THURSDAY, JULY 15, 1880

THE NEW MUSEUM OF NATURAL HISTORY

MR. WATERHOUSE'S new building at South Kensington has, we believe, been formally handed over to the trustees of the British Museum, and as will be seen by their Report, which we give in another column, it is in contemplation, or was so at the time the report was drawn up, to remove several portions of the natural history collections on to the new site during the present year. Up to this time, however, little has been done in the matter. The only beasts and birds to be seen in the new building are those stone images which it has pleased Mr. Waterhouse to place upon the corbels without and upon the pillars within. It is perhaps only fair that if the inside is devoted to *natural* history the outside should be similarly devoted to unnatural history, and architects must have their way. It may also be observed that if the trustees have really taken possession they have sadly neglected their garden department, for the vacant space round the building, which was nicely laid out last year, has been allowed to become overrun with weeds and rubbish. There are two subjects, we believe, which have caused some delay in the proposed removal—the questions of the library and of the mode of government of the new institution. The last-named and most important point being, as the Secretary of the Treasury had stated, still "under the consideration of my Lords," we will make so bold as to tender them a few words of advice on the former subject which also requires their serious attention.

A Library of Reference is, as we need hardly tell the readers of NATURE, an indispensable addition to a Museum of Natural History. No scientific work can be done without it. Of this we may remark the trustees appear hardly to have been aware, if, as we are informed is the case, there is no special room set apart for a library in the new museum. Had the trustees put aside a thousand a year, out of their annual grant of 10,000*l.* for printed books, for this purpose, when it was first determined to remove the natural history collections ten years ago, there would have been by this time in existence a library fully adequate for the purpose. But no provision of this sort appears to have been thought of, and it is only within the last year or so, when the building is ready and the time is come to remove the natural history collections into their new quarters, that any application for the necessary funds to buy a library has been made to the Treasury.

Now the special function of the Secretary of the Treasury is, as everybody knows, to keep down expenditure. We need not, therefore, be surprised if when the request was made to him for 30,000*l.* to buy a library of natural history books Sir Ralph Lingen stood rather aghast, and demanded time to consider the subject. But even were this great official most benevolently disposed towards the new natural history museum and ready to produce the sum demanded at once it would not by any means enable the trustees to meet the object in view. It is by no means simply a case of going into the market and ordering all the books required of the first bookseller. The greater number of the works required are out of print, and only to be picked up at scattered intervals at second-hand shops. To endeavour to purchase them all at a moment's notice would be simply useless. This is another reason why the policy above recommended of collecting the required library by slow degrees should have been adopted.

There is now in fact only one way out of the difficulty. It is a very simple one, but we fear the trustees will not like it. The naturalists and students of the British Museum have hitherto had the use of the Great National Library, which contains all the necessary scientific books. Let these necessary books be removed along with the collections to South Kensington, not as a *gift*, but as a *loan* to the new institution. Let the trustees devote an annual sum of such an amount as they can conveniently employ to their redemption—that is, to the purchase of second copies of these scientific books. As soon as the duplicates are received at South Kensington let the originals be returned to the British Museum. Thus the Great National Library will ultimately recover its own completeness, while at the same time the new museum of natural history at South Kensington will be able to start work with a perfect library—which could in no other way be provided for it. Moreover instead of having to find some 25,000*l.* or 30,000*l.* at the present moment, the Treasury will be able to spread the necessary expenditure over several years, during which it is certain that many of the rarer volumes unattainable at the present moment will come into the market. The only objection to this plan that we can see is that it will be sometimes necessary to refer an applicant for a particular volume at the reading-room of the British Museum to South Kensington. But when it is once understood that the natural history books are at South Kensington people will very soon learn to go there for them.

The real difficulty in the present situation is that the control of the whole museum is in the hands of the principal librarian, who naturally enough prefers the interests of the library to that of the natural history. He is glad enough to get rid of the beasts and birds, but when you ask him to give up, even temporarily, a portion of the books it is quite another question. Very few of the trustees who are nominally his masters care anything for natural history, so that from that quarter no intervention can be looked for in favour of the scheme we have put forward. The only way in which it can be carried out is by the *vis major* of the Treasury, which, as the plan is not only advantageous, but also economical, should surely be exerted in its favour.

If the Government had taken the advice of the Duke of Devonshire's Commission, and handed over the natural history collections to a director under the control of the Department of Science and Art, there would have been some one sufficiently interested to make a stir on the subject. As the matter now stands the principal librarian can of course do as much as he pleases, and will, no doubt, keep his books in Bloomsbury as long as possible.

ELEMENTARY EDUCATION

LORD NORTON and his friends seem determined to take every opportunity of hunting down the present system of education in Government elementary schools.

Last week the subject was again introduced in the House of Lords, with, as before, an unsatisfactory result. The action of Government with reference to Scottish educational endowments is rather an impressive commentary on the conduct of the obstructives who are so anxious to reduce the standard of education in England. The effect of the Scotch measure will be greatly to extend the means of education for those who usually attend Board Schools, placing as it does at their disposal the education to be obtained in secondary schools, an advantage, we should think, likely to be largely taken advantage of. Until some similar course be taken with reference to England, where so many valuable educational endowments have been diverted from their legitimate purpose, it seems to us cruel rigidly to limit the function of elementary schools in reference to pupils of exceptional promise. Still more cruel is it to turn out the great bulk of the children with an education quite unworthy of the name, and which renders them little better fitted to cope with their surroundings than if they were entirely unlettered. It is our bounden duty, since we insist on keeping children at school till a certain age, to do the best we can for them; and to turn them out equipped with nothing more useful than the three R's is a mere mockery of education. If reading, at all events, is to be a really useful acquisition, let us make them understand that there are things quite as wonderful and quite as well worth reading about as the horrors of the penny dreadfuls. Many of these children, the working men and working women of the future, will have but little time to put the three R's to much use, whereas if well grounded in the elements of one or two of the most useful of the sciences, they will have a continual source of pleasure within themselves, requiring neither books nor pens, but only the exercise of thoughtful observation. That education is admittedly the best which enables one to cope most successfully with the difficulties of his surroundings, and we cannot see how any candid man will deny that for this purpose an accurate training in the science of common things is worth all the books in the world. That the Government system as at present established commends itself to the sense of the people is clear from the fact that Government schools are practically killing all competitors. As to the dread of the over-education of the people, this is a bogy which only needs to be stared at to vanish. Do we find any lack of men and women to do all sorts of work in Germany or France, or in any other country where the people have a really substantial education? In nearly every county of the kingdom are local scientific societies, many of which are composed mainly of working men who have educated themselves into whatever they may know of science; but we have yet to hear that they are more discontented with their position than unlettered Hodge. The real truth is, as is too clearly shown on the Continent, the better educated the working man is, the better workman does he turn out to be. The great mistake is to confound a smattering with a grounding, and this, it seems to us, is the mistake made by Lord Norton and those who side with him, and possibly may account for the opposition to the Fourth Schedule. The exclusive use of such a reading-book as Lord Norton threatens to compile would be the best help to a smattering education; a very few hours a week devoted to a few well-selected experiments, the judicious use of specimens and diagrams, a little training of the observing faculties of children, and the systematic teaching of the great elementary facts of one or two sciences would be a welcome relief to the pupils, and would do far more for their real education than a library of reading-books.

Sir John Lubbock has given notice that he will shortly introduce the subject into the House of Commons; it is inconceivable that that body will permit anything like retrogression in the matter of education; they cannot do so without being liable to the imputation of class legislation. At the best, our working men and working women, it must be confessed, have a hard life of it, many of their hardships resulting from ignorance of the commonest laws and facts of nature. If we wish to make them contented with their lot, let us lighten it by enlightening their minds and giving them the means of making the best of their circumstances. It is against the teaching of all history to maintain that what the retrogressionists are pleased to call over-education will lead to all sorts of political and social evils. It is, history tells us plainly enough, the ignorance, and not the enlightenment, of the people that should be feared. The better educated we are all round the more likely are we to keep our foremost place among nations who have already, solely by the superior education of all classes, got ahead of us in some important respects, and the more likely are we to continue to advance by gradual evolution instead of by violent revolution, which always requires a large substratum of ignorance to work with.

ARGENTINE ENTOMOLOGY

Hemiptera Argentina enumeravit speciesque novas descripsit Carolus Berg (*Curonus*). Bonariæ, *ex typographiæ* Pauli E. Coni. Hamburgo, *in biblopolio gassmannii*. (Frederking et Graf, 1879.)

ENTOMOLOGY is finding a new centre in Buenos Ayres; synchronous with the first part of Dr. Burmeister's treatise on the Lepidoptera of the Argentine Fauna, lately noticed in these columns, has appeared the above work on the less popular and very much less known order Rhynchota. In common with many entomologists, we use this last term rather than that of Hemiptera, as written by our author, for the following reasons. Linnæus founded the order Hemiptera, but included therein non-allied insects, to which the name Orthoptera was ultimately applied by Olivier, whilst Fabricius was the first to separate the true "bugs," under the name of Ryngota, which was afterwards linguistically purified into Rhynchota. Not only, however, did the great Swedish naturalist first propound the order Hemiptera, but we are also indebted to Sweden, in the person of the late Prof. Stål, for gathering together with critical and exhaustive care the descriptive work of an intervening century, and, by the help of a splendid collection formed at Stockholm, reducing the classification to a system, and making the study of the order a possibility. It is this system which is followed by Prof. Berg in the modest work under notice, which is not a monograph, but rather an enumeration of the known species, accompanied by descriptions of new ones. The work is therefore special in its character and classificatory in its aim; no biological conclusions are attempted nor structural details given, save such as appertain to generic or specific diagnosis. Its value therefore is to the student of the local fauna and the generaliser in the study of geographical distribution.

The work of course must be considered to a certain extent as introductory only; many species will necessarily be discovered and added to the fauna, whilst of those described it is equally probable that some will prove of synonymic value only. The last conjecture becomes almost a certainty when an estimate is made of the difficulties under which Prof. Berg must have worked, so far removed from all the large collections, identifying or separating frequently by the help of poor descriptions, with the impossibility of examining the original types. His descriptions however are very clear, and have as a rule appended the *differentia specifica* from a nearly allied form. It is much to be regretted that this course is not more usually followed by some other entomologists, and it would almost appear in many cases that from being so frequently told by the biological philosopher that descriptive is the lowest form of scientific work, that the describers themselves in despair had done the work in the very lowest manner. It was well said that "some see differences and no resemblance, others resemblance and no difference, whilst some again can see neither the one nor the other," and thus the help acquired from comparative diagnosis appended to an exhaustive description becomes the more necessary when it is not possible to give a figure of the species. Whatever conception may apply in the mind of the individual worker as to the much vexed term "species," it is at least to be expected that the limits of variation can only be estimated by one who has thoroughly studied a group and knows some little of their life histories. It is in this field that the specialist should really be considered a prophet, and in entomology there are not only families but even genera which are so peculiar and unique in the variation of their species that the *variable* might with advantage be added to the *structural* diagnosis. In the Rhynchota this is extremely applicable, even structural characters which are constant and specific in one genus being variable and of no specific value in another, whilst colour and size, generally of no moment, are in some few instances beacons which denote specific differentiation.

In studying a work of this nature we become sensible of the vast unexplored field of entomology. We here possess the identifications and names of the forms constituting a fauna, but by what methods its homogeneity was secured remains still to be discovered. Which species or genera are even pleistocene forms which have been introduced by man, or by other means of involuntary migration, we have at present no record. The interdependence on the botanical geography of the district must always be a factor in the distribution of the noncarnivorous forms of the Rhynchota, and the meteorological conditions of a country will in future be more studied by entomologists who are investigating local faunas.

Prof. Berg has introduced a valuable addition to his work in the descriptions, where possible, of immature forms. Larvæ in this order are most difficult to adequately describe, and we may hope that the author in some subsequent publication may be able to give us illustrations of the same.

W. L. DISTANT

THE HUMAN VOICE

The Mechanism of the Human Voice. By Emil Behnke, Lecturer on Vocal Physiology at the Tonic Sol-fa College. (London: J. Curwen and Sons, 1880.)

THE object of this little book is to give singers a plain and comprehensible view of the musical instrument on which they perform. The author seems to have succeeded in this attempt remarkably well. He has evidently had much practical work himself, and has especially set himself the task of examining the action of the vocal organs during singing by means of the laryngoscope, and his record of his own experience in acquiring the use of that beautiful instrument is not only interesting but of much practical value. The last section of the book is devoted to the teachings of the laryngoscope, as to the action of the vocal ligaments in producing voice, with especial reference to the so-called registers. "A register consists of a series of tones which are produced by the same mechanism," is his definition (p. 71), which is new and complete, and he proceeds to explain the different mechanism of each kind of register as actually observed on singers. There are some good remarks on breathing (pp. 17-22). All information is given throughout in clear, intelligible language, and illustrated by fourteen woodcuts (not all original), which are purposely rather diagrammatic in character, in order not to confuse the eye with too many details at a time, but every essential point is gradually introduced. The author seems to have been diligent in the consultation of authorities as well as in practical work of his own, and the book may be safely recommended to all singers, and others who are desirous of knowing how vocal tones are produced.

There are a few things which may be pointed out in the hope that they will be corrected in a second edition, which ought to be soon required. On p. 4 the author implies that former musical pitch was a major to a minor third flatter than at present. For all music now sung the difference was scarcely more than a semitone. On p. 30, and again on p. 70, he says: "The vocal ligaments, by their vibrations, cut the stream of air passing between them into regular waves." It is difficult to see how these words convey, even metaphorically, a correct conception of what happens. "To cut a stream into regular waves," is not a very intelligible operation. The expression should certainly be altered, and a few lines added to convey the full notion. On p. 37 the author seems to be wrong in considering that glottis (or "tongue" in the singular) refers properly to the vocal ligaments (or "tongues" in the plural). It is merely what he terms the "chink," or the tongue-shaped space between the vocal ligaments as shown in Pl. X. A. He also omits to notice especially the cartilaginous glottis between the pyramids (arytenoids), although it appears in Plate X. C, and XIV., XV., XVI. On p. 44 he gives as a function of the pockets (ventricles of Morgagni) that "they allow the stream of air which has just been converted into tone to expand sideways, thereby materially adding to its resonance." The whole phrase is confused and should be entirely re-written; the conversion of a "stream" into a "tone," and "adding" to the "resonance" of such a converted stream, is very slipshod-writing. On the whole matter of resonance (p. 46) the writer is unsatisfactory. He does not include the cavities between the vocal ligaments and the lid (epiglottis) among the resonating chambers, except in the objectionable passage just cited, and he does not enter into the question of the modification of quality of tone by means of these resonances. By some accident in engraving Plate XIII. the letter w is placed on the windpipe, as well as on the cartilages of Wrisberg, and the vocal ligaments are not distinct enough. All the figures, XIII. to XVI., seem to be copied from the English edition of Madame E. Seiler's "Voice in Singing." It is a pity to waste space in such a little book on controversy. It was hardly necessary to quote Madame E. Seiler at length (pp. 81-90), and then controvert many of her statements. This only tends to confuse the learner. The result should be given from the author's own observations, and then, if desired, the points of difference might be explained in a note. Similarly for the controversy about the action of the "wedges" (cuneiform cartilages) on p. 45, which has no interest or use for a beginner. The space devoted to controverting Mr. Lunn's "Philosophy of Voice" (pp. 52, 69, 70), and to Mr. Illingworth's "hazelnut" theory of the "pockets," and other bits of controversy with Miss Sabilla Novello (p. 30) and Dr. Garrett (p. 32) might also have been saved with advantage.

It takes much space to point out a few minor blemishes that scarcely detract from the general merits of the book, which is clearly the result of much real work and careful observation.

OUR BOOK SHELF

Keith Johnston's Illustrations of Electricity and Magnetism. By W. Lees, M.A. (W. and A. K. Johnston, Edinburgh and London.)

MESSRS. W. and A. K. JOHNSTON have begun an excellent work in issuing these four sheets of diagrams in illustration of the fundamental experiments of electricity and magnetism. The subjects are well chosen, and with hardly any exception well drawn and coloured. They will be welcomed by teachers of science classes in schools for their clearness and general excellence. Mr. Lees, who has prepared them, has also issued a specially-written "Handbook" to accompany each sheet. Of these handbooks—though perhaps useful for such pupil-teachers as may have the misfortune to be set to teach a subject in which they have themselves never made a single experiment—the less said the better. The writer of them is in bondage to the ideas of half a century ago. Take as a specimen the following statement concerning the Leyden jar:—"Suppose, then, the accumulation of electricity in the jar to proceed, the quantity of free electricity in the inner coating goes on also increasing, *until the density of that electricity becomes the same as the density of the electricity of the prime conductor*." The italics are the author's own! This is no more absurd, as a scientific statement, than it would be to say that when a dock-sluice is opened the water rushes in from the higher level until the muddiness of the water inside is as great as the muddiness of the water outside; for the electric equilibrium of two conductors no more depends upon the *density* of their respective charges than does the flow of water upon its degree of turbidity. Yet the writer of this amazing sentence styles himself "Lecturer on Natural Philosophy, Edinburgh"! For the sheets of diagrams themselves we have nothing but praise.

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.*]

A Fourth State of Matter

MR. CROOKES has given us optical evidence of the existence of matter in a state of tenuity known hitherto only indirectly, and considers himself warranted in affirming the discovery of a fourth or ultra-gaseous condition; yet it can scarcely be conceded that he has demonstrated the truth of his views, or that his recent exposition of them has strengthened his position or satisfied the doubts of the sceptical. It is simply a question of the use or misuse of certain specific terms, and it is difficult to follow the logic which justifies the creation of a "fourth state" by the attribution of properties not differing essentially from those of matter in its normal condition. Before his contention be granted it should be proved that the substance under experiment possesses properties exclusively and inalienably its own; as rigidly defined as those which distinguish the solid from the liquid, or the latter from the gaseous.

By the abstraction from his experimental chamber of a large portion of its contents he has enlarged the interstitial spaces of the residual gas, and thus amplified the mean free path of molecular vibration from some millionths of an inch to several inches; but beyond this extension of the path of oscillation there seems nothing to warrant the opinion that the residual gas is essentially other than it was before.

If this amplification of the molecular path be the feature relied on for justifying the term "fourth state"—and this seems the only inference—then further travel in this direction brings us to a point easily within our conception, where the contents of the experimental chamber shall not exceed one or two molecules; and it becomes interesting to know if Mr. Crookes would then add a *fifth* to the other states of matter. To do so would seem the inexorable outcome of his reasoning, and inevitably resolves the question into one of the numerical contents of the chamber; and it rests with him to define the precise point where the ordinary conditions cease, and the *ultra-gaseous* commences.

In gases, whether at the normal density, or rarefied to 3 mm., we have an unbroken continuity of condition; which, contrasted with the solid and liquid forms of matter, is noticeable for the bsence of any point whence a new state can be said to originate: would Mr. Crookes assign a vacuum of 0·999 mm. or one of 0·00003 mm. as the critical point in the attainment of his "fourth state" or some intermediate density?

Again, has Mr. Crookes fully recognised the distinction between the properties of matter *per se* and those which are referable to electrical agency as revealed by the experiments of Messrs. De La Rue and Müller, where the projection of molecules against the walls of the containing vessel is attributed to electrification; or, further, the fact that a tenuity approaching that attained in his experimental chambers has been long familiar to us in the case of steam of very high pressure?

Whatever may be the solution of our speculations regarding the ultimate condition of matter, opinion seems unanimous that the concrete form in which it is known to us consists of an aggregation of particles having immutable properties and composition, gaseous bodies being definite molecular groupings of such particles; and if such be the case, and the chemical character of the contents of Mr. Crookes' experimental chambers remained unaltered, it is difficult, if not impossible, to conceive the existence of any further condition other than that produced by the breaking up of the molecule into its component atoms.

London, July 9 GEO. E. NEWTON

Permanent Record of Foucault's Pendulum Experiment

SOME four years since, while arranging a Foucault's pendulum for use in the class-room, it occurred to me to endeavour to obtain a permanent record of the experiment, and as the results were very good, and the method simple, they may be interesting to others.

The pendulum used was sixteen feet long, the height of my lecture-room at the Massachusetts Institute of Technolgy, and consisted of a cannon-ball weighing about 5 lbs., suspended by a fine steel wire, which at its upper end passed through a hole drilled in an iron plug. The pendulum would continue to vibrate for sixteen or eighteen hours after being set in motion. After obtaining satisfactory results by using a ring of sand in the ordinary manner, a very stiff bristle was attached to the terminal spindle, and under it was placed a thin smoked-glass plate. The resistance was too great to allow the bristle to strike against the plate at each vibration of the pendulum, so that the device was adopted of fixing the plate upon a heavy brass disk capable of being raised or lowered by levelling-screws. This was placed under the pendulum before the latter was set in vibration, and then carefully raised until the bristle scratched its trace on the smoked-glass plate. After two or three oscillations of the pendulum the plate was lowered, great care of course being taken to avoid all possibility of rotation during this operation. At the expiration of fifteen, thirty, or sixty minutes it was again raised, and this process was repeated as often as desired. The inclination of the tracings was beautifully shown, and its amount agreed exceedingly well with that given by theory. With a heavier ball and longer wire even better results might have been obtained, but the motion of the pendulum used was but very slightly interfered with by the friction of the bristle. I should not omit to mention that the details of the experiment were carried out by Mr. F. W. Very, then a student at the institute. CHAS. R. CROSS

Boston, Mass., June 19

The Freshwater Medusa

IN NATURE, vol. xxii. p. 218, Prof. Allman by mistake attributes to me the conclusion that Limnocodium has no marginal canal, and that its radial canals are not pervious. A reference to NATURE, vol. xxii. p. 147, will show that in my first publication on the subject I gave as a character of the new genus "Radiating canals 4, opening into the marginal canal. Marginal or ring canal voluminous." I made the same statement in my communication to the Royal Society on June 17, and have not since deviated from it. E. RAY LANKESTER

Artificial Diamonds

THE process of building up tubes, which Mr. Mallet has been so kind as to suggest to me through your valuable journal, has been tried, but was unsuccessful through the same defect as caused the failure of many of my other experiments, namely, leakage without bursting. Some of the tubes found empty would bear, when cold, a pressure of ten tons on the square inch without leaking, showing that the gases escaped through the porosity of the iron at a high temperature. Hydrogen and hydrocarbons seem to go through iron at a red-heat very easily, and the direction in which I am working is to obtain an impervious coating, or a method of "clogging" the iron, as seems to have sometimes taken place in the carbon experiments.

Experiments conducted since the reading of my paper have convinced me that the crystallisation of silica and alumina may yet be carried out with ease and certainty, and when I have rendered one of these processes a commercial success the experience gained in daily manufacturing operations will enable me to attack the carbon problem with much more certainty of obtaining definite results.

As I shall be writing an account of this work in the autumn I shall feel greatly indebted to any of your readers who, if they come across any not widely known experiments in this direction, will kindly communicate with me, so that I may have all the work done in this direction before me. Suggestions such as Mr. Mallet's are valuable to any worker, as the reactions of one brain must always be somewhat similar unless outside stimuli give new directions to its activity. I am always therefore thankful for either suggestion or corrections. J. B. HANNAY

Private Laboratory, Glasgow

Temperature of the Breath

THE average temperature of the interior of the human body, according to our best authorities, is 98°·6 F. What is the temperature of the breath? It might naturally be supposed that its temperature was the same as that of the interior of the body, or lower, if it is derived from the lungs, into which it is drawn from the cold outer air. But is this so?

The temperature of my body, as shown by the thermometer in the axilla and mouth, is normal, *i.e.*, about 98½°. On rising in the morning, before dressing or eating, I take the thermometer, wrap it up tightly in several folds of a silk handkerchief, and breathe upon it (expiring through the silk immediately over the bulb of the thermometer and inspiring by the nostrils). After five minutes of this operation I examine the thermometer, and find that it indicates a temperature of 106°·2. At 7 p.m., after brisk walking exercise, having eaten nothing since breakfast except a spoonful of boiled rice at 1 p.m., and having drunk nothing but half a tumbler of water and a mouthful of ginger-beer, I take the temperature of my breath in the manner described, for five minutes. I find the thermometer indicates 107°. Again, immediately after dinner, at which only water was drunk, the thermometer shows my breath to have a temperature of 108°. At other times the thermometer will not rise under apparently the same conditions higher than 102° to 105°. A temperature of 109° was observed by the correspondent of an American journal, but he does not mention under what circumstances this occurred.

How is this high temperature produced? It cannot, as a friend suggested to me, be caused by the condensation of the moisture in the breath by the silk handkerchief, for if the temperature of the breath as it issues from the lungs be the same as that of the lungs themselves, *i.e.*, not exceeding 99°, the silk, soon becoming much hotter, would rather tend to volatilise than to condense the moisture of the breath. Is it caused by the friction of the breath upon the fibres of the handkerchief? I know of no observations to show that a high temperature would be so caused. Is it the actual temperature of the breath as it issues from the lungs? If so, then it is by the breath that the system gets rid of its superfluous caloric. For this elevated temperature is not communicated to the blood oxygenated in the lungs; the blood in the left ventricle of the heart (which receives this oxygenated blood) being, according to some physiologists, lower in temperature than the blood in the right ventricle, which has not yet entered the lungs.

The few experiments I have made seem to show that the temperature obtained as above described is higher when the surrounding air is warm than when it is cold. This looks as if more caloric passed off by the breath when less can escape from the general surface of the body.

How these high temperatures are produced in the lungs, if they are developed there, is a mystery. Perhaps some of your readers may be able to explain.

53, Montagu Square, May 27 R. E. DUDGEON

Reversals by Memory

I SHOULD much like to know if it be a common thing for people to *reverse* the positions of objects in the memory. An artist, on returning from the National Gallery, painted the *Téméraire* from memory. Taking his picture to compare it with Turner's, he found to his surprise that he had reversed the positions of the ship, tug, sun, &c. His daughter tells me that if she wants to refer to a passage in a book she as often looks for it on a left-hand page, while it is on a right-hand page, or *vice versâ*. Another lady, on looking at a wood-engraving made from a sketch which she had seen some time previously, asked if the engraver had not reversed everything? These are the only cases known to me.

Is the following universally true?—

Let some one write with a blunt instrument the letter P on your forehead, or anywhere on the front half of the head from ear to ear, and the P must be written backwards for *you* to "see" it correctly. But if it be written anywhere at the back of the head, it must be written correctly both for you and the writer to read it. The change takes place abruptly in a line over each ear. GEORGE HENSLOW

Toughened Glass

THE night before last a lady of my family emptied a paper powder composed of 7½ grains of carbonate of potash and 7½ grains of carbonate of soda into a tumbler of what is called *toughened glass* less than half full of cold water. After stirring the mixture she drank the contents, leaving a silver tea-spoon in the tumbler, and then placed the empty tumbler on the table by her side within perhaps a foot of a burning duplex lamp. About five minutes afterwards a sharp explosion occurred, which startled all in the room. We found the tumbler shattered into fragments, the body of the glass ripped up, as it were, into several large, irregular-curved pieces, and the bottom of the tumbler broken into small pieces more resembling thick rough ice than anything else. Query: Was the explosion caused by the inherent properties of the toughened glass, or by the contact of potash, soda, the silver spoon, and proximity to a lamp, the heat from which was very slight, indeed scarcely perceptible to the hand at the spot where the tumbler stood?

The accident might have been very serious, for pieces of the glass flew to within a very few inches of the lady's face. A solution of the cause of the explosion is therefore of considerable importance to all who may have occasion to use vessels of this peculiar glass. NOBLE TAYLOR

Sunninghill, July 7

Great Meteor

A METEOR of extraordinary brilliancy was seen on Friday, July 9, about 8·20 p.m.—almost in full daylight, the sun having only just set—by the Rev. Mr. Lloyd-Jones, who kindly took me to the place of observation and gave me the following particulars:—

The meteor was quite half as large as the full moon, of dazzling light-blue colour. It moved slowly in a path inclined about 10° to the horizon, from left to right, and emitted a train of ruddy sparks. Mr. Lloyd-Jones was looking in the opposite direction, and had time, after his attention was called to it by a friend, to turn round and see the last 10° of the path. The total duration may have been ten seconds, and could not have been less than five, the meteor dying out slowly. The point of disappearance was carefully noted and referred to some trees about 200 yards distant. I afterwards found it to be in true azimuth N. 69½° E., altitude 9°. No detonation was heard. The place of observation was about two-thirds of a mile east of the Royal Observatory, Greenwich. G. L. TUPMAN

Iron and Hydrogen

MAY I be allowed to point out that the question of the occlusion of hydrogen in steel, and its influence in hardening, has been discussed by Mr. Wm. Anderson in his report to the Committee of this Institution on the Hardening, &c., of steel.

At the last meeting of this Institution Prof. Hughes stated that his experiments did not support the hydrogen theory, but rather the view that hardened steel was an actual alloy of carbon and iron, unhardened steel a mixture only. I may add that experiments are now in progress, designed to test the truth of this latter view. WALTER R. BROWNE
Secretary

Institution of Mechanical Engineers, July 12

The Stone in the Nest of the Swallow

THE swallow stone is the agate pebble, called in French *chélédoine*—the name given to the chalcedony (NATURE, vol. xxi. p. 494), but the same virtue is attributed to the swallow herb. This is the *Chelidonium majus*, about which Britten and Holland, in their "English Plant Names," give the following quotation from Lyte:—"Chelidonium, that is to say, swallowherbe, bycause (as Plinie writeth) it was first found out by swallowes and hath healed the eyes and restored sight to their young ones that had harme in their eyes or have bene blinde."

Littré, in his great *Dictionnaire*, gives two quotations, in which *Chélédoine* is used in a botanical sense:—

"Se vus avez as oils manjue
Dunc prenez celedoine et rue."
MS. St. Jean, 13*th century*.

"Aussi les guerit le jus de cheledoine, le lait de tithymal."—*Pare, v.* 21, 16*th century*.

He also gives its meaning as the name of a precious stone, and adds: "Petits cailloux appartenant aux agates, on dit aussi pierres d'hirondelle." With respect to its etymology he says he derives it from "χελιδόνιον, de χελιδών, hirondelle, à cause qu'on disait que l'hirondelle se servait de cette plante pour rendre la vue à ses petits." WILLIAM E. A. AXON

Fern Bank, Higher Broughton, Manchester

THE CARIBBEAN SEA

THE Coast Survey steamer *Blake*, Commander J. R. Bartlett, U.S.N., Assistant Coast Survey, recently returned from a cruise taking soundings, serial temperatures, &c., in the course of the Gulf Stream, under instructions from C. P. Patterson, Superintendent Coast and Geodetic Survey, has brought very interesting data in regard to the depths of the western portion of the Caribbean Sea.

The depths and temperatures obtained last year in the "Windward Passage" between Cuba and San Domingo were verified, and a few hauls of the dredge taken directly on the ridge in this passage. The data obtained render it very probable that a large portion of the supply for the Gulf Stream passes through this passage, and that the current extends in it to the depth of 800 fathoms. A few lines of soundings with serial temperatures were run from Jamaica to Honduras Bank, *viâ* Pedro and Rosalind Banks, and it was found that the temperature of 39½°, obtained at all depths below 700 fathoms in the Gulf of Mexico and the Western Caribbean, could not enter through this portion of the sea. But the temperature at the depth of 800 fathoms on the ridge in the "Windward Passage" between Cuba and Hayti was found to agree with the normal temperature of the Caribbean and Gulf of Mexico, viz., 39½°. Soundings were taken between Hayti and Jamaica, developing a general depth between these islands not exceeding 800 fathoms, except where broken by a remarkably deep channel connecting the waters of the main Caribbean south of San Domingo with those north of Jamaica. This channel runs close to Hayti with a greatest depth of 1,200 fathoms, and a general depth of 1,000 fathoms. Its course is northerly along the western end of Hayti, where it does not exceed a width of 5 or 6 miles; thence westerly, south of Navassa Island, with a tongue to the northward between Navassa and Foxmigas Bank, and another to the westward between Foxmigas Bank and Jamaica.

A line of soundings was run from San Iago de Cuba to the east end of Jamaica, where a depth of 3,000 fathoms was found 25 miles south of Cuba. This deep place was found by subsequent soundings to be the eastern end of an immense deep valley extending from between Cuba and Jamaica, to the westward, south of the Cayman Islands, well up into the Bay of Honduras. The Cayman and the Misteriosa Bank were found to be summits of mountains belonging to a submarine extension (exceedingly steep on its southern slope) of the range running along the south-eastern side of Cuba. This deep valley is quite narrow at its eastern end, but widens between the western end of Jamaica and Cape Cruz, where the soundings were 3,000 fathoms within 15 miles of Cuba, and 2,800 fathoms within 25 miles of Jamaica. Near Grand Cayman the valley narrows again, but within 20 miles of this island a depth was found of 3,428 fathoms. The deep water was carried as far as a line between Misteriosa Bank and Swan Islands, with 3,010 fathoms within 15 miles of the latter. On a line between Misteriosa Bank and Bonacca Island there was a general depth of 2,700 fathoms, and a depth of over 2,000 fathoms extended well into the Gulf of Honduras. Between Misteriosa Bank and Chinchorro Bank the soundings were regular at 2,500 fathoms. North of Misteriosa and Grand Cayman, to the Isle of Pines and Cape San Antonio, the soundings were generally 2,500 fathoms. The serial temperatures agree, in relation to depth, with those obtained in the Gulf of Mexico, by Lieut. Commander Sigsbee, and in the Eastern Caribbean by Commander Bartlett; decreasing from the surface to 39½° at 700 fathoms, or less, and constant at that temperature for all depths below 700 fathoms. At greater depths than 600 or 700 fathoms the bottom was always found to be calcareous ooze composed of Pteropod shells with small particles of coral. These Pteropod shells, as noted in previous expeditions by different nations, appear to be an important factor in the determination of the movements of great bodies of sea-water. The ridge at the "Windward Passage" is bare coral rock, and on the south side the Pteropod shells were found to be much more numerous than to the northward of the ridge. Soundings and serial temperatures being the special objects of the course, dredgings were only incidentally attempted for the purpose of reconnoitring, as it were, the ground, and it was found that the area passed over was not nearly so rich in animal life as that in which dredgings were taken last year under the lee of the Windward Islands at the eastward of the Caribbean Sea.

The development of the extraordinary submarine valley in the western Caribbean Sea is a matter of great interest considered as a physical feature. This valley extends in length 700 statute miles from between Jamaica and Cuba nearly to the head of the Bay of Honduras, with an average breadth of 80 miles. Curving around between Misteriosa Bank and Yucatan, and running along between Cuba and the ridge of the Caymans for a distance of 430 miles, with a breadth of 105 miles, it covers an area of over 85,000 *square miles*, having a depth nowhere less than 2,000 fathoms, except at two or three points (the summits of submarine mountains), with a greatest depth, 20 miles south of the Grand Cayman, of 3,428 fathoms, thus making the low island of Grand Cayman, scarcely 20 feet above the sea, the summit of a mountain 20,568 feet above the bottom of the submarine valley beside it—an altitude exceeding that of any mountain on the North American continent, above the level of the sea, and giving an altitude to the highest summit of Blue Mountain in Jamaica, above the bottom of the same valley, of nearly 29,000 feet, an altitude as great, probably, as that of the loftiest summit of the Himalayas above the level of the sea.

For the deepest portion of this great submarine valley the Superintendent of the Coast and Geodetic Survey has adopted the name of "Bartlett Deep."

ALBANIA AND THE ALBANIANS

ABOUT the dawn of authentic history the Balkan peninsula seems to have been mainly occupied by two kindred Aryan peoples—the Hellenes in the south, the Thrako-Illyrians in the north. Since then, or, say, for some 3,000 years, this region has been swept by more numerous tides of migration than almost any other country on the globe. Some of these waves, such as those of the Kelts 300 years before, and of the Goths 400 years after, the Christian era, receded without leaving any permanent traces behind them. Some, such as the Romans, are still represented by the Dako-Rumanians of the Danubian principalities and their southern kinsmen, the Zinzars or Kutzo-Vlachs of the Pindus range and Thessaly. Others, such as the Ugrian Bulgars, have been absorbed or assimilated to the Slaves, intruders like themselves, while others again have either resettled the land, as, for instance, the Serbo-Croatians, or else, like the Osmanli of Tûrki stock, have seized the political control without making any serious attempts at colonisation. The result is a condition of things absolutely without a parallel elsewhere—an utter chaos of races, languages, religions, a clash of social interests and national aspirations, which has long threatened the peace of the world, and the means of reconciling which the wisest heads have hitherto failed to discover.

But beneath and above all these strange vicissitudes and endless complications the two relatively aboriginal elements of the population still here and there hold their ground. The Hellenes have doubtless been largely Slavonised almost everywhere on the mainland,[1] although even here the old Dorians are still believed to survive in the Zakonians of the Spartan hills and the Mainotes of the Tænarum peninsula. The northern branch, also, of what has not inaptly been called the Thrako-Hellenic family still predominates, and even retains a certain vitality, in the Albanian highlands. Thracians, Pæonians, Dardanians, Mœsians, and all the other eastern and northern members of the race have long been extinct as independent nationalities; but the Illyrian or western branch still continues to be represented by the Shkipetars in their original home, on the south-eastern shores of the Adriatic.

[1] "La Grèce devint une Slavie, et l'idiome général fut une langue Slave" (E. Reclus, i. p. 62).

The term Albania, it is needless to say, possesses no administrative significance, nor even any very strictly-defined geographical limitations. It is purely an ethnographic expression, though even in this sense no longer quite conterminous with the people from whom it is derived. In its widest extent Albania stretches from the Montenegrin and Servian frontiers southwards to Greece, and from the Pindus, Grammos, and Char Dagh ranges westwards to the coast. Within this area are comprised three nearly coincident physical and ethnical divisions, for everything here seems to run in triads, so that the more technical data necessary to understand a somewhat intricate subject may be conveniently summed up in the subjoined series of triplets:—

I. THREE NATURAL DIVISIONS.—1. *Upper Albania*, reaching as far south as the river Shkumbi, about 41° N. lat., and mainly comprised in the Drin basin. 2. *Central Albania*, between the Shkumbi and Voyussa rivers, mainly in the Ergent basin. 3. *Lower Albania*, or *Epirus*,[1] thence to the present Greek frontier (Akarnania).

II. THREE POLITICAL DIVISIONS.—The Turkish vilayets of *Isgodra* (*Skutari*), *Monastir* or *Qosowa*, and *Yanina*, the two former stretching eastwards beyond the actual limits of Albania proper, most of the third awarded to Greece by the Berlin Conference, which has just concluded its labours in connection with the settlement of the new Turko-Greek frontier.

III. THREE GREAT LAKES.—Those of Skutari, Okhrida, and Yanina, convenient landmarks, a curve described through which from about Antivari to Prevesa, both on the coast, will roughly mark the inland frontier line of Albania proper.

IV. THREE MAIN RACIAL ELEMENTS.—1. The old Thrako-Illyrian, now everywhere largely intermingled with 2, The Slav (Serbo-Croatian branch) in the north, and with 3, The Hellenic (Dorian branch) in the south.

V. THREE COLLECTIVE ETHNICAL OR NATIONAL NAMES.—1. *Shkipetar*, the most general national appellative of the people, whence Shkiperia (in the Northern dialect Sipenia) the country, and Shkipeia, the language; from root Shkip, Shkup = rock; compare Greek, σκόπελος; Latin, *scopulus*; and Ptolemy's old Dardanian town of Skupi. Hence Shkipetar = hillmen, highlanders, according to the most accepted interpretation. 2. *Albanian*, unknown, at least in this form, to the natives, yet of respectable antiquity, and now mainly current in the west of Europe and Greece. The word is usually referred to the Keltic or Aryan root *alb*, *alp* = height, snowy crest, and has been connected with Ptolemy's Albani, a small tribe whose chief town was Albanopolis, north-west of the Lychnitis Palus (Lake Okhrida). As a general name it occurs first in the Byzantine writings of the eleventh century under the two forms Ἀλβανοί and Ἀρβανίται,[2]

[1] That is, Ἤπειρος, or "Mainland," so called no doubt originally by the Greeks of the adjacent island of Korkyra (Corfu)

[2] Kedrenus, Skylitzes, Anna Comnena. In Georg. Akropol. ("Annals," c. 68) occurs the expression τὸ τῶν Ἀρβανιτῶν ἔθνος. The forms Arberi or Arbernia for the land, and Arbereshi for the people are even still current amongst the Northern Albanians, and must at one time have been very general, for the various Albanian colonies settled in South Italy since the latter half of the fifteenth century even now call themselves Arbrèsh or Arberesh, and their language Arbrishte or Arberishte. In Greece also Ἀρβανιτία and Ἀρβανίτης are current as equivalents of Ἀλβανία and Ἀλβανός.

and from the latter seems to have been formed, 3, *Arnaut*, the general Turkish designation, though more strictly applicable to the Muhammadan Albanians. Thus Arnaut, Albanian, and Shkipetar, all traceable to roots meaning rock, height, would be practically synonomous, and aptly descriptive of an essentially "highland" race.

VI. THREE MAIN ETHNICAL DIVISIONS.—1. *Gheg* (Gepides) in Upper Albania, as far south as River Shkumbi, and penetrating eastwards across the Morava Valley nearly to Sophia, with detached enclaves in Servia, but on the other hand partly Slavonised on the Montenegrin frontier. Elsewhere the Ghegs are taken as the purest representatives of the old Illyrian stock. This word, the origin of which is unknown, was a term of contempt originally applied to them by their southern kinsmen. It has thus come into general use, although never employed by the people themselves, who use either the collective designation Shkipetar or the particular name of their tribe. 2. *Toshk* or *Tosk* (Toskides) in Central and Lower Albania, wherever not Hellenised. Originally confined to the Toskides proper of Toskeria, a small district on the right bank of the Lower Voyussa north-west of Topedelen, this word has also gradually acquired general currency, and so far differs from the corresponding Gheg that it is accepted and used by the people themselves, at least throughout the whole of the Voyussa basin. 3. The *Epirots* of the Vilayet Yanina from the remotest times largely intermingled with the Dorian Greeks, and now almost completely Hellenised. The term is of course rather geographical than ethnical, but very convenient in view of the political changes now pending in this district. In connection with these changes it will be useful to note that the Pindus range between Epirus and Thessaly is occupied by the Kutzo-Vlachs (the Kara-Guni or "Black Capots" of the Turks), with decided Hellenic proclivities, religious, political, and social, though still speaking a corrupt Rumanian (neo-Latin) tongue. Even in Epirus the Toshk itself, wherever still spoken, is largely mixed with Greek elements, and most of the Toshks themselves are here bilingual, speaking Greek and their mother tongue indifferently, while in Yanina, capital of the vilayet, Greek has long been supreme. Consequently the contemplated transfer of this territory to Greece, with which it has been uninterruptedly associated from prehistoric times,[1] cannot seriously affect the integrity of the Albanian race or do any undue violence to their legitimate national aspirations.

VII. THREE RELIGIONS: 1. *Muhammadan* everywhere, but rather more general in the south than the north; 2. *Orthodox Greek*, almost exclusively in the south; 3. *Roman Catholic*, of Latin rite, almost exclusively in the north. From this it follows that the Ghegs are partly Moslem, partly Roman Catholic; the Toshks partly Moslem, and partly Orthodox Greek; the respective numbers being as under, as far as any such estimates can at all be depended upon in Turkey:—

	Moslem.	Orthodox Greek.	Catholic (Latin).	Total.
Ghegs ...	400,000 ...	50,000 ...	150,000 ...	600,000
Toshks ...	600,000 ...	200,000 ...	— ...	800,000

The diffusion of Muhammadanism no more implies the presence of Túrki elements in Albania than it does in Herzegovinia or amongst the Bulgarian Pomaks of the Rhodope Mountains. Like causes have produced like results in all these places, and in Albania, when resistance ceased with the death of George Castriota, most of the influential and better classes adopted Islam, while the peasantry, who never had much to lose or gain either way, remained christian. We sometimes hear it said that religion is a racial test in Turkey, but from this it is evident that the statement can be true only in a negative sense. It is safe to say that here no Christians are of Tûrki stock; but the converse is very far from being the case, for we see from this table that in Albania alone there are no less than 1,000,000 Muhammadans who are not of Tûrki, but of Illyrian stock, apart always from a few Osmanli officials and others in the large towns.

TRIBES.—It is not a little remarkable that the country which might almost be regarded as the cradle of European civilisation has itself remained nearly stationary since the rude Dorians issued forth from the mountains of Epirus to the conquest of Peloponnesus. Of all the western Aryans the Albanians alone have remained in a semi-pastoral state, and retained the primitive tribal organisation. Both branches of the race, but especially the Ghegs, are still divided into a considerable number of *phis* or *phar*,[1] that is, clans or septs, some of which, such as the Suliots in the south, and the Mirdites in the north, have acquired historic renown. George Castriota, the Scanderbeg, or "Alexander the Great" of the Turks, who almost single-handed for thirty years stemmed the torrent of Osmanli conquest, was Prince of the Mirdites, and the astounding valour and self-devotion of the Suliots form one of the most stirring episodes in the Græco-Turkish wars during the early part of the present century. Recently also such tribal names as those of the Klementi, Hotti, Dukazin and others have been heard of in connection with the present political troubles on the Montenegrin and Albanian frontiers. As such troubles are likely to be of a protracted character, pending the definite settlement of the new northern and southern frontier lines, the readers of NATURE will probably be glad to have in the annexed table a complete classification of all the Albanian tribes:—

GHEGS.	MIRDITES:—	Dukazin; Dibri; Mats or Matia; Oroshi Fandi; Kushneni, Spachi; Kuchi
	PULATI:—	Giovagni; Planti; Kiri; Summa; Toplana; Dushmani; Shalla; Shoshi
	Other semi-independent tribes.	Klementi; Hotti; Shrelli; Kastrati Rechiluho; Rioli; Posripa; Kopliki Grica Gruemir; Busagwit; Grudda; Trepchi
TOSHKS.		Toshks proper of Toskeria; Yapides or Liapes; Kheimariots; Khamides or Khumis Tyames; Suliots

Of all the tribal associations by far the most important are the Mirdites, who, although numbering scarcely over 20,000 altogether, form a powerful political factor in the country. They constitute a Roman Catholic oligarchy, whose chief town is Orosh, where resides their prince or chief. The confederacy is fully recognised by the Porte, to which it is tributary. Amongst them has long been prevalent the custom of marrying none but Turkish, or rather Muhammadan, women, carried off from the plains and baptised in the mountains. Their territory lies chiefly south of the Drin, and with the Pulati ("Men of the Woods"), Klementi, Hotti, and other highland tribes between the head streams of that river and Lake Skutari, they are often collectively called Malliesor or "Black Mountaineers."[2] But they must not on that account be confounded with the neighbouring Montenegrins, as some writers have recently done.[3]

Of the Toshk tribes the most influential are the Toshks proper on both banks of the Lower Voyussa; the Yapides or Yagys, who are the Lapides, Liapes, or Lapes of the Greeks, on the Akrokeraunian coast range as far south

[1] Here were the famous Oracle of Dodona and the no less famous rivers Acheron and Cocytus, which play such a conspicuous part in Greek mythology, and here was one of the early seats of the Dorians before they migrated southwards.

[1] Terms probably referable to the same Aryan roots as the Greek φῖτυ, implying blood relationship, and φρατρία, a wider tribal signification.

[2] From *mal*, mountain, and *sy*, black.

[3] F. Bianconi ("Ethnographie et Statisque de la Turquie d'Europe," Paris, 1877), speaking of the Kuchi, Klementi, Pulati, and Mati, says (p. 45) that "toutes ces races sont Slaves." But Ritter zur Helle von Samo ("Die Völker des osmanischen Reiches," Vienna, 1877), with his usual accuracy, includes them amongst the independent Albanian tribes of the Vilayet of Skutari. So also E. Reclus (I. p. 188) and Vivien de Saint-Martin (Art. Albanie, p. 59):—"Leurs tribus les plus notables sont au nord du Drin inférieur, entre les confluences des deux branches supérieurs du fleuve et le lac de Scutari les *Klementi*, les *Hoti*, les *Kastrati*, et les *Poulati*, ou gens des forêts."

as the River Pavla,[1] and the Khamids or Khamis between the Pavla and Kalama Rivers over against Corfu. Many of the Khamids, however, have already been Hellenised, and the rest form detached communities everywhere surrounded by Greek-speaking populations, as correctly indicated on the ethnological map of European Turkey and Greece recently published by Stanford of Charing Cross.

Including the Albanian colonies since the fifteenth and sixteenth centuries settled in South Italy and Sicily, and many scattered Toshk settlements in the Morea, Attica, Eubœa, and the Archipelago, the whole race numbers at present considerably over a million and a half, as under:—

Upper Albania (Ghegs)	700,000
Central and Lower Albania (Tosks)	680,000
South Italy and Sicily	180,000
Greece and Archipelago	90,000
	1,650,000

LANGUAGE.—The broad distinction between the northern and southern branches of the race—Illyrians or Ghegs, and Epirots or Toshks—dates from the earliest historic records, and was clearly recognised by antiquity. The parting line between the two was much the same then as now, being fairly indicated by the famous Roman road, the Via Egnatia, running from Dyrrachium (Durazzo), on the Adriatic, through Okhrida and Bitolia (Monastir), to Thessalonica (Saloniki), on the Ægean. North of this great highway dwelt the Illyrians, Dardanians, and Pæonians, all closely allied in speech, south of it the Epirots and Southern Macedonians, also represented as originally of kindred speech and like customs, though both were later on largely Hellenised.[2] The difference between the northern and southern dialects still persists in Albania, where alone the Thrako-Illyrian language survives, the Gheg and Toshk standing in much the same relation to each other as High to Low German, or even to Danish. Hence the extreme northern and southern tribes are almost mutually unintelligible, although the the Toshks and Ghegs of the border districts (Ergent and Shkumbi valleys) are able to converse together. The Italo-Albanian Demetrius Kamardas accordingly takes the speech current in this central tract as the common "Illirio-Epirotic" standard.[3]

The linguistic affinities of Albania were long a source of great trouble to philologists, and its claims to membership with the Aryan family were only finally established beyond dispute by J. G. von Hahn.[4] But its position within the family itself can scarcely be said to have yet been satisfactorily determined. Bopp[5] compared it, after his usual method, chiefly with Sanskrit, while others have regarded it as simply an archaic or even a corrupt variety of Greek.[6] The truth would seem to lie between these extremes, and a more exhaustive study of the subject will probably show that in Albanian we have the only surviving link between the Asiatic and Græco-Italic branches of the Aryan family. An analysis of the southern dialect shows that of its roots about one-third are common to Æolic Greek, one-third to Italic, Keltic, Teutonic, and Slavonic, the rest consisting of an unknown element assumed to represent the speech of the ancient Thrako-Illyrians. The Italic, Keltic, Teutonic, and Slavonic words may be referred partly to their common Aryan inheritance, partly to contact possibly in prehistoric, certainly in historic times—the Keltic invasion third century B.C.; Gothic irruption under Alaric; Roman rule of five centuries; Serb occupation of Upper Albania to the Drin from 640 to 1360 A.D.; Bulgarian occupation of the central districts till 1019.

But what has been called the Æolic Greek element seems rather to date from a common pre-Hellenic period, for it often presents a more primitive phonetic system, and more archaic grammatical and lexical forms than the oldest Greek extant—forms which cannot be derived from Greek, but which are intermediate links between Hellenic and Asiatic Aryan. Thus the Albanian *bolnesa* = *will* (noun) explains the Greek βουλομαι for βολνομαι, connecting it with the Sanskrit *varnamai*. Alb. *dera* = *door*, stands between Gr. θύρα and Sans. *dvâra;* Alb. neër or niër = *man* between Gr. ἀ-νήρ and Sans. *nar*. Here the organic *a* has become *e* both in Alb. and Gr., but Alb. has not taken the prosthetic α, a sufficient proof that it does not derive from, but belongs to an older period than, Greek. Grammatical forms point in the same direction. Thus the Alb. genitive in *îye*, as in *atîye* = *of him*, answers to the Sans. *sia*, *sya*, and to the old Gr. εῖο, εο, οῖο = ου, as in ἐμεῖο, ἐμέο, ἐμοῖο, ἐμου. The numerals, often so instructive in comparisons of this sort, place the matter in a still clearer light. Thus Alb. *nyê*, *nya* = *one* = Gr. εἷς for ἕν-s, neutral ἕν; κаттερ = *four*, has the organic *k*, which in Gr. becomes *t* (τέτταρ-ες), Sans. *katvar*, *katur*, Lat. *quatuor*. Compare also Alb. *gvash-te* = *six* with the Sans. *shash* and Gr. ἕξ, where the Alb. *g* forms the intermediate stage between the original sibilant and the Gr. rough breathing. In *shetta-te* = *seven* Alb. retains the sibilant, here standing on the same level as Sans. *saptan*, as compared with Gr. ἑπτά for σεπτά.

In other instances Albanian shows great corruption and phonetic decay, as might be expected in a rude, uncultivated tongue never reduced to writing till quite recently. But the corruption and decay always proceed on different lines from those followed by Greek in its evolution. Thus Alb. *nēn-te* (Skutari dialect *nān*) and Gr. ἐννέα = nine, have both lost the digamma preserved in the Sans. *navan*, from which each flows in independent channels: Alb. *nefan*, *nean*, *nēn*, *nān;* Gr. ἀννεϝαν, ἀννεϝα, ἀννέα, ἐννέα, here prosthetic α causing reduplication and loss of final ν.

The general tendency of Albanian, as of French, is towards short and contracted forms, the suppression of middle and weakening of final vowels to *e* mute or *eu*. This, combined with a somewhat barbarous system of orthography, half Greek, half Latin, which has here been replaced by a simple phonetic system, gives the language a decidedly rough and uncouth look, though it is by no means deficient in harmony, and what Kamardas finely calls a certain Hellenic "aura," so that "at times we fancy we are listening to Greek instead of Albanian utterances.)"[1]

The determination of the true position of Albanian is of such importance in the history of Aryan speech that the reader will probably excuse this somewhat dry excursus.

TYPE.—From many of the foregoing indications it is obvious that the Albanians can by no means be regarded as a pure race. In popular works of travel or fiction a certain halo of romance is thrown over the people, who are represented as endowed with almost classic symmetry of form and beauty. This is to some extent true in the south, where intermixture with the kindred Hellenes could scarcely be otherwise than beneficial, and even in

[1] Here was Ptolemy's Albanopolis, and here is a maritime canton still called Arberia or Arberi, and in Gheg Arberia, that is, Albania. The interchange of *r* and *l* is a prevailing feature in Albanian, as in French, Chinese, Polynesian, and so many other tongues. The peasantry about Frascati and elsewhere in the Campagna call the English *Ingresi* for *Inglesi*.

[2] Thus Strabo (vii.): "Leaving Epidamnus and Apollonia (Durazzo and Polini) to follow the Via Egnatia, we have on our right the peoples of Epirus, bordering on the Sicilian Sea as far as the Gulf of Ambracia, and on our left the Illyrian highlands and the peoples of that region as far as Macedonia and the Pæonians."

[3] "Saggio di Grammatologia comparata sulla Lingua Albanese," Leghorn, 1865, p. 19.

[4] In his classical work "Albanesische Studien," Jena, 1854.

[5] "Ueber das Albanesische," Berlin, 1855.

[6] Amongst others the anonymous author of the introductory remarks to Stanford's Ethnological Map, who (p. 8) speaks of the Albanians as "Greeks in their original and elementary condition," a fact "now clearly established . . . by the study of the Albanian dialect, which modern comparative philology has shown to be but *another form of the Hellenic language*."

[1] "Una certa aura, per così dire, d'ellenismo, che ti fa talora credere d' udire parole greche invece di albanesi." *Op. cit.*, p. 19.

the extreme north, where the elements here absorbed belonged to some of the best Slav blood—Serbs and Montenegrins. But the plain and often even repulsive features met with in some of the central districts would seem to point at fusion with the Ugrian or Volga Finn Bulgarians, whose headquarters were at Okhrida, and who at that time (8th and 9th centuries) had not yet been Slavonised. Nevertheless, the Albanians are on the whole a fine and even a handsome race, with long head, oval face, long thin nose, rather high cheek bones, small eyes, generally grey or blue, hair often fair or light brown, long neck, broad chest, slim and upright figures. But descriptions of course vary with the experiences of the observer. Thus while Pouqueville speaks rather of black eyes, others describe the Toshks as essentially a blue-eyed and light-haired race. In general the purest type is found in the district between the Shkumbi and Voyussa, where Kamardas says that the language also is spoken in the greatest purity. North and south of this district both people and language are more or less intermingled with Slav and Hellenic elements respectively.

A. H. KEANE

REPORT OF THE BRITISH MUSEUM

THE Parliamentary Report of the Trustees of the British Museum, which has been lately issued, tells us that during the past year much progress has been made in arrangements for removal of the natural history collections, and in preparations for their reception in the new buildings designed for them at South Kensington. New cases and fittings have been provided and erected for the departments of botany and mineralogy, and in part for that of geology; and the transference of these three collections to the new museum will probably be effected in the course of the present year. The galleries vacated by these collections will be at once made use of for the exhibition of objects of archæological interest which have been accumulating for many years, and from want of space have been stored away in imperfectly-lighted rooms in the basement of the British Museum.

The whole of the zoological and geological portions of the India Museum at South Kensington, together with the friezes from the Amravati Tope and other remains of ancient sculpture, have been made over by the Secretary of State and Council of India to the Trustees of the British Museum. The sculpture will be exhibited in the Museum; the zoological and other collections have been removed to the New Natural History Museum at South Kensington.

Turning to Prof. Owen's special report on the departments of natural history, we are told that part of the work during the past year has been that of the preparation of the collections for the pending transfer to South Kensington.

In the department of zoology Dr. Günther informs us that not less than 45,881 specimens have been added to the several parts of the collection; of this, however, more than half is attributable to the collection of exotic butterflies, bequeathed to the nation by the late William Chapman Hewitson. This is one of the most extensive and valuable collections of this group of animals that has ever been formed; it consists of 24,624 specimens referable to 5,795 species, many of which have been described by the testator in his "Exotic Butterflies," "Diurnal Lepidoptera," and other works. The collection is in a perfect state of arrangement and preservation, and by Mr. Hewitson's direction a catalogue of its contents has been prepared and printed at the expense of his estate. The testator attached to this bequest the condition that the collection should be called the "Hewitson Collection," and should be kept in good order, preservation, and condition, and in the same cabinets, and in the same order and arrangement, and under the same nomenclature as they should be at the time of his decease, until the expiration of twenty-one years from that time.

Another important addition to the national collection of insects made during the last parliamentary year was the Wollaston collection of St. Helena Lepidoptera, consisting of 364 specimens, and including types of thirty-eight species, collected and described by Mrs. Vernon Wollaston. This must be regarded as one of the most important acquisitions of last year, as the accurate and perfect knowledge of the fauna and flora of so isolated a locality as St. Helena at a given period will enable future investigators to determine exactly the changes which are taking place in oceanic islands, not only with regard to the composition of their fauna and flora, but also with regard to the specific characters of the animals and plants imported into them.

Four additions have been made to the well-known series of zoological catalogues in 1879, namely, the fourth volume of Mr. Sharpe's "Catalogue of Birds"; an octavo volume by Mr. C. O. Waterhouse, containing descriptions of typical specimens of coleoptera, illustrated by coloured plates; a volume containing descriptions of a number of new species of hymenoptera by the late Mr. Frederick Smith, which the lamented author left nearly ready for publication at the time of his death; and the third volume of Mr. Butler's "Illustrations of Typical Specimens of *Lepidoptera heterocera*."

Mr. Waterhouse's report on the Geological Department and Mr. Story Maskelyne's on that of Mineralogy succeed that of Dr. Günther, but we observe nothing of very special interest contained in them. Mr. Carruthers' report on Botany records an important addition to that department in the shape of the extensive herbarium of the late John Miers, F.R.S., &c., the distinguished botanist, which he bequeathed to the Trustees. It contains the types of the species described in his numerous systematic works and memoirs, as far as they were in his own possession, together with an extensive series of South American plants from various collectors, and many valuable collections from other regions of the world. Besides the plants Mr. John W. Miers has presented to the department the large series of original drawings made by his father from the living plants in South America and from dissections of plants in later years.

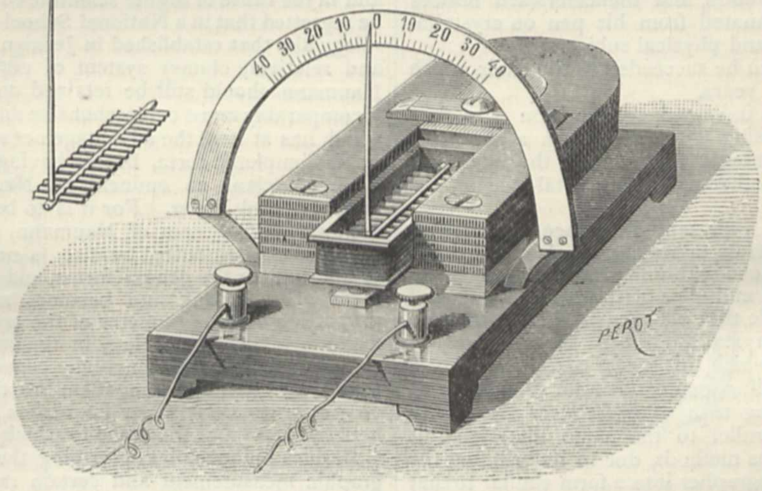
MARCEL DEPREZ'S GALVANOMETER FOR STRONG CURRENTS

PRACTICAL electricians have laboured up to the present time under a considerable difficulty in attempting to measure the strength of very powerful electric currents, such as are, for example, employed in the production of the electric light. There has been no simple instrument suited to the rapid direct measurement of the strength of such currents, much less one that would measure any fluctuations of short duration. Ordinary galvanometers have not been equal to the task, being adapted for a different class of work, usually of too high a resistance to be safely introduced into the circuit, and in general too leisurely in their movements to afford indications of any rapid fluctuations.

Although the current furnished by a good dynamo-electric machine, such as those of Gramme, Siemens and Brush, may for most practical purposes be considered both continuous and uniform, the construction of these instruments could hardly leave any doubt on *a priori* grounds that the current really consists of a number of successive impulses, which, although they may, as it were, run into one another and yield a continuous current, yet cause the strength of the current to be continually increasing and diminishing in rapid alternations; and indeed the telephone shows clearly that this is the case, for a low humming sound is heard in that instrument when its terminals are joined to the two ends of an insulated wire, part of the length of which is laid parallel and near to the conducting-wire of the dynamo-electric machine. M. Deprez's new galvanometer shows by the most direct evidence that this is the case, for when inserted in the circuit of any dynamo-electric machine its needle is observed to be in incessant vibration.

The only instrument constructed previously to that we are about to describe, suitable for measuring strong currents, was the tangent galvanometer of Dr. Obach, the essential feature in which consisted in the conducting-ring being made movable about a horizontal diameter, and therefore capable of being adjusted by inclining it at a greater or less obliquity to any degree of sensitiveness between its maximum and zero, the horizontal component of the magnetic force of the current circulating in it being zero when the ring was laid over into a horizontal plane.

M. Deprez's galvanometer is, however, a much more handy instrument, its indications are almost instantaneous, and the deflections with very strong currents are not unreasonably great. To secure this end it has been necessary to make the needle of the instrument very light, and at the same time to give it a very great directive force by placing it in an artificial "field" of very great intensity. The needle consists of twelve or fifteen little pieces of soft iron wire set side by side transversely



Marcel Deprez's Galvanometer for very strong currents.

upon an axis of brass which is supported between two pivots. The axis carries also a light hand or index of straw or aluminium fixed at right angles to the little iron needles. This compound needle is placed between the limbs of a powerful permanent magnet made of separately magnetised laminæ superposed upon one another (as suggested by Scoresby and Jamin), and is thereby powerfully magnetised and directed into the horizontal plane. The coils of conducting wire are carried round the needle by being wound upon a light rectangular frame which surrounds the needle, but lies within the limbs of the permanent magnet. When a current passes the needle jumps almost instantaneously to its position of equilibrium, its oscillations being of extremely short duration. M. Deprez has also tried needles made up of several superposed layers of the thin sheet iron used in telephones, but the form shown in the figure is, on the whole, the most satisfactory in practical operation. One advantage possessed by the instrument is that it is independent of gravity and of the magnetism of the earth, and can therefore be used anywhere in any position. It will, therefore, be found to be a very convenient instrument for electrical engineers, but as its readings are not capable of being translated into values representing current-strengths by any simple trigonometrical function, sines or tangents, it would require to be graduated empirically by a process similar to the method of "calibration" adopted for ordinary galvanometers by Melloni, before it could be regarded as more than a convenient galvanoscope.

PROF. W. H. MILLER

IT is only just to the memory of a man conspicuous within the circle of a not very large scientific class that more than a passing word should be spoken over his grave before the grass has grown on it.

William Hallows Miller, whose life began with the century, has lived far enough into it to experience what is a happy fate for a scientific man; he has seen the chief work of his life bear fruit; has seen the system he introduced holding its place in the face of other systems, and recognised more and more as a permanent addition to the agencies with which man may grapple with the problems that nature presents to him; he has seen it developed, but not superseded.

Crystallography was Miller's science. It had taken its first shape in the hands of Haüy in the decade of years before he was born, and in those of Weiss, of Mohs, and especially of Franz Ernst Neumann and of Grassmann, it had been receiving development during the years of Miller's growth and manhood.

The chair of mineralogy at Cambridge was filled previously to 1832 by Dr. Whewell, and a well-known memoir on the geometrical treatment of crystal forms which Dr. Whewell contributed to the *Transactions* of the Cambridge Philosophical Society gave an impetus to the study of crystallography in England which launched Miller on his career. For, taking this memoir and Neumann's treatise of 1823 (*Beiträge zur Krystallonomie*) as his starting-point, Miller, who was a pupil of Whewell's, proceeded to develop a system of crystallography which was not published till 1838, but which was the most important work of his life.

Dr. Whewell had already for some time recognised in his pupil the ability and accuracy that marked him out for the career he afterwards pursued, and in 1832 the historian of the inductive sciences resigned his chair and used his disinterested influence to obtain the appointment of Miller as his successor.

Previously to this, in 1825, Miller had taken his degree as a fifth wrangler, and he obtained some reputation as a tutor. In 1831 he published an elementary treatise on hydrostatics, and in 1835 one on hydrodynamics. They bore the mark of the same concise and precise treatment, and excision of all that was merely explanatory, which gave afterwards its character to his treatise on Crystallography, and probably deterred the ordinary student from that subject far more than any real difficulties inherent in the science.

Already in 1829 he had published a crystallographic notice of the forms of ammonium carbonate, followed in 1830 by two other memoirs, and thenceforward notices from time to time emanated from his pen on crystallography and on optical and physical subjects.

Miller was thirty when he succeeded to the chair, which he occupied forty-eight years.

The system of Weiss indicated the position of a face on a crystal by expressing its intercepts on a system of axes in the form of integer multiples of the intercepts (parameters) of some other selected crystal-face on the same axes.

The system of Miller represented the face by a symbol composed of three numerals, or indices, which are the denominators of three fractions with unity for their numerator and in the ratio of the multiples of the parameters ; and he asserted the principle that his axes must be parallel to possible edges of the crystal.

The elegant way in which this mode of representing a face lent itself to yielding expressions for the relations between faces belonging to a zone (*i.e.* faces that would intersect in edges parallel to the same line) gave it superiority over previous methods, due to its bringing the symbols of the crystallographer into a form similar to that employed in algebraic geometry. But though expressions were given for the relations connecting four crystal planes in a zone, the principle lurking in them of the rationality of the anharmonic ratios of four such planes was not recognised, or at least was not announced as such, by Miller till 1857, nor were the further results deducible from this principle ever propounded by him. It was by a pupil of Axel Gadolin's and by V. von Lang independently that the limitations imposed by this principle on the varieties of crystal symmetry were first set forth; but Bravais had already deduced the necessity for these limitations by a parallel method of reasoning founded on the idea of what may be termed a net-pile of the centres of mass (*Raumgitter*), that is to say, a parallepipedal system of arrangement of molecules. But Miller's work consisted in working out into a beautiful system the indicial method of notation and calculation in crystallography, and obtaining expressions adapted for logarithmic computation by processes of great elegance and simplicity. The faces of a crystal he followed Neumann, Whewell, and Grassmann in representing by normals to the faces, which are conceived as all passing through a common point; and this point is taken as the centre of an imaginary sphere, the sphere of projection. The points, or poles, in which the sphere is met by these normals, and which therefore give the relative directions in space of the faces of the crystal, can have their positions on the sphere determined by the methods of spherical trigonometry. Moreover a great circle (zone circle) traversing the poles of any two faces will traverse all the poles corresponding to faces in a zone with them.

By the aid of the stereographic projection, which Miller also adopted from Neumann, he was able at once to project any of these great circles on a sheet of paper with a ruler and compasses, and for the purposes of the crystallographer elaborate edge-drawings of crystals become of comparatively little importance. Miller's system then gave expressions for working all the problems that a crystal can present, and it gave them in a form that appealed at once to the sense of symmetry and appropriateness of the mathematician.

His book at length became recognised by physicists and by the higher school of crystallography as one to supersede what had gone before it, as is evidenced by its having been translated into French by no less a man than Senarmont, into German by Grailich, who added a valuable chapter to it on crystallographic physics, and into Italian by Quintino Sella, and by its being now almost universally employed in crystallographic physics.

The future development of crystallography, there can be little doubt, will follow on the lines laid down by Miller, whatever may be the direction that development will take ; and in the cause of higher scientific education, it is much to be regretted that in a National School of Mining and Mineralogy like that established in Jermyn Street the elaborate and relatively clumsy system of notation introduced by Naumann should still be retained, to the exclusion of an incomparably more comprehensive and reasonable system which has at least the advantage not only of being English in its completed form, but of having been originated by mathematicians so eminent as Neumann, Grassmann, Whewell, and Miller. For it is to be borne in mind that the (so-called) system of Naumann, apart from his long superseded geometrical treatise, is nothing but a system of notation for the general forms, and not for the particular faces of a crystal, and becomes more complicated in proportion as the symmetry of the crystal is more simple, while it is entirely useless in the methods of computation, its symbols being actually converted by the modern crystallographer who uses them into the Millerian symbols on every occasion when he wishes to deduce relations between faces and the zones to which they belong.

Besides his memoirs describing the results of crystallographic measurement and certain tracts such as that on the gnomonic projection and on the crystallographic method of Grassmann, Miller published in 1863 a tract on crystallography which was, in fact, a second edition of his original treatise.

In 1852 he published his great work, for it was all his own, on Mineralogy, modestly entitled a new edition of the "Elementary Introduction to Mineralogy, by the late William Phillips," by H. J. Brooke and W. H. Miller. The publication of this severe little volume was an epoch in the science it illustrated. It contained a mass of results obtained by Miller with all his accuracy and all his patience through many years, and tabulated in his usual concise manner. It may be said to have fired the zeal and directed the general form of the greater but still uncompleted work of his friend Des Cloizeaux. It is a monument to Miller's name, though he almost expunged that name from it. Like other work of his it may be merged in the larger works of newer men, but it will not be superseded, and will always have to be referred to.

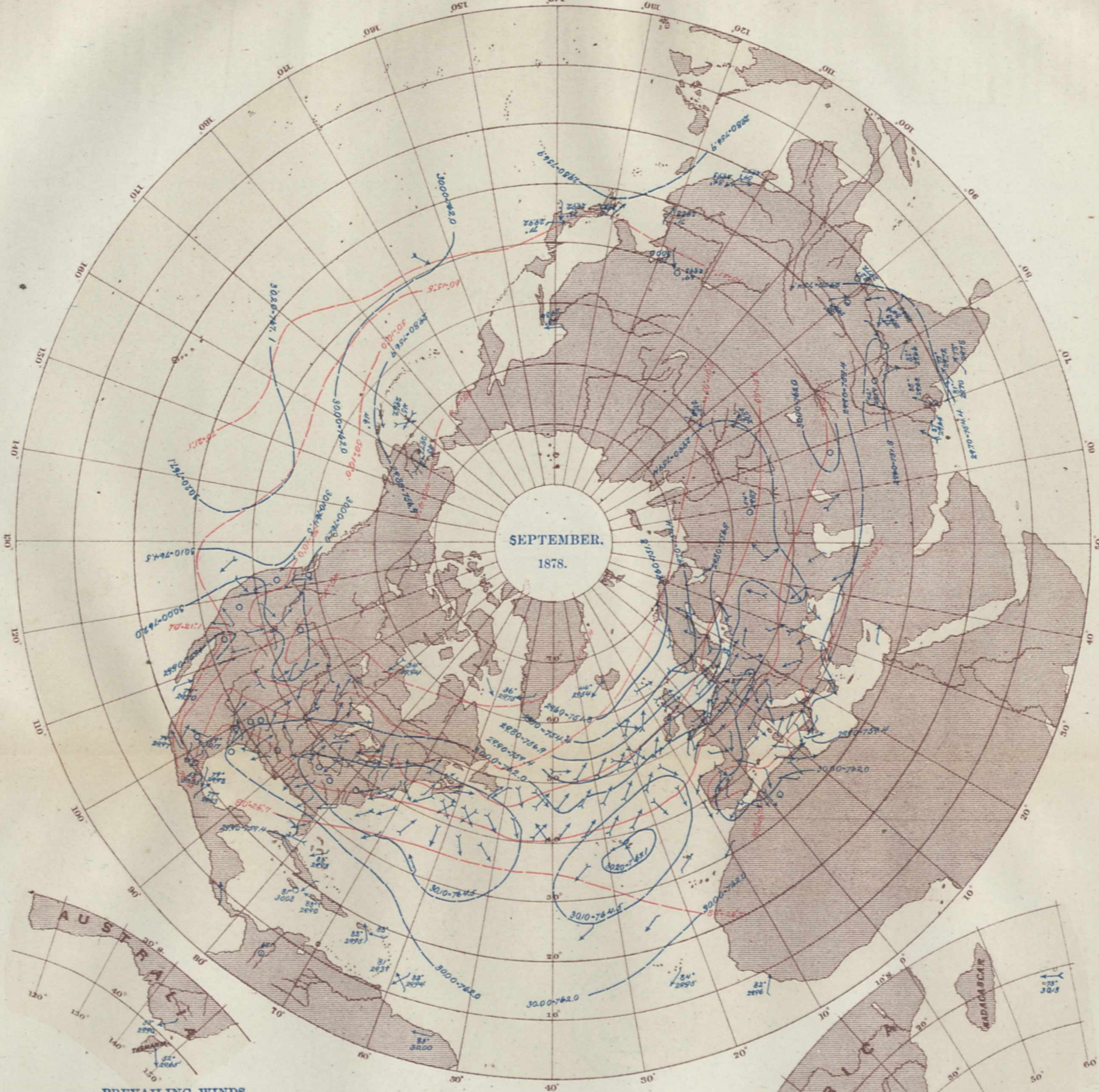
One of the great works of Miller's life was the restoration of the standards lost in the fire which destroyed the Houses of Parliament. The microscopic accuracy of his mind here had a congenial task ; and another conspicuous quality of that mind had to be brought into play in devising the elaborate precautions to be taken in order that the balances and apparatus employed might be sufficiently sensitive, and at the same time absolutely accurate when considerable weights were under determination. Indeed there was no faculty for which Miller was more remarkable than this of devising readily the most simple means of making an experiment and the apparatus needed for it.

His room at the Cambridge Museum was a storehouse of such simple and almost improvised furniture, embracing forms of apparatus needed by a crystallographer and observer using optical instruments : a little heliotrope suggested to him by a crack in the window of a railway

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously. Series commencing September, 1877.



PREVAILING WINDS.

Arrows show the direction of, and fly with, the wind.
Force is shown as follows:

Symbols.	Force.	Velocity. Miles per hour.	Velocity. Metres per second.
	1, 2	0 to 9	0 to 4.0
	3, 4	9.1 to 22.5	4.1 to 10.1
	5, 6	22.6 to 40.5	10.1 to 18.1
	7, 8	40.6 to 67.5	18.1 to 30.2
	9, 10	67.6 up.	30.2 & over.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of September, 1878, based on the daily charts of the International Bulletin

ISOBARS AND ISOTHERMS.

Isobars in *blue*; detached barometer means in English inches.
Isotherms in *red*; detached temperature means in degrees Fahrenheit.

carriage; a clock of wondrous simplicity and accuracy, the motive power of which was a drop of water, a fresh drop always waiting ready to be picked up and to give its impulse to the returning arm of the escapement; a goniometer, consisting solely of a block of wood with a straight edge, and an upright wire with its end bent round so as to carry a cork with a second wire on which the crystal was fastened, and by which it was adjusted for measurement on Wollaston's method, the angle between two positions of the straight edge being found by the aid of a pair of compasses and determined by a continued fraction. These are a few only of the marvels of ingenuity which every one admitted to that interesting room will remember; and there were implements of observation fashioned out of the simplest materials—deal, cork, glass tube, wire —by the hand of their inventor, rough to look at, but exact in their performance. Nor was there any man who better appreciated the elaborate mechanism of an important instrument; no one, for instance, who could make an afternoon at the Greenwich Observatory more interesting and suggestive alike to the instructed student and to the uninformed visitor.

Such was the work of Miller. Personally he was quiet, unobtrusive, but observant; retiring, almost shy, in his manner, but in the highest degree genial and full of cordiality when this curtain of instinctive restraint was drawn aside and you met the man himself face to face.

He was a traveller. Impelled by his old master Whewell to the study of German as necessary to a mineralogist, he spent many a long vacation in the German and Tyrolese haunts of the mineralogist, and lost no opportunity of exchanging speech and therewith winning the esteem of the masters of his science on the Continent. Most of those contemporaries he survived. Mitscherlich, Gauss (who paid him the just tribute of complimenting him with having "exactly hit the nail on the head" in his Crystallography), Dove, Gustav Rose, Haidinger, Breithaupt, Wöhler, Sartorius von Waltershausen—names many of them but yesterday of living workers, were those of silent men before Miller's grave was closed, but they and Miller had in life been united by esteem and regard, and in some cases by warm friendship.

Of the travels which thus brought friendships and new scenes home to him, and in which he acquired valuable additions to the mineral collection at Cambridge, he had other pleasant records in the sketch-books which his constant companion, Mrs. Miller, filled as they journeyed.

Those who know the broad strath of the Towey above Llandilo in Carmarthenshire will remember, near its head, in the neighbourhood of Llandovery, a pretty gentleman's seat named Velindra. This was Miller's birthplace. Here his father, Captain Francis Miller, had settled towards the close of the last century, after fighting as an officer in the English army throughout the American War of Independence, and after losing a good estate which he possessed in the Boston Government, and which he never recovered. He too came of a fighting family, and doubtless something of the independence, the reserve and gentlemanly courtesy of the crystallographer came to him through this inheritance.

The valuable collection of minerals at Cambridge was largely the fruit of Prof. Miller's long-vacation rambles. The addition to it of the collection of Mr. Brooke, presented by his son, the late Mr. Charles Brooke, was an appropriate gift, considering the illustrations Miller had so copiously drawn from that collection for the important treatise on Mineralogy, to which he modestly gave the title of an edition of Phillips' "Mineralogy," by Mr. Brooke and himself: the real authorship of all that made the book invaluable to the true mineralogist being his whose name stood last, though for ever greatest, on the title page.

Some of his later years were devoted to arranging in the New Museum at Cambridge the collection he had done so much to form. He did not live to make a catalogue of it, though Mr. Lewis, who during Prof. Miller's illness was intrusted with the duty of acting for him, has commenced the laborious work of a register, as a preliminary to a catalogue.

There have been rumours that a change would be made in the character of the chair before the appointment of a successor to Prof. Miller. Considering that but for the two mineralogical chairs at the two great universities of England the study of crystallography otherwise than as an almost childish adjunct to popular lectures on mineralogy would have been extinguished in England, it may be worth while to urge that the significance of crystallographic structure as a key to great physical problems, and probably too, when the chemists have awakened to the fact, as a key to some of the newest problems in chemistry, gives to crystallography a very considerable claim for recognition among the subjects taught in the university that produced the greatest crystallographer of our time. N. STOREY MASKELYNE

PAUL BROCA

WE regret extremely to have to announce the death of this distinguished physician and anthropologist, which took place suddenly at Paris on Thursday last. He had attended a meeting of the Senate, of which he had lately been elected a member, and died during the night in consequence of the rupture of an aneurism. He was fifty-six years of age, born at St. Foy, in the Gironde, educated for the medical profession, and became Professor of Surgical Pathology at Paris. He soon acquired a high reputation by his researches in cerebral pathology, and continued to devote himself with great zeal to hospital work and clinical teaching to the last; but it is chiefly in consequence of his having taken up the subject of anthropology that he has obtained a world-wide fame, and occupied a position which it will indeed be difficult to fill up.

Twenty years ago the science of physical or anatomical anthropology was in its infancy, and all investigations were at variance even as to the methods to be pursued in its cultivation. Broca devoted many years of unceasing activity in endeavouring to define, systematise, and perfect these methods. The thoroughness and energy with which he threw himself into any research which he undertook were marvellous, and only equalled by the clearness and facility of expression with which he communicated his results to others. His series of essays on various subjects connected with craniometry, published in successive numbers of the *Mémoires* of the Société d'Anthropologie of Paris, and the *Revue* which he founded, and his "Instructions craniologiques et craniométriques," with the introduction of numerous neat and happily chosen terms for descriptive processes, have made an immense advance in the progress of the science.

Happily Broca's perfect simplicity and amiability of character, his pure love of science for its own sake, and his readiness to help those engaged in pursuits similar to his own, have inspired with enthusiasm most of those who came in contact with him; and he has created at Paris a school which it is to be hoped will carry on the work which he inaugurated. We may take occasion to notice his scientific work in greater detail in an early number.

THE UNITED STATES WEATHER MAPS, SEPTEMBER, 1878

IN the description of the United States Weather Maps for August, 1878, attention was drawn to the fact (vol. xxii. p. 36) that in that month atmospheric pressure was under the normal over a broad belt going halfway round the globe, extending from the Rocky Mountains across the United States, the Atlantic, Europe, and thence into Asia as far as the valley of the Lena, and the bearing of this abnormal distribution of the pressure on the temperature, winds, and rainfall of this large and important part of the globe was adverted to. In the September following, the U.S. Weather Map for which appears with this notice, great and radical changes in the distribution of pressure took place—such as a change from a large defect from the normal pressure to a large excess above it in the New England States, South Britain, Central Europe, South Africa, and New Zealand; and on the other hand, a change equally striking from a large excess above the normal to a large defect from it over the West India Islands, South Greenland, Iceland, North Britain, and the whole of Southern Asia from the Bay of Bengal to Japan. As it is still premature to speculate on the causes of these enormous changes in the distribution of the mass of the earth's atmosphere and the still more enormous forces called into play in effecting them, we must content ourselves with stating them a little more in detail, and drawing attention to some of the more immediate and striking climatic consequences which followed in their train.

In North America pressure fell most below the normal about Lake Winnipeg, and southwards over the region traversed by the upper tributaries of the Missouri and Platte Rivers. This region of low pressure was extended, though in a less pronounced form, to the south-east, deepening again, however, on approaching Florida, to 0·090 inch, the greatest depression below the normal in the Bahamas. Over the Gulf States and westward through Texas and California, pressure was above the average; and to the north-eastward of the region where pressure was low it rose gradually, till in the Gulf of St. Lawrence it stood at 0·133 inch in excess of the average.

This high pressure extended across the Atlantic, and thence overspread Ireland, England, the northern half of France, Germany, all Russia except the extreme south near the Black Sea, and on into Siberia as far as the valley of the Tobol. As already stated, the southern half of Africa and the whole of New Zealand had a pressure considerably above their normal, the excess in the northern island of New Zealand being about 0·150 inch.

To the north of the European belt of abnormally high pressure there was a widespread region of low pressure including South Greenland, Scotland, Denmark, and Scandinavia, the centre of greatest depression being 0·209 inch below the normal in the north-east of Iceland. On the other side of the European belt of high pressure lay a most extensive stretch of low pressure covering the Spanish peninsula and the rest of Southern Europe; the north of Africa, all Asia, except Siberia to westward of the Tobol River and a small patch including the Lower Amur, the East India Islands, and the whole of Australia. In this widespread region centres of still deeper depression were formed in Italy, the Upper Obi, Western India, Southern China, and the south-eastern division of Australia, the depressions below the normal pressures of these five regions being respectively 0·133 inch, 0·146 inch, 0·084 inch, 0·070 inch, and 0·136 inch. The sharpness with which the regions were marked off will be seen from the statements that in their relations to the normals pressures showed differences of a fall of 0·342 inch from Nova Scotia to Bernfiord in Iceland, 0·329 inch of a rise from Bernfiord to Cork, and 0·153 inch of a fall from Cork to Rome, and 0·290 inch of a rise from near Melbourne to Napier in New Zealand.

In the United States, temperature was under the average on the western side of the area of low pressure, the deficiency from long. 98° W. to the Rocky Mountains being from 1°·5 to 3°·0. This low temperature extended far to northward, the deficiency from the normal amounting to 4°·5 at York Factory, Hudson Bay. In the region of high pressure which overspread the New England States the rainfall was small, and temperature from 1°·5 to 3°·5 above the normal. On advancing, however, to the north-east, temperature fell to near the average in Newfoundland, which lay just on the western outskirts of the great barometric depression which had its centre near the north-east of Iceland. Greenland was completely enveloped in the western division of this depression, and there it will be seen that winds were northerly and easterly, and temperature consequently fell to 4°·0 below the normal. On the other hand, Scotland occupied the south-eastern segment of the barometric depression, and there, consequently, winds were west-south-westerly; temperature was from 1°·0 to 2°·0 above the average; and the rainfall in the west of the country from 40 to 110 per cent. above the average; whereas near the east coast it was about, or rather slightly under, the average. Thus in Scotland the distribution of the rainfall of September was the reverse of what prevailed in August, the weather in the latter month being fine and dry in the west, but wet and backward in the east. These differences of weather were occasioned by the circumstance that in August the centre of greatest barometric depression was to the south-west of Ireland, thus resulting in rain-bringing easterly winds in Scotland with the distribution of the rainfall stated above; whereas in September the centre of the barometric depression was near Iceland, thus resulting in rain-bringing westerly winds in Scotland, and consequently unfavourable weather in the west, but favourable weather in the east for the ingathering of the harvest.

Temperature was about the average in England, slightly under it in France and Western Switzerland, but above the average over the whole of the rest of Europe, and eastward into Asia as far as the area of high pressure extended. The greatest excess of temperature over this extensive region occurred in the great plains of the Danube and the Dnieper, where it amounted to from 4°·0 to 5°·6. In Italy the excess was small, and in Sicily temperature even fell 1°·4 below the average, and this area of low temperature was continued to the north-west through France. Another breadth of low temperature, falling however nowhere lower than 2°·0 below the normal, extended from the Caspian Sea as far to the north-east as the head-waters of the Yenisei, in other words over the western side of the barometric depression which overspread this part of Siberia. To the eastward of the Yenisei temperature was above the average, but only slightly so, nowhere exceeding 2°·0.

The greatest barometric depression in Australia lay off the coast south of Melbourne, and in accordance therewith, keeping in view the law of the winds of the southern hemisphere, the prevailing winds were N.E. and N. at Gabo Island and Melbourne, and N.W. and W. at Sandhurst and Portland; in other words, with the distribution of pressure described, equatorial winds blew over this part of Australia, and the temperature rose at Wilson's Promontory to 3°·2 above the normal; and the winds being land winds, the rainfall, particularly at places in the interior, was considerably below the average. In New Zealand pressure was not only absolutely higher in the north than in the south, but also much higher relatively to the normals, and it was also higher in the west than in the east. Under this distribution of the pressure and the strong equatorial winds resulting therefrom, temperature rose above the normal over the whole of New Zealand, the excess being nearly 4°·0 at Dunedin, Christchurch, and Napier.

NOTES

It was scarcely to be expected that the debate last Friday in the House of Commons on Mr. Roundell's motion for the complete abolition of the clerical headships and fellowships at Oxford and Cambridge should have had any other ending than it had. The Government thought it scarcely fair to the University Commissioners to interfere with what is regarded as one of the points which they are bound to consider. At the same time it is believed that the Commissioners are favourable to the almost complete abolition of clerical tests, and if this is one result of their deliberations, it seems to us their appointment will not have been in vain. The memorial on the subject, with 800 signatures, presented to Mr. Gladstone, could scarcely be more influential. Among the names are those of Sir G. Jessel (Master of the Rolls), Sir Henry Thompson, Dr. Risdon Bennett (President of the Royal College of Physicians), Mr. Darwin, Prof. Huxley, Mr. A. R. Wallace, Dr. W. B. Carpenter, Dr. Abbott, numerous members of Parliament, the Presidents of the Congregational and Baptist Unions and the Dissenting Deputies, the professors of most of the Nonconformist colleges, and several hundred graduates of the Universities of Oxford, Cambridge, London, and Scotland. It seems clear that the days of this remnant of an age of intolerance are numbered, and that in the near future Oxford and Cambridge will be as untrammelled by antiquated restrictions as the London and Victoria Universities. The central institutions of these bodies have developed with a marvellous rapidity, one cause of which, we must believe, has been the perfect liberty of teaching. University College, as we intimated last week, feels urgently the necessity of more elbow-room, and yesterday the foundation of Victoria University was celebrated at Manchester, where Owens College, the nucleus of the University has developed quite as rapidly, at least, as her elder sister of London. When Oxford and Cambridge have been brought as much abreast of the age as the two younger institutions, an impulse will be given to higher education in this country, and an encouragement to research in all departments of learning and science, that in time will bring us on a level with Germany in respect of University education.

No more satisfactory token of the rapid progress of liberal and just ideas as to the proper functions of universities could be desired than the tone of the leading article in the *Times* of Tuesday in connection with the Victoria University ceremonies at Manchester. After giving a melancholy picture of the disastrous effects of the existing system at Oxford and Cambridge, both on crammers and crammed, the *Times* gives what is evidently its ideal picture of university life. "Let us imagine," the leader concludes, "a body of professors employed not in examining or in cramming, but in original research or original work of some sort, pushing forward the bounds of knowledge, adding new ideas to the possessions of the human mind, creating, in short, and not merely appropriating or aiding and testing the appropriations of other people. The stimulus of such work as this would be felt, we may be sure, by all who come in any sense within its range. The example would be contagious. Original workers will be in no want of pupils, whether they seek for them or not. When valuable ore is being dug there will always be some one with a due sense of its worth ready and eager to pick it up. It is for the promotion of such work as this that great funds and great institutions most properly exist. The professions and trades of the country have their own appointed rewards. The successful barrister or the successful merchant may or may not have been a university student. It is not in any case the chief duty of a university to assist him in the attainment of his rank, first to sharpen his tools for him and then to keep him in funds during the interval while he is waiting to use them. The professions and trades can hold their own very well without such adventitious help as this. Original work is not so directly remunerative; to the individual engaged upon it it may not be remunerative at all. It often bears fruit slowly, but it bears it abundantly in the end. It needs, therefore, and justifies the special encouragement which a university can most obviously provide. The Victoria University has its life before it. It can choose its own course. It may become a machine for turning out second and third-rate intelligences, a sort of procrustean bed, so constructed as to bring its sons as nearly as possible to the same intellectual stature and equally to forbid any of them from falling far short of it or from exceeding it. Or it may propose to itself another aim, and may seek principally to aid in the creation of knowledge rather than in its distribution, and even weighing out." We are pleased to find the views we have so long advocated finding acceptance in so influential a quarter, and we commend the article to the earnest consideration of the University Commissioners.

THE second annual meeting of the Index Society was held on Friday last, the 9th inst., in the rooms of the Society of Arts, when His Excellency the American Minister, Mr. J. Russell Lowell, presided. The Report contained an account of the work already accomplished and of that which is in hand or can be put in hand when the list of subscriptions is enlarged. Many of the Indexes issued through the Society refer to literature and history matters, but science is not overlooked. A Handbook of the Literature of Botany, by Mr. Daydon Jackson, the secretary of the Linnean Society, is just ready for the press, and a companion volume for meteorology is proposed. Indexes of Logic and Anthropology also find a place in the list of schemes. Besides the formal business at the meeting, resolutions were passed for the appointment of committees to consider the best means of carrying out the following objects:—(1) The indexing of biographical collections, especially those contained in the *Gentleman's Magazine* and the *Annual Register*: (2) the indexing of Roman antiquities and remains in Great Britain; and (3) the opening of an office to contain the printed and MS. indexes.

WE have already called attention to the fact that the friends of the late Prof. Alfred Henry Garrod, F.R.S., being desirous of possessing some memorial of him, it has been agreed, after due consideration, that this object will be best effected by the republication in a collected form of all his separate memoirs and papers, both zoological and physiological, prefaced by a biographical notice and portrait of the author. A committee has been formed to carry out this object, consisting of Prof. W. H. Flower, LL.D., F.R.S., P. L. Sclater, Ph.D., F.R.S., Dr. A. Günther, F.R.S., O. Salvin, F.R.S., F. M. Balfour, F.R.S., Prof. E. A. Schäfer, F.R.S., G. E. Dobson, E. R. Alston, Prof. F. Jeffrey Bell, W. A. Forbes, secretary. It is estimated that Prof. Garrod's collected papers will form a volume of about 500 pages, royal octavo, illustrated by twenty-five plates and numerous woodcuts. Each subscriber to the fund will be entitled to receive a copy of the work for every guinea subscribed. Intending subscribers are requested to forward their names, and to state the amount they are willing to subscribe, to the Secretary of the Garrod Memorial Fund, 11, Hanover Square, London, W.

DR. J. H. GLADSTONE, F.R.S., has presented 100*l*. to the Research Fund of the Chemical Society.

THE French Government has allotted M. Pasteur the sum of 50,000 francs for the purpose of enabling him to carry out his researches on the contagious diseases of animals.

WISHING to devote himself exclusively to scientific pursuits, Admiral Mouchez, director of the Paris Observatory, has asked to be placed on the retirement list, a request which has been granted by the Ministry.

THE well-known mathematician, Prof. C. W. Borchardt, died at Rüdersdorf, near Berlin, on June 27. He was formerly Professor of Mathematics in the Military Academy, and of late years Professor in the University of Berlin. Since 1856 he was editor of the *Journal for Pure and Applied Mathematics*, the oldest of the existing mathematical periodicals.

THE death is announced, at the age of fifty-seven years, of Dr. Karl Neumann, professor of history and geography in the University of Breslau; his name is well known to students of historical geography.

AT the *fête* in Paris yesterday the electric light played a prominent part. It was used to illuminate the fountains of the Tuileries Gardens, the upper part of Notre Dame, the Bourse, the dome of the Panthéon, Porte Saint Denis, and several other public places, besides private buildings. One of the most interesting experiments was that of M. Serrin from the top of his house, facing the Place de la République, where the gas companies organised an unrivalled display. M. Serrin has invented an apparatus which has been already tried with great success, and may be moved in any direction with an amazing velocity. His powerful ray of light describes curves in space visible at an immense distance. Some new forms of regulators were exhibited for the first time on this occasion. The *fête*, being national, was celebrated all over France in the 40,000 communes or townships of the Republic, and the electric light was used in the provinces as well as in Paris. The most notable display was probably at Rouen, where a group of sixteen Siemens lights, of a power of about 100,000 candles, was placed on the top of the spire of the Cathedral.

THE several improvements in the National Library of Paris have resulted in a large increase in the number of readers. In 1869, when the new hall was opened, the number of readers was 24,000, who used 71,000 volumes exclusive of the library of reference. In 1879 the number of readers was 63,000, and of volumes used 230,000. It must be added that other libraries are open to the public in Paris and largely frequented, such as the Conservatoire des Arts et Métiers for mechanical science and physics, the Muséum d'Histoire Naturelle for natural history; the Mazarin St. Genevieve, for general purposes; the Sorbonne, École de Droits, École de Médecine, &c., for the general public, as well as for students. Readers are admitted to the National Library reading hall only by tickets; a special room has been opened to the public, and is also largely frequented. The present hall is only provisional, and a new one, on a larger scale will be opened very shortly.

A TRIAL has just been made on the measured mile in Stokes Bay, under the superintendence of the Steam Reserve and in the presence of the Controller of the Navy, of a service steam pinnace propelled by the Mallory screw. This is the first application of the American invention in the English service, and much interest was manifested as to the results of the trial. The propeller, which was fitted to a pinnace constructed specially for the purpose, is capable of being turned to any angle by means of a pinion and gearing, like an ordinary rudder, with which it dispenses. The boiler is stowed away under the forecastle, while the cylinders are placed at the stern and act directly upon the vertical shaft which turns the screw. Six runs were made with the engines going ahead and two with the engines going astern, there being scarcely half a knot's difference in the mean speed realised, 8·828 knots being obtained while going ahead with 339 revolutions, and 8·451 knots going astern with 340 revolutions. The engines were reversed from full speed ahead to full speed astern in ten seconds. But the most remarkable results were obtained in turning, the little craft showing such remarkable handiness that it not only turned in its own length, 42 feet, but was put by Col. Mallory through the movements of a quadrille, chaining, setting to partners, and galloping to places. She made a circle to starboard in thirty-six seconds, and without stopping, made a second circle to port, thus completing the figure 8 in thirty-seven seconds. The trial was deemed satisfactory, but the vibration at the stern was so great that the after part of boats fitted with the Mallory propeller will require to be specially strengthened.

THROUGH the kindness of General Myer we have received some further details concerning the extraordinary memory credited to the man in charge of the hat room at the Fifth Avenue Hotel, New York, referred to in NATURE, vol. xxi. p. 562. He is an Irish-American about thirty years of age, Gilmartin by name, and has occupied his present position about a year. His sole duty consists in looking after hats during meal hours. The fact of his possessing a remarkable memory is indisputable, but still he is not looked upon as a prodigy by the hotel officials. They state that a Tommy Hart, now dead, who figured conspicuously in the "Stokes trial," was for a long time in charge of their hat-room, and was this man's superior as regards memory, and cited other instances of men now employed in different hotels throughout the country whom they consider his equals. It is very evident, however, that he possesses a wonderful talent for selecting the right hats, and mistakes are rare with him.

THE suggestion made by A. Martin with regard to radiometers (*British Journal of Photography*, July 9, p. 312) is a very obvious one, and has been made dozens of times. We believe that soon after Mr. Crookes commenced working with Becquerel's luminous sulphides he tried to get a radiometer to move by means of the light given out by these bodies after insolation. He used them painted on one side of the vanes of a radiometer, and also as luminous screens outside the radiometer to act on the darkened vanes, but it was all to no purpose. The light evolved was too faint to have any effect. It is just possible that if a room were entirely coated internally with Balmain's luminous paint and excited by sunlight or burning magnesium, a radiometer might revolve in it for a short time, but even this is not likely to occur. The most sensitive radiometer will not turn to a candle more than twelve feet off, and the torsion-balance photometer will only just move to a candle thirty feet off; yet the illumination given by a candle at this distance is far greater than any we have seen produced by the luminous sulphides.

FURTHER accounts of the earthquake in Switzerland on Sunday week prove it to have been one of the most severe and widespread which has happened in Switzerland for several years. It was felt in the Central and Pennine Alps, at Berne, Zurich, Payerne, Andermatt, on the Lake of Lucerne, in the Bernese Oberland, in the cantons of Geneva and Vaud, and doubtless in Savoy. The principal seat of disturbance was in the Valais, in the neighbourhood of Visp and Brieg. In both places the shock was preceded and accompanied by aërial noises and underground detonations. The time of its occurrence is variously stated at 9.20 and 9.30 a.m., and the direction of the movement, so far as can be made out, was from south to north. At Leukerbad the shock is said to have been accompanied by subterranean thunder. Further east, in the neighbourhood of Geneva and Lausanne, the oscillation was perceptible only in the upper rooms of houses near the Lake.

AN occurrence, which may be partially or wholly attributable to the rude shakings which Switzerland has recently undergone, is reported by the *Times* Geneva correspondent from Quarten, in the canton of St. Gall. A short time ago the people of the neighbourhood noticed signs of uneasiness about the Sehnebelberg. The summit of the mountain appeared to be in a very precarious position, and it was feared that it might slip down and overwhelm the Schnebelwald, an extensive wood in the valley below. In anticipation of a possible catastrophe, great efforts were made to cut down and carry away as many trees as possible, though the men engaged in the work wrought at the peril of their lives. On Sunday fortnight, when fortunately there was nobody in the wood, a deafening report, like the firing of heavy artillery, resounded through the valley, and the mountain was hidden from view by a thick cloud of dust. When it dispersed, the Schnebelberg was seen to be shorter by a few metres, and the beautiful wood in the Murgthal has disappeared beneath a huge avalanche of stones and earth.

AT the annual meeting of the Council of the Royal School of Mines, the prizes and associateships were awarded as follows:—The Edward Forbes medal and prize of books to H. M. Platnauer. The De La Beche medal to John Greene. The Murchison medal and prize of books to H. M. Platnauer. Associates: Mining and Metallurgical Divisions—E. B. Lindon, P. W. Stuart Menteath, Ralph Scott. Mining Division—John Greene, B. Mott, H. E. Tredcroft. Metallurgical Division—R. S. Benson, J. J. Beringer, D. B. Bird, H. S. Cotton. W. Cross, W. L. Grant, G. S. Grundy, C. L. Higgins, B, McNeill, T. H. Reeks, J. Taylor. Geological Division—H. H. Hoffert, H. M. Platnauer.

THE Agricultural Society's show at Carlisle, which was opened on Monday, is said to be unusually successful, so far as the exhibits are concerned.

MR. P. H. PEPYS writes:—"It may interest some of your geological readers to know that a branch canal is now in course of being made from the Grand Junction Canal at a point near the West Drayton Station of the Great Western Railway. This cut, which runs parallel with the Great Western Railway to a point not far from the Slough station, passes through beds of river gravel and brick earth, a very interesting section of which has just been opened up by the excavators."

A SAD balloon accident has taken place at Le Mans, and may be referred to as illustrating some useful facts relating to aëronautics. A man named Petit had ascended with two balloons connected by a long rope. The smaller, which was placed above, carried his son, almost a boy; Petit being in the larger with his wife. There was not much wind, and this foolish experiment would have ended without accident if Petit had not forgotten to loosen the neck of the balloon, so that no escape was left for the gas which was gradually expanding. When the balloon arrived at an altitude of 400 to 500 metres it burst in the vicinity of the "equator," and descended with great velocity, dragging the smaller balloon. Petit, who was devoid of any scientific knowledge, supposed his son was in danger, and with true heroism he cut the rope connecting the two balloons when at 250 to 300 metres from the ground. He placed his wife on the ring and remained himself in the car. The shock was so terrible that his spinal cord was broken, and he died on the following day. His wife was very badly hurt, and though in danger, is alive. If Petit had not cut the rope by an act of unintelligent devotion he would very likely have escaped, and his son would not even have touched the ground.

WE have received the first two parts of Dr. Braithwaite's "British Moss Flora," published by the author at 303, Clapham Road. We hope to notice the work at length on its completion.

FROM Dr. Schomburgk's Report on the progress and condition of the Botanic Garden and Government Plantations of South Australia during the year 1879, we gather many interesting facts. First, with regard to the climatic changes, temperature, sunshine, &c., and their effects on vegetation in Adelaide. During the Australian autumn, winter, and spring the country was visited with the most favourable and seasonable weather on record, the influence of such a season had, of course, a wonderful effect on the agricultural and pastoral produce of the colony, the wheat crop, for instance, being one of the most abundant on record. We are told that owing to a "part of the spring months—September and October—being cool and cloudy, and showery, the roses flowered in such perfection as was never witnessed in South Australia. Flowers were seen from five to six inches in diameter. On the subject of forage plants, a subject that has occupied a good deal of attention in our colonies of late, *Cyperus esculentus*, known as the chuffa or earth almond, takes a prominent place. This plant it appears is extensively grown in the Southern States of America, where the tubers are used for feeding hogs, sheep, and poultry. These tubers are said to contain a quantity of air and sugar, and are consequently very fattening to animals fed upon them. Dr. Schomburgk also recommends the cultivation of the Nardoo plant (*Marsilia macropus*, Hook.), which, in the interior of South Australia, where the plant is common, forms a valuable nutritious forage plant. Attention is also drawn to the Tagasaste (*Cytisus proliferus*), a shrubby leguminous plant of the Canaries, the leafy branches of which have a reputation as a useful fodder. Dr. Schomburgk announces the probable early completion of the new Museum of Economic Botany in the Botanic Garden, the cases in which are arranged on the plan "adopted in the new Kensington and Kew Museums." The museum collection already numbers 2,000 specimens, and these are being constantly added to, contributions constantly arriving in very large numbers.

THE annual meeting of the Royal Society of New South Wales, Sydney, was held May 12; the number of new members elected during the year is fifty-one, making the total number of ordinary members upon the roll to date, 430. During the year the Society has elected the following gentlemen as honorary members, viz.:—Mr. George Bentham, F.R.S., C.M.G., Dr. Charles Darwin, F.R.S., Prof. Huxley, F.R.S., Prof. Owen, C.B., F.R.S., making the total number of honorary members nineteen. Mr. R. Etheridge, jun., F.G.S., has been elected a corresponding member of the Society. Financially the Society's affairs are in a satisfactory condition. At the Council meeting held on April 28 it was unanimously resolved to award the Clarke memorial medal for 1878 to Prof. Owen; for the year 1879 to Mr. G. Bentham; and for 1880 to Prof. Huxley, for their valuable contributions to the knowledge of the palæontology, botany, and natural history respectively of Australia. During the past year the Society has received 664 volumes and pamphlets as donations, against which it has distributed 523 volumes and pamphlets. The honorary secretaries are Prof. Liversidge and Dr. Leibius. At this meeting Sir Joseph Dalton Hooker was elected an honorary member.

METEOROLOGICAL NOTES

PROF. NIPHER has sent us the *Missouri Weather Service Report* for April, 1880, and the *Daily Times* of St. Louis of May 4, in both of which publications interesting and valuable details are given of the tornadoes which desolated Marshfield, and were attended with disastrous results at other places in their route through the south-west of the State of Missouri. The details were collected with great labour and care, Professors Nipher and Shepard, Judge Barker, and Messrs. Smith and Kribben having spent four days in the saddle, from the 22nd to the 26th, in collecting the evidence of eye-witnesses and examining the effects produced by the tornado. The Marshfield tornado was one of three whirlwinds which occurred in this part of Missouri, separated only by short intervals of time. The most violent of these began near the south-west corner of the state, and thence swept up the Finley Creek Valley. The width of its path exceeded a mile at points, and over this breadth even oak saplings were torn out by the roots, and either thrown out of its path or laid down in rows in the lee of ridges. The average width of its destructive path for a distance of 100 miles was 3,000 feet, thus covering an area of 60 square miles. The Marshfield tornado originated about half an hour earlier and at a point a little to northward, slightly diverging from the path pursued by the previous tornado. Though less violent, considered as a whole, it proved much more destructive to life, no fewer than sixty persons being killed in the town of Marshfield, that town itself being wholly destroyed. The destructive path of this tornado was about 45 miles in length, and as its average breadth was about 1,500 feet, it covered an area of 13 square miles. This storm has been successfully traced to its origin in a harmless dust whirl generated between two currents of air which met in such a way as to produce a whirl in the opposite direction to the hands of a watch, the air at the same time along its subsequent path being oppressively warm and moist. The third tornado occurred about the same time, and passed to the north-east, near Jefferson City. The area covered by these three tornadoes is about 80 square miles, and more than 100 persons lost their lives. Many interesting points were noted by Prof. Nipher and his staff of observers. Almost all the trees blown down were thrown down in the line of the tornado track, and the lane of prostrate trees lying in the line of the storm's path was continued across sparsely wooded tracts, where, consequently, the destructive lane was formed, not by the trees falling on each other, but by each tree being overturned by the violence of the gust. One of the observers, Mrs. Lenz, reports that the whirlwind cloud seemed to be of a circular or wheel shape, dark and heavy on its edges, and white or more like an ordinary cloud in the interior; her description being that it looked like a coiled snake whirling round and round a white centre. In this connection an additional observation was made by another observer, Mr. Steel, to the effect that the bottom of the cloud-funnel seemed to sway somewhat, as well as to move up and down; it looked like dark smoke, and he could occasionally see up into the funnel, which seemed to be hollow, the inside appearing to be lighter coloured than the outside. It is much to be wished that future observers who may be so circumstanced as to be able to observe this feature of whirlwinds would endeavour to note the motions, whether upward or downward, in the interior and on the outside of the funnel, accurate observations on this point being of supreme importance in arriving at a correct knowledge of whirlwinds. It was also noted that trees were stripped of their bark only where the ground was covered with *débris*, and the barking was confined to the sides of the trees exposed to the flying missiles. It is a singular circumstance that along the whole path of the tornado not a single flash of lightning was observed.

IN the *Missouri Weather Service Report* referred to above the tracks of these tornados are laid down on the map accompanying the report, and it is in this part of the State that the rainfall of the month was greatest, the maximum of 8·00 inches being at Verona, which is situated near the point where the tornadoes originated. The rainfall over the southern portion of the State equalled five inches, and the amount diminished on proceeding northward. The minimum amount was recorded along the northern slopes of the Missouri valley, the least fall being 1·07 inch at Glasgow. The mean temperature was 58°·7 at St. Louis, or 2°·6 in excess of the average of April. A general and severe fall of temperature followed the storms of the 18th, when snow fell at Oregon, Palmyra, Neosko, and Greenfield.

WE are indebted to Mr. W. A. Dixon, Sydney, for a communication on the meteorology of a guano island, originally made by him to the Royal Society of New South Wales. The island referred to is Malden Island, in 4° 2′ S. lat. and 154° 58′ W. long.; it is triangular in shape, of purely coral formation, and comprising a land area of little over 10,000 acres. The climate of the island, though near the equator, and sometimes having the north-east and sometimes the south-east trades, is generally characterised by extreme dryness. Mr. Dixon resided in Malden Island two and a half years, dating from October 13, 1866, when the following amounts of rain were collected:—In November, 1866, there fell 0·50 inch; in 1867 there fell in September 0·26 inch; October, 0·23 inch; November, 0·63 inch; and December, 0·19 inch; in all, 1·31 inch in twelve days. In 1868 there fell in January 0·69 inch; February, 0·002 inch; March, 0·17 inch; April, 0·19 inch; May, 0·56 inch; June, 0·12 inch; July, 3·82 inches; August, 0·87 inch; September, 0·11 inch; October, 2·89 inches; November, 0·77 inch; and December, 3·46 inches; in all, 13·60 inches in fifty-two days. In 1869 the rainfall was in January, 12·73 inches; in February, 4·83 inches; and March, 2·77 inches; for the three months, 20·33 inches in twenty-eight days. On January 28–29, 1869, there fell in eight and a half hours 4·57 inches of rain. It was often noticed in the daytime that whilst it rained heavily over the ocean all round the island the moisture-laden clouds from the east disappeared as they drifted over the island, and no rain fell. As regards temperature, the variations of the thermometer in shade were extremely regular. At daybreak it stood at 80°, when it gradually rose to 96° between 9 and 10 a.m., about which point it stood till shortly after sunset, when it began gradually to fall to 80° at 10 p.m., remaining near this point till morning. From January 16 to 29, 1869, the temperature did not rise above 82°, there being continuous rain, and no sun visible, for thirteen days, with the wind due west. An unblackened thermometer frequently exposed to the sun was never observed to rise above 106°·0, but, covered with one inch of light grey soil, it rose to 135°·0. Evaporation was observed at irregular intervals; an average of eight days ending December 11, 1868, gave 0·387 inch per day. In the beginning of October the wind was generally light east, with calms; and the north-east trades began about the middle of the month, varying from east to north-east till the end of February, when light winds and calms again set in, followed by south-east and east trades till October. The currents round the island changed with the changing of the trades, and this change was marked by the movement of an immense mass of sand forming the west beach. From the beginning of March the sand went on accumulating till the beginning of October, forming a beach 120 feet wide, 9 feet high, and a mile long. When the sun crossed the zenith the sand began to move to the south, and all that the waves could reach was removed and carried to the south beach; and the whole of this sand was washed back when the sun again had crossed the zenith going north.

GEOGRAPHICAL NOTES

IT is stated that Col. Prjevalsky and his party are prisoners in the hands of the Chinese, who, it will be remembered, prevented him from proceeding to Lhassa.

THE *New York Herald* publishes a telegram from St. John's, Newfoundland, stating that the steamer *Gulnare*, conveying Howgate's expedition to Lady Franklin Bay, has been towed into St. John's with her machinery disabled. The message adds that it is thought probable that she will be sufficiently repaired to proceed north in about a fortnight.

NEWS from the Azores states that a disturbance of the earth has occurred in the island of St. George, resulting in the formation of another small island of about 18,000 square yards, and distant 600 yards from the shore.

AN Arctic Exhibition has been opened at the Alexandra Palace, in which a great variety of objects, pictures, photographs, and other things connected with Arctic exploration are displayed. The collection is both interesting and instructive, and is well worth a visit, whatever we may think of Commander Cheyne's scheme, in connection with which the exhibition is being held. Mr. Coxwell makes an experimental ascent to-day at the Palace in connection with Commander Cheyne's project.

IN the *Archives des Sciences* for June 15, Prof. Forel describes researches on the temperature of Lake Leman and other freshwater lakes. *Inter alia*, it appears that the heat penetrates very rapidly into the 50 or 100 metres next the surface (in Lake Leman) and very slowly in the deeper layers. The temperature proved to be variable even at the extreme depth of 335 m. and the degree of variation showed that depth was still far from the depth where variability ceases. Heat penetrates more deeply into Lake Leman than into Lake Thun; the isotherms descend on an average 24 m. deeper. By January 15, 1880, Lake Leman is considered to have expended all the heat put in reserve during the summer of 1879. (This point was not reached in 1879 till February 7.)

NO. 87 of the *Zeitschrift* of the Berlin Geographical Society has a long and important article by G. Harting on the formation of valleys. K. Himly gives an interesting account of the "Si Yü Shui Tao Ki," a Chinese work, published in 1824, on the hydrography of Central Asia. There are two articles on South America: one by Max Beschoren, on the forest region of the Rio Uruguay in the Brazilian province of Rio Grande do Sul, and the other by Arthur Werthemann, on the Rivers Paranapura and Cahuapanas in the Peruvian department Amazonas. The journal of the late Erwin v. Bary in North Africa is continued. From the *Verhandlungen*, No. 6, we learn that the Swiss contemplate a survey of both coasts of the Red Sea for commercial purposes, and a list is given, based on Schlagintweit's investigations, of the greatest heights of North India and Central Asia.

THE principal article in the July number of *Petermann's Mittheilungen* is on the variation in the quantity of water in the rivers and other bodies of water of the various continents, by Prof. H. Fritz. The author does not think there is any reason for believing that anything like a permanent decrease of the volume of water in rivers has taken place, but that this volume is subject to variations, which, when grouped in periods of about ten years, are seen to be wonderfully regular. He gives, for example, the years 1804, 1816, 1829, 1837, 1848, 1860, 1871, as years of water maxima, and notes as at least a coincidence that these were years of maximum sun-spots. An article by P. F. Bainier refers to the recent discovery of the Niger sources; there is information on various recent Nile expeditions, and some notes in connection with the projected railway from Mejillones to La Paz in Bolivia.

ARTIFICIAL DIAMONDS[1]

IN a preliminary notice, which the Royal Society has done me the honour of publishing in the *Proceedings*, I gave a very short sketch of the work I have done which led me to a reaction whereby hard crystalline carbon has been produced. I have now the honour of laying a detailed account of the methods and results before the Society. As far back as September, 1879, I was searching for a solvent for the alkali metals, and tried experiments with many liquids and gases, but invariably found that when the solvent reached the permanently gaseous state chemical action ensued. This was the case even with hydrocarbons, the metal combining with the hydrogen and setting free the carbon. Paraffin spirit, boiling at 75°, was first used in experimenting, and the spirit contained a considerable amount of olefines; but even these unsaturated hydrocarbons seemed to be split up in like manner. The experiments were conducted in thick tubes from 1 to 1·5 millims. internal, and 10 to 15 external diameter, and made of hard glass.

The alkali metal which decomposes the hydrocarbon retains a quantity of pure hydrogen, which may be seen by exhausting it by the Sprengel pump. A piece of sodium was exhausted in the molten state for five hours by the Sprengel pump, and when no more hydrogen had been evolved for an hour, a piece was placed in a tube with paraffin spirit and heated for two hours, and when a considerable quantity of carbon was deposited, as much of it was removed as could be conveniently obtained and again exhausted, when 32 times its volume of hydrogen was extracted from it. This was repeated several times, and quantities of hydrogen, varying from 17 to 25 times the volume of the sodium, obtained. The carbon deposited on the tube is of a hard scaly nature, and when the sodium is slowly oxidised and dissolved in water, some very hard scales of carbon are often obtained. This was then the reaction on which my work was built. As potassium is a metal of stronger affinities I thought that an examination of its action on paraffin would yield somewhat better results, but in this I was disappointed. Sometimes its action was very great, but it seemed to combine with some of the substance in the tube, and formed black compounds, having no hard carbon amongst them. Some of the experiments did yield a little, but on the whole it was not so good as sodium. Lithium was next tried, and yielded results which were much more hopeful.

After an account of experiments on gaseous solution the author proceeds:—The general result obtained from these experiments was that the solvent power of water was found to be determined by two conditions: 1. Temperature or molecular *vis viva;* and 2. Closeness of the molecules on pressure, which seems to give penetrative power. From these observations it will be seen that if a body has any solvent action on another and does not act upon it chemically, such solvent action may be indefinitely increased by indefinitely increasing the temperature and pressure of the solvent. In nature the temperature has been at one time higher than we can obtain artificially, and the pressure obtained by a depth of 200 miles from the surface is greater than can be supported by any of the materials from which we can form vessels. It will thus be seen that, whereas in nature almost unlimited solvent power could be obtained, we are not as yet able to reproduce these conditions artificially. Could pressure alone increase solvent power, then much might be done, but pressure only acts by keeping the molecules close together when they have great *vis viva*, and this latter is only obtained by high temperature.

As glass tubes were quite out of the question when a red heat and very high pressure were required, iron tubes were resorted to, and a series of attempts made to dissolve carbon by various gaseous solvents. The difficulty of closing iron tubes as compared with glass tubes caused me to try various methods, which I shall describe here. Tubes were made of strong hydraulic tubing 20" long, 1" thick, and $\frac{1}{2}$" bore. These were fitted with a plug, screwed with a strong screw fitting very well. There was placed in the tube some powdered charcoal from which all the inorganic matter had been removed by immersion in hydrochloric and hydrofluoric acids and washing with water, and then sufficient paraffin spirit to fill the tube two-thirds of its volume. The plug was screwed in with a lute composed of silicate of soda and manganese dioxide, but after heating the tube in a reverberatory furnace for four hours it was found to be impossible to remove the plug, so the end had to be bored out. There was neither liquid nor gas in the tube, the luting having leaked. Another tube similarly filled was fitted with a plug with a copper washer, the end of the tube, plug, and washer being polished, but this also leaked, and no result was arrived at. Baryta, clay, asbestos, and other substances, wet with silicate of soda, were all tried with the same result—leakage. A silver washer kept comparatively tight, but only on one occasion. It was thus seen that screw-closing would give no reliable results, so another method was tried. A ball of iron, fitting the tube tightly, was placed in it after the materials had been introduced. The end of the tube was then narrowed by compression between rollers and turned smooth inside. The iron ball was then drawn up by a wire attached and luted by silicate of soda and fine manganese dioxide. It was expected that the pressure would only serve to make the closing more secure, but, on heating, the iron yielded, and the ball was driven out with a loud explosion. After trying several other methods of closing—outside screwing and filling the mouth with molten metal on the top of a clay plug being amongst them—I came to the conclusion that nothing would suffice but welding up the open end. This has been, when carried out efficiently, invariably successful, and in all my later experiments I have used it alone. It requires great skill on the part of the workman, and it is only one man in a hundred who can perform the operation with invariable success. The furnace used in these experiments was a reverberatory one, 6 feet long (internal measurement) and 2 feet broad; fire-place, 15 inches; bridge, 9 inches; hearth, 4 feet. The roof sloped down towards the flue, and the spent gases had exit at the level of the hearth, thus carrying the flame down as it receded from the fire in order to have the hearth of one temperature. The walls were 13 inches thick, and the roof formed of 4-inch fire-clay covers.

Three tubes, 20" × 1" × $\frac{1}{2}$" bore, were filled as follows:—

No.	I.	3 grms.	sodium,	$\frac{3}{4}$	full	paraffin spirit.
,,	II.	,,	,,	$\frac{2}{3}$	,,	,,
,,	III.	,,	,,	$\frac{3}{5}$	,,	,,

On heating them in the reverberatory furnace, No. I. exploded before a visible red-heat had been obtained, so the temperature was not allowed to rise any higher, and Nos. II. and III. allowed to lie for four hours and then slowly cooled. On being bored open next day, No. II. contained a little scaly carbon, but No. III. contained almost none, and nearly all its liquid had been converted into gas, which rushed out on boring it open. It was noticed by the workmen that the inside of the tube was harder to bore than the outside, and I thought, as I found out afterwards rightly, that the iron had been carbonised and converted into steel. It seemed, then, that the free carbon had been taken up by the iron.

An account of a number of preliminary experiments with various tubes here follows:—The iron used in making the tubes is what is known as "Lowmoor" iron, a very pure and strong quality, and a portion removed from the interior of a tube which has been used gave, on analysis, 2·17 per cent. of carbon, showing to what an extent carbonisation had gone on.

Having obtained results from this process of a kind which showed that diamond was unlikely to be formed by its agency, I reverted to the original idea of solution of carbon in a gaseous menstruum, and from some experiments I had been carrying on with the view of finding some commercial use for "bone oil," I concluded that the distillate from bone oil containing the nitrogenous bases would be most likely to yield such a solvent. Bone oil, the nitrogenous distillate obtained in the manufacture of bone char, and for a plentiful supply of which I am indebted to Messrs. John Poynter and Sons of Glasgow, was distilled, and the portion boiling between 115° and 150° was taken and rectified

[1] "On the Artificial Formation of the Diamond." Paper read at the Royal Society by J. B. Hannay, F.R.S.E., F.C.S. Abstract by the Author.

over solid caustic potash, and latterly over sodium. When satisfied that it was free from moisture, oxygen, and sulphur, a tube, $2\frac{3}{4}'' \times 20'' \times \frac{1}{2}''$ bore, was three parts filled, and some charcoal powder added, and the whole welded up solid. I found that the nitrogenous liquid was even worse to work with than the hydrocarbon, as on coming into contact with the hot iron it burnt it away at once, and as the tube was of great diameter it was extremely difficult to keep the lower part cool. For welding it had to be arranged so that it was standing in a tub of ice, and the top projecting through the bottom of the forge, and heated until it was at a welding heat, with as little delay as possible. When a tube was obtained welded up solid it was heated to a dull red-heat for 14 hours and allowed to cool; on opening the tube there was a very great out-rush of gas, and the carbon was to a certain extent dissolved, and some minute portions of it very hard. Still, under the microscope it presented little difference in appearance from the wood charcoal employed, some of the features, however, being obliterated, and it had a bright appearance. Another tube of the same dimensions and contents was closed up in the same manner, but after eight hours' heating it burst with a loud explosion. I had noticed that a tube which had been once used and been partially carbonised would not stand a second heating, and for this reason I had no belief in the power of cast-iron or steel to withstand the great pressure at a red heat. Nevertheless, as many of my friends had urged upon me to try these materials, I had a cast-iron tube made, $3\frac{3}{4}'' \times 24'' \times \frac{3}{4}''$ bore, and filled two-thirds of its volume with bone oil distillate and carbon, and then welded up. We succeeded after a little trouble in making a good weld, and the tube was then slowly raised to a dull red-heat in the furnace. It had not been heated for more than an hour when it exploded with a great noise and knocked down the back and one of the ends of the furnace, leaving the whole structure a wreck. The tube had broken into small fragments, and was quite unlike the malleable iron tubes which generally tore up. Thinking that it was perhaps a bad casting, I tried another, but it leaked all over, and emptied itself before the temperature was nearly up. A third tube of the same material burst like the first, but as I had built up the furnace with large blast-furnace blocks, it was not blown down. Cast-iron being inadmissible, experiments were then made with steel. I had several tubes made of this material by the best firms in the kingdom—made by the three methods, Bessemer, Siemens, and the crucible method—but they had the same faults as cast-iron, although to a less degree. The difficulty in making a good weld in cast-iron and steel tubes makes their employment in such experiments as these a matter of inconvenience. Out of five tubes made of steel, some of which were made of the very toughest material manufactured by Messrs. Cammell and Co., only one held in the substance completely. Three burst in the furnace, and one had leaked by its porosity. The top of the furnace, by the continued shocks of explosions, fell in at the bursting of the last of the steel tubes. The continued strain on the nerves, watching the temperature of the furnace, and in a state of tension in case of an explosion, induces a nervous state which is extremely weakening, and when the explosion occurs it sometimes shakes one so severely that sickness supervenes. An account of several experiments follows, none of which were, however, successful.

I thought I should either have to abandon the attempt or begin experiments of a very expensive nature, using large tubes and a large furnace, as 20-inch tubes of a greater diameter than four inches could not be closed when three parts filled—at least by welding. As some of them, however, seemed to stand, I determined to make some further trials with the apparatus I had at my disposal; so another tube, $20'' \times 4'' \times \frac{1}{2}''$ bore was filled, using 4 grms. of lithium and a mixture of bone oil, carefully rectified, 90 per cent., and paraffin spirit 10 per cent., using these proportions because I had never had any results with a high percentage of bone oil, the tubes so filled having burst. The tube was closed with great difficulty, being three-parts full of liquid, and then heated to a visible red heat for fourteen hours, and allowed to cool slowly. On opening the tube a great volume of gas was given off, and only a little liquid remained. In the end of the tube which had been the upper end in the furnace, the tube lying obliquely, there was a hard smooth mass adhering to the sides of the tube, and entirely covering the bottom. As I had never obtained all the solids in one piece before, I wished to examine it, and so had the other end of the tube cut off, exposing the hard mass. It was quite black, and was removed with a chisel, and as it appeared to be composed principally of iron and lithium, it was laid aside for analysis. I was pulverising it in a mortar when I felt that some parts of the material were extremely hard—not resisting a blow, but hard otherwise. On looking closer I saw that these were mostly transparent pieces imbedded in the hard matrix, and on triturating them I obtained some free from the black matter. They turned out to be crystalline carbon, exactly like diamond. I shall describe further on the analyses, &c., but will here go on with the account of my further experiments. Two tubes were filled in the same manner as the last, but one burst on heating, and the other had leaked so that there was no reaction. Two more tubes were prepared, but were spoiled on welding, and on cutting off the carbonised portion the remainder was too short to work. After much trouble three tubes were obtained, well closed, in which the three alkali metals were inclosed with liquid containing 20 per cent. bone oil and 80 per cent. paraffin. All three stood, and, on opening, only the potassium one had leaked to any extent. The results were not good, however, the sodium tube containing only soft scaly carbon, and the other two very little better. The reaction did not seem to have proceeded in the same manner in the lithium tube as before, as the mass was soft and friable. Still, lithium seemed to yield the best results, so it was adhered to in the further experiments. A list of disasters now awaited me. Eight tubes failed through bursting and leaking, and one of the explosions, when two were being heated together, destroyed a part of the furnace and injured one of my workmen. Besides this, two tubes were spoiled in welding. However, I had four experiments after this, all withstanding the pressure, and in one of these, with 10 per cent. bone oil and 90 per cent. paraffin spirit, a small quantity of diamond was found. The contents of this tube were different from the other successful one, being much looser and not in the same hard mass as the first. In another series of six experiments two were at first thought to have been successful, but I afterwards found that one of them was not so, the transparent matter being siliceous, but insoluble in cold hydrofluoric acid, although it dissolved on boiling. The uncertainty and great expense involved in using these forged coils of iron with tubes bored out of the solid induced me to again try steel, and Messrs. Cammell and Co., having prepared some tubes for me, I tried them, but with the same results—they exploded into fragments at a red heat. And herein they are much more dangerous than coiled tubes, because the latter seldom fly into fragments, but just tear open a little. A further unforeseen danger in using steel tubes was discovered. One which had stood the heating very well was being bored, and when the inner skin was cut so that the gas rushed out, the whole exploded, endangering the life of the workman who was boring, but as he was standing at the end of the tube and the pieces flew laterally, he was not hurt. I have performed over eighty experiments, and have only obtained three results of a successful nature. The identification of the crystalline pieces as carbon was easy enough, but I have been anxious to find whether they are pure carbon or a compound with some other element, and to that end the following experiments were conducted.

A portion of the substance from the first successful experiment was weighed out after it had been freed from all foreign matter adhering to it, and placed in a very small platinum boat made of a strip of thin foil, the ends of which were wrapped round two stout platinum wires which were sealed into a wide glass tube. The carbon particles were transferred to this boat after being weighed, and the tube connected by india-rubber stoppers with an oxygen gasometer on the one side and a series of potash bulbs on the other. The oxygen was dried over solid caustic potash before entering the tube, and again after leaving the potash bulbs. The carbon (14 mgrms.) having been weighed out, the potash bulbs were weighed, and a current of oxygen passed through the apparatus, and the platinum wires connected with a battery strong enough to heat the foil to a bright red-heat. After a few minutes the oxygen was stopped and the bulbs weighed, when it was found that they had gained 1 mgrm. On repeating this operation no gain was found, the moisture having been entirely driven off by the first treatment. The carbon was now placed in the boat, and a slow current of oxygen started, then the bulbs connected and the current made to pass through the platinum until all the diamond had been burnt, when the current was stopped and the oxygen allowed to pass for fifteen minutes more, when the bulbs were detached and weighed. They were then reconnected and the gas passed for other ten minutes to find whether all the carbonic acid had been expelled, and reweighed. They weighed 0·2 mgrm. less than before. The numbers were as follows:—

Potash bulbs before combustion	...	43·8308	
,, ,, after ,,	...	43·8776	
			·0468
Drying tube before combustion	...	26·4294	
,, ,, after ,,	...	26·4328	
			·0034
			·0502

This gives a composition of 97·85 per cent. of carbon, which is a pretty fair approximation to pure carbon. However, to determine whether or not this was the case, some further experiments were tried. A small quantity of the carbon was placed on the platinum boat and burnt in oxygen without any of the gas being allowed to pass out of the apparatus, and the mixed gases so obtained transferred to a eudiometer, and the carbonic acid and oxygen absorbed. It was then found that a residue amounting to about 3 per cent. of the carbonic acid was left unabsorbed by alkaline pyrogallate solution. This proved to be nitrogen. A blank experiment was done, but it gave only a minute bubble of nitrogen. Another experiment was performed with the following results:—

Total volume	183°·7		
After absorption of CO_2	148·5	CO_2 =	35·2
After ,, O	1·1	O	147·4
		N	1·1

This plainly shows that nitrogen was present from some cause or another, and as every precaution was taken in transferring the gas from one vessel to another, and as the blank experiment showed nothing, I am inclined to believe that the carbon, or at least some portions of it, contained nitrogen chemically combined. The numbers above given are degrees on the eudiometer tube, and are not more than one-third of a cubic centimetre each. Their exact value was of no consequence in the experiment, and the tube was only calibrated by comparing one part with another, and not with an absolute measure.

From the fact that no diamond was found when nitrogen compounds were absent, and from the fact that the mixed product (for only a portion of the 14 mgrms. was clear diamond) contains nitrogen, I am inclined to believe that it is by the decomposition of a nitrogenous body, and not the hydrocarbon, that the diamond is formed in this reaction. The experiments are, however, too few, and the evidence too vague, to draw any conclusions, as there are even very few negative experiments from which anything can be learned, most of the results being lost by explosion. I intend, when my other work—which I laid aside for the diamond experiments—is finished, to begin a series of experiments on the decompositions of carbon compounds by metals, to find whether a more easily-controlled reaction may not be discovered.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

THE following circular has been issued by the Science and Art Department:—"It having been represented to the Lords of the Committee of Council on Education that many parts of the kingdom are still in ignorance of the system of aid to the formation of classes for instruction in the principles of agriculture afforded by the Science and Art Department; that the supply of teachers who have obtained the necessary qualification to earn payments on results is very limited; and that a strict adherence to the rules of the Science Directory, which require that, in order to obtain aid, classes must be under the instruction of such teachers, would entail the delay of a year in the commencement of classes in this important subject, my Lords decide that §§ xxxiv. and xxxvi. of the Directory may be relaxed for this year in the following manner:—My Lords will be prepared to consider an application from any committee, formed in accordance with § x. of the Science Directory, to grant a temporary qualification to any person selected by it as fitted to teach the principles of Agriculture, and, if such application be found satisfactory, will permit the teacher to earn payments on the results of the examination in May, 1881; on the condition that this provisional qualification shall then determine, and that the only teachers who can after that date be recognised as qualified to earn payments on the results of their teaching in this subject will be such as have complied with the ordinary rules. In making the application the committee must show that there is no technically qualified teacher in the locality who could be employed to instruct the class, and also state the grounds on which the proposed teacher is considered to be really capable of giving instruction in agriculture, by his knowledge of chemistry and other sciences bearing on the subject."

MR. RICHARD CHARES ROWE, M.A., B.Sc., Fellow of Trinity College, Cambridge, has been appointed Professor of Mathematics in University College, London.

PLANS have been prepared for a new botanical class-room in connection with Edinburgh University, the present room being much too small. The plans have been submitted to Government; if approved there will be a grant for the purpose required. The new class-room proposed will be seated for six hundred students, while the old class-room will be altered so as to be used as a practical and histological class-room.

SCIENTIFIC SERIALS

American Journal of Science, June.—Physical structure and hypsometry of the Catskill Mountain region, by A. Guyot.—Recent explorations in the Wappinger Valley limestone of Dutchess Co., N.Y., by W. B. Dwight.—The colour-correction of certain achromatic object-glasses, by C. A. Young.—Note on the companion of Sirius, by A. Hall.—Study of the Emmet Co. meteorite that fell near Estherville, May 10, 1879, by J. Lawrence Smith.—Oxidation of hydrochloric acid solutions of antimony in the atmosphere, by J. P. Cooke.—Relation between the colours and magnitudes of the components of binary stars, by E. S. Holden.—Occurrence of true lingula in the Trenton limestones, by R. P. Whitfield.—Experiments on Mr. Edison's dynamometer, dynamo-machine, and lamp, by Profs. Brackett and Young.—On substances possessing the power of developing the latent photographic image, by M. Carey Lea.

Archives des Sciences Physiques et Naturelles, June 15.—Researches on the temperature of Lake Leman and other freshwater lakes, by Prof. Forel.—The disease of workmen employed in the St. Gothard tunnel, by Dr. Lombard.—Explosions by freezing, by Prof. Hagenbach.—On a yellow rain observed near Bonneville in Savoy, on April 25, 1880, by M. de Candolle.—Diatoms of the Alps and the Jura, and of the Swiss and French region in the environs of Geneva, by M. Bonn.—On a simplification of the theory of vibratory movements, by M. Cellérier.

Atti dei R. Accademia dei Lincei, fasc. 6, May.—Distribution of electricity in equilibrium on two parallel indefinite plane conductors, subjected to the induction of a point in the space included by them, by Dr. Maggi.—On a meteoric rain, containing an abundant quantity of metallic iron, observed at Cattania on the night of March 29-30, 1880, by Prof. Silvestri.—On bromocamphor, by Prof. Schiff.—Chemical and pathological studies on the hematopoetic function, by SS. Tizzoni and Fileti.—Influence of light on the production of hæmoglobin, by the same.—On ethylnaphtaline, by S. Camelutti.—On phenol derived from santonosic acid, by the same.—On a connection between meteorological phenomena and the time of arrival of the earth at perihelion, by Mr. Jenkins.—On the electric polarisation produced by metallic deposits, by Prof. Macaluso.—On the envelope and structure of the uveal tract in vertebrates, by Dr. Angelucci.—Helminthological observations on the endemic malady of the workmen in the St. Gothard (*Anchylostoma duodenalis*), by Prof. Perroncito.

Reale Istituto Lombardo di Scienze e Lettere. Rendiconti. Vol. xiii. fasc xii.—On the aberration of sphericity, &c. (continued), by Prof. Ferrini.—On injury to agriculture caused by the winter 1879-80, by Prof. Cantoni.—On a problem of electrostatics, by Dr. Maggi.

La Natura, vol. iv. Nos. 3 and 4 (February).—On some recent studies in agrarian meteorology, by S. Porro.—Morphogeny of animal individuality, by Dr. Cattaneo.

Bulletin de l'Academie Royale de Sciences de Belgique, No. 4, 1880.—Letter from Dr. Huggins on the subject of M. Fievez's recent note.

Journal de Physique, June.—Vibrations on the surface of a liquid in a rectangular vessel, by Prof. Lechat.—On the economic yield of electric motors, and on measurement of the quantity of energy which traverses an electric circuit, by M.

Deprez.—An experiment in physiological optics, by M. Bibart. —Measurement of the refractive indices of liquids, by MM. Macé de Lépinay.

SOCIETIES AND ACADEMIES

London

Royal Society, May 27.—"A Preliminary Account of the Reduction of Observations on Strained Materials, Leyden Jars, and Voltameters," by John Perry and W. E. Ayrton. Communicated by Prof. G. G. Stokes, Sec. R.S. [Abstract].

In discussing the residual-charge phenomena of condensers, the authors point out that in spite of certain elaborate measurements which have been made on different kinds of glass, nobody has yet discovered a constant such that it expresses the residual charge property of a particular substance. They therefore say that the simple plan of charging a Leyden jar for a long time, short-circuiting for a small definite period, then insulating and giving the residual charge at certain times from insulation (thus getting say three definite numbers for each dielectric experimented upon), is more accurate than, and is just as definite as, any plan hitherto proposed for determining the residual-charge properties of a dielectric. They show that if Prof. Clerk Maxwell is right, the only correct means of studying these properties are given by the constants of Maxwell's differential equation, and they describe experiments on the Leyden jar of a Thomson's electrometer, and reductions of observations to obtain such constants. Thus one such constant is found to satisfy all the observations made from the 500th to the 900th minute of insulation of a jar. The authors draw attention to the analogy which they have pointed out between condensers and voltameters charged by electromotive forces less than one and a half volts, and show that if we assume Maxwell's equation to be true for voltameters, that is, if we assume a voltameter to be a condenser, one constant satisfies observations from the 50th to the 190th minute of charging, and from the 20th to the 80th minute of discharging. They then proceed to develop a theory of the increasing strains in bodies subjected to constant stresses. When a homogeneous substance is suddenly subjected to stress, there is a suddenly produced strain which follows Hooke's law, depending on a constant k, but besides this there is a viscid increase of strain whose rate is proportional to the stress depending on a constant r. In steel the viscous strain is not of much importance, whereas in water strained by bodies moving in it it is very important, as it is also when a beam of sealing wax is loaded. They show that the viscid increase of strain is exactly analogous with the flow of electricity in accordance with Ohm's law, and that the suddenly-produced strain is analogous with induction; and considering a heterogeneous material subjected to shearing stress, they find that the above assumptions lead, for strained materials, to exactly the same equation as Prof. Maxwell found for condensers. They found that the support of this theory is exactly the same as the support which they have given of Maxwell's theory of condensers. Thus one constant of the equation satisfied the recovery from deflection of a glass beam from the 4th to the 240th hour of relief, and satisfied the recovery from twisting of a glass fibre for all but the first few observations. They have also constructed a voltameter such that the platinum electrodes may be maintained at any temperature in an atmosphere of any gas for any length of time, maintaining a vacuum over the liquid or saturating it with any gas, and they give the different values of the residual charge constant, which satisfies all but the first few observations of charge and discharge in different cases. The authors conclude their paper by saying that, regarding a voltameter as a condenser, then as the plates of the charging battery are larger and nearer together, and as the times of charge and discharge of the voltameter are made less and less, the more do the total quantities of the charge and discharge approximate to one another.

Physical Society, June 26.—Prof. W. G. Adams in the chair.—Mr. C. V. Boys read a paper, by Prof. Guthrie and himself, on the measurement of the conductivity of liquids by means of magneto-electric induction. The liquid is suspended in a glass vessel by a fine iron wire in the centre of a cylindrical electro-magnet formed of two semicircular parts. This electro-magnet is rotated at a velocity not exceeding 3,000 turns per minute, and the liquid being drawn round in the direction of rotation, the wire is subjected to torsion, which, under correction for certain errors, is proportional to the resistance of the liquid. The torsion is observed by means of a scale and microscope. The results, plotted in a curve, agree very closely with those of Kohlrausch, obtained by alternate currents, and Dr. Guthrie thinks that they are probably more correct and trustworthy than Kohlrausch's, for the method would seem to be superior and the curve contains fewer excentric points than his.—Dr. Gladstone read a paper on the refraction equivalents of isomeric bodies, in which he described the present state of the subject and his own contributions to it. He showed that the refractive power of bodies over light was of great importance to chemists, since it depended on their essential structure.—Dr. Huggins described his latest results of star spectra, and illustrated his remarks by photographic spectra taken by his improved method. From these it appears certain stars, such as Vega, give a complete spectrum of hydrogen. Others, more yellowish in colour, show a thinning of these lines, such as Sirius, η Ursæ Majoris. Others show the intrusion of more refrangible lines; for example, Arcturus, α Aquila, α Virginius; while Capella gives a complex spectrum like that of the sun. Dr. Huggins also showed a spectrum of the flame of a spirit lamp, which presented a strong group of lines at S, and he considered it to represent the light emitted by the molecules of water. He further observed that the spectrum offered a highly sensitive test of the presence of carbon.—Mr. Liveing exhibited a new fire-damp indicator, capable of detecting ¼ per cent. of marsh gas in air. It is based on the fact that an incandescent body shows more brilliantly in proportion to the amount of marsh gas in the air, and consists of two fine platinum wires kept incandescent by a magneto-electric current sent through them in one circuit. One wire is excluded from the fire-damp, the other is exposed to it, and the relative intensities of the two glowing wires is compared by a photometric screen placed between them and adjustable to a position between them at which the reflections of the wires on the screen are of equal intensity. The position of the screen relatively to the wires is given by a scale, and measures the proportion of fire-damp in the air. This contrivance is more advantageous than the safety-lamp, which only indicates 2 per cent of marsh gas in the air.—Dr. Stone exhibited a vacuum-tube of variable resistance and a large electro-magnet wound with iron wire. The former consists of a barometer-tube thirty-two inches long, terminating above in a short vacuum-chamber arranged transversely, and closed at either end by adjustable india-rubber stoppers, through which platinum terminals are passed. Above this the vertical tube is continued to a glass stopcock, by means of which small quantities of air can be introduced. The foot of the tube is attached to an india-rubber flexible pipe with a cistern like that of Frankland's gas apparatus. The cistern full of mercury is counterbalanced, and can be raised or lowered at will through the whole thirty-two inches. A Torricellian vacuum can thus be made in the upper chamber, or one of more or less perfectness. On passing the induction-spark between the terminals in the former case all the discharge is carried off, none appearing at the discharger. By gradually raising and lowering the cistern, after admitting a little air by the stopcock, the resistance of the partial vacuum thus obtained can be altered within wide limits. A point can also be found where the spark of breaking-contact is shunted through the vacuum-tube, while the weaker discharge of making-contact is stopped. The induction-current is thus obtained in a single direction, a matter of some importance in physiological experiments. The electro-magnet could not be described from pressure of other matter. Its peculiarities consisted in its being wound with best charcoal-annealed wire of about 5 millim. section in four parallel circuits, and in each pole being cast, after winding into a solid block of paraffin. It was expected that the latter device would increase the inductive effect of the spirals; and indeed it appeared that the lifting power was somewhat strengthened. The cores had been originally wound with large copper wire of about the same weight as the iron wire. But the lifting power for batteries of moderate size, five or six Bunsen's cells, for instance, had increased fourfold after the substitution.—A paper by Mr. McFarlane Gray entitled specific heats calculated from entropy. This is a re-affirmation of a paper on the value of v, declined by the committee of the Royal Society in February, 1878. The author read a paper at the last meeting of the Institution of Naval Architects, which we said was a singularly bold and original attempt to account for many of the phenomena of steam and other effects of heat when applied to matter. In the present paper Mr. Gray continues in the same line of startling generalisation. The following is a specimen:—Taking the $p\,v$ of hydrogen at 493°·2 F., as in Rankine's tables, to be 378819 foot pounds, he writes—

$$u = \frac{mpv}{J\theta} = \frac{2 \times 378819}{772 \times 463 \cdot 2} \; 1 \cdot 989856.$$

The letter u in the paper with the value obtained as above is applied in the following remarkable generalisations: m being the molecular weight of the substances, and $p\,v$ and θ being the pressure, volume, and absolute temperature in any standard units.

$$\text{The thermal equivalent of } pv = \frac{u}{m}\theta.$$

$$\text{Specific heat at constant volume } = 2\tfrac{1}{2}\frac{u}{m}\theta$$

$$\text{Specific heat at constant pressure } = 3\tfrac{1}{2}\frac{u}{m}\theta$$

The specific heat in the gaseous state is therefore at constant pressure.

$$\frac{3\tfrac{1}{2} \times 1 \cdot 989856}{17 \cdot 96} = \cdot 387779$$

for H_2O, water in the gaseous state. By calculating the difference of entropy for water at numerous temperatures for the different states of aggregation, first absolute H_2O without energy volume, secondly, water as we know it with a volume increasing with temperature; thirdly, water split into single molecules, but these yet without motion; fourthly, single molecule H_2O or steam gas; he shows that the difference of entropy between the third and the fourth state is equal to the specific heat at constant pressure, and that the whole energy possessed by the water up to the split and motionless state is a constant quantity at all temperatures for the same substance. He calls this quantity the absolute splitting heat; the splitting heat above any standard state he calls the nominal splitting heat, S a constant quantity for all temperatures. From the entropy calculation for more than twenty temperatures, all calculate to seven places of decimals from Regnault's exact formula (H) for saturated steam, he takes two temperatures indiscriminately, and equates the value of S expressed in entropy quantities with one unknown quantity, the specific heat entropy.

Equating 278° C. with 374° C. gives ...	·387729
,, 278° C. with 494° C. gives ...	·387867
	2)·775596
Mean calculated specific heat	·387798
Instead of	·387779
Difference	·000019

The value of S above melted ice is for water

Calculated at 278°	S = 502·386
,, 294°	S = 502·405
	2)1004·791
	502·395 C.
	or 904·311 F.

This is a remarkable corroboration of the kinetic theory of gases, quite unlooked for in steam experiments, and, as the author of the paper remarked, it shows how reliable are the results of the experimenter Regnault. The author also explained a new diagram, in which the area is energy, the length entropy, and the height temperature. In such a diagram it becomes as simple an idea as temperature. From this it appears that the ratio of the two specific heats is 1·4 for steam.—Mr. Clark communicated a paper on the behaviour of liquids and gases near their critical temperatures.—Mr. Winstanley exhibited two new varieties of air-thermometers and a thermograph actuated by an air-thermometer on the principle of his radiograph exhibited at last meeting. The first thermometer consists of a U tube with terminal bulbs and the left leg of much finer bore than the right. Mercury is in the right leg, sulphuric acid surmounted with air in the left. The apparatus is a barometer to the air inside the left bulb, and a thermometer to that outside. A similar combination of an air-thermometer and an aneroid barometer constitutes the second instrument. The expansion or contraction of the air in the stem by external temperature expands or compresses a small aneroid chamber in the bulb.—Mr. Gee and Mr. Stroud made a communication on a modification of Bunsen's calorimeter, which will be found in the *Proceedings* of the Society.—The meeting then adjourned till the winter session commences.

Geological Society, June 23.—Robert Etheridge, F.R.S., president, in the chair.—Edwin Muir, Benjamin Sykes, and John Thorburn were elected Fellows of the Society. The following communications were read:—On the skull of an *Ichthyosaurus* from the lias of Whitby, apparently indicating a new species (*I. zetlandicus*, Seeley), preserved in the Woodwardian Museum of the University of Cambridge, by Prof. H. G. Seeley, F.R.S.—Note on the cranial characters of a large Teleosaur from the Whitby lias, preserved in the Woodwardian Museum of the University of Cambridge, by Prof. H. G. Seeley, F.R.S.—On the discovery of the place where Palæolithic implements were made at Crayford, by F. C. J. Spurrell, F.G.S.—The geology of Central Wales, by Walter Keeping, F.G.S., with an appendix by C. Lapworth, F.G.S., on a new species of *Cladophora*.—On new Erian (Devonian) plants, by J. W. Dawson, F.R.S. The paper first referred to recent publications bearing on the Erian (Devonian) flora of North-East America, and then proceeded to describe new species from New York and New Brunswick, and to notice others from Queensland, Australia, and Scotland. The first and most interesting is a small tree-fern, *Asteropteris noveboracensis*, characterised by an axial cylinder composed of radiating vertical plates of scalariform tissue imbedded in parenchyma and surrounded by an outer cylinder penetrated with leaf-bundles with dumb bell-shaped vascular centres. The specimen was collected by Mr. B. Wright in the Upper Devonian of New York. Another new fern from New York is a species of *Equisetides* (*E. wrightianum*), showing a hairy or bristly surface, and sheaths of about twelve short acuminate leaves. A new and peculiar form of wood, obtained by Prof. Clarke of Amherst College, Massachusetts, from the Devonian of New York, was described under the name *Celluloxylon primævum*. It presents some analogies with *Prototaxites* and with *Aphyllum paradoxum* of Unger. Several new ferns were described from the well-known Middle Devonian plant-beds of St. John's, New Brunswick; and new facts were mentioned as confirmatory of the age assigned to these beds, as showing the harmony of their flora with that of the Erian of New York, and as illustrating the fact that the flora of the Middle and Upper Devonian was eminently distinguished by the number and variety of its species of ferns, both herbaceous and arborescent. It will probably be found eventually that in ferns, equisetaceous plants, and conifers, the Devonian was relatively richer than the Carboniferous. Reference was also made to a seed of the genus *Ætheotesta* of Charles Brongniart, found by the Rev. T. Broun in the Old Red Sandstone of Perthshire, Scotland, and to a species of the genus *Dicranophyllum* of Grand'-Eury, discovered by Mr. J. L. Jack, F.G.S., in the Devonian of Queensland. In all, this paper added six or seven new types to the flora of the Erian period. Several of them belong to generic forms not previously traced further back than the Carboniferous. The author uses the term "Erian" for that great system of formations intervening in America between the Upper Silurian and the Lower Carboniferous, and which, in the present uncertainty as to formations of this age in Great Britain, should be regarded as the type of the formations of the period. It is the "Erie Division" of the original Survey of New York, and is spread around the shores of Lake Erie, and to a great distance to the southward.—On the terminations of some Ammonites from the inferior oolite of Dorset and Somerset, by James Buckman, F.L.S.—Faröe Islands: Notes upon the coal found at Suderöe, by Arthur H. Stokes, F.G.S.—On some new cretaceous *Comatulæ*, by P. Herbert Carpenter, M.A. Communicated by Prof. P. Martin Duncan, F.R.S.—On the Old Red Sandstone of the north of Ireland, by F. Nolan, M.R.I.A. Communicated by Prof. Hull, F.R.S.—A review of the family Vincularidæ, recent and fossil, for the purpose of classification, by G. R. Vine. Communicated by Prof. P. M. Duncan, F.R.S.—On the zones of marine fossils in the calciferous sandstone series of Fife, by James W. Kirkby. Communicated by Prof. T. Rupert Jones, F.R.S.—The glaciation of the Orkney Islands, by B. N. Peach, F.G.S., and John Horne, F.G.S. In this paper, which forms a sequel to their description of the glaciation of the Shetland Isles, the authors, after sketching the geological structure of Orkney, proceeded to discuss the glacial phenomena. From an examination of the various striated surfaces they inferred that the ice which glaciated Orkney must have crossed the islands in a north-westerly direction from the North Sea to the Atlantic. They showed that the dispersal of the stones in the boulder-clay completely substantiates this conclusion; for in Westray this deposit contains blocks of red sandstone derived from the Island of Eda, while in Shapincha blocks of slaggy diabase, occurring *in situ* on the south-east shore, are found in the boulder-clay of the north-west of the island. Again, on the mainland, blocks of the coarse siliceous sandstones which cross the island from Inganess to Orplin are met with in the boulder-clay between Honton Head and the Loch of Slennis. Moreover, they discovered in the boulder-clay the following rocks, which are foreign to the island: chalk, chalk-flints, oolitic limestone, oolitic breccia, dark limestone of Calciferous-sandstone age, quartzites, gneiss, &c., some of which closely resemble the representatives of these formations on the east of Scotland, and have doubtless been derived from thence. From this they infer that, while Shetland was glaciated by the Scandinavian *mer de glace*, Orkney was glaciated by the Scotch ice-sheet, the respective ice sheets having coalesced on the floor of the North Sea and moved in a north-westerly direction towards the Atlantic. They also found abundant fragments of marine shells in most of the boulder-clay sections, which are smoothed and striated precisely like the stones in that deposit. They conclude that these organisms lived in the North Sea prior to the great extension of the ice, and that their remains were commingled with the *moraine profonde* as the ice-sheet crept over the ocean-bed. From the marked absence of shell-fragments in the Shetland boulder-clay they are inclined to believe that much of the present sea-floor round that group of islands formed dry land during the climax of glacial cold.

Paris

Academy of Sciences, July 5.—M. Edm. Becquerel in the chair.—The death of M. Borchardt (correspondent in Geometry) was announced.—The following papers were read:—Study of the variation of the line of sight, on the great meridian circle of Paris Observatory (constructed by M. Eichens), by means of a new apparatus, by M. Loewy. The essential part is a small glass disk giving simultaneously three images in the eye-piece: (1) that of the cross wires, (2) that of a division drawn on the objective, and (3) that of one of the divisions of a plate inserted in the axis.—On the photography of the chromosphere, by M. Janssen. The exposure is continued till the solar image is positive to the border; the chromosphere then appears as a dark circle 8″ or 10″ in width.—On the integration of linear equations by means of the sines of superior orders, by M. Villarceau.—On the consequences of the experiment of MM. Lontin and de Fonvielle, by M. Jamin. He indicates experiments which should test his explanation.—On the vision of colours, by M. Chevreul.—On some general relations between the chemical mass of elements and the heat of formation of their combinations (continued), by M. Berthelot. The influence of mass of the elements in diminishing the stability, and therefore the heat liberated, may be conceived simply by supposing that the system formed by two molecules will be more exposed to destruction by movements of the whole system (rotations, vibrations, &c.,) the heavier the molecules. On the other hand, the reserve of energy (which is gradually expended in combination), should, *ceteris paribus*, be greater in light elements than in heavy ones.—Epochs of vegetation for the same tree in 1879 and in 1880, by M. Duchartre. Though the temperature was much more severe in December and January last than the previous year, the renewal of vegetation in six chestnuts was earlier. The mild time between the cold of December, 1879, and January, 1880, does not account for this, for a longer and milder time intervened in 1878–79. Nor does the method of sums of heat explain it. But the trees received more heat this year from the beginning of vegetation to complete expansion of their leaves.—On a meteorite which fell on November 16, 1874 at Kerilis (Côtes du Nord), by M. Daubrée. This belonged to the sub-group Oligosideres in the Sporadosideres.—On a meteorite which fell on September 6, 1841, in the vineyards of Saint Christophe-la-Chartreuse (Vendée), by M. Daubrée.—Inquiry into the situation of agriculture in France in 1879, by M. Chevreul.—On the utility of quarantines, by M. de Lesseps. He gives examples of their inadequacy.—Nature of the immunity of Algerian sheep against spleen-disease; is it an aptitude of race? by M. Chauveau. The property is congenital and natural. It may be communicated by crossing to European sheep. French sheep bred in Algeria do not acquire it, and it is not proved that Algerian sheep bred in France may not lose it.—Determination of the difference of longitude between Paris and Bonn, by MM. Le Clerc and De Bernardières. The figures obtained are 19m. 2·269s., probable error $\pm$ 0·009s. German astronomers found for the same arc, 19m. 2·231s.—Some remarks on the equation of Lamé, by M. Escary.—Integration of any number of simultaneous equations between a given number of functions of two independent variables and their partial derivatives of the first order, by M. Turquan.—On the bright spectral lines of scandium, by M. Thalén.—Improvements in Siemens' bobbins, by M. Trouvé. He suppresses the two periods of indifference, making the polar faces of snail form, so that the surfaces approach those of the magnet gradually, till the moment that the posterior edge escapes from the pole, when repulsion commences. The work is thus economised.—On the sensibility of the eye to differences of light, by M. Charpentier. A given light, strong or weak, must (in his case) be increased or diminished about eight hundredths to give a distinct new sensation; and it seems to be the same in indirect vision as in direct, and with coloured as with white light.—Thermic study of polysulphides of ammonium and persulphide of hydrogen, by M. Sabatier.—On the density of iodine vapour, by M. Troost. He finds it to diminish both at a low and at a high temperature, so that dissociation or isomeric change seems hardly admissible.—On the atomic weight and on some characteristic salts of ytterbium, by M. Nilson.—On the dissolution of platinum in sulphuric acid, by M. Scheurer-Kestner. The attack of platinum is always due to presence of nitrogenised compounds in the sulphuric acid.—Remarks on etherification of hydracids, by M. Villiers.—Atmospheric bacteria, by M. Miquel. The number, very small in winter, increases in spring, and is high in summer and autumn; but while spores of mould are abundant in wet, and rare in dry, periods, it is the opposite with aërial bacteria. At Montsouris, in summer and autumn, 1,000 germs of bacteria are sometimes found in 1 cubic metre; in winter the number may go down to 4 or 5, and on some days 200 litres of air are insufficient to infect the most alterable liquors. In ordinary houses air proves fertilising (to neutral bouillon) in a volume of 30 to 50 litres. M. Miquel notes an increase of deaths from contagious and epidemic diseases in Paris, about eight days after a recrudescence of aërial bacteria. Water vapour from the ground, rivers, or putrefying masses is always micrographically pure.—On a digestive ferment contained in the sap of the fig, by M. Bouchut.—A work by M. de Koninck, on the fauna of the carboniferous formation of Belgium, was presented.

Vienna

Imperial Academy of Sciences, May 7.—B. Bolzano's significance in the history of infinitesimal calculation, by Prof. Stolz.—Investigation of the roast products of coffee, by Herr Bernheimer.—On direct introduction of carbonyl groups into phenols and aromatic acids (third part); behaviour of pyrogallic and gallic acids with carbonate of ammonia, by Prof. Senhofer and Dr. Brunner.—On Guthrie's cryohydrates, by Herr Offen.—On the relation of the coefficients of diffusion of gases to the temperature, by Herr von Obermayer.—On the coincidence of disorders of the skin and of the grey axis of the spinal cord, by Dr. Jarisch.

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