THURSDAY, AUGUST 14, 1884

THE REPORT ON TECHNICAL INSTRUCTION

THE Report of the Royal Commissioners on Technical Instruction is now before the public. These two volumes, together with the short interim Report on Apprenticeship Schools in France, which was issued two years ago, extend over a wide range of matter. The Commissioners' account of their travels abroad and at home is narrated in vol. i., which concludes with their various recommendations. Vol. ii. contains a Report on Agricultural Education, by Mr. Jenkins, and another on Technical Education in America, by Mr. Wm. Mather. In the remaining volumes will be found a Report by Mr. Wardle on Silk Industries, and a scheme by Prof. Sullivan for Technical Education in Ireland, and a variety of Statistics and Programmes are also promised.

The immense mass of detail thus gathered together in this voluminous and interesting blue-book renders it a matter of some difficulty to give anything like an adequate review of the labours of the Commission. In the present article we shall confine our attention to that part of the Report which deals with technical schools in foreign countries, reserving for a second notice that part of the Report which relates to Great Britain.

The Commissioners preface their account of Continental Technical Instruction with some concise introductory notices of the general conditions of Primary and Secondary Education in various nations. Their remarks on the gradation of schools, on the use of school museums, and on the prominence given to drawing are worthy of attention. After these notices the Commissioners deal with artisans' evening technical schools, artisans' apprenticeship schools, intermediate technical schools for foremen, trade and professional schools for women, and the higher technical instruction for employers and managers. Concerning the first of these matters the Commissioners remark on the value of the numerous continuation-schools (Fortbildungschulen) which exist in nearly all towns of Germany and Switzerland. It appears that in Bavaria, Baden, and elsewhere, pupils leaving the primary schools at the age of 13 are compelled by law to continue their studies in the evening schools until the age of 16: a truly wise rule, calculated to sustain the benefits of school training at a period when such training is too often prematurely cut short. It also appears that although in no country abroad is there any organisation for systematic evening instruction at all comparable to that under the control of our Science and Art Department, the teaching, at least in many foreign towns, is conducted by professors of higher standing than, and of superior attainments to, the ordinary English "science-teacher" who, it must be confessed, is too often sadly deficient in training. On the subject of artisan apprenticeship schools the Commissioners do not add much to the information given two years ago in their preliminary report, so far as France is concerned; but, in relation to some of the German schools, as, for example, the clock-making and wood-carving schools at Furtwangen and other districts of the Black Forest, there is much interesting information. In Wurtemburg there are no such schools, as the authorities prefer to attempt to give sound education by means of evening and Sunday schools, without interfering with the conditions of daily labour.

In regard to Intermediate Technical Schools for foremen and others much is being done abroad, both in the special departments of weaving, mining, and industrial art, and in more general schools. In France particularly this is the case. The great schools of this type at Lyons, Rheims, and Paris are practically unique. There is nothing approaching them in this country except perhaps the Allan Glen's Institution in Glasgow. These schools and the secondary technical schools of Germany are elaborately described. The Higher Trade Institute of Chemnitz, and the four "Industrie-Schulen" of Munich, Augsburg, Nüremberg, and Kaiserslautern are of this class, intermediate between the Real-Schulen and the Polytechnics. No classics are taught in these schools. Throughout Austria, Germany, France, and Holland there are also special schools for mining and for the building trades. The Commissioners devote many pages to the weaving schools, which, like those of Chemnitz, Crefeld, and Mulhouse, are to be found doing work of utmost importance to the continental industries. The spirit with which municipalities and manufacturers support these schools is truly remarkable. Employers are constantly looking out for students who have attended the technical classes. The manufacturers feel it imperative to extend their work in order that in troublous times they may have more than one string to their bow. Thus in Crefeld, where silk goods are the staple manufacture, much attention is given in the weaving school to the weaving of jute, wool, and cotton. The people cheerfully tax themselves to pay for efficient management. They recognise that the day has gone by when money can be made without effort: "to exist they must move on." Heavily taxed as the German people are by the burden of enormous civil and military expenditure, they yet believe that it is cheapest in the long run to educate the "human machine" to the highest pitch of perfection.

It is, however, with the higher technical instruction, with the great Polytechnic colleges of Germany, and with the École Centrale and École Polytechnique of Paris that the interest of the Commissioners' Report culminates. The German Polytechnics form a group of institutions of which the type is absolutely wanting in this country. These institutions, though in many respects resembling the German universities, differ absolutely from them, not merely in being technical and practical, but in having fixed curricula of study, and regular systems of examination. The eleven schools of this type (eight of which are in Germany proper, one at Zürich, one at Delft, one at Moscow) have been built at a cost of not less than three millions sterling, and are maintained at an annual cost of over 200,000*l.* This amounts to a State expenditure of about 100*l.* per annum for each student in attendance. This may be contrasted with the case of the two leading English Universities of Cambridge and Oxford. These and their colleges are believed to have a total annual income from endowments of 500,000*l.*, and as there are about 5000 men in total attending the two Universities, this also is at the rate of 100*l.* per annum per student. There is, however, room in the Polytechnic for three times the number of students actually in attendance. A few figures respecting some of these schools will show how these institutions stand in public opinion. The Munich Technical High School cost 157,000*l.*, the apparatus alone being worth 36,000*l.*, and the annual expenses amounting to 20,000*l.* The Zürich Polytechnic spends 20,000*l.* annually, 13,800*l.* being derived from Federal taxes, and 3794*l.* only from fees. There are forty-five professors on the lecturing staff. 50,000*l.* have just been spent on laboratory extension. The Stuttgart Polytechnic has a State subvention of 12,000*l.*, that of Dresden 12,200*l.* The Hanover Polytechnic cost 350,000*l.*; its collection of models (chiefly engineering), 36,000*l.*, and 1250*l.* is spent every year in adding to the collection. Some idea of the preparation made for teaching engineering students may be gathered from the fact that there are stated to be in this one school no fewer than 673 tables for drawing. The Berlin Polytechnic, now nearly completed, has cost 450,000*l.*; that of Moscow 496,000*l.* The chemical laboratory of the Polytechnic of Aachen alone cost 45,000*l.* The Bernouillianum of Berne cost that little town more than 1*l.* per inhabitant! At such a price do our neighbours provide for the higher technical training. In France, too, the technical schools are maintained at great cost. In the École Polytechnique, salaries alone amount to 22,000*l.* per annum. A new addition to the laboratories is costing 96,000*l.* All this is found by the Government. On the other hand the École Centrale, which spends 17,836*l.* per annum, is self-supporting, the fees being very high.

From this enormous expenditure of money on Higher Technical Education, tangible results cannot but accrue. Many such are mentioned in the pages of the Commissioners' Report. They adduce examples of improvements in machinery which are the result to a large extent of students' training. They point out how in Continental chemical works and dye works there is a thoroughly trained chemist at the head of each separate department. They indorse the opinion of Prof. von Helmholtz as to the absolute economy of employing as heads of departments persons conversant with the theory of their work, and able by virtue of their scientific knowledge to anticipate results and to make quantitative calculations. They remark that in physics, as also in chemistry, the knowledge of the principles of the science and of the methods of research is the more important part of the equipment of the technical student. They ascribe the general diffusion of high scientific knowledge in Germany to the multiplication of the Polytechnics, and to the small cost of a higher or University education. Amongst the opinions, which they quote, of authoritative speakers, there is one of particular appositeness from the mouth of Prof. Quincke. He holds that it is an error to suppose that any Polytechnic course of instruction can *by itself* teach a student to erect an engine, work a blast-furnace, or manufacture sulphuric acid: he holds that lectures and laboratory work are obviously insufficient to prepare the student for carrying on work where actual practical experience is needed; but that, in contradistinction, the object of the Polytechnic School is *to facilitate the transition from pure science to practice.* The functions of the Polytechnic have probably never before been so well defined. It may be an open question what kind of training is the best to qualify a man to be manager of an industrial concern. But there can be no question whatever of the consensus of opinion on the Continent as to the value of the Polytechnic training. It may not, nay, cannot, supplant the experience of the workshop: but it gives something that no amount of mere workshop experience can give—something which, were it suitably introduced into industrial Britain, would supply the greatest industrial want of our time.

BRITISH MINING

British Mining, a Treatise on the History, Discovery, Practical Development, and Future Prospects of Metalliferous Mines in the United Kingdom. By Robert Hunt, F.R.S. 4to. Pp. xx. 944, 231 Woodcuts and 2 Folding Plates. (London: Crosby Lockwood and Co., 1884.)

THE title shows that the author's object is to describe the past and present condition of British metal mines, and to venture some prophecies as to their future. It requires a bold heart to attempt a work of this kind; but, as explained in the preface, Mr. Hunt's long connection with mines and his official position as Keeper of Mining Records have given him excellent opportunities for gathering information.

The work is divided into four books. Book I. gives a long historical sketch of British metal mining from the time of the Phœnicians downwards. With reference to St. Michael's Mount being their trading station, the author indorses the old Cornish tradition and disagrees (p. 845) with Prof. Rhys, who has suggested that the Isle of Thanet was the *Iktis* of Diodorus. From detached memoirs and reports much information has been collated concerning mining work carried on by the Romans for lead, iron, copper, and gold.

In Chapter III., upon mining to the eighteenth century, Mr. Hunt fixes very exactly the date of the introduction of gunpowder for blasting in Cornish mines. Chapters IV., V., and VI., relating to the mining of tin, copper, lead, silver, iron, and zinc to the end of the eighteenth century, are full of valuable facts, and both here and in Chapter III. we notice many interesting statements concerning the special privileges of miners and the charters granted to them.

Book II., occupying one-third of the volume, is devoted to the formation of metalliferous deposits. The rocks and mineral veins of the principal mining districts are described, and long quotations are made from sundry writers. Mr. Hunt then sets forth the hypotheses of the best-known authors concerning the origin of lodes, and very wisely does not bind himself to any particular theory; he admits that mineral veins have been formed by deposition in fissures from lateral infiltration, from surface-water carrying down soluble salts they have dissolved out in their passage, and lastly, from ascending mineral springs. He further considers that many of the conditions observed are due to electro-chemical influences.

In the last chapter of this book the author brings forward instances of remarkable tin, lead, and copper mines in Cornwall, Wales, Ireland, and the North of England.

Book III., which is of the same length as the preceding one, is a treatise on practical mining. Rock-boring by machinery very properly comes in for a large share of attention, but some other departments of mining are treated rather cursorily. In speaking of the *man-engine* for raising and lowering men, Mr. Hunt points out that the reason why this valuable invention is so little used is "the unfortunate system under which the mines of Cornwall and Devon are worked—a system which does not encourage the holder of shares to take any interest in the mines themselves, his interest being confined to the market value of the shares which he holds." This remark is unhappily applicable to other districts.

In Chapter IV., on ore-dressing, after an historical sketch, the principles of the mechanical preparation of ores for the smelter and the various kinds of machines now in use are described with the aid of numerous illustrations.

Chapter V., upon the discovery and extraction of iron ores from veins and other deposits, is disappointing, on account of its meagreness compared with the space devoted to less important metals, and the Cleveland ore should scarcely have been dismissed in a dozen lines.

Book IV. relates to the future prospects of British mining. To persons interested in mines, whether as owners, shareholders, workmen, or merchants furnishing them with supplies, this book will no doubt seem the most important in the volume. Mr. Hunt is not sanguine about better prices for tin, and he says that "it is improbable that our native copper mines can be expected to prove profitable for some time to come"; in the case of lead he evidently is not more hopeful, and though the prospects as regards zinc are brighter, still we are unable to supply our own wants. In spite of the productiveness of our iron mines, we have to import more than three million tons of iron ore annually.

The fourth chapter of this book contains numerous useful suggestions for working mines, and is well worthy of consideration by miners and shareholders in mines. With reference to profitable mining, Mr. Hunt says (p. 868):—"The question is frequently asked, Is British mining a remunerative pursuit? Various replies might doubtless be given in accordance with any particular set of views and opinions held on the subject, but mines promoted by mere speculation can scarcely be expected to become profitable, inasmuch as they are too frequently grounded upon a misrepresentation of facts, while the capital connected with them is often largely diverted to the pockets of individuals whose main purpose is immediate gain. Further, the management or conduct of affairs is often leavened with ignorance and incompetency; the acquisition of personal gain, at the cost of unsuspecting shareholders, being unfortunately sometimes the rule of action." No one who knows anything about mining can fail to indorse these remarks.

In Chapter V., which contains the general summary and conclusion, Mr. Hunt says that "the exhaustion of our mineral wealth is now going onward at a rapidly increasing rate," and the question arises whether we can meet the demands of trade from British mines or not. According to the author, our tin ore is practically inexhaustible, but for copper, lead, zinc, and silver we must depend greatly upon foreign and colonial mines; of iron ore we have enough for some years, though certain foreign ores are of importance to us.

The situation is summed up as follows:—"Without great improvements in the principles of mining it will not be possible to work, at a profit, many of our deeper and more extensive mines."

The last two pages of the work, before the appendix, contain several important maxims which deserve the careful study of all persons engaged in mines, such as the necessity of supplying pure air *at any cost*, of raising and lowering the men by machinery, and providing for them in the event of accident or disease. The concluding words very properly strike at the rascality which has done much to wreck British metal mining. "Beyond these, to enable the adventurers in our Home Mines to compete satisfactorily in the metal markets with the proprietors of colonial and foreign mines, and to realise a profit on the sale of their minerals, it is absolutely necessary to study the strictest economy, and to establish—beyond the risk of any failure—the highest principles of honesty in every department, directly or indirectly, connected with British Mining."

The size of Mr. Hunt's volume is apt to alarm the reader, and the publishers would probably have done better by issuing the work in separate books. It strikes us, too, that undue prominence is given to tin, to the detriment of the more important metal iron. From the "Mineral Statistics" for 1883, we see that the iron ore raised had a value of about $5\frac{1}{4}$ millions sterling, whereas the value of all the other metalliferous ores put together was only $1\frac{1}{2}$ million. However, in spite of this favour shown to tin and of occasional inaccuracies, Mr. Hunt's *magnum opus* is very praiseworthy, as it contains a vast store of useful information, and the antiquary, the miner, and the capitalist are greatly indebted to him for having taken the trouble to chronicle so many valuable facts relating to such an important branch of British industry as Metal Mining.

LETTERS TO THE EDITOR

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

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

The International Geological Congress

WILL you allow me to announce in your columns that, in consequence of the outbreak of cholera in the South of Europe, the International Geological Congress is postponed to September 1885.

JOHN MCKENNY HUGHES

Woodwardian Museum, Cambridge, August 12

The Volcanic Dust Phenomena

I WOULD draw the attention of such of your readers as may be travelling in Switzerland or other mountainous countries to the circumstance that in the clear atmosphere of the mountains the great corona or circle round the sun, as well as the semicircle seen opposite the sun before and after sunset continue to be markedly conspicuous; and the higher one ascends the more striking these phenomena are. I saw both the phenomena especially remarkable on the Gornergrat, altitude 10,289 feet, on the 21st and 22nd of last month; and even as low as 4000 feet they are decidedly more striking than at sea-level. It appears, therefore, that the bulk of the volcanic dust, if such it be, that still remains continues at a great elevation, and the prediction made last autumn that it might remain for years in the atmosphere, seems likely to be fulfilled.

The explanation of the strange sunsets given by "F. A. R. R." in NATURE (p. 155), seems a good one, except as regards the green appearance of the moon and stars; I must confess I am not convinced that this was anything but a subjective pheno menon. It is true I saw it myself when there was little if any redness perceptible in the sky; but the probability is that one's eyes had become so dazzled by, and used to, the intense redness previously existing, that one was rendered incapable of seeing a moderate degree of red, and the complementary colour was produced in uncoloured objects. Besides, gas-lights sometimes partook of this colour. As regards the sun, I agree with "F. A. R. R." in the impression that when it was moderately near the horizon it was whiter than usual all last winter and spring, and perhaps to the present time.

Sunderland, August 6 T. W. BACKHOUSE

Upon the Occurrence of Bacteria and Minute Algæ on the Surface of Paper Money

THE recent researches of Paul Reinsch of Erlangen have shown the occurrence of different schizomycetes and of two new minute algæ (*Chroococcus monetarum, Pleurococcus monetarum*, Paul Reinsch) on the surfaces of the coins of many nations, living in the thin incrustations of organic detritus (composed especially of starch grains, fibres, &c.) deposited upon their surfaces in the course of long circulation. This extremely thin incrustation renders the coins very suitable for this micro-vegetation, but the same phenomenon is also exhibited in the case of paper money, and indeed by notes of clean and, to the unassisted vision of a quite unaltered appearance.

Having scraped off some of these minute incrustations with a scalpel and needle and divided them into fragments in recently boiled distilled water, with lenses of high powers (1/10th inch of Messrs. Beck) there were distinctly seen various schizomycetes, &c.

I have investigated the Hungarian recent and older (from the year 1848-49) bank and State notes, also Russian 1-rouble notes, and have found upon all of them—even upon the cleanest —schizomycetes, &c.

On the surface of all the paper money is always to be found the bacterium of putrefaction (*Bacterium termo*, Dujardin).

In the thin incrustations of paper-money the occurrence of starch grains, especially that of wheat-starch, linen, and cotton fibres, animal hairs, &c., are easily to be demonstrated, and upon the 1-forint[1] State-notes in such deposits the common saccharomyces are also to be found. Various micrococci, leptotriches (many with club-shaped swelled-up ends), and bacilli are also very frequent plants in these deposits on paper-money.

The two new species of algæ described by Paul Reinsch are very rare on the paper-money. The green pleurococcus cells I have observed in some cases on 1- and 5-forint State-notes and the bluish-green minute chroococcus on the edges of the 5-forint State notes.

The vegetation of the paper-money is, as a result of my researches, composed of the following minute plants :—

1. *Micrococcus* (various forms).
2. *Bacterium termo.*
3. *Bacillus* (various forms).
4. *Leptothrix* (various forms).
5. *Saccharomyces cerevisiæ.*
6. *Chroococcus monetarum.*
7. *Pleurococcus monetarum.*

From a hygienic point of view, also, the investigations of the commonest necessary household objects may not be superfluous, and I would especially call attention to these forms as occurring on the means of instruction, viz. the handbooks, &c., used by our young scholars.

JULES SCHAARSCHMIDT,
Privat docent of Cryptogamic Botany and Anatomy of Plants, Assistant at the Botanic Institute and Gardens, Royal Hungarian University, Kolosvár

Fireballs

THE following account I have received from a lady at Brühl near Cologne, July 26 :—"8.22. A large fireball of scarlet fire almost as large as a harvest moon just sailed along and upwards, at a varying but mostly very rapid rate, until, at a great height, it remained for some minutes almost or quite stationary; then after some uncertain movements rose again, and rising, became smaller, until it finally disappeared. . . . Every one who saw it seemed petrified with amazement." This is of interest from the long time that the ball was visible, and its being seen by several people. I described some time ago some fireballs which I saw slowly moving at a distance during a storm in Egypt, which were then put down as illusory results of a flash (NATURE, vol. xxiv. p. 284), but now many similar cases have been lately reported. A large fireball, described as about a foot in diameter, was seen a few years ago near here; it struck a pavement, went over a low wall, moved across a wide lawn, and finally vanished in a wet ditch.

While living lately at San (Tanis), thirty-two miles south-west of Port Said, there occurred a most remarkable thunderstorm on May 12, lasting from 1.15 till 4 p.m. The rainfall in two hours was over $1\frac{1}{2}$ inches; the hailstones (which covered half the area of the ground) were mostly 3/10ths to 4/10ths inch in diameter, and some 7/10ths, of concentric structure with jagged edges. Whenever I could hear anything above the battering of the hail on my iron roof there was always thunder going on; and as soon as the rain ceased I went out of doors, where for half an hour longer I can positively assert that there was not an instant of silence. This thunder was not in loud, reverberating peals, but was a continuous rushing, gusty, swishing sound; the noise rising and falling just like a gusty, tearing, high wind, without any crashes or explosive bursts, and with very little bumping or knocking sounds. It only lightened once or twice during that half hour, and there was but a faint breeze of wind. To the best of my belief the thunder was similar during the whole time of the storm, though with more explosive sounds and more lightning in the early part. It is impossible to refer such a storm to the ordinary instantaneous, sharp discharges with echoes, as the sound had no character of a reverberation; it appears to be due to a continuous discharge like that from a point. The storm was quite local, only extending a few miles. Since returning to England I have also heard thunder which was apparently not from an instantaneous discharge, as it began lightly and waxed louder for two or three seconds, until a loud crash of the main discharge took place.

The whole question of slow or peculiar discharges and of fireballs needs clearing up by careful observation; it is useless to ignore it or refer it to illusion, merely because we have not imitated it artificially or made a theory on the subject.

Bromley, Kent W. M. FLINDERS PETRIE

Museums

IN an excellent article on "Practical Taxidermy" in NATURE of August 7, reference is made to the Museum at Leicester as approaching to the ideal of what museums should be. While fully agreeing with the opinions attributed in that article to Mr. Bowdler Sharpe, and admitting that the Leicester Museum has at last taken one step towards the ideal which was worked out for it some years ago, I feel bound to point out to such other museums as are waking up to the necessity of a radical revolution, that perfection is a long way off yet; that there is ample room for each to do better than its predecessor; that Leicester has not even carried out the general principles laid down by Mr. Bowdler Sharpe; and that these general principles may be developed in various directions.

They should consider what a provincial museum can do to the best advantage, for the world, for local students, and for the unlearned public; and by what methods of arrangement, of public exhibition and of private access, its highest functions can be most completely brought out.

Of the three educational objects for which rates can be levied by Town Councils, viz. museums, free libraries, and art galleries, the popular taste is rather tending just now towards the free libraries and the art galleries. There is a disposition to regard museums as mere hobbies for the few, and to devote the lion's share of the rate to literature and art. This is perhaps only a swing of the pendulum, but it is justified to a large extent by the condition of nearly every provincial museum at the present time.

Science is taught in most museums as reading, writing, and arithmetic were taught in the old-dame schools—in a clumsy, thoughtless, perfunctory manner, which wasted half the time and interested nobody. Mr. Mundella, with the Education Act in his hands, has made a revolution in the schools; if Mr. Bowdler Sharpe will get his ideas developed in museums with equal success, he will supplement the schools in a most valuable and important direction.

[1] 1-forint (to German Gulden) = 2*s*.

His first principle, that the primary object of every county museum should be to make as perfect a collection as possible of the natural productions of that county, exhibited in the most attractive form, is undoubtedly correct, and has been definitely sanctioned by a large body of competent authorities. This is just what can be done by each provincial museum better than by any other institution in the world, and it is just what is especially wanted by scientists, by students, and by the public. But this unfortunately has not been made the primary object either at Leicester, Nottingham, or Derby.

Mr. Sharpe's second principle, that each museum should possess also a typical series of foreign specimens for comparison with the local ones is equally correct. Science depends upon the appreciation of similarities and differences. The faculty of careful observation and comparison is of such fundamental value in all education and might be so effectively cultivated in museums that these institutions will in the future be found essential adjuncts to the schools. But here all existing museums are particularly weak. Opportunities for comparison are not sought out. The collections are not arranged with any special view to making comparisons easy and obvious. If, for instance, the local birds are in one room, and the foreign types in another, comparison is made as difficult as possible. Even if they are on opposite sides of one gallery, and the divisions of the orders made exactly to correspond, it is still difficult. They must be brought so near together that the eye can match them as it would match two patterns. This can be accomplished, and in an artistic and very interesting manner. It is to be hoped that the museum of the future will work out Mr. Bowdler Sharpe's principles much more completely than has yet been done.

Birstal Hill, Leicester F. T. MOTT

Measuring Heat

DURING the past twelve months I have been endeavouring to construct some form of calorimeter which should aid me in the identification of minerals, and which should, to that end, combine accuracy with ease of manipulation. The avoidance of thermometry seemed highly desirable, and a *differential* method suggested itself.

One gramme of the mineral undergoing investigation, and one gramme of pure silver, are heated in the same steam chamber and simultaneously transferred into the muffles of two Favre and Silbermann's calorimeters, made of uniform size and placed side by side, similarly shielded from external sources of error during experiment. The specific heats are compared by the index movements of the calorimeters, the index tubes being either simply calibrated or empirically graduated.

Both calorimeters are here exposed to the same external sources of error. The amount of heat lost by radiation, however, will, for each calorimeter, depend on the duration of the experiment and the rise of temperature experienced. Now the heat received is communicated to the walls of the calorimeters by convection currents, ascending from the muffles, in the first instance, very much more slowly by conduction. It appeared, then, that an *internal* non-conducting shield of a porous nature lining the walls and retarding convection currents might reduce such loss very considerably. Experiment confirmed this supposition. An apparatus I have had constructed on this principle by Yeates of Dublin is now nearly ready for experiment.

J. JOLY

Engineering School, Trinity College, Dublin, August 5

Circular Rainbow seen from Hill-top

THIS is not such an unusual phenomenon. It depends of course on the position of the observer as regards the sun, and his "coin of vantage," viz. having a space below him. I have seen it several times in my life, and remember a beautiful illustration of it given by Mr. Bains, the artist who accompanied the traveller Chapman to the Victoria Falls on the Zambese. His painting was, and probably is, in the Library at Cape Town. He is represented as standing on a projecting rock overlooking the Falls, or perhaps I should say looking up the crevice into which the water falls, and in the centre of a glorious double circular rainbow. I have heard the picture much criticised and its accuracy doubted, but having had actual experience of such a sight, I always maintained its correctness.

I saw lately another "bow," which struck me as very remarkable—perhaps because I never saw one like it before. My house stands on a hill-top; below me at some distance is a piece of low ground, covered by the tide at high water. The sun was low behind me, and the "bow" was formed on a mist coming up from the sea and swamp. It was, however, so *flat* that it at once arrested my attention, and I called the members of my family to see a "flat rainbow"! All agreed they had never seen one like it. It was quite near us, as was proved by its intervening between certain objects; but I subsequently detected one part a long way to the left of me, showing it was, of course, a true "bow," but of an enormous size.

British Consulate, Noumea, June 17 E. L. LAYARD

THE MIGRATION OF SALMON

DURING the last ten years some exceedingly interesting researches have been effected by German, Finnish, Swedish, and Norwegian ichthyologists as to the migration of salmon on their respective coasts. Thus, by careful researches, some Swedish and Finnish *savants* have proved that the salmon, which in the summer are caught in the rivers of the upper gulf of the Baltic, have at another season, most probably in the winter, paid a visit to the shores and rivers of Northern Germany. This has been conclusively proved by salmon caught in the Swedish and Finnish rivers having German-made hooks in their gills and stomach. From this it is therefore apparent that, in the Baltic, salmon are in the habit of quitting the rivers of Northern Sweden and Finland in the autumn in order to visit the shores of Northern Germany during the winter, and return to their haunts in the spring. That the fish should be capable of performing the enormous journey across the Baltic—from the upper gulf to the Pomeranian coast—and back every year may indeed seem incredible, but that it is impossible is fully disproved by the experiments with salmon and trout effected by the late Mr. Frank Buckland on the coasts of Scotland and England in the same direction.

In March 1872 Profs. Virchow and Hansen were commissioned by the German Fishery Association to "mark" some of the salmon which had been hatched artificially near Hameln, in order to ascertain whether they were in the habit of returning to the river. The fish then in the hatching reservoirs were one year old, and mostly seven centimetres in length, although some were twice the size. Having tried cutting off various parts of the fins, it was found that it was most suitable for the object in view and the health of the fish to cut the so-called "fat" fin right away, particularly as the fish would retain this mark even when full grown.

On March 23 and 24, 1872, a thousand salmon marked in this manner were let out into the Weser. The marking was effected by taking the fish in the left hand, and then cutting the fin away with a pair of scissors, whereby the fish were perfectly uninjured. The little fat fin, which is mostly found on Salmonidæ only, contains no nerves of any importance, and has no particular function, so that its removal does not impair the fish in the least.

Ever since that year the fishermen between Bremen and Hameln have been on the look out for the marked fish, but not until a month ago a fish was caught, weighing 30 lbs., at Osterdeich, just above Bremen. The fat fin, which, on the fish one metre long, ought to have been six centimetres, was entirely absent; and, when the well-healed cut was felt, the hard membrane indicated that an operation had at one time or another been performed at this spot. The fish, which was marked as a grilse in 1872, was then thirteen years old—an age which in every respect corresponds with the age fixed by the fishermen. According to general observation, it has been demonstrated that the salmon in the Weser is, when one year old, from five to twelve centimetres long. In the second year it has been proved that the salmon go into the sea, and when they re-enter the river at four years of age they weigh from eight to twelve pounds, and in the fifth year from twelve to fifteen pounds. From that age upwards the weight increases rapidly.

The results of the artificial hatching in the Weser are exceedingly promising. Thus the salmon fisheries at Hameln have been doubled in consequence during the last ten years, the tax at present paid to this town alone by the salmon fisheries being more than a thousand pounds.

In Norway, too, efforts have been made in the same direction during the last few years. Thus in 1883 the Storthing granted a sum of money for this purpose, and with this amount the Chief Inspector of Fisheries, Herr A. Landmark, has effected the marking of several hundreds of salmon and trout, chiefly on the west coast of Norway, during last autumn and winter. The marking here is effected by means of a tiny bit of platinum, 7 mm. long, and 4 mm. broad, being thus about the size of the nail on the little finger, which is attached by a very fine platinum wire to the fat fin of the big fish and the tail of the smaller ones. The piece has a number stamped on it, which corresponds with one in a "log" giving all the particulars as to the date the fish was marked, its weight, size, &c.

In order to encourage fishermen to be on the look-out for these marked fish, the inspector offers a reward of two shillings and sixpence for each mark forwarded to him, if accompanied with precise information as to the spot and date when it was taken, the length and breadth of the fish, and its weight.

As these researches will tend greatly to ascertain the habits and migrations of *Salmonidæ*, the result will be watched with interest.

THE TRINITY HOUSE EXPERIMENTS ON LIGHTHOUSE ILLUMINANTS

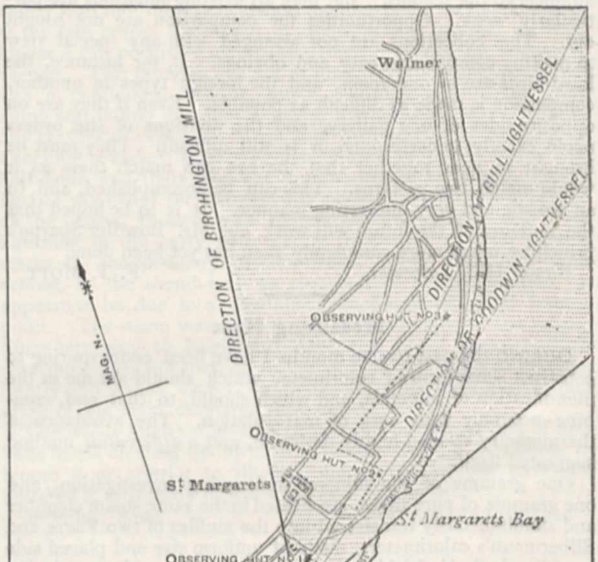
THE great advances made during the past few years in the science of illumination have rendered it desirable, or rather absolutely necessary, that experiments should be undertaken with a view to the determination of the advantages and disadvantages attending the use of different illuminants in lighthouses. With this view the Corporation of Trinity House have commenced a series of experiments at the South Foreland.

There are at present on the South Foreland two lighthouses, known as the high light and low light, and both of these are illuminated by electricity. Near these, three experimental lighthouses have been erected for use with the electric light, with gas and with oil respectively. The electric apparatus consists of three arc lamps and three magneto-electric machines made by Baron de Meritens. The lamps are placed one above the other in the tower. The carbons being used are "compound carbons," made up of many small rods of carbon of square section, coated with copper, and Siemens's "core-carbons," made of gas-carbon, with a central rod of graphite. When worked up to their full power, each lamp is estimated to be capable of giving a light equal to 30,000 candles.

The second tower is fitted up with Mr. Wigham's gas-burners. To supply the burners a small gasworks, fitted with retorts, purifiers, and a gasholder capable of holding about 5000 cubic feet, have been erected near by. The tower contains four burners, one above the other, each burner consisting of concentric rings of jets. The total number of jets on each burner is 108, making a total on the four burners of 432 jets; but the outer rings may be removed when less light is required: so that each burner may be used with 28, 48, 68, 88, or 108 jets. A talc chimney above the flame produces the necessary draught; no glass or talc is placed over the most luminous portion of the flame.

The intensity of the light when all the jets on all four burners are used is stated by the inventor to be equal to 12,000 candles. The third tower is for the present devoted to the oil and gas-burners invented by Sir James Douglass. The oil is supplied from a tank to the burners under a slight pressure. One oil-burner has six concentric wicks, and has a power of 720 candles; a second has seven wicks and a power of 1000 candles. There are three burners in the tower, placed one above the other. Each tower is provided with lenses both for revolving and for fixed lights. The highest power of the gas tower is a quadriform light, of the other towers a triform light. Besides the illuminants already mentioned, there are gas-burners from the Sugg and from the Siemens Companies, which will be tested in the lighthouse towers.

For observing the lights and testing them, a line of



Local Map for Observations on Land.

observation has been measured out in the direction of Deal, and three huts have been erected at a distance of ½ mile, 1¼ mile, and 2½ miles respectively from the towers. These huts are fitted up as photometric observatories. The lights are focussed on one of the huts, and they are then measured in all conditions of weather by means of the pentane unit of light devised by Mr. Vernon Harcourt. When the weather is too thick to allow of direct comparison with the unit, the lights are compared one with another by means of a polariscope-photometer, in which the ordinary image of one light is brought to equality by means of a Nicol prism with the extraordinary image of another light. In ordinary weather a ray from the lighthouse tower enters a hole in a shutter and falls on a portion of a paper disk: a contiguous portion of the disk is illuminated by the pentane candle fixed on one side of the opening in the shutter. The disk can be moved on a trolley to and fro until equality of illumination is reached, when its distance from the candle is measured. This measure and the known distance of the observatory from the lighthouse give the necessary data for determining the illuminating power of the light. By these measurements, taken at different distances in various states of the atmosphere, the penetrative power of the several illuminants will be determined. For instance, in very clear weather the electric light may give twenty times the light of the oil light; a slight haze comes on and the electric light is found to be only ten times as bright. It has suffered in a greater ratio than the other. A mist blows by the towers, and the superiority of the electric light becomes less and less marked: before the lights are finally obscured the superiority has vanished. It need hardly be stated that this question of penetration is the most important point the Trinity House are called on to settle.

The principle of superposition of lights also raises an interesting point. When two lights are placed close together they can be seen at a greater distance than one light. Up to what point will this increase of range continue on multiplying the lights—without altering the intrinsic brightness of each? It may be that in thick weather the eye can detect a large area of low illumination better than a smaller area of higher illumination; and it may be that the electric light with its smaller lenses suffers from this reason in comparison with the oil and gas lights with their larger lenses.

We hope that the experiments will not be discontinued before these points have been thoroughly sifted, as they only can be satisfactorily, on the actual working scale.

We may add that the electric machines and cables are being tested by Prof. Grylls Adams, and the photometric observations taken by Mr. Harold Dixon. Mr. Vernon Harcourt is appointed to watch the experiments generally and report to the Board of Trade.

We give a plan of the district showing the point of observation, which includes the coast-guard stations and light-ships in the vicinity.

THE INTERNATIONAL CONFERENCE ON EDUCATION

THE Conference which was held at the Health Exhibition last week has achieved a remarkable success. It was attended by upwards of a thousand persons, including many of the leading teachers in English, Scotch, and continental schools, University professors, statesmen, managers of schools, and others interested in different ways in the subject of education. The interest was so well sustained that all four sections were more crowded on the last day than the first, and very general regret was expressed that the Conference should close so soon. Two circumstances mainly contributed to this result. The president, Lord Reay, by his tact and courtesy, his knowledge of foreign languages, and his cosmopolitan experience was singularly qualified, both to obtain from different continental States their most fitting representatives, and to give to these representatives when they arrived appropriate tasks and a worthy welcome. And Lord Reay was helped in the task of organising the Conference by a small but efficient committee, by whom during several previous months the work of selecting the readers of papers had been sedulously pursued. Unless pains had been taken in relation to each subject of discussion to secure that it should be initiated by a person who spoke upon it with some authority, and special knowledge, the result would have been far less satisfactory.

The Conference sat in four sections, which were at work simultaneously during five days. The first of these was devoted mainly to the consideration of questions relating to elementary education. The best and most fruitful subjects of discussion here were the Kindergarten, physical training, and the right way of inspecting, examining, or otherwise testing the work of pupils. Fröbel's principles, which have done so much to transform the system of training very young children in England, in Belgium, and in France, were expounded with much fulness of knowledge and felicity of illustration by some of Fröbel's own countrymen and disciples, as well as by ladies who have in England qualified themselves by special sympathy and knowledge to become his exponents. Closely akin to this subject were the topics of gymnastic and physical training, the better construction of schools and school apparatus, and the indirect effect of pictorial or other decorations in improving the taste and cultivating the imagination, and of increasing the scholars' interest in their work. The Swedish and other systems of bodily exercise, and the means of sense training by music and by object lessons were well discussed. On the general subject of the organisation of elementary education, which was debated in a crowded audience under the presidency of the Vice-President of the Council, the results were somewhat disappointing. Some of the teachers took the opportunity of the presence of their official chief to urge the demand with which the public have been long familiar, for grants of public money on easier conditions, and for the abandonment of the principle of payment by results. But no other practical method of distributing the public money was suggested, and it was generally felt that the Vice-President had an easy victory over those who sought to attack the principles of the recently-modified Code. A more important subject was raised in the animated debate on the inspection and examination of schools, which was rendered more apposite at the moment by the appearance of the recommendations of the Select Committee of the House of Commons, recommending that there should be in England a Minister of Public Instruction, and that he should have *inter alia* the duty of inspecting and annually reporting on the endowed secondary schools. It was perceived that this was a step of considerable moment and significance. Under the Act of 1869 endowed schools have been re-organised, and their governing bodies and schemes of study re-constituted. But neither the Commissioners who administer that Act, nor the public, know anything of the way in which those schemes are carried out, nor of the actual performances of the schools from year to year. There was among the larger number of earnest speakers on this point, a very general agreement on two points: first that some such public supervision over the reformed foundations was absolutely necessary, in order to keep them efficient; and secondly, that as there would be in this case no grant to administer, there would not be, as in elementary schools, any need to formulate conditions as to instruction, but simply to inquire in every case what the endowed school professed to do, and to see how far it had realised its own ideal. It is rather for the purpose of knowing what the schools are doing, than for that of imposing upon them by authority any theory or official ideal that State supervision seems to be demanded in regard to endowed schools.

In the second of the sections the principal topics of discussion were connected with scientific, technical, and artistic instruction. The fact that the Conference held its sittings in the new and beautiful buildings recently erected for the City and Guilds of London Technical Institute, naturally excited special interest, and awakened discussion as to the place which the physical sciences ought to hold in general education, as well as the special uses to which the Institute might be put in connection with the improvement of handicrafts and skilled trade. Mr. Magnus, Prof. Armstrong, Mr. Sparkes, and other authorities whose names are associated with the improved teaching of science or of art in this country, were enabled to compare notes with professors of similar subjects from France and the United States, and some useful results were arrived at. In one special department of this Section, the agriculturists, under the presidency of Lord Fortescue and Sir Thomas Acland, held several long and animated discussions on the better teaching of agricultural science, on farm schools, and on the right education of boys intended to be farmers. In another department the subject of school museums was brought forward in an interesting paper by Dr. Jex-Blake of Rugby, and divers subsidiary aids to school instruction, such as field excursions, organised visits to factories, museums, and other places of interest, were suggested or described. Some of the more skilled and earnest of the elementary teachers, who, by their own personal influence, have secured the co-operation of their scholars in the formation of school museums illustrative of the flora, fauna, history, or industry of particular districts, gave interesting accounts of their plans and of the practical results which attended them; and from France and Belgium, and particularly from Liverpool, remarkable testimony was produced as to the success which had attended school savings' banks, and the influence they had exercised on the children and their parents.

The third section was mainly concerned with Universities and their relation to secondary instruction on the one hand, and to the liberal professions on the other. Profs. Morley, Fleeming Jenkin, and Seeley discoursed severally on those parts of the University curriculum with which their own names are most prominently associated, while the legal and theological aspects of the University question were discussed by Sir C. Bowen and Prof. Lorimer, by Cardinal Manning and Dr. Wace. The chief interest of this section, however, lay in that department in which the proper relation between the teaching and the examining functions of a University were examined by Sir George Young and others. The status of the present University of London was regarded by many speakers as unsatisfactory, notwithstanding the searching and effective character of its examinations, and the stimulating influence which its regulations have had upon the education of students in all parts of the country. A strong wish was expressed by many speakers, that the greatest city in the world should possess a teaching University, rather than a mere examining Board; and that some means should be found of co-ordinating all the higher agencies now at work in the metropolis in such a way as to constitute a London University of a new and nobler type. The duties of the Universities to our Indian Empire were well urged upon the Conference by Prof. Monier Williams; and the whole subject of the relations of the Universities to the education of women was debated in a crowded room and with great animation and interest, *apropos* of a paper by Mrs. Henry Sidgwick, whose own valuable services at Newnham have given her a special claim to speak with authority on such a topic.

The fourth section had a somewhat miscellaneous programme, but may be briefly described as concerned with problems connected with secondary and intermediate education. The first of these problems was the training of teachers, and the best means of securing for secondary schools a supply of teachers, qualified in respect to their knowledge of the theory and practice of their art, not less satisfactorily than the trained and certificated teachers of the elementary schools are, relatively to the humbler work which they have to do. Mr. Quick, Mr. Storr, Professors Laurie and Meiklejohn, and others who have made this a special subject of investigation, were enabled to throw much light on the recent efforts of the Universities to provide instruction in the art and philosophy of teaching, and to give professional certificates to persons qualified to receive them. It was manifest, however, from this discussion, that the one great hindrance in the way of such progress was the practical disbelief among the head-masters in the value of special professional training. Were it once understood that over and above the possession of a good University degree a head-master in search of an assistant would require, or would even *cœteris paribus* prefer that the candidate should show a knowledge of the principles of teaching or the literature of his profession, the arrangements of the Universities for imparting such knowledge would soon produce good fruit. At present, however, the teacher's diplomas issued by the Universities of Cambridge and London appear to possess but little market value in the public schools. It was shown, however, that in girls' schools of the highest class the work of professional training was much more keenly appreciated; and that among the foremost women engaged in the teaching profession, the strongest interest had been taken not only in the proposals of the Universities, but also in the Bishopsgate Training College, the Lectures of the College of Preceptors, and other public measures for ensuring specific instruction in the art and mystery of their craft for the skilled teachers of the future. One of the warmest, and at the same time one of the ablest debates in the Conference concerned the possible future relations of the State to secondary and higher education. Mr. Lyulph Stanley contended strongly for some public provision for the establishment of good secondary schools where they are deficient, and sketched out a plan which had evidently been thought out with some care, for the creation of such schools by means of rates, and for the supervision of such schools by local bodies having the public confidence. Canon Daniel, on the other hand, contended with much ability in favour of absolute freedom for local and religious bodies in the matter of secondary instruction, and against any attempt on the part of the State to initiate or control it. He pointed out, with considerable force, the remarkable success of the Girls' Public Day Schools Company, and remarked on the rapid growth of other agencies of a similar kind for supplying good middle-class schools, and for adapting the supply to the religious, social, and educational wants of different classes of the community.

Perhaps, on the whole, the most striking feature of the Conference, in the eyes of the numerous foreigners who were present and took part in the proceedings, was the remarkable interest evinced in the improved education of women; the variety of new fields now opening to their intelligence, activity, and public usefulness, and the number of ladies who took an active and effective share in the various discussions. Another point of special interest was the international character of the whole Conference, and the warm welcome with which the experience of experts from France, Belgium, Switzerland, Germany, and the United States, was received in all the sections. There has probably never been in the history of education in this country a gathering which afforded such an excellent opportunity for the interchange of opinions and suggestions between English and foreign teachers. And the executive of the Exhibition may well be congratulated on having added to their other successes the completion of a work of pre-eminent and far-reaching usefulness—a Conference which, for the ability of those who took part in it, for the high tone and courtesy of its discussions, and for the fruitfulness of its practical suggestions, has left an enduring and most pleasing impression on all who took part in it.

Among the subsidiary features of the Conference not the least useful were the visits organised by the Committee to some of the more characteristic and important of English schools. The most successful of these visits was that paid to the new buildings of St. Paul's School at West Kensington, which, though not yet occupied by the scholars, is now nearly complete in all its appointments. The party, nearly fifty in number, consisted largely of foreign teachers from various countries. They were conducted over Mr. Waterhouse's costly and beautiful building by the Clerk of the Works and by a member of the governing body, and evinced much interest in observing all the latest improvements in school construction and fittings, and in inspecting the library, laboratories, lecture-rooms, and the ample appliances for physical training.

It is understood that the results of the Conference, the text of the papers, and a summary of the discussions will shortly appear in four or five volumes.

THE VOYAGE OF THE "VETTOR PISANI"

KNOWING how much NATURE is read by all the naturalists of the world, I send these few lines, which I hope will be of some interest.

The Italian R.N. corvette *Vettor Pisani* left Italy in April 1882 for a voyage round the world with the ordinary commission of a man-of-war. The Minister of Marine, wishing to obtain scientific results, gave orders to form, when possible, a marine zoological collection, and to carry on surveying, deep-sea soundings, and abyssal thermometrical measurements. The officers of the ship received their different scientific charges, and Prof. Dohrn, director of the Zoological Station at Naples, gave to the writer the necessary instructions for collecting and preserving sea animals.

At the end of 1882 the *Vettor Pisani* visited the Straits of Magellan, the Patagonian Channels, and Chonos and Chiloe Islands; we surveyed the Darwin Channel, and following Dr. Cuningham's work (who visited these places on board H.M.S. *Nassau*), we made a numerous collection of sea animals by dredging and fishing along the coasts.

While fishing for a big shark in the Gulf of Panama during the stay of our ship in Taboga Island one day in February, with a dead calm, we saw several great sharks some miles from our anchorage. In a short time several boats with natives went to sea, accompanied by two of the *Vettor Pisani's* boats.

Having wounded one of these animals in the lateral part of the belly, we held him with lines fixed to the spears; he then began to describe a very narrow curve, and irritated by the cries of the people that were in the boats, ran off with a moderate velocity. To the first boat, which held the lines just mentioned, the other boats were fastened, and it was a rather strange emotion to feel ourselves towed by the monster for more than three hours with a velocity that proved to be two miles per hour. One of the boats was filled with water. At last the animal was tired by the great loss of blood, and the boats assembled to haul in the lines and tow the shark on shore.

With much difficulty the nine boats towed the animal alongside the *Vettor Pisani* to have him hoisted on board, but it was impossible on account of his colossal dimensions. But, as it was high water we went towards a sand beach with the animal, and we had him safely stranded at night.

With much care were inspected the mouth, the nostrils, the ears, and all the body, but no parasite was found. The eyes were taken out and prepared for histological study. The set of teeth was all covered by a membrane that surrounded internally the lips; the teeth are very little and almost in a rudimental state. The mouth, instead of opening in the inferior part of the head, as in common sharks, was at the extremity of the head; the jaws having the same bend.

Cutting the animal on one side of the backbone we met (1) a compact layer of white fat 20 centimetres deep; (2) the cartilaginous ribs covered with blood vessels; (3) a stratum of flabby, stringy, white muscle, 60 centimetres high, apparently in adipose degeneracy; (4) the stomach.

By each side of the backbone he had three chamferings, or flutings, that were distinguished by inflected interstices. The colour of the back was brown with yellow spots that became close and small towards the head so as to be like marble spots. The length of the shark was 8·90 m. from the mouth to the *pinna caudalis* extremity, the greatest circumference 6·50 m., and 2·50 m. the main diameter (the outline of the two projections is made for giving other dimensions).

The natives call the species *Tintoreva*, and the most aged of the village had only once before fished such an animal, but smaller. While the animal was on board we saw several *Remora* about a foot long drop from his mouth; it was proved that these fish lived fixed to the palate, and one of them was pulled off and kept in the zoological collection of the ship.

The *Vettor Pisani* has up to the present visited Gibraltar, Cape Verde Islands, Pernambuco, Rio Janeiro, Monte Video, Valparaiso, many ports of Peru, Guayaquil, Panama, Galapagos Islands, and all the collections were up to this sent to the Zoological Station at Naples to be studied by the naturalists. By this time the ship left Callao for Honolulu, Manila, Hong Kong, and, as the *Challenger* had not crossed the Pacific Ocean in these directions, we made several soundings and deep-sea thermometrical measurements from Callao to Honolulu. Soundings are made with a steel wire (Thomson system) and a sounding-rod invented by J. Palumbo, captain of the ship. The thermometer employed is a Negretti and Zambra deep-sea thermometer, improved by Captain Maguaghi (director of the Italian R.N. Hydrographic Office).

With the thermometer wire has always been sent down a tow-net which opens and closes automatically, also invented by Captain Palumbo. This tow-net has brought up some little animals that I think are unknown.

Honolulu, July 1 G. CHIERCHIA

The shark captured by the *Vettor Pisani* in the Gulf of Panama is *Rhinodon typicus*, probably the most gigantic fish in existence. Mr. Swinburne Ward, formerly Commissioner of the Seychelles, has informed me that it attains to a length of 50 feet or more, which statement was afterwards confirmed by Prof. E. P. Wright. Originally described by Sir A. Smith from a single specimen which was killed in the neighbourhood of Cape Town, this species proved to be of not uncommon occurrence in the Seychelle Archipelago, where it is known by the name of "Chagrin." Quite recently Mr. Haly reported the capture of a specimen on the coast of Ceylon. Like other large sharks (*Carcharodon rondeletii*, *Selache maxima*, &c.), Rhinodon has a wide geographical range, and the fact of its occurrence on the Pacific Coast of America, previously indicated by two sources, appears now to be fully established. T. Gill in 1865 described a large shark known in the Gulf of California by the name of "Tiburon ballenas" or whale-shark, as a distinct genus—*Micristodus punctatus*—which, in my opinion, is the same fish. And finally, Prof. W. Nation examined in 1878 a specimen captured at Callao. Of this specimen we possess in the British Museum a portion of the dental plate. The teeth differ in no respect from those of a Seychelles Chagrin; they are conical, sharply pointed, recurved, with the base of attachment swollen. Making no more than due allowance for such variations in the descriptions by different observers, as are unavoidable in accounts of huge creatures examined by some in a fresh, by others in a preserved state, we find the principal characteristics identical in all these accounts, viz. the form of the body, head, and snout, relative measurements, position of mouth, nostrils and eyes, dentition, peculiar ridges on the side of the trunk and tail, coloration, &c. I have only to add that this shark is stated to be of mild disposition and quite harmless. Indeed, the minute size of its teeth has led to the belief in the Seychelles that it is a herbivorous fish, which, however, is not probable.

ALBERT GÜNTHER

Natural History Museum, July 30

PYROMETERS

THE accurate measurement of very high temperatures is a matter of great importance, especially with regard to metallurgical operations; but it is also one of great difficulty. Until recent years the only methods suggested were to measure the expansion of a given fluid or gas, as in the air pyrometer; or to measure the contraction of a cone of hard, burnt clay, as in the Wedgwood pyrometer. Neither of these systems were at all reliable or satisfactory. Lately, however, other principles have been introduced with considerable success, and the matter is of so much interest not only to the practical manufacturer but also to the physicist, that a sketch of the chief systems now in use will probably be acceptable. He will thus be enabled to select the instrument best suited for the particular purpose he may have in view.

The first real improvement in this direction, as in so many others, is due to the genius of Sir William Siemens. His first attempt was a calorimetric pyrometer, in which a mass of copper at the temperature required to be known is thrown into the water of a calorimeter, and the heat it has absorbed thus determined. This method, however, is not very reliable, and was superseded by his well-known electric pyrometer. This rests on the principle that the electric resistance of metal conductors increases with the temperature. In the ca e of platinum, the metal chosen for the purpose, this increase up to 1500° C. is very nearly in the exact proportion of the rise of temperature. The principle is applied in the following manner:—A cylinder of fireclay slides in a metal tube, and has two platinum wires 100th of an inch in diameter wound round it in separate grooves. Their ends are connected at the top to two conductors, which pass down inside the tube and end in a fireclay plug at the bottom. The other ends of the wires are connected with a small platinum coil, which is kept at a constant resistance. A third conductor starting from the top of the tube passes down through it and comes out at the face of the metal plug. The tube is inserted in the medium whose temperature is to be found, and the electric resistance of the coil is measured by a differential voltameter. From this it is easy to deduce the temperature to which the platinum has been raised. This pyrometer is probably the most widely used at the present time.

Tremeschini's pyrometer is based on a different principle, viz. on the expansion of a thin plate of platinum, which is heated by a mass of metal previously raised to the temperature of the medium. The exact arrangements are difficult to describe without the aid of drawings, but the result is to measure the difference of temperature between the medium to be tested and the atmosphere at the position of the instrument. The whole apparatus is simple, compact, and easy to manage, and its indications appear to be correct at least up to 800° C.

The Trampler pyrometer is based upon the difference in in the coefficients of dilatation for iron and graphite, that of the latter being about two-thirds that of the former. There is an iron tube containing a stick of hard graphite. This is placed in the medium to be examined, and both lengthen under the heat, but the iron the most of the two. At the top of the stick of graphite is a metal cap carrying a knife-edge, on which rests a bent lever pressed down upon it by a light spring. A fine chain attached to the long arm of this lever is wound upon a small pulley; a larger pulley on the same axis has wound upon it a second chain, which actuates a third pulley on the axis of the indicating needle. In this way the relative dilatation of the graphite is sufficiently magnified to be easily visible.

A somewhat similar instrument is the Gauntlett pyrometer, which is largely used in the north of England. Here the instrument is partly of iron, partly of fireclay, and the difference in the expansion of the two materials is caused to act by a system of springs upon a needle revolving upon a dial.

The Ducomet pyrometer is on a very different principle, and only applicable to rough determinations. It consists of a series of rings made of alloys which have slightly different melting-points. These are strung upon a rod, which is pushed into the medium to be measured, and are pressed together by a spiral spring. As soon as any one of the rings begins to soften under the heat, it is squeezed together by the pressure, and, as it melts, it is completely squeezed out and disappears. The rod is then made to rise by the thickness of the melted ring, and a simple apparatus shows at any moment the number of rings which have melted, and therefore the temperature which has been attained. This instrument cannot be used to follow variations of temperature, but indicates clearly the moment when a particular temperature is attained. It is of course entirely dependent on the accuracy with which the melting-points of the various alloys have been fixed.

Yet another principle is involved in the instrument called the Thalpotasimeter, which may be used either with ether, water, or mercury. It is based on the principle that the pressure of any saturated vapour corresponds to its temperature. The instrument consists of a tube of metal partly filled with liquid, which is exposed to the medium which is to be measured. A metallic pressure gauge is connected with the tube, and indicates the pressure existing within it at any moment. By graduating the face of the gauge when the instrument is at known temperatures, the temperature can be read off directly from the position of the needle. From 100° to 220° F. ether is the liquid used, from thence to 680° it is water, and above the latter temperature mercury is employed.

Another class of pyrometers having great promise in the future is based on what may be called the "water-current" principle. Here the temperature is determined by noting the amount of heat communicated to a known current of water circulating in the medium to be observed. The idea, which was due to M. de Saintignon, has been carried out in its most improved form by M. Boulier. Here the pyrometer itself consists of a set of tubes one inside the other, and all inclosed for safety in a large tube of fireclay. The central tube or pipe brings in the water from a tank above, where it is maintained at a constant level. The water descends to the bottom of the instrument and opens into the end of another small tube called the explorer (*explorateur*). This tube projects from the fireclay casing into the medium to be examined, and can be pushed in or out as required. After circulating through this tube the water rises again in the annular space between the central pipe and the second pipe. The similar space between the second pipe and the third pipe is always filled by another and much larger current of water which keeps the interior cool. The result is that no loss of heat is possible in the instrument, and the water in the central tube merely takes up just so much heat as is conducted into it through the metal of the explorer. This heat it brings back through a short indiarubber pipe to a casing containing a thermometer. This thermometer is immersed in the returning current of water and records its temperature. It is graduated by immersing the instrument in known and constant temperatures, and thus the graduations on the thermometer give at once the temperature, not of the current of water, but of the medium from which it has received its heat.

In order to render the instrument perfectly reliable, all that is necessary is that the current of water should be always perfectly uniform, and this is easily attained by fixing the size of the outlet once for all, and also the level of water in the tank. So arranged, the pyrometer works with great regularity, indicating the least variations of temperature, requiring no sort of attention, and never suffering injury under the most intense heat; in fact the tube, when withdrawn from the furnace, is found to be merely warm. If there is any risk of the instrument getting broken from fall of materials or other causes, it may be fitted with an ingenious self-acting apparatus shutting off the supply. For this purpose the water which has passed the thermometer is made to fall into a funnel hung on the longer arm of a balanced lever. With an ordinary flow the water stands at a certain height in the funnel, and, while this is so, the lever remains balanced; but if from any accident the flow is diminished, the level of the water in the funnel descends, the other arm of the lever falls, and in doing so releases two springs, one of which in flying up rings a bell, and the other by detaching a counterweight closes a cock and stops the supply of water altogether.

It will be seen that these instruments are not adapted for shifting about from place to place in order to observe different temperatures, but rather for following the variations of temperature at one and the same place. For many purposes this is of great importance. They have been used with great success in porcelain furnaces, both at the famous manufactories at Sèvres and at another porcelain works in Limoges. From both these establishments very favourable reports as to their working have been received.

W. R. BROWNE

THE AGRICULTURAL INSTITUTE OF BEAUVAIS

WE have already referred to the interesting collection exhibited in the Technical School at the Health Exhibition by the Brothers of the Christian Schools. One of the most instructive of their specimen museums is that from their Agricultural Institute at Beauvais.

This Institute was founded in 1855, the late Prince Consort being one of its first patrons. Recently the Agronomical Society of France have extended to it an encouraging hand.

Candidates for admission to the school must be at least sixteen years of age, and must give evidence, either by certificates obtained or by a preliminary examination, of their having successfully studied the recognised branches of a good modern education. The course of instruction extends over a period of three years, and is intended to prepare young men to manage and develop estates and direct all farming operations. Special provision is made, in the third year, for those who wish to qualify themselves for agricultural professorships. The syllabus of subjects is framed by a Board appointed by the prefect of the *département*, and consists of the Director and Professors of the Institute, of the Professor of Agriculture, and the Veterinary Surgeon of the *département*, as also of three other members.

The subjects for the first year are: French language, book-keeping and commercial subjects, elementary algebra and geometry, the fundamental principles of agriculture, rural law and engineering, general zoology, arboriculture, horticulture, physics, chemistry, and linear drawing.

In the second year the students follow more advanced courses of agriculture, zoology, botany, entomology, geology, surveying, levelling, physics, general and analytical chemistry, rural law and engineering, linear drawing, arboriculture, and horticulture.

The instruction for the last year comprises agriculture, arboriculture, horticulture, analytical chemistry, botany, geology, entomology, applied mathematics and mechanics, and architectural drawing.

Science teaching, to be of any use, must be practical; the authorities of the Agricultural Institute, fully convinced of this, attach great importance to laboratory and field work. In the physical laboratory, the work is exclusively of a demonstrational kind, the students not being required to test the accuracy of their knowledge or their familiarity with instruments by the actual and precise measurement of physical constants. Nor do such measurements appear necessary for the object in view. It is, of course, quite different with chemistry, where skill in quantitative analysis is of the highest value to any one who intends to direct the agricultural interests of a district. The students are consequently trained with much care in those branches of analytical chemistry which bear directly upon the science of agriculture. The study of botany, geology, and entomology is encouraged and stimulated by frequent excursions to the neighbouring country, the specimens brought back being compared, classified, and minutely described in appropriate language.

The school has also a model farm of 325 acres, in which the principal operations of farming are extensively carried on. The students visit this farm at stated hours every week; they are familiarised with the chief implements and agricultural appliances, and are required to take part in all the regular work that may be going on.

The Professors have set aside a number of acres for experimenting upon the conditions most favourable to the growth of the principal cereals. These comparative studies are carried out with the assistance of the students mainly for the purpose of showing them how to practically initiate a scientific investigation of an agricultural nature. The results of these studies are fully described in the *Annales de l'Institut agricole*, a yearly publication of considerable merit. A valuable synopsis of the results obtained by the Director of the School, Brother Eugene, will be found in the Educational Section of the International Health Exhibition, Room 5.

From a recent report, we find that there have been, this year, under cultivation no less than sixty-five kinds of wheat, twenty of oats, ten of barley, eight of rye, besides fields of potatoes, beetroot, cabbage, &c. There are also pasture lands for sheep and cows, and a well-stocked poultry yard.

At the end of each year the students are put through a practical examination, when they are expected to give satisfactory evidence of their competency to deal with the general working of the farm. It is also required by the programme of the Institute that the students shall visit exhibitions of an agricultural character which may be held in the vicinity, and attend with their Professors certain markets and sales of live stock.

The attention of the students is maintained and quickened by requiring them to write, with considerable care, notes of all their courses, as well as detailed reports of what they may have seen in their visits or met with in their excursions. Several volumes of these reports, notes, and theses, together with typical herbaria, specimens of grain and seeds, may be seen in the Exhibition, Room 5.

Besides superintending the museum and giving instruction in the laboratories, the Brothers teach drawing, physics, chemistry, botany, geology, zoology, &c., leaving such subjects as rural jurisprudence and engineering, agriculture, and the like to other eminent professors.

IS SALPA AN EXAMPLE OF ALTERNATION OF GENERATIONS?

THE chances against the accidental discovery of a great natural law are so great that we cannot feel surprise that naturalists are slow to believe that Salpa, the animal in which Chamisso discovered alternation of generations, is not an example of alternation.

The historical associations which render the life-history of Salpa so interesting to the naturalist have induced me to restate briefly my reasons for believing that the solitary Salpa is a female and the chain Salpa a male; since a recent contributor to NATURE ("Recent Morphological Speculations," by R. N. G., in NATURE, May 15, p. 67) rejects my observations for reasons which a little examination will show to be inconclusive.

The author characterises my opinion as "Brooks' theory," but it is neither a theory, nor was I the first to describe the phenomenon in question. Embryological observations by Kowalevsky must be received by all

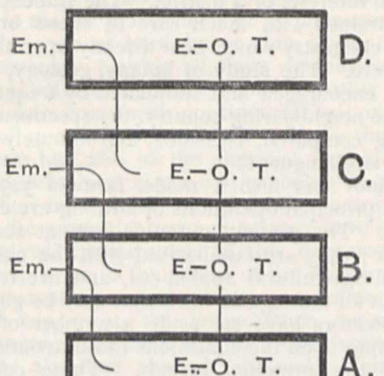


Fig. 1

naturalists with the greatest respect, and I therefore call the attention of R. N. G. to the fact that this great observer published, while my first paper was in the press, the following account of the life-history of Salpa (see *Arch. f. Mik. Anat.* xi. 604):—"Bei den Salpen giebt es bekanntlich zwei Generationen, in der einen entwickelt sich der aus vielen eikeimen bestehende Eierstock, welcher in den Stolo hineingeht, und sich hier zu je einem Eie vertheilt, sodann die einzelnen Knospen resp. Kettensalpen in welchen weiter aus diesem Eie ein Embryo entsteht, wieder mit einem aus mehreren Eikeimen bestehende Eierstock."

No one will question the statement that the animal in whose body an ovum is produced is the mother of the

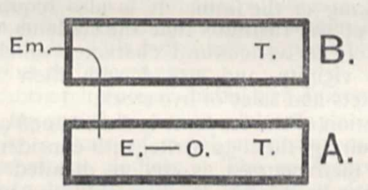


Fig. 2

embryo to which this ovum gives rise, and if the egg which is fertilised in the body of the chain Salpa is developed, as Kowalevsky and I have stated, in the body of the solitary Salpa, the latter is certainly a female, and as no one has ever observed the production by a chain Salpa of more than one embryo, either from an egg or by budding, there is no true alternation of generations.

This view is in no sense a "morphological speculation," nor should it be spoken of as "Brooks' theory." It is either an observed fact or an erroneous statement, and its untruth can be proved only by observation.

R. N. G. lays much stress upon the life-history of Pyrosoma, a closely related but less modified form, and regards it as an "indirect negation" of my statement that the solitary Salpa is a female, and the chain Salpa a male. Our knowledge of Pyrosoma and of other Tunicates certainly leads us to believe that Salpa is the descendant of a hermaphrodite ancestor, but it proves nothing more.

The fact that nearly all the Arthropods are bisexual does not disprove the hermaphroditism of Balanus. It simply shows that Balanus is the modified descendant of bisexual ancestors.

While the life-history of Pyrosoma cannot be quoted to disprove the statement that the solitary Salpa has an ovary, it can help us to understand the way in which the present life-history of Salpa has been acquired, and thus show that my own view is not very anomalous after all.

As the phenomena are very complex, I have attempted to exhibit the leading features by diagrams, and Fig. 1 shows the points of greatest importance in the life-history of Pyrosoma.

The egg gives rise, by a process which does not here concern us, to several sexual animals, one of which is represented by A in Fig. 1. It has a testis, T, and an ovary, O, which consists in part of "generative blastema," and, in part, of ova in various stages of growth. It is, therefore, a hermaphrodite. One of the ova, E, is very much larger than any of the others. This hermaphrodite,

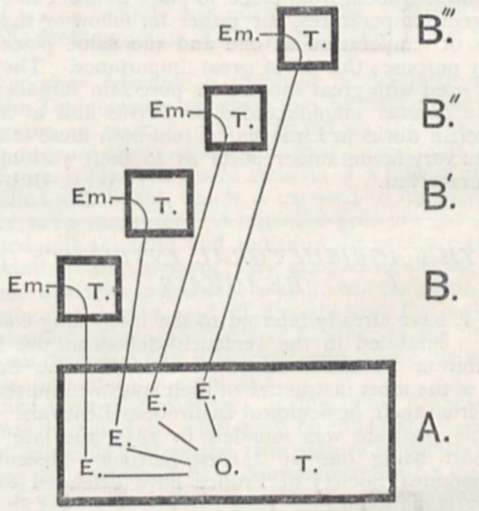


Fig. 3

A, produces a second, B, by budding, and during this process part of the "generative blastema" from the ovary of A passes into the body of B, and forms its ovary, O, which here produces one fully developed ovum, E, and a number of small ones. As B has a testis, T, it is a hermaphrodite like A.

The single mature ovum, E, of A, also passes into the body of B, where it is fertilised and gives rise to an embryo, EM, which undergoes development within, and finally escapes from, the body of B, although A is its mother, because the egg which has produced it was formed in the ovary of A before the body of B was formed by budding.

B then gives rise by budding to C, and the single mature egg of B passes into the body of C, where it is fertilised, and gives rise to an embryo.

Part of the "generative blastema" of B's ovary passes into the body of the bud C, and becomes an ovary, O, which again gives rise to one mature ovum, E; and C produces another bud, D, and discharges into it one ripe ovum and part of the ovary in the same way, and so on indefinitely. As C and D have testes like A and B, they are all hermaphrodite.

After the bud B has become independent of A, another ovum is matured in A's ovary, another hermaphrodite bud is produced, and so on indefinitely, and each hermaphrodite bud produces in succession an indefinite series of similar buds.

Now let us imagine a limit to this indefinite series of buds, and examine its effect.

Suppose that, while B retains its power to produce in succession an indefinite series of C's, the C's lose this power. As the function of the ovary of C is to provide the "generative blastema" for the ovaries of the series of D's, and to mature the eggs E, which are to be fertilised and developed within the bodies of the D's, it is plain that with the loss by the C's of the power to reproduce by

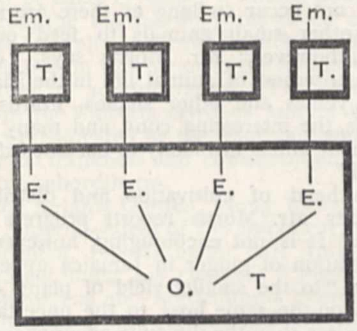


Fig. 4

budding, the ovary will be left without function, and we should therefore expect it to disappear. C would then become simply a male, but it would while young contain a single unfertilised egg, EM, derived from the ovary of B.

If the power to bud were lost by the first generation of buds, B, we should have the condition of things which is shown in Fig. 2, where the hermaphrodite A produces a male bud, B, and discharges the egg E into its body, there to be fertilised and developed into the embryo EM. A has, however, the power to repeat this process indefinitely, and to produce in succession a series of buds of the generation B, and the life-history is therefore now exactly shown in Fig. 3.

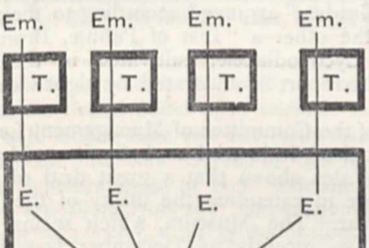


Fig. 5

Now suppose that, instead of appearing in succession, a number of buds of the generation B are formed at the same time, we shall then have the phenomena shown in Fig. 4, where a number of eggs, E, E, E, E, are matured simultaneously in the ovary, O, of the hermaphrodite A, and are discharged while still unfertilised into the bodies of the male buds, B, B, B, B, there to give rise to the embryos, EM, EM, EM, EM.

This is very nearly what we have in Salpa, where very many chain Salpæ are produced at one time. As these have no power to reproduce by budding, they have lost their ovaries, although each of them, when it is born, contains, like the buds of Pyrosoma, a single unfertilised egg, derived, according to my observations and those of Kowalevsky, and according to the analogy of Pyrosoma, from the ovary of the solitary Salpa A, Fig. 5.

The solitary Salpa is therefore a true female, and as it has lost the testis which, according to the analogy of Pyrosoma, its ancestors must have possessed, it is a true female and not a hermaphrodite.

We therefore have in place of the indefinite series of hermaphrodite buds of Pyrosoma, a single generation of male buds, each of which receives, like the buds of Pyrosoma, a single mature ovum from the ovary of its gemmiparous ancestor.

While the series of stages which are here described may not correspond exactly to the actual phylogeny of Salpa, it certainly shows that our knowledge of Pyrosoma cannot be quoted as an "indirect negation" of my view; for it shows that the analogy of Pyrosoma would lead us to look to the ovary of the solitary Salpa for the origin of the egg which is fertilised and developed within the body of the chain Salpa.

All observers agree that the so-called "ovary" of the chain Salpa consists of a single egg, which is fertilised while the animal which carries it is very young and almost embryonic, and all agree that normally no more eggs are produced by the chain Salpa. A "rudiment of an ovary, which only consists of one fully developed ovum" is certainly not an *ovary* at all, but an *ovum*, for the origin of which we must search elsewhere, and Kowalevsky's observation as well as my own show that it originates in the ovary of the solitary Salpa.

As all observers agree that the chain Salpa has a testis, and that it normally contains only one egg, it is certainly a male; and as all observers agree that the solitary Salpa has no testis, while Kowalevsky and I agree that it has an ovary, we must regard it as a female, and we therefore have, instead of an instance of alternation, a very remarkable example of sexual difference.

There seems to be only one way to escape this conclusion;—that is, by denying that the structure which Kowalevsky and I have described as an ovary is an ovary at all.

Salensky is an advocate of this view, and claims that my so-called ovary is simply a mass of embryonic cells destined to give rise to the branchial sacs, as well as the ovaries of the chain Salpæ, but I have shown in a recent paper in the *Zoologischer Anzeiger* that the branchial sacs of the chain Salpa originate from quite a different part of the stolon, and that the ovary contains cells which are in no sense embryonic or unspecialised, since they have all the characteristics of ova. In a paper which is now ready for publication, I shall give photographs of sections which prove this point beyond question.

R. N. G. gives, as another reason for rejecting my view, the fact that Salensky has found a second ovary in a chain Salpa.

This is clearly exceptional, for all observers agree that no such second ovary normally occurs, nor has Salensky given conclusive proof that the cells which he observed were ova at all, as he has not observed their development. Out of many thousand sections which I have examined, I have found three chain Salpæ which had received two ova from the ovary of the solitary Salpa instead of one, and if Salpa is descended from a form like Pyrosoma, it is quite possible that a chain Salpa may occasionally receive with its ovum part of the ovary, and that this may give rise to other ova, but the discovery of such an abnormal Salpa would not prove that the normal chain Salpa is hermaphrodite, even if it could be shown that these eggs completed their development and became embryos.

In conclusion, I wish to point out to R. N. G. that, inasmuch as the writer who attempts to generalise from the observed phenomena of science for the benefit of the public should use every precaution to insure accuracy in the statement of facts, he will do well to examine his authority for his statements that I have called the *solitary* Salpa a *nurse;* that I have described a Cunina in which the "hydroid produces medusæ by gemmation;" and that I believe "that the solitary Salpa is hermaphrodite."

Baltimore, July 14 W. K. BROOKS

COLONIAL AND FOREIGN REPORTS

THE annual reports of colonial botanical gardens, Government plantations, museums, &c., form at the present day no inconsiderable item of the literature of scientific progress in different parts of the world which constantly crowd an editor's table. These records become, year after year, of increasing importance as well as of increasing bulk, and it is right that their contents should be better known, so that they may become useful, and this can only be done by a wide distribution of the reports themselves, and attention drawn to them by other publications.

Taking a few of these reports, which have recently come to hand, in the order of their issue, we first find one from Wellington, New Zealand, under the following title, "Eighteenth Annual Report on the Colonial Museum and Laboratory," together with the "Fourteenth Annual Report on the Colonial Botanic Garden, 1882-83." This Report treats of various branches of science, and, as might be expected, geology has its full share. In the observatory the principal work is said to have been the observation of the transit of Venus, Dr. Hector's account of his observation, which, he says, was written out within an hour after the transit, being given as an appendix. Under the head of Botanic Garden, after describing some successful experiments in planting wattles (species of *Acacia*), Dr. Hector refers to experiments in the cultivation of *Sorghum*, which, however, are said not to have been continued in the garden, but in the northern part of the colony, the results were very favourable, proving that quite as large a percentage of crystallisable sugar can be obtained in New Zealand as in America. "Recent improvements," it is said, "have been made in the machinery, and by the use of a vacuum evaporating pan all the causes of the former miscarriage in the production of the sugar appear to have been removed, so that there is every prospect of the growth of the *Sorghum* becoming an important industry in the north of New Zealand." A most interesting and important feature of the year is said to be the sudden expansion of the cultivation of hops in the colony. In Nelson it is shown that the cultivation has been most successful, and in the neighbourhood of Wellington the hop also grows well. The plants are subject more or less to attacks from the red spider and what is known as the plant louse, but they have not yet committed any great damage.

Mr. Morris's "Annual Report of the Public Gardens and Plantations for the year ended September 30, 1883," shows that the usual operations of the department have been fully maintained, while the "chief scientific work of the year has been connected with the collection and determination of numerous native plants of the island which have been added to the Department Herbarium, and the large addition of others to the growing collections." Referring to the attacks by insects on the sugar cane, Mr. Morris points out that the spasmodic or intermittent character of the attack is in accordance with their general habit in all parts of the world; "but," he says, "it is well for us to note their appearance and disappearance with great care, in order that we may thereby be prepared for their attacks, and reduce the amount of damage they do to our crops to a minimum."

The indiscriminate destruction of small birds in the island has attracted some attention, and measures have been suggested whereby it may be checked or perhaps stopped.

The mungoose, which has been imported from India to destroy rats on sugar estates, is stated to be increasing very rapidly, not only on sugar estates, but on the highest mountains along the shore, and even amidst swamps and lagoons. The sugar planters have greatly benefited by its introduction, rat-eaten canes being now scarcely known. The negro settlers and persons not connected with sugar estates complain of its ravages amongst their poultry, fruit, and vegetables. Mr. Morris says, however, that poultry is still fairly plentiful in country districts, and from his experience of the mungoose in confinement, the creature is not likely to eat either sugar cane, banana, or field vegetables, except under the influence of extreme hunger, which would not occur so long as there are rats, mice, lizards, and other small animals to feed on. "The mungoose is, however," Mr. Morris says, "disturbing greatly the distribution of animal life in the island; and the harmless yellow and other snakes, lizards, ground-hatching birds, the interesting cony, and many members of our indigenous fauna, are likely to become extinct at no distant period."

Under the head of cultivation and distribution of economic plants Mr. Morris reports progress in many new products. It is not encouraging, however, to find that the cultivation of ginger in Jamaica appears to be dying out, due "to the smaller yield of plants cultivated so persistently on the same land, to the uncertain nature of the crop, no less than the difficulty experienced in many districts in curing it properly." Jamaica ginger has hitherto held a prominent position in the market as to quality, and it is a pity that its reputation should become a thing of the past.

The next report before us is that of Dr. Schomburgk, and treats of the "Progress and condition of the Botanic Garden and Government plantations" at Adelaide, South Australia. A similar work seems to be going on here as at most other colonial gardens at the present time, namely, the distribution of native, and the acclimatisation of foreign plants, chiefly of economic value. The Gardens seem to be very popular, as well as the Museum of Economic Botany, which is a comparatively new institution to Adelaide. Two appendices are added to Dr. Schomburgk's report, one consisting of a "Catalogue of Plants added during 1883 to those under cultivation in the Botanic Garden," arranged according to their natural orders, and the other a "List of Palmæ, Bromeliaceæ, Filices, and Lycopodiaceæ, cultivated in the Botanic Garden." The report is illustrated by eight views in the Gardens.

A Report of the Committee of Management for 1883 of the Technological Industrial and Sanitary Museum of New South Wales shows that a great deal of progress has been made in extending the utility of the Museum during the year. The Museum, which seems to have been opened so recently as December last, bids fair to become of very great service to the colony. One paragraph in the Report says, "Special endeavours are being made to collect the raw products and samples illustrative of the industries and manufactures of the Australian colonies, and the Committee have already secured a considerable number of native vegetable and mineral products and a comprehensive series of specimens of wool."

The "Annual Report of the Royal Botanic Garden, Calcutta, for the year 1883-84," and that of the Government Cinchona Plantations in Bengal for the same period, are, as usual, very creditable to Dr. King as superintendent. Dr. King's reports are always concise and interesting records of admirable work both at the Botanic Garden and at the cinchona plantations, and those before us show that in the former a good deal of consideration has been paid during the year to the extension of plants of real commercial value, such, for instance, as paper materials, including the sabai grass (*Pollinia eriopoda*, Hance). and the paper mulberry (*Broussonetia papyrifera*, Vent), also fibrous plants, including the Rhea, or China grass (*Boehmeria nivea*, W. and A.). Much progress has been made in arranging the specimens in the new building which has been providedf or the herbarium, and numerous contributions have been received both to the herbarium and to the gardens. In the Report on the cinchona plantations Dr. King gives details of the year's crop, of the expenditure for the year, and of the progress of the several forms or varieties. At the factory the total out-turns for the year was 8714 lbs. of febrifuge, 250 lbs. of which were of the new crystalline preparation, which closely resembles the ordinary febrifuge, but, on examination, the grains are seen to be small crystals; it differs, however, in constitution from the old febrifuge, inasmuch as it contains none of the amorphous alkaloid which is the ingredient in that preparation which causes the nausea which sometimes follows its administration. The efficiency of the staff both in the Calcutta Gardens and at the cinchona plantations is indicated by the testimony which Dr. King, with his usual frankness and consideration, bears to the ability of his subordinates.

From the Botanic Garden, Hong Kong, Mr. Charles Ford, the Superintendent of the Botanical and Afforestation Department, reports, under date April 30, 1884, of the department under his charge. A good many plants both of commercial and horticultural interest have been grown with more or less success, including the carob tree (*Ceratonia Siliqua*) of Southern Europe, the Chinese tea oil tree (*Camellia drupifera*), the Chinese varnish tree (*Aleurites vernicia*), and many others. A very interesting account of a visit to the Lo-fau-shan Mountains and a list of the plants collected is given in this Report.

NOTES

HER MAJESTY'S GOVERNMENT, on the recommendation of the Lords of the Committee of Council on Education, have given their adhesion to the International Geodetic Association, and have nominated the undermentioned gentlemen as delegates of the United Kingdom to the Association, viz.:—The Director-General of the Ordnance Survey (for the time being), Col. A. R. Clarke, R.E., F.R.S., the Astronomer-Royal, the Hydrographer of the Navy (for the time being), General J. T. Walker, R.E., C.B., F.R.S.

Two academic honours have recently, *Science* states, been conferred in the United States upon scientific men, which are worthy of note because more rare and costly than such distinctions usually are. At New Haven, on the day before commencement, a bronze statue of Prof. Silliman, for more than fifty years a teacher of chemistry, mineralogy, and geology in Yale College, and the founder of the *American Journal of Science and Arts*, was placed on its pedestal near the new chapel. The other honour is that of a medal struck at the U.S. Mint in Philadelphia, at the request of the colleagues and friends of Prof. Sylvester, to commemorate his residence in Baltimore during a period of seven years, marked, among other things, by the establishment of the *American Journal of Mathematics*. The medal, in size and general aspect, is not unlike that which was struck in commemoration of the life of Agassiz. On one side is an accurate and spirited portrait of the mathematician, with the name Sylvester; on the reverse a Latin inscription commemorates the fact that he was for seven years Professor of Mathematics in the Johns Hopkins University—from 1876 to 1883. The original medal in gold was sent to Prof. Sylvester, in his new home in the University of Oxford; a duplicate in silver was retained in Baltimore, and a few impressions in bronze have been distributed among his scientific friends and correspondents.

Science, in referring to the recent researches of Koch, states that work of value upon the subject of micro-organisms is not done in this country (the United States), nor will it be until some such encouragement is offered to investigators as is the case in France and Germany. This kind of research requires the rare combination of many forms of training, added to a critical, analytical, and judicial mind. These we can have; but until the facilities for the work are offered, until the necessity for personal sacrifice and self-denial is done away with, we can hope for no better work in the future than has been done in the past; in other words, what is first needed in order to place our own investigations upon an equality with those of the two countries mentioned above, is a thoroughly-equipped, fully-endowed laboratory, with a strong corps of well-trained and salaried officials. These remarks might very well have been written concerning our own country, and the official mission of Dr. Klein to India is a tardy recognition by our Government of the necessity of State intervention if scientific research is to be pursued with any hope of speedy and substantial practical results. The true way to encourage such inquiries (*Science* truly says) lies in the establishment of a Commission composed of men thoroughly trained and qualified for the work, and then to treat it as the German Government has treated its Cholera Commission, that is, to give it full powers and funds to allow the prosecution of its labours to the end.

THE death is announced at the age of seventy-five years of Sir Erasmus Wilson, the eminent surgeon.

THE death is also announced of Mr. John Aitken, J.P., of Urmston, well known as a geologist in the northern counties. Deceased was born in 1820. He was early distinguished for his application to scientific matters, and he twice filled the office of President of the Manchester Geological Society. He wrote for the Society's papers a number of articles relating chiefly to the geology of Clitheroe, Bacup, and Holcombe, and he also contributed to the *Geological Magazine* and the *American Journal of Science*. He furnished for Newbiggin's "History of the Forest of Rossendale" the geological section relating to that district.

SIR JOHN LUBBOCK has been compelled, for personal reasons, to abandon his intention of attending the meeting of the British Association at Montreal.

A COMMITTEE was appointed in 1882 at the Montreal meeting of the American Association for the Advancement of Science, "to confer with committees of foreign associations for the advancement of science with reference to an international convention of scientific associations." The committee consists of Dr. T. Sterry Hunt, Mr. Alexander Agassiz, and Prof. Simon Newcomb. If the British Association responds, as has been suggested, by also appointing a committee, the official channels for the interchange of opinion between the two national bodies will be suitably established on both sides. We (*Science*) are unable to make any authorised statement as to what the American committee has done or proposes, but its membership justifies the conviction that it is capable of efficient action, wisely planned. We shall await their report with interest.

THE Committee appointed by the Government at M. Pasteur's request to verify his experiments in the treatment of hydrophobia has just presented its first report. M. Bouley is president, his colleagues being MM. Beclard, Paul Bert, Tisserand, Villemin, and Vulpian. The Committee states that M. Pasteur's experiments have been entirely borne out. Inoculation with the attenuated virus of hydrophobia gives a dog immunity from the disease, just as similar treatment preserves a sheep from *charbon*. All the twenty-three dogs submitted by M. Pasteur as having been thus inoculated have resisted the strongest virus on inoculation, whereas the majority of the nineteen non-inoculated dogs have succumbed. Of the latter, six were bitten by mad dogs, three of them becoming mad, eight were subjected to intra-venous inoculation, all becoming mad, and five to inoculation by trepanning, all becoming mad. The result is decisive; but the Committee will now inoculate a large number of fresh dogs, and will compare these with an equal number of dogs not inoculated. It will likewise investigate the question whether after a dog has been bitten inoculation with the attenuated virus will prevent any consequences from the bite. M. Pasteur will lay before the International Health Congress at Copenhagen results which, as the Committee remarks, "are so honourable for French science, and give it a fresh claim on the gratitude of mankind."

A CORRESPONDENT living about two hundred yards from the river at West Chelsea complains that mosquitos first appeared sparingly in the middle of July, but are now almost nightly visitors. There is too much reason to fear, he states, that they are thoroughly acclimatised in this part.—Mosquitos and gnats are synonymous terms. Whenever the heat is greater than usual we constantly receive notices similar to the above. Possibly it renders the gnats more vicious, and at the same time the object of their attacks more irritable. Gnats (mosquitos) inhabit water (not sea-water) in their early stages, and from this reason it is practically impossible to import them, unless intentionally. The conditions at West Chelsea at the present moment are particularly favourable to the welfare of gnats (see article "Mosquito" in the new edition of the "Encyclopædia Britannica").

THE eighth International Medical Congress, of which the King of Denmark has consented to be the patron, was opened on Sunday in the Grand Hall of National Industry, Copenhagen, in the presence of the King and Queen of Denmark, the King and Queen of the Hellenes, the Crown Prince and Crown Princess of Denmark, and the rest of the Royal Family, the Danish Ministers, the Corps Diplomatique, the official authorities, civil and military, and delegates from Great Britain and Ireland, Germany, France, Russia, Austria, Holland, Belgium, Greece, Switzerland, Japan, New York, Columbia, Kentucky, and California. Addresses were delivered by the President, Prof. Panum, the Secretary, Dr. Lange, Sir James Paget, Prof. Virchow, and Prof. Pasteur. The assembly consisted of about 1500 members.

EARTHQUAKES have been frequent and widespread during the past few days. The inhabitants of the towns and villages along the whole range of the Alban hills were alarmed at two a.m. on August 7 by a sharp shock of earthquake, followed by another at a quarter past three. The direction taken by the wave was through Velletri, Nemi, Ariccia, Albano, Castel Gandolfo, and Rocca di Papa and Frascati. The shocks were most severely felt at Rocca di Papa, but no damage was done beyond the felling of two chimneys at Ariccia. At half-past three a severe shock, quickly followed by another, was distinctly felt at Rome, and that which shook the Alban hills extended also as far as Porto d'Anzio, on the coast.

AN earthquake shock shook the most solid buildings in New York at two o'clock on Sunday afternoon, and produced a sensation like that on board a steamer under way. At Brooklyn the residents were frightened into running out of their houses. The earthquake suddenly moved along the Alleghany Mountains and their eastern slopes, from Virginia to Vermont, in a direction from south-west towards north-east, extending over the entire country from the mountains to the ocean. The most southerly city in which the shocks were noticed was Washington, and the most northerly Brattleborough, Vermont. Two distinct shocks, each of about two seconds' duration, with an interval of about four seconds, were generally felt, while in New York and further eastwards a slight third shock was experienced a few minutes afterwards. The earthquake was observed at nine minutes past two o'clock in the afternoon at Philadelphia, and somewhat later to the eastward of this city. It was most severe in New York City, Connecticut, and Boston. The vibration was slighter elsewhere.

SLIGHT earthquake shocks, recurring at short intervals, have recently been felt at Massowah.

PROF. MILNE, of Tokio, Japan, writing to the *Times* on the subject of the Essex earthquake, concludes as follows:—"Before earth movements can be generally understood, it is necessary that they should be observed as other natural phenomena are observed. A reason that has been expressed against the establishment of seismometers in British observatories is that in Britain earthquakes are a rare occurrence. Such a reason appears to arise from an imperfect acquaintance with the phenomena to be observed. Earth-tremors, which are minute earthquakes, may be observed in Britain every day. Messrs. George and Horace Darwin have shown that such movements are of common occurrence in Cambridge. Then there are the slow earthquakes or earth-pulsations, like those which I have from time to time observed in Tokio. Whether these exist in Britain cannot be known until they are sought for. That they existed on the outer rim of the area where the Essex earthquake was felt is tolerably certain. It is also certain that shortly after great earthquakes—as, for instance, some which have shaken South America—pulse-like motions have been observed in the bubbles of astronomical levels at places as distant as St. Petersburg. When we consider that we are observing meteorological changes with which earth-tremors have a close relationship, that we observe the tides, magnetic and electric changes in our earth, and the escape of gas in our mines, with all of which earth-movements may be closely associated, when we possess so many earthquake-shaken colonies, and send our Navy and mercantile marine to all the earthquake countries of the world, it would certainly not be an unreasonable undertaking for us to investigate the ill-understood phenomena which continually occur beneath our feet. We study our oceans, our atmosphere, the sky above us, and, I may add, the ice at our poles, while the changes in the earth on which we live are almost neglected."

MESSRS. COTTEAU AND KORTHALS, members of the French Mission sent by the Minister of Public Instruction to explore the Krakatoa volcano, write from Batavia on June 2 that the object of the expedition has been fully realised. Soon after their arrival at Batavia on May 14, the Dutch Colonial Government placed at their disposal a small steamer, on board of which they started for the Sunda Strait on the 21st. Along the west coast a well-marked line, running at an elevation of from fifty to eighty feet above sea-level, indicated the limit reached by the terrible wave that spread disaster far and wide towards the end of August 1883. The plantations had been swept away, and all the houses of this populous district, together with the town of Anjer, had completely disappeared. On the 23rd the steamer cast anchor at the head of Lampong Bay on the south coast of Sumatra, whence a visit was paid to the Telok-Betong district. Here the extensive and thickly-settled coastlands had assumed the aspect of a desolate swamp, relieved here and there by a few bamboo huts recently set up. Nearly three miles inland lay the steamer *Borouw*, which had been borne on the crest of the wave into the forest, where it now forms a sort of bridge across a small stream. On the 25th the formerly fertile and densely-peopled islands of Sibuku and Sibesi were successively visited and found to be entirely covered by a deposit of dry mud several yards thick and furrowed by deep crevasses. Of the inhabitants, all had perished to a man. Continuing the trip on the 26th to Krakatoa itself, the mission was surprised to note the complete disappearance of the three islands of Steers, Calmeyer, and the islet east of Verlaten, which had risen above the surface at the time of the eruption, but which are now covered by 12 or 14 feet of water. Approached from the north Krakatoa seemed wrapped in a whitish smoke, vapours apparently issuing from fissures on this side, and settling on the summit, which is at present 2730 feet high. It was at this point that the great convulsion took place on August 26-27, when about half the island was blown into the air. A closer examination showed that what had been taken for fissures were simply ravines, and the vapours were clouds of dust stirred up by stones incessantly rolling down the steep slope of the mountain. This was accompanied by a continuous noise like the rattling of distant musketry, while stones of a certain size were seen whirling in the air, then falling and ricochetting down to the sea. Notwithstanding the evident danger, the boats of the expedition succeeded in approaching the foot of the volcano and collecting specimens of the rocks at several points. The same afternoon they reached the island of Verlaten, formerly one mass of verdure, now uniformly covered with a layer of solidified ashes about 100 feet thick. The deep crevasses, widened by the erosion of tropical rains, give the aspect of a glacier to this island, which has been doubled in extent by the deposits from the last eruption. Returning next day to Krakatoa the members of the expedition found a safe landing place, where it was possible to study the nature of the rocks and other matter ejected by the volcano. No trace was found of animal or vegetable life, with the exception of a solitary little spider, and the solidified bed of mud and ashes was estimated in some places to have attained a thickness of from 200 to 260 feet. A black rock rising a few yards above the surface about a mile and a quarter from the present shore, represents a last fragment of the portion of the island engulfed during the eruption. After touching at Lang Island, which presented much the same appearance as its neighbour Verlaten, the expedition concluded its survey of the Strait, landing on the 28th at Merak at the north-west extremity of Java. Merak had shared the fate of Anjer, and the coast-line in this district had been considerably modified. The expedition returned to Batavia on the 29th, after determining two new facts—the disappearance of the islands upheaving during the eruption, and the total cessation for the present of all volcanic activity at Krakatoa.

On Saturday, August 9, M. Renard, Captain of Engineers, and M. Krebs, Captain of Infantry, made an experiment with the directing balloon which they are constructing at the expense of the French Government in the aëronautical works of Chalet Meudon. The balloon, which is about 60 metres in length and 10 metres in diameter, carries a long platform of about 40 metres in length and 3 metres in breadth. At one of its extremities sit the aëronauts in a car. The aërial helix and a gramme magneto-electric machine are placed at the other. The voltaic elements and ballast are disposed on the platform. The wind not being strong, the aëronauts ascended and tried first the effect of their rudder, which is a sail of about 10 metres square. The results were very satisfactory indeed, and the steering of the balloon remarkably quick and easy. The balloon was drifted by the wind from Chalet Meudon to Petit Bicetre, above the Meudon woods. Then the aëronauts, wishing to return home, adjusted the rudder and the experiment succeeded wonderfully; in five minutes the distance, which is about two miles, was run. The balloon landed just before the doorway of its wooden house. This experiment will be tried again in a few days for a longer distance. The system practised by the French officers is a slight modification of the one used by Gaston Tissandier and described in Nature. The French officers were originally adherents of the helix moving round an axis traversing the balloon, but the result of the experiments published by Tissandier seems to have modified their opinion.

M. F. Lhoste, Secretary of the Académie d'Aérostation Météorologique de France, who started in a balloon from Boulogne on Thursday last, descended at Romney, fifteen miles from Folkestone, at half-past eight o'clock the same evening. M. Lhoste left Boulogne at seven p.m. He encountered three distinct currents of air, one of which carried him in the direction of the North Sea. The descent was effected without difficulty.

Already a prospectus has been issued of the International Exhibition of Inventions and of Musical Instruments, to be opened in May 1885, in the buildings now standing in the gardens of the Royal Horticultural Society at South Kensington. The Exhibition will have all the advantages of royal patronage and support. Her Majesty the Queen becomes patron, and the Prince of Wales assumes once more the duties of president. The Executive Council, appointed by the royal president, having for chairman Sir Frederick Bramwell, F.R.S., vice-president of the Institute of Civil Engineers, and for vice-chairman the Marquis of Hamilton, is composed of Sir Frederick Abel, C.B., Mr. I. Lowthian Bell, F.R.S., president of the Institution of Mechanical Engineers, Mr. Birkbeck, M.P. (honorary treasurer), Colonel Sir Francis Bolton, Sir Philip Cunliffe-Owen, C.B., C.I.E., Prof. Dewar, F.R.S., Mr. Joseph Dickenson, Sir George Grove, D.C.L., Mr. E. W. Hamilton, Mr. Henry E. Jones, M.Inst.C.E., Mr. W. H. Preece, F.R.S., Sir E. J. Reed, M.P., F.R.S., Prof. Chandler Roberts, F.R.S., Mr. John Robinson, Mr. Warington W. Smyth, F.R.S., Dr. Stainer, and Mr. R. E. Webster, Q.C., with Mr. Edward Cunliffe-Owen as secretary. Mr. J. R. Somers Vine will be the City and official agent. The idea upon which the Exhibition is planned is not to bring together a mere collection of models of inventions, but rather to illustrate the progress which has been made in the practical applications of science during the past twenty years. In order to carry out this intention the Council will, as far as possible, confine the exhibits to processes and appliances, products being admitted only where they are themselves novel or where their introduction is required to make the purpose or advantages of that which is new in any process more interesting and intelligible. It is not proposed to allot space for manufactured goods unaccompanied by any illustrations of the process of manufacture. Generally it may be said that, as far as is practicable, inventions will be shown by models, with, in the case of models of entire machines, actual specimens of the portions improved under the exhibitor's patent, and when the invention relates to parts only the whole machine will not be admitted unless indeed the improvement effected cannot be sufficiently shown without the exhibition of the entire apparatus. The limitations of space which make these restrictions necessary, also compel the Council to decline, unless in exceptional circumstances, to receive objects which have already been shown in the Smoke Abatement Exhibition, 1881, in the Fisheries Exhibition, 1883, or in the present Health and Education Exhibition, and it is thought that the annual shows of the Royal Agricultural and kindred Societies have served so well to exhibit inventions bearing upon agriculture that it will suffice to present a few typical examples (and these models or diagrams) of each class of improvements effected during recent years.

The U.S. National Academy of Sciences recently received a gift of 8000 dollars from the widow of the late Dr. J. Lawrence Smith. The deed of trust has now been executed, and provides that the interest of the fund shall be used in striking a gold medal of the value of 200 dollars, to be called the "Lawrence Smith Medal," and to be awarded by the Academy, not oftener than once in two years, "to any person in the United States of America, or elsewhere, who shall make an original investigation of meteoric bodies, the results of which shall be made known to the public, such result being, in the opinion of the National Academy of Sciences, of sufficient importance and benefit to science to merit such recognition."

Any sums which may accumulate from the interest of the fund, above what is required for the purposes specified, are to be used "in aid of investigation of meteoric bodies, to be made and carried on by a citizen or citizens of the United States of America."

THERE being a notable difference between the determinations of specific weight of the normal hydrate of sulphuric acid, H_2SO_4, which have been made by Marignac in 1853 and 1870, and later on by MM. Schertel, Kohlrausch, Lunge, and Naeff, Prof. Mendeléeff, aided by M. Pavloff, has recently determined it again with all possible accuracy, and communicated the results of his determinations to the Russian Chemical Society (*Journal*, vol. xvi. fasc. 5). The hydrate was crystallised four times, the operations being made in a perfectly dry atmosphere of carbonic acid. Out of 6 kilogrammes, a remainder of only 300 grammes was received. The thus prepared hydrate melted at 10°·1 to 10°·6, and an accurate titration of it gave the following figures: 81·71, 81·52, and 81·58, that is, on the average, 81·6 per cent. of SO_3, the theoretic percentage deduced from the chemical formula being 81·64. The specific weight of the hydrate has been determined with great accuracy, and the average result, with all necessary corrections, was 1·83295 at 19°·02. The reduction to 15°, as compared with water at 4°, being made with Marignac's data for dilatation, the final result will be 1·8371, which figure differs only by 0·0001 from that of Marignac, and widely differs from those of Kohlrausch, Lunge, and Naeff.

WHEN submitting the Baku naphtha to fractional distillation, carried on at each 2°, Prof. Mendeléeff had shown that the specific weight of the products of distillation, while rising on the whole together with temperature, decreases however three times, namely, between 55° and 62°, between 80° and 90°, and between 105° and 110°. He shows now, in a recent communication to the Russian Chemical Society (*Journal*, vol. xvi. fasc. 5), that this is not a peculiar feature of the Baku naphtha, but that the same decrease of specific weights is displayed also by American naphtha, if this last be submitted to fractional distillation at each 2°, and that the phenomenon is produced at nearly the same temperatures. The products that boil below 60° were insufficiently represented in Prof. Mendeléeff's samples; but from 60° (where the specific weight, reduced to 17°, like all following, was 0·6642) until 124° (where it was 0·7322), there are two decreases of specific weight. Thus, at 80° it was 0·7347, but only 0·7069 at 92°, that is, the same as at 75°. After that it increases until 104°, where it reaches 0·7543; but it soon decreases for a second time, and at 115° to 117° it reaches 0·7270, that is, the same figure as it had between 85° and 98°. Beyond 117° it continues to rise. Both kinds of naphtha—Caucasian and American—however different their origin, thus display the same phenomena at nearly the same temperatures; the corresponding specific weights, however, are not the same; the portion at 80° has, in the Baku naphtha, a specific weight of 0·7486, and only 0·7347 in the American; and at 100° the respective densities are 0·7607 and 0·7380. The amounts of substance distilled at each temperature are also different. The researches will be continued in Prof. Mendeléeff's laboratory.

WE have been requested to state that at the meeting of the Essex Field Club, referred to in last week's NATURE (p. 343), the natural history and archæological conductor who addressed the Club on the "salting mounds" and other subjects was Mr. Henry Laver, F.L.S., of Colchester.

THE additions to the Zoological Society's Gardens during the past week include a Bonnet Monkey (*Macacus sinicus* ♂) from India, presented by Mr. T. S. T. Tregellas; a Striped Hyæna (*Hyæna striata*) from North Africa, presented by Sir John H. Drummond Hay, K.C.B., C.M.Z.S.; three Greater Sulphur-crested Cockatoos (*Cacatua galerita*), three Leadbeater's Cockatoos (*Cacatua leadbeateri*), a White-backed Piping Crow (*Gymnorhina leuconota*) from Australia, a Red-sided Eclectus (*Eclectus pectoralis*) from New Guinea, a Blue and Yellow Macaw (*Ara ararauna*) from South America, six Amherst Pheasants (*Thaumalea amherstiæ*) from China, eight Himalayan Monauls (*Lophophorus impeyanus*) from the Himalayas, two Javan Peafowls (*Pavo spicifer* ♂ ♂) from Java, presented by Mr. Charles Clifton, F.Z.S.; a Rough-legged Buzzard (*Archibuteo lagopus*), British, presented by Sir R. Payne Gallwey, Bart.; a Cockateel (*Calopsitta novæ-hollandiæ*), a Rose-Hill Parrakeet (*Platycercus eximius*) from Australia, presented by Mr. J. W. Dixon; a Green Turtle (*Chelone viridis*) from the West Indies, presented by Mr. A. E. Painter, F.Z.S.; a Loggerhead Turtle (*Thalassochelys caouana*) from the Atlantic Ocean, presented by the Surrey Commercial Docks Company; a Leopard Tortoise (*Testudo pardalis*) from South Africa, presented by Mr. William Lane; a Slow-worm (*Anguis fragilis*) from Norfolk, presented by Mr. T. E. Gunn; a Bonnet Monkey (*Macacus sinicus*) from India, a Blue-fronted Amazon (*Chrysotis æstiva*) from Brazil, a Grey Parrot (*Psittacus erithacus*) from West Africa, an Alligator Terrapin (*Chelydra serpentina*) from North America, deposited; two Jardine's Parrots (*Pœocephalus gulielmi*) from West Africa, two —— Conures (*Conurus perlatus*) from the Lower Amazons, an Electric Eel (*Gymnotus electricus*) from British Guiana, purchased; a Mule Deer (*Cariacus macrotis*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

THE NEXT MINIMUM OF MIRA CETI.—In the ephemeris of variable stars for 1884 in the *Vierteljahrsschrift*, the next minimum of Mira is fixed to 1884 October 24, a date which does not appear to result from Argelander's formula of sines, as it is given in Schönfeld's Catalogue of 1875, viz.:—

$$\text{Epoch Min.} = 1866 \text{ August } 8{\cdot}0 + 331^{\text{d}}{\cdot}3363\,.\,E$$
$$+\,10^{\text{d}}{\cdot}48 \sin\left(\frac{360^\circ}{11}\,.\,E + 282^\circ\,45'\right)$$
$$+\,18{\cdot}16 \sin\left(\frac{45^\circ}{11}\,.\,E + 31\;\;15\right)$$
$$+\,33{\cdot}90 \sin\left(\frac{45^\circ}{22}\,.\,E + 70\;\;5\right)$$
$$+\,65{\cdot}31 \sin\left(\frac{15^\circ}{11}\,.\,E + 179\;\;48\right)$$

For the present year E = 20, and hence substituting logarithms the four perturbations become—

$$+\,[1{\cdot}02036] \sin(217^\circ{\cdot}29) = -\;6^{\text{d}}{\cdot}35$$
$$+\,[1{\cdot}25912] \sin(113{\cdot}07) = +\,16{\cdot}71$$
$$+\,[1{\cdot}53020] \sin(110{\cdot}99) = +\,31{\cdot}65$$
$$+\,[1{\cdot}81498] \sin(207{\cdot}07) = -\,29{\cdot}72$$

The Julian date of the initial minimum is 2402822, and we have—

	2402822·0
331·3363 . E	6626·73
Sum of perturbations	+ 12·29
Julian date of next minimum	2409461·0

Which it will be seen from the *Nautical Almanac* (p. 486) corresponds to 1884 October 11. In 1882 by a very precise determination of the time of minimum, Schmidt found that it occurred on December 16, which is 18 days earlier than the date given by Argelander's formula, and the previous maximum had also been earlier by about 19 days. If this correction still applies the next minimum might be expected to fall about September 23, or a month earlier than the *Vierteljahrsschrift* has it. Still there is the possibility that Prof. Schönfeld may have applied corrections to the formula.

The present year's minimum may be therefore advantageously observed. In that phase Mira descends to about the brightness of the well-known star following it, not far from the parallel, or to about 8·5 m.

Another of the more interesting variables, χ Cygni, may be expected at a maximum about November 15, and R Leporis, "the crimson star," at a minimum on January 5.

THE DOUBLE-STAR 99 HERCULIS.—Mr. S. W. Burnham, in his last Catalogue of double-star measures, refers to a statement by M. Flammarion to the effect that the change in the position of the companion of 99 Herculis (one of Alvan Clark's discoveries) very nearly corresponds to the proper motion of the large star. But although the alteration in position between Dawes' measures in 1859 and Mr. Burnham's in 1880, may be fairly represented by rectilinear motion, it will hardly appear, when the best value we can assign at present for the proper motion of 99 Herculis is introduced, that it accounts for the observed change in the position of the companion. If we compare Bradley for 1755 with the Greenwich Catalogue for 1864, employing the accurate formulæ, we find :—

Secular proper motion in right ascension ... $-11''\cdot34$
,, ,, ,, declination ... $+6''\cdot90$

Mädler assigned for the respective proper motions $-10''\cdot4$, and $+7''\cdot0$.

Taking for comparison the following measures of 99 Herculis,

	Position	Distance	
	°	″	
1859·63 ..	347·2 ...	1·705 ...	Dawes
1880·18 ...	29·9 ...	0·91 ...	Burnham

we find on bringing up Dawes' measures to Burnham's epoch, with the proper motions of the principal star given above, the angle of position becomes $81°\cdot5$, and the distance $1''\cdot65$, showing a great difference from the result of the American astronomer. It seems at least probable, as he remarks, that it will prove to be a physical pair.

THE WATER SUPPLY CONFERENCE

THE Water Supply Conference of the Society of Arts, held at the National Health Exhibition, in the unavoidable absence of the President, H.R.H. the Prince of Wales, was opened by Sir Frederick Abel, C.B., F.R.S., chairman of the Council, who alluded in his introductory address, to these Congresses having been originated by His Royal Highness, who hoped a comprehensive scheme might be elaborated that would provide not only for the urban populations, but for the rural communities. He alluded to the good and useful work done by the Congress held in 1878, and in 1879, and reviewed the present position of the water-question in this country.

The papers read at the Conference were placed under three heads, viz. :—"*sources of supply*," "*quality of water*, with methods of filtration and softening," and "methods of *distribution*, with modes of giving pressure, house fittings, discovery and prevention of waste." Under all heads valuable papers were contributed, and the Society may again be congratulated on bringing together a jury of experts capable not only of showing us the weak points in our existing water-supply, but the methods by which these defects may be remedied. This was done to a large extent by the previous Conference, but the dangers then pointed out have been hardly appreciated, owing to the years of the Conference being followed by a remarkable succession of wet seasons. Now that a hot summer is succeeding a dry winter, the gravity of the situation is forcing itself upon public attention, and the importance of husbanding our water resources is found to be a matter of vital necessity, the neglecting of which has already facilitated the spread of English cholera, in certain districts, and will be a constant element of danger, should Asiatic cholera appear on this side of the English Channel.

Rainfall being the source of all water supply, it may be well to first notice the paper contributed by Mr. G. T. Symons, F.R.S., who, just a quarter of a century ago, instituted the first general series of rainfall observations ever made in this country, and who since that time has been gradually increasing their number, until there are now nearly 3000 observers, no less than 2433 stations having furnished perfect records of rainfall last year. Worthy of all praise as is this remarkable voluntary staff of observers, not only giving their services, but actually contributing 99 per cent. of the cost of publishing the observations made, it is obvious, looking to the direct bearing such observations have on engineering, agricultural, and sanitary questions, bearing on the health and welfare of our population, that the scope of the inquiry should be enlarged so as to increase its sphere of usefulness, and that it should be placed under a Government department with a grant from Parliament, and the inquiry be no longer crippled for want of funds as regards possible and necessary extensions, though ten years ago the British Association for the Advancement of Science, feeling it their duty to initiate, rather than support, investigations of national importance, withdrew the vote with which they had aided the work for many years, it is due to Mr. Symons to point out that he has not merely maintained the standard of excellence found in his annual volumes of that period, but has increased their size and usefulness. In his paper Mr. Symons urges as a question of general policy the necessity of the formation of an hydraulic office, the early duty of a Government being "to see that all parts are completely supplied with the chief necessary of life. Englishmen," he says, "have a dread of centralisation, but in many ways they pay a long price for their dread. At present, it is not often that any town can even state before Parliament its views as to the effect upon it of what its next neighbour may be obtaining powers to do," and which, when passed by Parliamentary Committees become law, and "law for all time to come;" he truly adds that "no one can foresee what will be the total population of the country a century hence. No one can tell where the bulk of the people will reside, nor what will be the need for water in various parts of the country," and he justly urges that special water rights, "now asked to be created, should be subject to revision, *without compensation*, after the lapse of 100 years."

Mr. E. Bailey-Denton, in his paper on "The Water Supply of Villages and Rural Districts," points out that though a state department exists charged with sanitary matters, the condition of our rural districts as regards water supply "is a positive disgrace," and he considers the department should have their efforts specially directed to the protection of small communities, and states that those who form the "Local Boards" and "Boards of Guardians," having jurisdiction over such districts are elected under pledges to oppose all sanitary works that will increase the rates, and that even when men of knowledge and position are elected to such posts—outvoted by the majority they fall back to quietly agreeing with the *laissez faire* policy of their colleagues, and allow their constituents to continue to inhale and imbibe those germs of disease which float in the foul air that surrounds them, and are present in the only water provided for their use. Mr. Denton is evidently of the opinion that the writer has already advocated in these columns, that the Local Government Board should not only have the power to sanction local authorities providing pure water and efficient sanitary arrangements, but should themselves survey the country and seek out the districts where advantage is not taken of the law, as it even now exists, and to compel the authorities to remedy the abuses and shortcomings discovered.

In the present position of our knowledge it would be difficult, and often impossible, for an engineer to advise such a rural authority, suddenly called on to provide itself with an efficient water supply, even were the legal difficulties, and cost of parliamentary struggles obliterated. Thanks to Mr. Symons, we know something of the rainfall, but as Mr. Conder and others have pointed out, our knowledge of the discharge of our rivers is lamentably small. Daily gaugings have been taken of the Thames, but no systematic examination of the quantities run off by streams draining equal areas of rocks of varying degrees of permeability have been carried out, and the necessity of such observations being taken in all our streams cannot be too highly insisted on, and should be made a matter of State care. The few observations we have were chiefly made in the last century by Rennie, if we except the comparison of chalk and clay basins, made by Mr. C. Homersham, who showed the large quantity of water absorbed by the chalk, which never appears as streams. As regards underground waters, our knowledge is also not yet sufficiently definite to safely predicate the quantity of water a given unknown district will yield. A large body of information has been published by the Underground Water Committee of the British Association, during the past ten years, from which the direct relation of yield to rainfall, modified by degree of permeability is clearly made out, and details given of actual supplies obtained in enormous quantities, in certain districts, but what is still required, is a systematic examination of the height of water in wells and borings throughout the kingdom, and until the seasonal variation is clearly established, the minimum yield to be obtained in a given district, during a dry year, and still more after a succession of dry years cannot be ascertained, or calculations made be depended on with any safety. Information of this class is being steadilyaccumulated in the Epsom, Croydon, and in some other districts by Mr. Baldwin Latham, C.E., who is ascertaining the seasonal variation in level of the underground waters, and the difference of cubic discharge of springs by self-recording apparatus. Valuable as are such observations for special districts for general use and public advantage, it is necessary that they should be extended to the whole country and be made by official observers for public use, and free access to the results.

In a paper on "Water from the Chalk," Mr. Joseph Lucas alluded to the work he has been doing during the past twelve years in measuring the height of the water in the wells over a large district in the Thames and Hampshire Basins, connecting together the points of observations by imaginary lines, or underground contours. He is able to map out with some degree of accuracy the height at which water stands in the rocks, the varying width, or proximity of the contours, indicating the varying decrease or increase of the steepness of the water gradients, *i.e.* the angle which the slope of the water-plane makes with the sea-level, which, as shown by the Rev. J. Clutterbuck in 1841, varies in the chalk from 14 to 47 feet per mile. Mr. Lucas is of opinion that a comprehensive and uniform survey of the sources of water-supply, both surface and subterranean, should be carried out by the nation, and that maps should be constructed, "defining levels, areas, and quantities of water."

The Geological Survey have done much to prepare the way for such an examination as was pointed out by Mr. Edwin Chadwick, C.B. at a previous Congress, and it is encouraging to note that the first four papers read on "Sources of Supply" at the present Conference, were contributed by three present officers, and one former officer of that staff. Mr. Whitaker's paper commenced by pointing out that ordinary geological maps, including the greater number as yet issued by the Geological Survey, are of little use in estimating the quantity of water obtainable from a given porous rock that may be represented on the map, and whose water-bearing capacity may be well known, owing to the thick covering of various beds of clay, sand, gravel, loam, and alluvial silt, together called by geologists drift, which obscures the solid geology, and where the beds consist of impermeable material entirely cut off the percolation of rainfall into the pervious rock beneath. Before, therefore, any estimate can be made with any degree of accuracy, of the quantity of water capable of being yielded by a given area of permeable rock, as represented on the ordinary geological map, it is necessary to have a Drift survey, showing the actual condition of the surface. Such maps are now being issued by the Geological Survey, the various rocks, being shown by their proper colour, in the areas, when they are not overlaid by any material, the surrounding districts being coloured to indicate the nature and character of the drift deposits overlying them, distinguishing the different clays and various gravels by distinct tints. For waterworks purposes, so elaborate a classification is not requisite, and in the interesting and valuable series of maps Mr. Whitaker laid before the Congress, the results of many years of work, he has adopted the following classification:— 1, bare chalk; 2, chalk covered only by beds of a permeable kind; 3, chalk protected by beds of mixed or varying character; 4, chalk protected by impermeable beds. The result of Mr. Whitaker's investigations is to curtail the somewhat excessive estimates that may have been made in bygone years of the amount of chalk area available for the absorption of rain, but he states that the "chalk remains our chief water-bearing bed in the south-east of England; for though not always coming up to some of the sand-beds in permeability or porosity, it is pre-eminent over all other geological formations in thickness and extent of outcrop."

Mr. Topley contributed an interesting paper on a subject he has already done good and original work, "Water Supply in its Influence on the Distribution of the Population." He shows there "is a well marked and constant relation between the outcrop of porous strata and the parish or township boundaries, the longer axes of the parishes crossing the outcrops more or less at right angles." The arrangement of parish boundaries depends upon the sites of early settlements, which were entirely controlled by the outcrop of the water-bearing beds. Mr. Topley points out that with the river, London has at present no less than four different sources of supply of water, each giving a different quality, and he notes that no city in Europe is better situated for supplying itself from its own area, but it has become so vast that all sources have become insufficient. He notes that most of the other great capitals of Europe are also situated on basins capable of yielding deep well water, and instances Paris, Berlin, and Vienna.

Mr. De Rance, in a paper on "A Possible Increase of Underground Water Supply," endeavoured to show that the flow of intermittent springs might be increased, and the violence of floods diminished by the construction of "dumb wells," through impermeable beds to pervious beds below, draining what is now unproductive rainfall, passing in destructive floods to the sea, into permeable rocks which are now not storing water owing to their being covered by impermeable formations.

Mr. Edward Easton gives a useful *résumé*, gathered from his own practical experience, of well recognised principles which should govern the supply of water for domestic and other purposes, which, he justly observes, are too often neglected or forgotten. He appears to have a very decided predilection for soft water in preference to hard, and alludes to the value and cheapness of the lime-softening process of Prof. Clark; as regards filtration of supplies, in which it is found impossible to altogether prevent the chance of contamination, the filtering medium should include some deodorising agent, and he refers to the good results obtained in this direction at Wakefield by Spencer's magnetic carbide of iron, and at Antwerp by Prof. Bischof's spongy iron; in both cases the water was much contaminated, and was rendered perfectly wholesome. Referring to the dangerous practice of storing water in cisterns, he states that after an elaborate and exhaustive examination of the waters supplied by the London water companies, by Sir Frederick Abel, assisted by Dr. Dupré, Mr. G. H. Ogston, Prof. Voelcker, and the late able chemist to the Metropolitan Board, Mr. Keates, it was found that during the session of 1877-8, when two bills were introduced into Parliament at the instance of the Metropolitan Board of Works for purchasing the undertakings of the London water companies, and for providing a separate supply from the chalk for drinking purposes, that whilst the water in the main was in almost all cases excellent, the condition and position of the cisterns frequently rendered it utterly unfit for human consumption, a condition of affairs affording a most fruitful source of disease, and not alone confined to the dwellings of the poor, cisterns fixed on the roofs of the better class of houses being "rarely sufficiently covered, and often open to contamination from soot, dust, inroads of blackbeetles, and other abominations." Mr. Easton quotes Sir F. Bolton as to the importance of waste-pipes from cisterns being carried outside each house and the end left exposed to the air, instead of communicating, as now, with the drains, from which gases flow back into the cisterns, and are absorbed by the water; but it is to be hoped, with the steadily increasing expansion of the constant service in London, this frightful evil will cease to exist. According to Colonel Sir F. Bolton's return for the month of May, the quantity of water supplied to London amounts to 32 gallons per head per day, about 20 per cent. of which, say 6 gallons, it is estimated is used for other than domestic purposes, leaving 26 gallons per head as the quantity supposed to be absolutely consumed in the houses, while long practical experience has proved that the water really required is not half that quantity, and there can be little doubt that a system of supervision like that carried out at Liverpool would have similar results. The use of Deacon's meter has reduced the consumption of water from 33 to 22 gallons per head per day; this ingenious instrument enables waste of water to be localised, and the house or place detected where the flow-off is taking place.

Mr. Easton then shows the advantage to consumer and supplier of a constant service being given to each house by water, the quantity being regulated by the rateable value of the property, but returns to the keynote of all the speakers, that "it is useless to discuss the method and conditions of supply if the sources of water are not to be preserved to us," and adds, "it is quite certain that with the immense growth of the population of this kingdom, it will not be long before this preservation becomes a pressing necessity."

Mr. Easton repeats the proposition he made in his Presidential address to the Mechanical Section of the British Association at Dublin in 1878, which, expressing as it does a widespread feeling shared by all who have given attention to the subject, it may be well to quote at length. Mr. Easton considers that the question "of the management of rivers is of sufficient importance to make it worthy of being dealt with by new laws, to be framed in its exclusive behalf;" and that "a new department should be created—one not only endowed with powers analogous to those of the Local Government Board, but charged with the duty of collecting and digesting for use all the facts and knowledge necessary for a due comprehension and satisfactory dealing with every river-basin or watershed area in the United Kingdom

—a department which should be presided over, if not by a Cabinet Minister, at all events by a member of the Government who can be appealed to in Parliament."

Mr. J. Mansergh, C.E., states that "altitude and geological structure of a district on the two principal factors which determine what the source of water-supply must be in each district." He divides source of supply into (*a*) aboveground, and (*b*) underground. The former he subdivides, into—1. Water taken from heads of streams by pipes, just when it ceases to be underground water, as in the case of Lancaster. 2. Water obtained from natural lakes, as in the case of Glasgow. 3. Water collected from high-lying moorland watershed areas, as at Manchester. 4. Water taken from a large river flowing past a town, as the Thames and Lea, near London. His second class (*b*) he does not subdivide, and includes all waters taken from all classes of stratification; he appears to take twelve degrees of hardness of Dr. Clark's scale as the maximum limit of safety for health, and regards a pure soft supply as preferable to a pure hard supply, using the word "pure" to mean absence from organic impurity. Speaking of towns which are compelled by position, and on the score of expense to be content with a water-supply derived from an adjacent river, he states that such sources "would be inadmissible but for the great rehabilitating process which nature silently carries on in a river, and to which chemists apply the term 'oxidation.'" In this wonderful process the polluting organic matters which the water contains are converted by the agency of oxygen into harmless inorganic salts, and the water again becomes fit for the use of man. He here refers to the burning controversy between the two schools of opinion on this matter, which have at their heads Dr. Frankland and Dr. Meymott Tidy respectively; the former admits that oxidation is effective in converting the most vile contamination into a harmless condition, but does not admit it destroys the organised germs, which he believes cause the virulent zymotic diseases, and which, being indestructible, may travel scores of miles in a running stream without being deprived of their fatal potency. Dr. Tidy, on the other hand, denies the existence of the germs, and affirms, after a run of a few miles, a river is fully oxygenated. Mr. Mansergh observes that, though Dr. Frankland's opponents appear to have the facts in their favour—as London, a city chiefly supplied from a polluted river, being one of the healthiest cities in the world—yet the "germ" theory is making steady advances under the investigations and researches of competent men.

Since the London water companies have come under the official supervision of Sir Francis Bolton, large sums of money have been spent in increasing the efficiency of the subsidence tanks, by greatly augmenting their capacity, in fact, their operations have converted them into storage reservoirs; from these the water is delivered into filter beds, the varieties in the construction of which, adopted by the different companies, are shown in the angle of the very interesting water pavilion erected in the Health Exhibition, under the auspices of Sir Francis Bolton, and which is full of interest to the student of the subject, and is decorated with some very artistic representations of the various waterworks on the banks of the Thames.

Any scheme of new legislation, and construction of a new department to carry out its provisions should, in the opinion of the writer, be made to include underground water supplies, the state of the law at the present time being exceedingly unsatisfactory, and the decisions of parliamentary committees being uncertain and contradictory. The law places underground water in the category of wild and free creatures, that he who can catch can hold, and just as one landowner can shoot a hare on his own property that has been bred on his neighbour's land, so can he take, by sinking a well, the water that has been received on his neighbour's property, notwithstanding his neighbour may be wholly dependent upon it for water supply, and it may have been used from time immemorial, and further than this, on the principle "of doing what you like with your own," he may actually pour poison down his own well, and destroy the value of the water in the well on his neighbour's land without hindrance and without compensation. Two of the essayists at the congress referred to the recent judgment of Justice Pearson confirming this view.

Considering the opinions expressed in the papers read at this congress, and the statements made in the discussion upon them, it appears to be generally believed by those who have made the water question a special study, that the existing complex legislation, sanctioning various and often antagonistic authorities in our water-basin, is productive of the greatest harm to the community, and can only be remedied by the constitution of an hydraulic department with absolute control over streams from their source to their outfall; that such department should at once make systematic arrangements for taking rain-gauge observations, the gauging of the whole of our streams, and the height and seasonal variation of the water stored in the rocks beneath the surface.

C. E. DE RANCE

THE CITY AND GUILDS OF LONDON INSTITUTE

FROM the Report on the Technological Examinations, 1884, we learn that a considerable increase is shown in the number of candidates at the recent examination, May 28, 1884, as compared with that of the previous year. In 1883, 2397 candidates were examined, of whom 1498 passed. In 1884, 3635 were examined, of whom 1829 passed. There is also shown a satisfactory increase in the number of centres at which the examinations have been held.

From the returns received at the office of the Institute in November last, it appears that 5874 persons were receiving instruction, with a view to these examinations, in the registered classes of the Institute. The number of students at the corresponding period of the previous year was 4052, this being 585 in excess of the number in 1882. Of the candidates who received instruction in the registered classes of the Institute, about one-half presented themselves for examination; of the remaining candidates who came up, some had received instruction in colleges the Professors in which do not accept payment on results, whilst others had supplemented their workshop practice by private study.

This year, as last year, Glasgow heads the list of centres from which the largest number of candidates have passed, the number being 139, as compared with 123 in 1883. Of the other centres, Manchester sent up 115 successful candidates, as against 76 in the previous year; Bolton 98, as against 117; Bradford 90, as against 51; Leeds 70, as against 64 (50 coming from the Yorkshire College, as against 43); Preston 59, as against 46.

In carpentry and joinery, which was added this year to the examination programme, 369 candidates were examined, of whom 125 passed. Nottingham sent up this year for the first time 19 candidates in lace manufacture, of whom 13 succeeded in satisfying the examiner.

Examinations were held this year in 43 subjects, as against 37 in 1883, the only subjects included in the programme in which no examinations were held being the Mechanical Preparation of Ores and Salt Manufacture.

Practical examinations were held this year for the first time in weaving and pattern designing, and in metal plate work, and owing to an alteration in the arrangements for the conduct of the Practical Examination in Mine Surveying, the results of the examination in this subject are also included in the accompanying tables.

Of the 23 candidates for honours who, besides undergoing a written examination in pattern designing and weaving, sent up specimens of their work, 13 succeeded in obtaining a certificate. In metal plate work, two candidates presented themselves for honours, but neither succeeded in obtaining the institute's certificate. In all subjects of examination, the honours certificate of the Institute is intended to be regarded as a diploma of proficiency, and is awarded in those cases only, in which the candidate shows a sound theoretical and practical knowledge of the subject.

The percentage of failures on the results of the examinations in all the subjects has increased from 37·5 in 1883 to 49·7 in 1884. This increase in the number of failures is due to many causes, which are referred to in the separate reports of the examiners, prominent among which is the want of skill in drawing, and of previous science teaching on the part of the candidates. In many subjects, too, there is still experienced the serious want of competent teachers, which it is hoped will to some extent be remedied when the Central Institution is in working order.

The large accession to the total number of candidates is due mainly to the increase in the number of candidates in cloth and cotton manufacture, in weaving and in mechanical engineering, and to the addition of the subject of carpentry and joinery to the programme. In 28 subjects there has been an increase in the number of candidates; in nine subjects, chiefly chemicals, there has been a slight decrease, and in the remaining subjects the number has remained the same.

Table III. shows the proportion of candidates in each subject who have attended classes the teachers of which receive payment on results. By reference to this table it is seen that of the 1829 successful candidates, 1387 were taught in such classes, and of these, 176 have obtained certificates in honours.

Of the 1829 successful candidates, 1362 were examined this year for the first time. Of the remainder, 189, who had previously obtained an ordinary certificate, have this year gained an honours certificate; 98 have gained a higher place in the same grade; 180 have obtained a second class only in the same grade in which they previously passed, or have competed for a prize and failed to obtain it, and their names are consequently not included in the pass list. Last year, the number of candidates who passed the examination, but in the same class and grade as in the previous year, was 128.

A satisfactory feature of this year's examination is the increase, although small, in the proportion of candidates who, having already passed examinations under the Science and Art Department, are qualified to receive the Institute's full technological certificate. Although the returns of the candidates have not yet been verified, it may be assumed that at least 570 of the successful candidates will be entitled to the full certificate. The corresponding number last year was 420, and comparing these numbers with the total number of successful candidates, it will be seen that the percentage of those to whom full certificates will be awarded has increased from 28 per cent. last year to 31·2 per cent. this year.

In several subjects the full complement of prizes has not been awarded, the merits of the candidates not having justified the examiners in awarding them, whilst in other subjects additional prizes have been given. We see that 156 prizes have been granted, including 137 money prizes, 44 silver medals, and 112 bronze medals. Last year 143 prizes were granted, including 129 money prizes, 48 silver medals, and 95 bronze medals.

Looking at the general results of the examination, the large increase in the number of students under instruction and of the candidates who presented themselves for examination, may be considered satisfactory, as indicating the more general desire of artizans and of those engaged in manufacturing industry to take advantage of the opportunities now offered to them of receiving technical instruction. At the same time, the large proportion of failures consequent upon the accession of candidates, the majority of whom are already familiar with the practice of their trades, but possess a very imperfect knowledge of the application thereto of the principles of science, shows the need that still exists of improved and of more systematic technical instruction for those who are employed in factories and workshops.

Although the Royal Commissioners on Technical Instruction, the Report states, have spoken encouragingly of the facilities now offered to artizans of obtaining in evening classes good scientific and technical teaching, it would appear that the number of persons engaged in manufacturing industry, who avail themselves of the Science and Art Classes under the Department, is still comparatively small, and that the proportion of children who learn drawing in the public elementary schools is, as yet, inconsiderable. These causes doubtless prevent our artizans from deriving the full advantage of the Technical Classes now organised in different parts of the kingdom.

In considering the foregoing results, the inadequate supply of competent teachers in technology must also be taken into account.

SCIENTIFIC SERIALS

American Journal of Science, July.—Contributions to meteorology, twentieth paper: reduction of barometric observations to sea-level, by Prof. Elias Loomis. The results embodied in this paper have been determined by an extensive comparison of observations at five mountain stations, three in the United States and two in Europe. The reductions thus obtained were compared with those computed from the theories of Laplace and Plantamour, and exhibited very great discrepancies for all the stations, especially at the lowest pressures. The cause of these discrepancies is referred to the pressure coefficient in the Laplace formula, which appears to be too small.—Light of comparison stars for Vesta, by Edward C. Pickering. The light of the planet is here determined from comparison with the two stars $DM_1 + 22°$ 2163 and 2164, observed with the large meridian photometer of the Harvard College Observatory. The mean result thus obtained for the magnitude of Vesta is 6·64, as compared with 6·49 and 6·45 of previous observations at the same Observatory.—Mineral notes from the laboratory of the United States' Geological Survey, by F. W. Clarke and T. M. Chatard. The paper embodies a complete analysis of the jade or nephrite and pectolite implements in use amongst the Eskimo of Point Barrow, Alaska, and obtained from a region to the east, not yet visited by civilised man. Analyses are also given of Saussurite from Shasta County, California; of Allanite from Topsham, Maine; of Damourite from Stoneham, Maine; of Margarite from Gainesville, Georgia; of Halloysite from near Lake Mono, California; and several other rare minerals.—On the occurrence of alkalies in beryl, by Samuel L. Penfield. The results of numerous investigations show that alkalies are always present, undoubtedly replacing the beryllium, that water is also present, and cannot be disintegrated in the formula, and that the formula

$$Al_4Be_5H_2Si_{11}O_{34}$$

is the one best agreeing with the analyses.—The Niagara River and the Glacial Period, with map, by Prof. G. F. Wright. The author infers that the Niagara River itself has worn the whole of the Gorge, from Queenston to the falls, with perhaps some little help from pre-Glacial erosion above the whirlpool. The rate of erosion, calculated at about 3 feet a year, would make the time required not over 10,000 or 12,000 years.—Note on the discovery of primordial fossils in the town of Stuyvesant, Columbia County, New York, by S. W. Ford. The fossils obtained from the stratified rocks of this region show that they belong to the Lower Potsdam formations. Amongst the species obtained were *Palæophycus incipiens*, *Obolella crassa*, *Stenotheca rugosa*, *Hyolithes Americanus*, *H. impar*, *Hyolithellus micans*.—Notes on some apparently undescribed forms of freshwater infusoria (ten illustrations), by Dr. Alfred C. Stokes. The species named and described are: *Loxodes vorax*, *Apgaria undulans*, *A. ovata*, *A. elongata*, *Ileonema dispar*, *Solenatus apocamptus*, *S. orbicularis*.—On the causes of variation of species, by Romyn Hitchcock. The author combats Dr. Carpenter's view, published in the Reports of the *Challenger* Expedition, that variation in the orbolites group is the expression of a not understood "progressive tendency along a definite line towards a higher specialised type of structure in the calcareous fabric." He contends that the highly complex form of shell developed by this simple sarcode organism is not due to any inherent tendency towards a definite plan, but to change of environment and other easily understood causes.—Remarks on the crustacea of the *Albatross* dredgings off Cape Hateras, and thence to the region of George's Banks in the year 1883, by Sidney J. Smith. The whole number of species of Decapoda determined from these dredgings was 72, of which 40 were taken below 500 fathoms, 29 below 1000, 13 below 2000, and 6 at a single haul in 2949 fathoms. Striking characteristics of the deep-sea specimens are their red or reddish colour and distinctly faceted eyes in the normal position, showing conclusively against the arguments of physicists that some rays of light must penetrate to depths of over 2000 fathoms.—Crystallised gold in prismatic forms, by Wm. P. Blake.—Mode of action of shell- and rock-boring molluscs, by Prof. F. H. Storer. The author argues that it is not a drilling or other mechanical action, but a distinctly chemical process, the solvent being probably free muriatic acid.—Memorials of the late George Engelmann and Oswald Heer, Associate Fellows of the American Academy, Botanical Section, by Asa Gray.

Journal of the Chemical and Physical Society, vol. xvi. fasc. 4.—On the action of aldehydes on zinc-organic compounds, and the formation of secondary alcohols, by G. Wagner. Aldehydes of the fatty and aromatic series give, with zinc-ethyl, alcoholates of secondary alcohols, these last being the exclusive, or nearly exclusive, produce of the reaction, which circumstance gives an easy means for preparing secondary alcohols; the speeds of the the reactions are, however, very different. On the influence of temperature on the acceleration of certain reactions, a preliminary communication by M. Menschutkin.—Quantitative determination of zinc in zinc-powder, by Th. Beilstein and G. Javein.—On anhydride of erythrite, by S. Prybitek.—On canarine, a new tinctorial substance discovered by O. Müller, by W. Markovnikoff. It is not soluble in water, spirit, ether, and benzene, but only in bases, according to the strength of which it gives different colours from pale yellow to red.—On anhydrides of mannite, by A. Sivoloboff and A. Alekhin.—On the structure of the atmosphere and on the general laws of gases (second paper), by E. Rogovsky. The criticism of the author brings him to the conclusion that the kinetic theory of gases must be revised before deducing the hypsometrical formula. The inquiry is to be continued.—On the magnetism of iron wires which are partially inclosed by a magnetising bobbin, by P. Bakhmetieff. The curve which expresses the relations between the magnetic momentum (m) and that part of the wire (l) which is directly submitted to the action of the bobbin has an irregular shape; the fraction $m : l$ reaches a maximum, which is reached sooner when the magnetising force is greater.—On the specific heat of liquids, by A. Nadejdin.—On the theory of dimensions, by N. Sloughinoff.—On a general law of dilatation of liquids, by M. Avenarius.—Remarks on M. Bardsky's paper on the intramolecular force.

Vol. xvi. fasc. 5.—On alizarine oils, by P. Loukianoff. They are found to consist chiefly of basic salts of common fatty and sulpho-fatty acids, the former in greater amount.—On the dependency of photo-chemical phenomena upon the amplitude of the luminous wave, by C. Timiriazeff. On the ground of several observations the author concludes that it is probable that the more energetic reactions are due to waves having a greater amplitude; and that, out of the waves absorbed by a body, those having a greater amplitude act more energetically.—Action of ethylic iodide on the azobenzoate of silver, by P. Goloubeff.—On naphtochinone and its derivatives, by O. Miller.—On the separation of calcium from strontium by Snidersky's method, by J. Bogomoletz.—On triphenylamidomethan, by W. Hemilian and G. Silberstein.—On some salts of mesotartaric acid, by S. Przibytek.—On the heat of magnetisation of a circular magnet, by P. Bakhmetieff. It is much less than in rectilinear magnets, and seems to follow other laws; the development of heat is altogether doubtful in such magnets.—The steam-engine made by Polzounoff in Siberia in 1763, by W. Lermontoff.—Notes on elementary optics.—Note on M. Kraævitch's paper on a hydrodynamic equation, by N. Petroff.—On the dilatation of liquids and its relation to their absolute boiling-points; an answer to M. Avenarius, by D. Mendeleeff, being a few remarks on the history of the subject and on M. Avenarius's logarithmic formula of dilatatiin.

Schriften der Physikalisch-Ökonomischen Gesellschaft, Königsberg, 1883.—On hybrid varieties of the violet; inaugural dissertation, by A. Bethke.—Memorial address on Charles Darwin, by Dr. Richard Hertwig.—Report on the twenty-first meeting of the Prussian Botanical Society at Osterode, October 1883, by Dr. Caspary, President.—Memoir on the latest discovery of the Stone Age in the East Baltic region, and on the beginning of plastic art in North-East Europe, by Dr. Otto Tischler.—On the sources whence plants derive their nourishment, by Dr. Klien.—Report on the expedition to Aiken to observe the transit of Venus, by Dr. Franz.—On some disputed questions connected with the anatomy of the eye, by Dr. Schwalbe.—On the degrees of sensitiveness in living substances, by Dr. Grünhagen.—On abnormal vision, by Dr. Richard Hilbert.—On the geology of the region between Elbing and Dirschau.—On the primeval history of the Caucasus, by Dr. Otto Tischler.—Anatomical description of the cinnamon plant, by Prof. Sanio.—On the microscopic Algæ and spores of the Russian coal-measures, by Prof. Robert Caspary.—Anatomical and physiological remarks on the wasp family (*Nematus pollipes* and *N. rufipes*), by Prof. Gustav. Zaddach and C. G. A. Brischke.—Description of a new myograph for measuring the velocity of the nervous processes, by Prof. A. Gruenhagen.—On subjective impressions of colour, by Dr. Berthold.—On some new and rare plants found in Prussia, by Prof. Caspary.—On the fossil fishes in the provincial museum, by Dr. Jentzsch.—On the Jurassic system of the Inovrazlav district, by Dr. Jentzsch.—On the site of the Oracle of Dodona, by Dr. G. Hirschfeld.

Atti della R. Accademia dei Lincei, April 20.—Report on the archæological discoveries made in various parts of Italy during the month of March, by S. Fiorelli.—On the normal annual recurrence of certain meteorological phenomena deduced from the observations made at the Collegio Romano, by Pietro Tacchini.—Note on the equilibrium of elastic and rigid surfaces (continued), by S. Betti.

May 4.—Inaugural address by the new President, Cavaliere Francesco Brioschi.—Obituary notice of M. Dumas, by S. Cannizzaro.—On the relations existing between the refrangent power and chemical constitution of organic substances, by Drs. R. Nasini and O. Bernheimer.—On the groups of the series of $a, b \ldots k$ dimensions, by Giovanni Frattini.—Observations of the new planet 236 between Mars and Jupiter, made at the Observatory of the Collegio Romano, by Elia Millosevich.—Observations of the Pons-Brooks comet made at the Observatory of the Campidoglio, by Francesco Giacomelli.—Remarks on the declination and horizontal composition of terrestrial magnetism in Rome during the last ten years, by Filippo Keller.—Influence of magnetism on the embriogenesis and sterility of the ovum, by Carlo Maggiorani.—Meteorological observations at the Observatory of the Campidoglio during the month of March.

Rendiconti del R. Istituto Lombardo, June 19, 1884.—The concept of linear length is independent not only of the idea of derivation but also of that of continuity, by Prof. G. Ascoli.—A contribution to the study of the Northern Apennines, by Prof. T. Taramelli.—On the representation of the Newtonian forces, by means of the elastic forces, by Prof. E. Beltrami.—On the integration of the differential equations of the conic pendulum, by Dr. Gian Antonio Maggi.—On the revival of the critical philosophy of Kant, by Prof. C. Cantoni.—Note on a poem of Alessandro Volta in honour of Saussure's ascent of Mont Blanc in 1787, by Zanino Volta.—Meteorological observations made at the Brera Observatory, Milan, during the month of May.

July 3.—New measurements of the planet Uranus, by Prof. G. V. Schiaparelli.—Researches on the alkalis of the blood and their variations in intensity artificially produced; physiopathological and therapeutic importance of these experiments, by Prof. C. Raimondi.—Integration of the differential equation $\Delta^2 u = 0$ in the area of a circle, by Prof. Giulio Ascoli.—A pathological study of the cellules and parasites in the animal system, by Prof. G. Sangalli.—Meteorological observations made at the Brera Observatory, Milan, during the month of June.

SOCIETIES AND ACADEMIES

PARIS

Academy of Sciences, August 4.—M. Rolland, President, in the chair.—Reply to two notes of M. Wroblewski on the subject of the liquefaction of hydrogen and other gases, by M. L. Cailletet.—On the influence of temperature on the property of absorbing and losing moisture, possessed by vegetable earth and other substances exposed to contact with the atmosphere, by M. Th. Schlœring.—On the change in the excentricities of the planetary orbits due to the concentration of matter in space, by M. Hugo Glydén.—Report of Messrs. Gosselin, Vulpian, Marey, Bert, Pasteur, Richet, Bouley, and Charcot on various communications received by the Academy on the subject of cholera. An examination of forty-three letters, notes, and memoirs has led to no results calling for special consideration. The chief remedies proposed are hypodermic injections of chloride of pilocarpine, the internal application of sulphate of quinine, of oxygenated water, sulphuric lemonade, &c. More important are the views of Dr. Duboué of Pau, who recommends as a preventative the strengthening of the endothelial and epithelial systems by the daily administration of two doses of 0·25 grain of pure tannin prepared with ether. His curative method consists in restoring the circulation by copious intravenous injections of an artificial serum to which should be added one grain per litre of pure tannin.—Observations of the Barnard comet made in Algiers, by M. Trépied.—Note on the distribution of the facules on the solar disk during the year 1883, with tabulated results, by M. P. Tacchini.—Description of a fixed astronomic telescope, being a modification of M. Lœwy's "*equatorial coudé*," by M. G. Hermite.—An account of the method by which the absolute value has been determined of the horizontal component of terrestrial magnetism at the observatory of the Park Saint-Maur, Paris, by M. Mascart.—Description of a new apparatus for collecting the snow of carbonic acid required in producing low temperatures (one illustration), by M. Ducretet.—On the decomposition of white cast iron by heat, by M. L. Forquignon.—Note on the composition of the cyanides of mercury, zinc, and of some other elementary compounds of cyanogen, by M. G. Calmels.—On the nature of the visual faculty, and on the respective parts played by the retina and the brain in the elaboration of optical impressions, by M. H. Parinaud.—Researches on the biological *rôle* of phosphoric acid, and on the part played by this substance in the formation of the animal tissues, by M. A. Mairet.—On the permanent immunity from charbon of rabbits vaccinated with the attenuated virus of this disease, by M. Feltz. Seven months after the vaccination six rabbits so treated and six others were operated on with a strong preparation of the virus. The six fresh animals all died of charbon, while the six that had been vaccinated remained unaffected by the second operation. But when again treated, eighteen months afterwards, they yielded to the virus, and all ultimately perished. The author infers that the operation preserves its efficacy in the rabbit not longer than eighteen months.—Description of a filter which yields absolutely pure water free of all animal life, by M. Ch. Chamberland.—On the anatomical origin of spermaceti; description of the so-called spermaceti case, by MM. Pouchet and Beauregard.—Memoir on the carboniferous measures of the Central Pyrenees, by M. L. Lartet.—On the composition and quality of coal in connection with the nature of the plants from which it has been formed, by M. Ad. Carnot.—On the oxychloride of calcium, and the simple and chloruretted silicates of lime, by M. Alex. Gorgen.—On the origin of the phosphorites and of the ferruginous clays in limestone districts, by M. Dieulafait.—Account of the effects produced by a stroke of lightning at Campan on July 24, by M. A. Soucaze. A house near the telegraph station was entered through the closed door by a living mass of flame, which, after a few seconds withdrew by the same way without injuring any of the inmates or damaging the furniture.—A hypothesis on the temperature of the zone of the solar protuberances, by M. Tardy. The author suggests that in this zone the hydrogen is rendered luminous by an atmosphere of oxygen, in which case the temperature would be that of the fusion of platina, while the temperature of the inner zone would be still higher.

Berlin

Physiological Society, July 18.—The conception that, just as the chemical elements in *status nascendi* are characterised by greater energy of action than in the ordinary state, so also in the living organism the substances in process of generation and development would exhibit a different or more intense action than substances already fully formed, has been subjected to an experimental proof by Dr. Falk. He first made an examination in the case of prussic acid. A dilute mixture of emulsin and amygdalin, which yielded prussic acid both outside as well as in the body, was divided into two halves, one being injected by a syringe, immediately after the process of mixture, subcutaneously or directly into the sanguineous channel of one of the animals operated on, the other into that of the other animal intended to serve the purpose of comparison, but not till twenty-four hours after the process of mixture, and therefore after all the hydrocyanic acid had become completely formed in the solution. In both cases the phenomena of poisoning occurred, produced by the prussic acid. In the first case, however, in which the prussic acid was developed in the organism, the phenomena of poisoning occurred always at a later stage and in a milder form than in the second case, in which the prussic acid was administered when it was already completely formed. The second substance examined by Dr. Falk was the oil of mustard, which was produced from the myrosin and myronic acid salts contained in black mustard. The experiment in this case was performed in the same manner, and yielded a similar result, as in the former case. Thirdly, an experiment was instituted with hydroquinine, which was formed from arbutin; and here, too, the substance acted more weakly and slowly when it had first to develop itself in the body. From these experiments Dr. Falk drew the conclusion that substances in process of formation, or in the so-called *status nascendi*, possessed no peculiar or greater activity than in the ordinary state.—Prof. Kronecker spoke of a series of precautionary measures to be observed in cases of saving life by an infusion of common salt solution. He first described how animals after severe loss of blood recovered in the best and most rapid manner by introducing into their blood-channels a like quantity of physiological common salt solution. In the case of infusions of albuminous solutions, of serum sanguinis, and even of the blood of another individual of the same species deprived of its fibrin, there was, according to direct measurements, an invariable destruction of blood-corpuscles. With infusions of common salt solution, on the other hand, blood-corpuscles were seen to increase somewhat rapidly. Prof. Kronecker then proceeded more particularly to lay down precautionary rules to be observed in applying this agency to man. In the first place, the composition of the solution must be such as was most compatible with the human organism. It would appear that a solution of 0·73 per cent. exercised the least irritation on the human body, and was therefore the most appropriate for infusions designed to save life. The addition of carbonate of alkali, recommended by some, had an injurious effect. Of great importance were the velocity and pressure with which the infusion was injected; both ought to correspond with the velocity and pressure in the vein into which the solution entered. The common salt solution should, further, be disinfected beforehand by boiling, and the air which penetrated into the reservoir while it was being emptied must be filtered off by means of a wadding stopper. The injurious effect of too strong pressure was illustrated by a comparative experiment on two rabbits.—Dr. Krause reported some attempts towards the experimental production of contractions of the vocal chords. The possibility he had demonstrated on a former occasion, by pulling forward the tongue and pushing back the epiglottis, of observing the vocal chords of dogs by daylight, facilitated these experiments in a very considerable degree. He applied a prolonged, weak, mechanical stimulation of the nervus recurrens or vagus. A thin slice of cork having, by means of a piece of catgut, been loosely wound together with the nerve so as to exercise on it a continuous moderate pressure, he observed, about the second day of the experiment, the vocal chords under inhalation lie close to each other, and only under exhalation form a small opening between each other. This continuous closure of the glottis was followed, in about four to five days, by a paralysis of the chords, which lasted to the death of the animal. Sections showed in the first stages of the experiment reddening of the nerve and infiltration of the surrounding tissue; later on were found inflammation and extravasation in the nerve; and ultimately molecular decay of the nerve-fibrillæ. The closure of the glottis during the continuance of a prolonged moderate pressure on the recurrens or vagus was explained by Dr. Krause as a contraction of the laryngeal muscles, of which the stronger sphincters of the glottis obtained the preponderance. That the contraction occurred only the second day after the operation was effected, according to the ideas of the speaker, in this way: that the moderate pressure in the normal nerve produced no stimulation beyond what caused the minimum of irritability, and that only after the nerve had become inflamed by the pressure did that pressure suffice to produce a contraction of the muscles and to maintain it till the destruction of the nerve-fibrillæ brought about a paralysis.

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