detached and carried off from the electrode; the negative disk-figure, on the other hand, by gas-discharges. In the former case the particles, while they communicate their positive electricity to the resin, describe radial paths rendered visible and yellow by the dusting process. The reason why one never gets a negative (red) radiating figure, or even branch, is that the electro-negative discharge from a metal or other conductor in air is neither capable of effecting an electric disaggregation of the electrode, nor a carrying away of dust-particles.

TO obtain an enlargement (on a screen) variable at will, at any distance, M. Crova (*Journ. de Phys.*, April) places between the object and the screen (which are fixed) a projection-apparatus formed of two lenses, one convergent (plane-convex), the other divergent (plane-concave), of the same focal distance, and capable of being moved apart by means of a rack and pinion arrangement.

GEOGRAPHICAL NOTES

MR. JAMES GLAISHER writes from the office of the Palestine Exploration Fund, announcing the discovery of a "Hittite" City.—"A great battle," he states, "figured in Sir G. Wilkinson's 'Ancient Egyptians,' was fought between Rameses II. and the Hittites near their sacred city of Kadash, which is shown as a city with a double moat, crossed by bridges beside a broad stream running into a lake. The lake has been generally identified with the Baheiret Homs, through which the Orontes passes south of Homs, but the site of the city, as important in Hittite records as the northern capital of Carchemish, remained to be discovered. We now learn from a despatch received from Lieut. Conder, the officer in charge of our new expedition, that he has identified the lost site with the ruins known as the Tell Neby Mendeh. They lie on the left bank of the Orontes, four English miles south of the lake. The modern name belongs to a sacred shrine on the highest part of the hill on which the ruins lie, and the name of Kadesh still survives, so that here is another instance of the vitality of the old names which linger in the minds of the people long after they have forgotten the Roman, Greek, or Crusaders' names. Not only the name is preserved, but the ancient moat of the city itself. Lieut. Conder writes:—'Looking down from the summit of the Tell we appeared to see the very double moat of the Egyptian picture, for while the stream of the Orontes is dammed up so as to form a small lake fifty yards across on the south-east of the site, a fresh brook flows in the west and north to join the river, and an outer line of moat is formed by earthen banks, which flank a sort of aqueduct parallel with the main stream.'"

THE French Government is taking advantage of the occupation of a part of Tunis to extend their ordnance survey to regions hitherto untrodden by ordinary travellers. Col. Perrier, the member of the Institute who is at the head of the French Survey, has been ordered for this service.

THE death is announced of Gessi Pasha, the friend and coadjutor of Col. Gordon in the Sudan. He died on the evening of April 30, in the French hospital at Suez, after protracted sufferings caused by the terrible privations he endured in the months of November and December last, when he was shut in by an impassable barrier of weed in the Bahr-Gazelle River, Upper Egypt, as already recorded. Capt. Gessi conducted some valuable exploring work on the Nile under Col. Gordon, and in 1876 succeeded in circumnavigating Albert Nyanza, adding greatly to our knowledge of that lake.

IN the *Revue Scientifique* of May 14 M. G. Rolland has a long article on the Sand Dunes of the Sahara, in which he adduces data to show that these dunes shift but very little, that although they move towards the south-east, it is very slowly, and that little difference is made upon them in the course of a generation.

"Cameos from the Silver-Land," by Mr. E. W. White, F.Z.S., will shortly be issued in two volumes by Mr. Van Voorst. It relates to the author's experience in the Argentine Republic, and will be specially full on the natural history of the country.

We regret to learn the death of Admiral La Roncière le Noury, president of the Geographical Society of Paris, who died on Saturday after a protracted illness. He was born in 1813. In 1856 he went to the Arctic Ocean in the *Reine Hortense* on a scientific exploration professedly conducted by Prince Napoleon, who was on board. On the death of M. Chasseloup Laubat the Admiral was elected president of the Paris Society of Geography, in which office he continued without opposition up to the last election. The Admiral took great interest in scientific geography, as well as in zoology and botany.

Dr. Gerhard Rohlfs, who has been travelling in Abyssinia, has returned to Berlin.

THE HYPOPHYSAL GLAND IN ASCIDIANS

SINCE the publication of Kowalewsky's remarkable discovery of the course of development in Ascidians, and its confirmation, in all the leading features, by Kupffer and others, any morphological work on the Tunicata is naturally regarded with great interest on account of the possibility of its throwing light on the difficult problem of the relationship of that group to the Vertebrata.

Embryological investigations have clearly demonstrated that the fully-formed larval Ascidian (in most genera, at least) possesses an axis occupying the centre of the tail, and comparable with the vertebrate notochord; that the dorsal region of the body contains a neural canal—of epiblastic origin, and formed by the rising up, arching over, and coalescence of "laminæ dorsales"—expanding anteriorly as a vesicle, in the walls of which certain sense-organs are developed, and being continued posteriorly as a fine canal running along the tail on the dorsal surface of the notochord. The ventral region of the body is occupied by the alimentary canal, lying below the nerve vesicle, and, in its most posterior prolongation, below the anterior extremity of the notochord, which in this locality separates the neural and visceral canals. These developmental researches have also shown that in the adult Ascidian the branchial aperture must be regarded as homologous with the vertebrate mouth, and the branchial sac with the pharynx.

An excellent paper by M. Charles Julin [1] in the last number of the *Archives de Biologie* (tome ii. fascicule i., 1881), of which a preliminary account appeared lately in the *Bulletin* of the Académie Royale de Belgique (3me ser., t. 1, No. 2, Fevr. 1881), adds to this interesting list of homologous organs by showing strong grounds for the belief that the little-understood "neural gland" in the Ascidians represents the glandular portion of the hypophysis cerebri, or pituitary body of Vertebrates.

M. Julin gives a minute account of the structure and relations of the peripharyngeal bands, the dorsal lamina, the nerve ganglion, and that enigmatical organ generally known as the olfactory tubercle; the most important section of his paper, however, is that dealing with the neural gland. This structure was first discovered by Hancock, and more recently its glandular nature was demonstrated by Ussow, who called it the olfactory gland, and stated that it was connected with the olfactory tubercle by a narrow canal, an observation since confirmed by Nassonoff. Julin contends that the so-called olfactory tubercle is not a sense-organ at all, but merely the curiously complicated opening into the pharynx of the duct of his "hypophysis." He states that he has been unable to find any nervous connection whatever between the tubercle and the ganglion, and that the nerve which has frequently been observed and described as supplying the supposed sense-organ really passes behind it without communicating, and that therefore he cannot confirm the innervation described and figured by Ussow. The histological structure of the tubercle is also opposed to the probability of its sensory function, as no modified cells are present, the whole surface being covered by normal ciliated columnar epithelium.

The reasons which M. Julin advances in support of the homology of the neural gland with the pituitary body are its structure, its position on the ventral surface of the ganglion, and its relation with the pharynx. The glandular nature of this body was first shown by Ussow, and its minute structure has been investigated by Julin. It consists of branching glandular tubules surrounded by connective tissue richly supplied with blood-sinuses, while the excretory duct in its posterior part has a complete dorsal wall only, as ventrally it communicates freely with the ends of the tubules, just as is the case with the duct during the development of the pituitary body.

Julin points out that in the Ascidians the duct, in running anteriorly towards the olfactory tubercle, is in direct relation with the ventral surface of the nerve ganglion, no layer of connective tissue intervening; and this he states is also the case in Vertebrates.

The position of the neural gland, or "hypophysary gland," as Julin proposes it should be called, is constant. Wherever the nerve-ganglion may be,—and it varies considerably in its position in different species,—the gland is always situated on its ventral surface.

The excretory duct arising from the dorsal surface of the gland, runs anteriorly, directly below the nerve-ganglion, to the olfactory or hypophysary tubercle, where it communicates with the pharynx, probably within the region formed by the epiblast involved in the oral invagination.

It is evident that Julin's observations throw the gravest doubts on the always somewhat questionable olfactory nature of the dorsal tubercle. A ciliated pit having no apparent nervous relations, and connected by a duct with a body having a well-marked glandular structure, has no claim to be regarded as a sense organ. Its function, and that of the gland, remain a mystery; Julin states that he is unable to throw any light upon this question. From the large size of the gland and the constant presence and usually extraordinary complication of the tubercle one would imagine that they performed an important function in the economy of the Ascidian; but what that function is, and why the duct of a gland should have so elaborate an opening into the pharynx, are at present totally unknown.

Julin gives us no information as to the development of these organs. In 1871 Kowalewsky [1] described, in the course of the development of *Ascidia mammillata*, the formation of an aperture connecting the anterior end of the nerve vesicle with the region of the epiblast which was being invaginated to form the oral funnel, and he declared that this aperture of communication between the neural and visceral canals persisted in the adult as the ciliated tubercle. Kupffer,[2] in the following year, while referring to Kowalewsky's statement, declared that he had been unable to discover any such aperture in the larva of *Ascidia mentula*. If Kowalewsky's observation is confirmed, and if the canal is found to remain as the duct of the neural gland, the course of its development would seem to differ considerably from that of the hypophysis cerebri as described by Mihalkovics, Balfour, and Kölliker, which are the views approved of by Julin and confirmed from his own observations.

In conclusion, the arguments in favour of the homology of the Ascidian's neural gland with the glandular portion of the pituitary body are very strong. The structure, position, and relations of the two organs are, in a certain stage of development, identical—admitting, of course, that the branchial sac is a modified pharynx, and that the nerve-ganglion is homologous with the vertebrate brain—and the only point required for the proof of the hypothesis is the demonstration that the neural gland and its duct are epiblastic in formation, and that their development corresponds with that of the pituitary body.

W. A. Herdman

STORING OF ELECTRICITY

SECONDARY batteries to store up currents of electricity in the form of chemical work promise to play so important a part in the ultimate adoption of the electric light, that improvements in their construction are of peculiar interest. The latest innovation is due to M. Faure, who has modified with great success the secondary battery of Gaston Planté by covering the surfaces of the lead plates with a coating of minium, thereby increasing their capacity manifold. This device possesses the additional advantage that it obviates the necessity of "forming" the cells by the tedious process of charging and discharging them for many days, as in Planté's batteries. Two sheets of lead are separately coated with minium and are rolled together in a spiral, being kept apart by a layer of felt, and are then placed in a

[1] "Recherches sur l'Organisation des Ascidies simples—sur l'hypophyse et quelques organes qui s'y rattachent dans les genres *Corella*, *Phallusia*, et *Ascidia*. Par Charles Julin, Assistant du Cours d'Embryologie à l'Université de Liège.

[1] "Weitere Studien über die Entwicklung der einfachen Ascidien" (*Arch. f. microsc. Anat.*, vol. vii.).

[2] "Zur Entwickelung der einfachen Ascidien" (*Arch. f. microsc. Anat.*, vol. viii. 1872).

vessel containing dilute acid. When a current is passed into this cell the minium on one plate is reduced to metallic lead that on the other is oxidised to the state of peroxide. These actions are reversed while the charged cell is discharging itself. According to M. Reynier one of these cells made large enough to weigh 75 kilograms may store up energy sufficient to furnish afterwards one-horse power of work for an hour.

A correspondent of the *Times* of Monday gave an interesting account of an experiment he witnessed in Paris of storing electrical energy by the method adopted by M. Faure.

"A Faure battery, or *pile secondaire*," he states, "was charged with the electric fluid direct from the ordinary Grove battery and in my presence. It may be more economically done from a Gramme or Siemens machine. The receptacle consisted of four Faure batteries, each about five inches diameter and ten inches high, forming a cylindrical leaden vessel, and containing alternate sheets of metallic lead and minium wrapped in felt and rolled into a spiral wetted with acidulated water, and the whole placed in a square wooden box measuring about one cubic foot and weighing some seventy-five pounds. This was protected by a loose wooden cover, through which the electrodes (in lead) protruded, and were flattened down for convenience of transport. This box of 'electric energy' was handed to me by M. Faure at my request, with the object of submitting it for examination and measurement to our eminent electrician, Sir William Thomson, F.R.S., at the University of Glasgow. I had the box by me all through the journey from Paris on Tuesday night (last week), including a five hours' delay at Calais. I arrived at Charing Cross at 11 a.m. on Wednesday, after running the gauntlet of customs and police authorities, who suspiciously looked askance and seemed to doubt my statement that my box only held 'condensed lightning,' and contained no infernal machine or new explosive destined to illustrate some diabolical socialistic tragedy. From time to time on the journey I tested the force of the discharge and found it to have well maintained its energy. From London to Glasgow required only another ten hours, and finally, in about seventy-two hours from the time of charging in Paris, I had the satisfaction of presenting to Sir William Thomson M. Faure's rare offering of a 'box of electricity,' intact and potent, holding by measurement within that small space of one cubic foot a power equivalent to nearly one million of foot pounds! This wonderful box is now deposited in the laboratory of the Glasgow University, under the vigilant eye of its director, and being submitted to a series of tests and measurements, the results of some of which made Sir William exclaim, 'Why, it's a little witch.'" With reference to this Sir Wm. Thomson writes to us under date May 17:—"I had the marvellous box under trial for seventy-two hours before I left Glasgow yesterday, giving it successive charges, and discharging to various degrees, measuring approximately the whole quantity sent in during the charge, and taken out in the discharge. Thus I shall be able to calculate the amount of energy spent, and the amount recovered under various conditions. Mr. J. T. Bottomley continues the trials in my absence. A considerable time must pass before I have results to publish."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—The report of the Botanic Garden Syndicate, as it now stands, recommends the admission of members of the Senate into the Garden on Sunday afternoons from three to six during the present summer, and as an experiment only; three friends may be introduced at the same time, their names being written in a book. Only one entrance is required to be opened, and the curator or his deputy and one policeman are to be present. The number of signatures of residents in favour of this change is very large. Prof. Babington objects, and so do the heads of Queen's, Pembroke, and St. Catherine's Colleges, Professors Cowell and Westcott, and several resident clergymen.

At Trinity College W. R. Sorley (second year) has been elected to a Foundation scholarship for Moral Science, and D'Arcy Thompson (first year) to a Scholarship for Natural Science; E. D. Ritchie (Winchester) and W. B. Ransom (Cheltenham) to Exhibitions of 40*l.* for Natural Science. At King's College S. F. Harmer has been awarded the Vintner Exhibition for Natural Science, and A. P. Laurie (Edinburgh Academy) an Exhibition of 50*l.* for two years.

Mr. Lea is lecturing, in Dr. Foster's advanced course, on the Physiology of Vision.

Mr. Hicks is taking an examination class in Elementary Botany at Sidney College.

Dr. Vines' course of botany this term is one of Morphology, chiefly cryptogamic, with practical work.

The first M.B. Examination commences on June 13, the second on June 7, the third on May 10; the M.C. Examination on June 13.

The open mathematical lectures this term are those of Mr. Dale (Trinity) on Heat, and Mr. Taylor on Higher Plane Curves, Mr. Besant (St. John's), on Sound and Vibrations, Mr. Webb (Emmanuel) on the Potential and Green's Theorem, and Mr. Temperley on Finite Differences.

The first part of the Natural Sciences Tripos begins on June 6.

IN the report of the last Local Examinations (December, 1880) it is stated that the juniors answered satisfactorily in Botany, while the descriptions of specimens by the seniors and their answers in Vegetable Physiology were very weak. In Zoology the seniors did better relatively than the juniors, but practical work was largely deficient. In Geology the answering was bad, and the practical knowledge of specimens extremely meagre.

LONDON.—At the presentation day last week at the University of London, when the certificates of degrees and honours won by the successful students at the late examinations were distributed, three ladies received certificates of matriculation, and four degrees of B.A. Earl Granville said that this year they had lost by death Sir Philip Egerton, a man of great cultivation, who had always shown the greatest interest in the work of the University. There were other losses which they regretted, but which carried some consolation with them, as being highly to the credit of the University—as, for instance, the departure of Dr. Greenfield, who had for so long been identified with the Brown Institution, to Edinburgh University. They were perhaps aware that in 1852 Mr. Brown had left a sum exceeding 20,000*l.* for the creation of an institution for the investigation and cure of diseases peculiar to animals useful to man, the donor expressing a desire that the University of London should appoint a committee of their body or of medical men outside to scientifically carry out his views. Ten years ago that institution was established, and during that period few or no cases of interest to it had been discussed in which it had not taken a leading part. These investigations had, he believed, been carried on in a manner which promised the greatest possible advantage, not only with regard to the diseases of animals, but also to those of man. During the past year 3870 animals had been cured, and as an example of the great kindness with which the patients were treated he would relate the following anecdote:—A distinguished member of the Senate was driving along the road in which the institution was situated when suddenly his hack cab came to a dead stop. He asked the driver whether his animal was lame or ill, but the driver answered, "No sir. I never can get him past this place since he had his corn cured here; he likes it so much that he always wants to stop." Results had shown that the University was justified in extending the limits of its operations to the Brown Institution. After careful consideration it had been determined to extend the examinations into the science and art of teaching, for which purpose a scheme had been prepared, which would shortly be carried out. As a member of a Government which adopted as its first principle economy of public funds he was glad to be able to give an instance that this did not always degenerate into niggardly stinginess. Their application to the Treasury for the establishment of a practical museum of natural history to enable them satisfactorily to carry on examinations on their own premises had been most liberally met, and he hoped that in a very short time such a department would be opened.

THE annual distribution of prizes to the successful students at the London School of Medicine for Women took place on Wednesday last week. The report stated that up to the present eighty-six pupils had been received, of whom forty-four are now attending. Nine of these were studying for the University of London, four were amateurs, and the remaining thirty-one were training for examination by the College of Physicians in Ireland. Altogther twenty-five ladies had now been declared qualified to practise. The report of the treasurer, the Right Hon. James Stansfeld, M.P., stated that the expenditure had been 2018*l.*, of which one-half had been provided by the students' fees. The subscriptions had been 626*l.* 17*s.* 6*d.*, as against 723*l.* 15*s.* 6*d.*

last year; and the donations 33*l.* 2*s.*, as against 18*l.* There had been several large legacies realised, amongst them one of 4050*l.* from Mrs. George Oakes.

MANCHESTER.—We understand that a sum of 1500*l.* has been offered by a benefactor to the Council of Owens College for five fellowships of 100*l.* a year, each renewable for a second or third year, the conditions being that they shall be awarded on evidence given by the candidates of their past work in literature or science, and on their satisfying the electors as to their subsequent devotion to original work. The scheme is as yet only under consideration. We likewise understand that Mr. Waterhouse is preparing plans for completing a portion of the buildings required for Owens College, including museums for natural history, geology, and mineralogy, and for the lecture-rooms and laboratories required for the professors of the above subjects.

On Saturday next (May 21) Prof. Boyd Dawkins, F.R.S., will begin the seventh series of Field Lectures in Geology, at Miller's Dale Station, Derbyshire. That and the two following Saturdays will be devoted to the examination of the Carboniferous rocks of the Pennine Chain. On Saturday, June 9, the class will visit the British Museum (natural history) under the guidance of Dr. Woodward, F.R.S., for the study of the mammalia associated with Pleistocene Man. On June 10 the brickfields at Crayford and Erith, in Kent, will be visited under the guidance of Mr. F. C. Spurrell; and on the 11th the subject of the Antiquity of Man will be finished by an examination of the collections of prehistoric archæology in the British Museum (Bloomsbury).

THE Queen has directed letters patent to be passed under the Great Seal granting and declaring that the degrees of Bachelor and Master of Arts and Bachelor and Doctor of Medicine, of Laws, of Science, and of Music, granted or conferred by the University of Adelaide, South Australia, on any person, male or female, shall be recognised as academic distinctions and rewards of merit, and be entitled to rank, precedence, and consideration in the United Kingdom and in the colonies and possessions of the Crown throughout the world, as fully as if the said degrees had been granted by any university of the United Kingdom.

SCIENTIFIC SERIALS

Journal of the Royal Microscopical Society for April, 1881, vol. i. ser. ii. part 2, contains—Prof. P. Martin Duncan, on a Radiolarian and some Microspongidæ from considerable depths in the Atlantic Ocean (plate 3).—Dr. Lionel S. Beale, the President's address.—Prof. E. Abbe, on the conditions of orthoscopic and pseudoscopic effects on the binocular microscope.—A. D. Michael, on a species of Acarus believed to be unrecorded (plate 4).—Prof. E. Abbe, on the estimation of aperture in the microscope. The summary of current researches, pp. 217–364.—Proceedings of the Society. (In the summary of current researches appears a memoir by Mr. Crisp, "On Aperture, Microscopical Vision, and the Value of Wide-Angled Immersion Objectives," in which the whole subject is very exhaustively and clearly put.)

Annalen der Physik und Chemie, No. 4.—Experimental investigation of the connection between refraction and absorption of light, by E. Ketteler.—On the ratio of intensity of the two sodium lines, by W. Dietrich.—On the condensation of gases on surfaces in their relation to pressure and temperature, by H. Kayser.—Influence of pressure on the surface-tension of liquids, by A. Kundt.—Variations of the vapour-density of some esters with pressure and temperature, by P. Schoop.—On differences of tension between liquids touching each other, with reference to concentration, by E. Kittler.—On electric ring-figures and their alteration of form by the magnet, by E. Reitlinger and F. Wächter.—On the divergence of Ampère's theory of magnetism from the theory of electromagnetic forces, by J. Stefan.—On some remarks of Herr C. Neumann on electrodynamics, by R. Clausius.—The law of Clausius and the motion of the earth in space, by E. Budde.—On the extent of the electric expansion in glass and caoutchouc, by Dr. J. Korteweg and V. A. Julius.—The glass plate battery, by Th. Erhard.—Some remarkable properties of flames, by W. Holtz.

American Journal of Science, April.—Monograph by Prof. Marsh on the Odontornithes, or toothed birds of North America, by G. B. Grinnell.—On some elements in orographic displacement, by W. J. McGee.—On the indices of refraction of certain compound ethers, by J. H. Long.—On the Whitfield County, Georgia, meteoric iron, by W. E. Hidden.—The basin of the Gulf of Mexico, by J. E. Hilgard.—On the geology of Florida, by E. A. Smith.—The magnetic survey of Missouri, by F. E. Nipher.—American sulpho-selenides of mercury, by G. J. Brush.—Analysis of Onofrite from Utah, by W. J. Comstock.—Effect of great cold on magnetism, by J. Trowbridge.—Channel fillings in Upper Devonian shales, by H. S. Williams.—A new order of Jurassic reptiles (Cœluria), by O. C. Marsh.—Discovery of a fossil bird in the Jurassic of Wyoming, by the same.—American pterodactyls, by the same.

Journal of the Franklin Institute, March.—Experiments with the Perkins machinery of the *Anthracite*, by Mr. Isherwood.—The wearing power of steel rails in relation to their chemical composition and physical properties, by Dr. Dudley.—Note on steam cylinders, by Prof. Marks.—Novel mode of originating an index wheel, by Dr. Grimshaw.—The polarisation of sound and the nature of vibrations in extended media, by Prof. Robinson.—Gyroscope model for class-illustration, by Dr. Rand.

Reale Istituto Lombardo di Scienze e Lettere. Rendiconti, vol. xiv. fasc. vii.—Grafts of the vine, by Count Trevisan.—On the determination of maximum moments, &c. (continued), by Prof. Clericetti.—On two rare helminths of reptiles, by Prof. Pavesi.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, April 28.—"The influence of Stress and Strain on the Action of Physical Forces." By Herbert Tomlinson, B.A. Communicated by Prof. W. Grylls Adams, M.A., F.R.S. Part I.—Elasticity. "Young's Modulus."

The values of "Young's modulus" were determined for several metals by a method devised by Sir W. Thomson.

A large number of experiments with different loads were made, and after a great many unsuccessful attempts to account for certain discrepancies which could not be explained away as errors of observation, the following facts were elicited:—

1. After a wire has suffered permanent extension, the temporary elongation which can be produced by any load becomes less as the interval between the period of permanent extension and that of applying the load becomes greater.

2. This increase of elasticity is greater in proportion for large loads than for small ones.

3. The increase of elasticity takes place whether the wire be allowed to remain loaded or unloaded between the period of permanent extension and that of the testing for the elasticity.

4. The *rate of increase* of elasticity varies considerably with different metals; with some the maximum elasticity is apparently attained in a few minutes, and with others not till some days have elapsed, iron and steel being in this last respect very remarkable.

5. The elasticity can also be increased by heavily loading and unloading several times, the rate of increase diminishing with each loading and unloading.

6. A departure from "Hooke's law" more or less decided always attends recent permanent extension, even when the weights employed to test the elasticity do not exceed one-tenth of the breaking weight.

7. This departure is diminished very noticeably in the case of iron, and much less so in the case of other metals, by allowing the wire to rest for some time either loaded or unloaded; it is also diminished by repeated loading and unloading.

The effect of permanent extension on the value of "Young's modulus" was tried according to the direct method for iron and copper, and indirectly for most of the metals.

From both the direct and indirect methods results were obtained which showed:—

1. That, in all metals, provided the wire has not been kept heavily loaded for some time before testing, permanent extension produces decrease of elasticity, if the strain be not carried beyond a certain limit.

2. That, if the extension be carried beyond the above-mentioned limit, further permanent increase of length causes increase of elasticity.

3. That, in the case of iron, heavy loading for some time so increases the elasticity that, even when the extension would have caused diminution of elasticity without such continued loading, the latter will, if sufficient time be allowed, change this diminution into an increase; in the case of copper this is not so.

The effect of suddenly chilling steel heated to a high tempera-

ture was found to be similar to that of excessive permanent extension of iron.

Several experiments were made to test the effect of permanent torsion and permanent extension on the modulus of rigidity.

From these experiments it was concluded :—

1. That the loss of rigidity produced by twisting or stretching a wire beyond the limits of elasticity is partly diminished by rest.

2. That the loss is more sensible with large arcs of vibration than with small ones.

3. That the influence of rest is more apparent in the case of large vibrations than in that of small ones.

4. That continual vibrating through large arcs has a similar effect on the rigidity to that produced on the longitudinal elasticity by heavily loading and unloading. And—

5. That in the case of hard steel the effect of vibrating through a large arc for several minutes makes temporarily the rigidity as determined from such vibrations greater than that determined from smaller vibrations.

The influence of an electric current and of magnetism on the torsional rigidity of metals was also investigated, and the following results arrived at :—

1. The torsional rigidity of copper and iron is temporarily decreased by the passage of a powerful electric current, but is very little, if at all appreciably, altered by currents of moderate intensity.

2. The torsional rigidity of iron is temporarily diminished to a small but perceptible extent by a high magnetising force.

3. The effects mentioned in 1 and 2 are independent of any changes produced by the current in the temperature of the wire.

Finally, certain critical points are alluded to, there being at least two such for each metal, at which sudden changes take place in the ratio of the permanent extension produced by any load and the load itself.

May 5.—"On the Structure and Development of the Skull in Sturgeons (*Acipenser ruthenus* and *A. sturio*)," by W. K. Parker, F.R.S.

I must refer the reader to Prof. Salensky's[1] invaluable work on the development of the sterlet (Kasan, 1878), unfortunately published in *Russian*, and to the second volume of Mr. Balfour's new work, for an account of the earliest stages of the *Acipenserine* embryo.

Even in larvæ one-third of an inch in length, the cartilage was becoming consolidated, and I was able to work out, by sections and dissections, the structure of the cranium and visceral arches; the one specimen which was seven-twelfths of an inch in length, and which was made into a large number of extremely thin sections, left nothing to be desired.

The development of the skull of the sturgeon is very similar to what we find in the sharks and skates ("Selachians"), but the suspension of both the mandibular and the hyoid arches by one pier, derived from the hyoid (the *hyostylic* skull), which is seen in the Selachians on one hand and in the Holostean Ganoids and Teleosteans on the other, attains its fullest development in the "Acipenseridæ," or Chondrosteous Ganoids; for in them the "symplectic" is a separate cartilage, and not a mere osseous centre as in *Lepidosteus* and the Teleostei.

Here I find a very noticeable fact, namely, that whilst in the salmon the metamorphosis of the simple primary arches of the face can be followed step by step, in the sturgeon the peculiar modification of the arches shows itself *during chondrification;* the hyoid arch, from the first, is inordinately large.

Notwithstanding the huge size of the sub-divided hyoid pier, its head only articulates in the larva with the auditory capsule; later on the basal cartilage reaches it, as in the Selachians.

But the arches that retain their normal size lend no colour to the theory that the visceral arches are related by their dorsal ends to the paired cartilages that invest the notochord, a state of things like that seen in the ribs and in the superficial cartilaginous hoops that surround the huge pharynx of the lamprey.

Mr. Balfour has demonstratively shown that in the branchial region, when the pleuro-peritoneal cavity has been sub-divided by the hypoblastic outgrowths of the pharynx, the aortic arches lie *inside* the small temporary "head cavities," or remnants of the once continuous sub-division of the body wall into an inner layer, the "splanchno-pleure," and an outer layer, the "somato-pleure."

But the aortic arches mount up, on each side, *outside* the proper branchial arches, which become grooved to receive them; these arches must therefore be considered as developments of the temporarily separate "splanchno-pleure"; they cannot be classed with the *costal* arches, which are developed in the permanently distinct "somato-pleure."

My dissections and sections, both of this type and of the Selachians, show, without leaving room for doubt, that all the visceral, or, properly speaking, *branchial* arches, mandibular, hyoid, and post-hyoid (branchial proper) are developed in the outer walls of the large respiratory pharynx, quite independently of the base of the skull and the fore part of the spinal column.

I have at last ceased to contend for true branchial or visceral arches in front of the mouth, and also to look upon the mouth and the openings around or in front of it as more than mere *involutions* of the epiblast; the *first cleft* is that between the mandible and the hyoid arch, the first arch is the mandibular.

With regard to the skull, it is now very evident that the "trabeculæ cranii," even in their furthest growth forwards from the end of the cephalic notochord, are merely *foregrowths* from the moieties of the investing mass (the parachordals), the true axis of the cranial skeleton ending under the fold of the mid-brain. The "cornua trabeculæ," and the "intertrabecular" part or tract, are *fresh shoots*, so to speak of cartilage that are specially developed to finish the cranial box and the internasal framework. I fear that my long-cherished *pre-oral visceral arches* will now have to go down and take their place among these *secondary* or *adaptive* growths.

I may remark, in concluding this very imperfect "abstract," that the sturgeon is a very important type for the morphologist to get clear light upon.

In the Selachians the huge pterygoid foregrowth of the mandibular arch aborts the apex of its pier, whose *function* is supplied by the hyo-mandibular; fragments only are developed in its upper part.

In the sharks from *one* to *three* mere "rays" are developed in front of the small upper remnant of the first cleft ("spiracle"); in skates there is, as a rule, a small separate piece, the true apex of the arch, its "pedicle." In one kind, however, the torpedo, four such fragments appear on each side, as shown by Gegenbaur. In the sturgeon there is a most remarkable plate in the common metapterygoid region, its form is rhomboidal; it is composed of a number of well-compacted pieces of cartilage, a middle series of *azygous* plates, and a somewhat irregular arrangement of plates right and left of these. This remarkable structure only exists in the Acipenseroids; it is not found in *Polyodon*.

In the Selachians the "placoid" plates or spines are not brought under the influence of the chondrocranium, which has neither parosteal plates applied as splints to it nor ectosteal plates grafted upon it.

In *Acipenser* there are both parostoses applied to the oral apparatus, and ectosteal centres in the post-mandibular arches; morever, along the side of the skull, in old individuals, plates of bone appear as splints or parostoses, that are manifestly the forerunners of the deeper plates that in the higher Ganoids and the Teleostei form the proper ectosteal bony centres of the more or less ossified cranial box.

The Ganoid scutes of the sturgeon are so far dominated by the huge chondocranium, that *by courtesy* they may be called frontal, parietal, opercular, and the like; of course such scutes are not the accurate homologues of the bones so named in the Teleostei, which at the most can only correspond to the inner layer of the scute of such a fish as the sturgeon.

The sturgeons as a group cannot be said to lie directly between any one family of the Selachians and any one family of the Bony Ganoids, yet on the whole that is their position; the Bony Ganoids on the whole approach the Teleostei, especially such forms as *Lepidosteus* and *Amia*, which have lost their "spiracle," and in other things are less than typical, as Ganoids.

Larval sturgeons are, in appearance, miniature sharks; for a few weeks they have a similar mouth, and their lips and throat are beset with true teeth that are moulted before calcification has fairly set in. Their first gills are very long and exposed, but not nearly so long, or for such a time uncovered, as in the embryos of sharks and skates.

Mathematical Society, May 12.—S. Roberts, F.R.S., president, in the chair.—Prof. C. Niven, F.R.S., was admitted into the Society, and the following were elected members :—I. Rosenthal, B.A. Dublin, C. A. van Velzer, F. Franklin, Ph.D., and Miss Christine Ladd, the last three of the Johns Hopkins

[1] My smallest specimens were the gift of Prof. W. Salensky, the larger of he late Mr. William Lloyd.

University, Baltimore.—The following communications were made:—On Ptolemy's theorem, by Mr. Merrifield, F.R.S.—The summation of certain hypergeometric series, by the Rev. T. R. Terry.—Quaternion proof of Mr. S. Roberts's theorem of four co-intersecting spheres, by Mr. J. J. Walker.—Some solutions of the "15-girl" problem, by Mr. Carpmael.—Note on the co-ordinates of a tangent line to the curve of intersection of two quadrics, by Mr. W. R. W. Roberts.—Shorter communications were made by the President, Prof. Cayley, F.R.S., Mr. Hart, and Mr. J. J. Walker.

Entomological Society, May 4.—H. T. Stainton, F.R.S., president, in the chair.—Two new Members and one Subscriber were elected.—Mr. R. Trimen made some observations on the sexes of *Pieris saba*, *Diadema mima*, and *Papilio cenea*, and exhibited specimens in illustration. He also remarked on *Tinea gigantella* having been bred from the hoof of a dead horse, and on the uncertainty which still exists as to whether the larva of this species ever feeds on living horn or not.—The Secretary read a letter from the Colonial Office respecting the occurrence of *Phylloxera vastatrix* on vines in Victoria.—Mr. A. G. Butler communicated "Descriptions of New Genera and Species of Heterocarous *Lepidoptera* from Japan—*Noctuites*."

PARIS

Academy of Sciences, May 9.—M. Wurtz in the chair.—The following papers were read:—Reply to some criticisms of the note of February 21, on the parallax of the sun, by M. Faye. He invites his English critics to correct his ten numbers according to their best information, and expects they will reach nearly the same result.—On nitrate of diazobenzol, by MM. Berthelot and Vieille. This solid crystalline body ($C_{12}H_4N_2NO_6H$) detonates with extreme violence when heated above 90° (and is thus much more sensitive to heat than fulminate of mercury). It also detonates when struck with a hammer or rubbed. It is now much used in making colouring matters.—On a new derivative of nicotine obtained by the action of selenium on this substance, by MM. Cahours and Étard. The collidine obtained is one of the propylpyridines corresponding to the isomeric position, still unknown, of nicotianic acid. Theory anticipates six collidines of this species. Selenium is found to be capable of removing nitrogen from an organic substance.—On the divisors of functions of periods of primitive roots of unity, by Prof. Sylvester.—On the densities of liquefied oxygen, hydrogen, and nitrogen in presence of a liquid without chemical action on these simple substances, by MM. Cailletet and Hautefeuille. The mixture was chiefly with carbonic acid. The density varied considerably with temperature and pressure. The coefficients of dilatation are so little different that the densities must be sensibly in the same ratio at 0° and at −23°. The atomic volumes calculated are 17 for O, 30·3 for H, and 31·8 for N (dividing each of the atomic weights by the density at −23°, viz. O, 0·89, H, 0·033, and N, 0·44). Gaseous O, H, and N diverge very unequally from Mariotte's law, at the pressures employed (275 and 300 atm.), and there is not then a simple relation between the atomic weight and the density; but on change of state by lowering of temperature in presence of a gas easily liquefiable, the atomic volume is found to reveal a positive relation between density and equivalent weight.—M. de Gasparin was elected Correspondent in Rural Economy, in room of the late M. Kuhlmann.—On displacement of a figure of invariable form in its plane, by M. Dewulf.—On the work-product of secondary batteries, by M. Regnier.—M. Mascart stated that Admiral Cloué, Minister of the Marine, would probably organise an expedition to islands near Cape Horn, taking part in the international scheme of simultaneous observations on terrestrial magnetism, &c.—On seeds of two species of Chinese vines discovered in 1872 by Abbé David in the province of Chen-si, by M. Du Caillaud.—M Vinot submitted a telescope made on a suggestion of M. Caussin. The image formed by one telescope is looked at with another of the same or different power.—Observations of Saturn's satellites at Toulouse in 1879 and 1880, by M. Baillaud.—Observations, elements, and ephemerides of the comet *a* 1881 (discovered by Mr. Lewis Swift on April 31), by M. Bigourdan.—On a system of differential equations, by M. Halphen.—On trilinear forms, by M. le Paige.—On some actinometric measurements made in the Alps in 1880, by M. Puiseux. The total radiation (that diffused by ground and sky as well as that direct from the sun) was found to be increased 0·10 at an altitude of 800 m. and 0·21 at 2100 m. At greater heights (3380 and 3251 m.) the numbers were much higher, but less easy of interpretation, because of snow and mist; the reduced figures were 1·25 and 1·24 (showing good agreement with the others). Phanerogamic plants are found up to 3900 m., and must accomplish all their phases in the three summer months at a temperature below that of a polar summer. Doubtless the intensity of radiation compensates.—Action of light on phosphorescent substances, by M. Clémandot. He notes the confirmation, by M. Yung of Geneva, of his views that the phenomenon is physical, and the vibratory influence strongest in the blue ray. M. Becquerel called attention to his own researches thirty years ago.—Action of light on bromide of silver, by M. Noel. *Ceteris paribus*, silver bromide retains longer the molecular modification impressed on it by the chemical spectrum, the greater its sensibility, and when this first modification disappears it seems to have recovered its initial sensibility.—Action of carbonic acid on baryta and strontium, by M. Raoult.—On the products of action of perchloride of phosphorus on acroleine, by M. van Romburgh.—On the nature of the troubles produced by cortical lesions of the brain, by M. Couty. He rejects the theory of localisations, both on anatomical and physiological grounds.—On the poisonous action of the juice of manioc, by M. de Lacerda. It is not great, and it seems to affect the central nervous system.—On the *rôle* of marine currents in geographical distribution of amphibian mammalia, particularly Otaria, by M. Trouessart. These animals seem to have radiated from Antarctic regions. Their course to the North Pacific, &c., corresponds remarkably with that of certain currents.—Movements of juices and various plant-organs referred to a single cause; variations of hydrostatic tension, by M. Barthélemy.

VIENNA

Imperial Academy of Sciences, May 12.—V. Burg in the chair.—The following papers were read:—C. Claus, on tomora and tomorella.—Prof. L. Ditscheiner, on searching for spots of interruption at insufficiently insulated circuits.—E. Sathey, on the phenomena of exsiccation and imbibition on the involucra of Cymareæ.—Dr. R. Maly, on yolk-pigments.—E. Weiss, on the comet discovered by Lewis Swift (Rochester, U.S.) on May 2, &c.—E. Weiss, on a new method of computation of the apparent anomaly in orbits of great excentricity.—Dr. Zd. Skraup, on cinchonidine and homocinchonidine.

Imperial Institute of Geology, May 3.—The following papers were read:—Prof. Cornel. Doelter, on the geological state of the Cape Verde Isles.—M. Vacek, exhibition of the geological map of Trieste.—Dr. L. Szaynocha, on the occurrence of petroleum at Sloboda Rungurska.—Dr. E. Hussak, on the inclusion of resinous matters in the pycrite porphyry of Steyrdorf.

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