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THURSDAY, JUNE 23, 1870

THE UNIT OF LENGTH

THE battle of the Standards is over, and we may say the Metre has gained the victory. The need of a new system of weights and measures to amend the strange diversities which disfigure our practice being admitted, the question has once more been started—Should we once for all found our system on a natural basis? The pendulum vibrating seconds in a certain latitude, was long ago proposed as a universal basis of linear measure, and the House of Commons somewhat countenanced it years ago, by prescribing that the length of the yard shall be determined by the length of the second's pendulum. But the action of gravitation on which the terms of the vibration depends, is subject to so many variations and disturbances, that the quantity sought cannot, even on the same spot, be absolutely the same at all times. The real length of a normal pendulum is almost unattainable, so limited is our knowledge of the force of gravity on land and at sea. A more certain basis for a natural unit has been found in the polar axis, the length of which, according to Sir John Herschel, bears a close relation to our imperial inch, and has the advantage of avoiding the many causes of error resulting from the physical peculiarities of the countries through which any measured arc may happen to pass. But are our physicists agreed as to the real length of the polar axis, and would it be worth while to make any alteration in our weights and measures for the sole purpose of attaining some scientific correspondence between the unit in use and a unit founded on nature?

The advocates of the metre rest their arguments on a much broader basis. They do not assert that the metre is absolutely and mathematically the ten millionth part of the quadrant of the earth; they know that the meridians of places differing in longitude are not all precisely of the same length; and they admit that were we now to make a new measurement with our better instruments and more extended information, we might attain much greater accuracy than was arrived at by the French philosophers at the end of the eighteenth century. What commends the metre above any other unit, is the fact, that it is already a cosmopolitan unit, widely recognised, and in general use among many nations; and that whilst other units remain as philosophical abstractions, the metre is the basis of a system, not only perfectly complete, homogeneous, and scientific, but simple and practical in all its parts. Any slight error in the determination of the metre, is more than counterbalanced by the extreme simplicity, symmetry, and convenience of the metric system; and not the least of its recommendations are, that the unit of linear measure applied to matter in its three forms of extension, viz., length, breadth, and thickness, is the standard of all measures of length, surface, and solidity; and that the cubic contents of the linear measure in distilled water at a temperature of great contraction, furnish at once the standard weight and measure of capacity.

When we said that the battle of the Standards is over and that the Metre has gained the victory, it was meant that, for practical purposes, all opposition to the introduction of the metric system has been abandoned, and that Parliament and the Government are now left to introduce it in such a way and at such a time as may be found at once practicable and satisfactory. The use of the metric system has been legalised for the last half-dozen years, but it was not till quite lately that the whole question was submitted to the calm deliberation of a Royal Commission. The Standard Commissioners, who included among their members the Astronomer Royal, the President of the Royal Society, and the late Master of the Mint, considered the question of the introduction of metric weights and measures, in any form, *ab initio*. And after careful examination they gave their verdict in its favour in the following terms:—

"Considering the information which has been laid before the Commission,—

"Of the great increase during late years of internationa communication, especially in relation to trade and commerce;

"Of the general adoption of the metric system of weights and measures in many countries, both in Europe and other parts of the world, and more recently in the North German Confederation and in the United States of America;

"Of the progress of public opinion in this country in favour of the metric system as a uniform international system of weights and measures;

"And of the increasing use of the metric system in scientific researches and in the practice of accurate chemistry and engineering construction;

"We are of opinion that the time has now arrived when the law should provide, and facilities be afforded by the Government, for the introduction and use of metric weights and measures in the United Kingdom."

The Commissioners further recommended that metric standards, accurately verified in relation to the primary metric standards at Paris, should be legalised; that verified copies of the official metric standards should be provided by the local authorities for inspectors of such districts as may require them; and that the French nomenclature, as well as the decimal scale of the metric system, should be introduced in this country. The Commissioners, whatever might have been their predilections, could not resist the fact that the civilised world pronounced itself for the metre, and they sanctioned its legalisation. What is to be regretted is that they stopped there. Since the complete substitution of the metric for the present practice is now practically certain, would it not be much better to prepare for the change and carry it into effect as speedily as possible? No advantage can come from a policy of indecision, and we trust that the Legislature may adopt a more definite course than the one sketched out by the Royal Commissioners. Let it not be imagined that the people will give themselves the trouble of learning the new system, however beautiful and easy, so long as its use is not absolutely necessary. With all the desire of the teachers to introduce it in the schools, they find that they cannot teach the old and the new tables. They cannot afford the time. A compulsory measure is the only method of dealing with the question.

The Warden of the Standards being now employed in procuring Metric Standards, it may be well to add that the mode of constructing them, either from the original Metre at the Archives, or from the copy at the Conservatoire des Arts et Métiers, has been much debated. The

International Statistical Congress, held at Berlin, decided "That the care of preparing and putting into execution the regulations to be followed in the construction of the standards, and of the system itself, should be entrusted to an International Commission, which will also see to the correction of the small scientific defects of the system." The International Geodesical Conference held at Berlin in 1867 decided: "In order to define the common unit of measures for all the countries of Europe, and for all times, with as much exactness as possible, the Conference recommends the construction of a new prototype European Metre. The length of this European Metre should differ as little as possible from that of the Metre of the Archives in Paris, and should in all cases be compared with the greatest exactness. In the construction of the new prototype standard, care should be taken to secure the facility and exactness of the necessary comparisons." And "the construction of the new prototype metre, as well as the preparation of the copies destined for different countries, should be confided to an International Commission, in which the States interested should be represented." Since then, the Imperial Academy of Science of St. Petersburg has taken the matter in hand, and a committee of the Physico-Mathematical class, consisting of MM. Struve, Wild, and Jacobi, has made a report on the subject, observing that the standard metric weights and measures of the various countries of Europe and of the United States differ by sensible though small quantities from one another. They expressed their opinion that the continuation of these errors would be highly prejudicial to science. They believed that the injurious effects could not be guarded against by private labour, however meritorious, and they recommended that an International Commission should be appointed by the countries interested to deal with the matter. This suggestion was approved by the French Government, and consequently the Conference will take place in Paris in August next, when the Astronomer Royal, Professor William H. Miller, and the Warden of the Standards, will represent this country. Everything seems thus tending towards the early realisation of the great scheme of uniformity of weights and measures throughout the world.

MUSEUMS OF NATURAL HISTORY

THERE is no doubt of the popularity of museums of natural history with the lower classes. That it is otherwise with more educated people is perhaps attributable, not so much to indifference to scientific knowledge, as to the fact that hardly any scientific knowledge is to be gained by a cursory inspection of crowded collections, arranged with reference to economy of space rather than to the existing conditions of zoological science. It must not be forgotten that the sentiment of mere wonder, which the stranger forms of animal life are so calculated to excite, was satisfied, or at least blunted, in early childhood, in the case of those of us who have had access to well-illustrated books, and to the zoological gardens of great cities.

Twenty years hence it will hardly be credited that in the year 1869 a competent naturalist, after visiting fifty of the principal museums of Europe, reported on them in the following terms:—"So far as his observations extended, he found no museum where any other purpose than a desire to produce a pleasing and convenient disposition of the specimens was manifested in the general plan of arrangement. In the few cases where there was an evident intention of showing some of the more important general features connected with the distribution of life over the face of the globe, or in the successive geological formations, the imperfection of the means has been too great to afford any great result. Among the fifty museums visited, not one was found in a building especially designed for the purpose of exhibiting collections arranged to show the history of life."* We may fairly hope that the condition of things above described will not endure much longer. The ever-widening interest in the higher problems of zoology awakened by the writings of Darwin and his followers, will no doubt, in time, move even the conservative professors and curators of the great European museums to urge upon their Governments the necessity of providing them with the means of making the collections under their charge visible embodiments of what is now known of the history, distribution, and affinities of animal life, instead of simple gatherings of curiosities, or at best mere storehouses of materials for the professed naturalist. The rearrangement of the great national collections in properly constructed buildings would, even under the most favourable circumstances, be a work of years, and one entailing great and irksome labour upon the distinguished officers of these museums. Meanwhile, there is every prospect that the hopes we have expressed in reference to the European collections will be almost immediately realised in the case of the great museum of Harvard College, under the charge of one of the most eminent of living zoologists, Professor Louis Agassiz. Thanks to the liberality of the State Legislature of Massachusetts, a sum of 75,000 dollars, payable in three annual instalments, is available for this great work, conditionally upon the raising by subscription of like sums. We are glad to learn from the trustees that the first 25,000 dollars have been subscribed, and the corresponding 25,000 dollars received from the State. The spirit which is animating Prof. Agassiz in this matter will be best gathered from his own words in the official report now before us. After paying due tribute to those who, by bringing together the great collections of the old world, laid the foundations of our present knowledge, he says: "We have no longer the right to build museums after this fashion. If I mistake not, the great object of our museums should be to exhibit the whole animal kingdom as a manifestation of the Supreme Intellect. Scientific investigation in our day should be inspired by a purpose as animating to the general sympathy as was the religious zeal which built the cathedral of Cologne or the basilica of St. Peter's. The time is past when men expressed their deepest convictions by these wonderful and beautiful religious edifices; but it is my hope to see, with the progress of intellectual culture, a structure arise among us which may be a temple of the revelations written on the material universe" (p. 6). Prof. Agassiz is able to write in the following encouraging terms of the immediate prospects of his great undertaking:—"With the prospect for

* These words are to be found at p. 41 of a paper entitled, "Annual Report of the Trustees of the Museum of Comparative Zoology at Harvard College, Cambridge, together with the Report of the Director, 1868." Boston: 1869.

the next three years of an income large enough to secure the aid of competent assistants in the different departments, we shall be able to put our immense collections in complete order, and to enlarge the building sufficiently to exhibit all our specimens in their true relations. I hope that in three years any intelligent observer will be able to say that a mere walk through our museum teaches him something of the geographical distribution of animals, of their history in past ages, of the laws controlling their growths as they now exist, and of their mutual affinities—in short, that the whole will be so combined as to illustrate all that science has thus far deciphered of the plan of creation. This is my hope, and it is shared by the efficient corps of assistants on whose co-operation I largely depend for its fulfilment (p. 4)." Prof. Agassiz has set himself a noble task, and we doubt not that when it is completed, the museum of Harvard College will be an intellectual monument worthy alike of its curator and of the science of which he is so distinguished an ornament.

OUTLINES OF HUMAN PHYSIOLOGY

Grundriss der Physiologie des Menschen. Von Prof. Dr. L. Hermann. Dritte gänzlich umgearbeitete Auflage. 1870. (Berlin: Hirschwald. London: Williams and Norgate.)

WHEN this work first appeared, now more than seven years ago, it at once became our favourite handbook of physiology, and it has ever since been our constant companion. Perhaps the chief reason why it so especially commended itself to us was the fact that it served as the clearest and best exponent of what may be called the radical school of physiology. Its general arrangement differed altogether from that of most modern text-books. It entirely threw on one side that division into "functions" (function of respiration, function of digestion, and the like) which, after all, does not lessen much the labour of the author, and certainly leads the student astray, throwing, as it does, into the background, or even completely hiding, the essential oneness and solidarity of the animal body, and bringing the learner to regard the organism as a bundle of "functions," one of which might easily be pulled away without much harm being done. The leading idea of the book was to follow out as closely as possible the doctrine of the conservation of energy. That idea was kept steadily in view throughout the volume, and faithfully adhered to.

Another remarkable feature was the bold attitude taken up towards recent discoveries. These are always great stumbling-blocks to teachers and text-books. Some authors, especially German authors, put in everything that comes up, leaving time and future editions to take out again the things that wither up. Others, again, put in nothing that does not seem to be already fairly established, and the student who trusts to these alone has perhaps to wait several years, till a new edition tells him of results which have had, it may be, a most powerful influence on the progress of the science for as many years back. A third class, and of these Prof. Hermann is one, make up their mind as to what they think will stand and what will not, and so accept the one and reject the other, though both may have been published yesterday. This course being bold is of necessity dangerous; and a new edition is, in the case of such books, a most critical occasion.

An unusual popularity has now brought the present work to a third edition, and the author may certainly congratulate himself on the little which he has had to undo. Many new things which in 1863 he boldly accepted have since been ratified by general consent.

The present edition differs from the preceding two in being made much larger and more complete. We trust that it has now reached its full growth, for one of the great merits of the first edition was its small size. Otherwise, beyond the increased filling up of all parts, the book does not differ materially from what it was. We are glad to see that several oversights, such, for instance, as the extraordinary statement of the first edition that the apex of the heart beats between the seventh and eighth ribs, have been corrected, and that the author gives a fair account of matters in reference to which he has been engaged in personal controversies, as, for example, in the physiology of muscle.

The boldness in selection of material to which we have referred, renders the book in some measure unsuitable for a student not sufficiently advanced to have acquired a physiological judgment; but we would urge it upon the notice of all who wish to have a clear and succinct exposition of the physiology of the present day.

M. F.

OUR BOOK SHELF

On the Strength of Beams, Columns, and Arches. By B. Baker, Assoc. Inst. C.E. (London: E. and F. N. Spon, 1870.)

THE subject matter of this little volume is of great importance to Civil Engineers. All structures resolve themselves ultimately into beams, columns, and arches, of some kind. It is therefore of great importance that the engineer should be familiar with the mode of ascertaining their strength or their resistance. We approve, in the main, of Mr. Baker's endeavour to dispense with high mathematics by substituting geometrical solutions for ordinary problems, because, unfortunately, mathematics is not the strong side of English engineers, although England has produced the greatest of mathematicians. But the author seems to labour under serious misapprehensions. He proposes his geometrical solutions, because he thinks that the use of mathematics "involves an unjustifiable waste of time, with the great contingent disadvantage that it checks the growth of sound judgment in the engineer, by giving a fictitious appearance of accuracy to his results which are not susceptible of exact deduction." This is a grievous error. The spirit of mathematics is the expression of most acute and refined reasoning; and how can the practice of intellectual reasoning check the growth of sound judgment in the engineer? The fictitious appearance of accuracy above mentioned, is altogether beside the question, because it is optional; but not so the correctness of our reasoning and arguments. The author makes the above statement in his preface, and we find, unfortunately, that throughout the volume the spirit of mathematics is sadly offended. Let us take for example the author's mode of calculating the strength of beams. He shows us how the strength of a beam may be found geometrically, and derives the formulæ for rectangular and other beams, assuming the neutral axis of the beam to pass through the centre of gravity of the sectional area of the beam.

He then proceeds to compare the calculated resistance of certain simple beams with the observed resistance as ascertained by experiment, and he finds that there is a large discrepancy between the calculated and the experimental ultimate resistances. Adopting Mr. Barlow's notation, he calls f the ultimate resistance to direct tension, F the "apparent" resistance to the same force excited by transverse strain, and ϕ the "resistance due to flexure," then $F = f + \phi$. This will be better understood by reference to figures. Mr. Hodgkinson found in the experiment under consideration, that a square inch of cast iron was ruptured under direct tension by 18,750lb., which in the above equation would be the value of f. When, however, a rectangular bar of the *same* material, one inch square, was tested, a weight of 527lb. applied at the centre of a span of sixty inches, just broke the bar. Applying now the formulæ for rectangular beams to this result, the author finds that the ultimate tensile strength of the sample under consideration must be assumed at 45,630lb. in order that the bar may be able to offer the resistance shown in the experiment; the figure 45,630 he calls the "apparent" tensile strength, and would be the value of F in the above equation; accordingly, $45,630 = 18,750 + \phi$, or $\phi = 26,880$lb., this value of ϕ being termed "resistance due to flexure," a term, we are informed, invented by Mr. W. H. Barlow; * and this new resistance being described as "lateral adhesion of the fibres;" and the author informs us, that the neglect of it may result in an error up to 190 per cent.

We have here a fine confusion of everything referring to the subject. An error is made, which to explain away, a new one must be committed; forces hitherto not suspected by mathematicians are discovered by those whose sound judgment was not checked in its growth by the infinitesimal calculus.

Does the author not know the condition which determines the position of the neutral axis of a beam? The neutral axis passes through the centre of gravity of the sectional area of a beam, provided *the resistance of the material to tension and to compression be alike.* In almost every material these resistances differ from one another, but when only a small fraction of the ultimate resistance of the material need be taken into account—say one fourth—then for practical purposes they may be assumed to be alike.

The author proceeds, however, to breaking strain, using cast iron; its ultimate resistance to tension is about eight tons per square inch, to compression about forty tons. Under these circumstances his original formula no longer holds good; the neutral axis no longer passes through the centre of gravity of the section of the beam, it approaches more and more the side where the greater resistance is offered; and were the resistance to compression infinitely great, the neutral axis would coincide with the position of the extreme fibre of the beam on the compression side, and the whole sectional area would be resisting tension only, and the extreme fibre balanced by compression. The beam would then have just double the resistance without assuming the least increase of tensional resistance of the material. The author's ϕ expresses, therefore, the amount of error into which he and others have fallen, and in case it should be zero, they will find $F = f$ as it should be, and the elaborate fabric of confusion disappears.

In other respects, the work contains much valuable information, and if the unfortunate mistake above referred to, did not crop up throughout the 300 pages, and a natural flow of clear language were substituted for a rather dogmatic and vague style, we should be glad to recommend it to the profession, which ought to have all the aid that modern science can afford. * * * * *

* Mr. Barlow, F.R.S., recently read a paper before the Royal Society on this subject, reviving his theory on the resistance of beams to transverse strain.

Meteorology. By Sir John F. W. Herschel, Bart. From the Encyclopædia Britannica. Second Edition. (Edinburgh: A. & C. Black.)

Introductory Text-book of Physical Geography. By D. Page. Fourth Edition. (Edinburgh: W. Blackwood & Sons.)

WE class these two books together as new editions of standard treatises in their respective departments of science that are among the best that can be used by students or teachers. The term "Meteorology," which has entirely lost its etymological meaning, is defined by Sir John Herschel as "the description and explanation of those phenomena which group themselves under the head of the weather, of the seasons, and of the climate," a branch of natural science of the laws regulating which we are at present almost entirely ignorant, as Dr. Balfour Stewart has shown in these pages. Writers on physical geography content themselves at present with a description of the physical contour of the globe, with some slight reference to its climatology, and the distribution of its animal and vegetable life, Mrs. Somerville's handbook being, as far as we know, the most complete in this respect. The better and more logical mode would seem to us to be, first of all to treat of the earth as a member of the solar system, and thence to deduce the laws which govern its natural phenomena; we believe that in this way such phenomena as those of ocean currents and trade winds, and the variations of climate, would be rendered far more quickly intelligible to the learner than is now the case. From his stand-point, Dr. Page's "Introductory Text-book" discusses the subject in his usual clear, concise, and systematic manner.

Rustic Adornments for Homes of Taste. By Shirley Hibberd. New Edition. (London: Groombridge & Sons.)

THAT two editions of this book have been disposed of in a short time is ample justification for the publication of a third, especially when got up in so handsome a style as the one before us. Works of this kind appeal to a large public, not over-critical as to scientific accuracy, but glad to possess that amount of knowledge which enables them to talk about ferneries and aquaria without committing any egregious blunder. We are far from depreciating the value of this smattering of science where it is all that opportunity permits to be attained. Those who like their homes to be surrounded by beautiful natural objects will here find a large fund of information respecting the aquarium, the fernery, the aviary, the apiary, the conservatory, &c., given in a pleasant style, illustrated with woodcuts and coloured plates. The volume makes altogether a very pretty gift-book, especially for a young lady.

E. Millon, sa Vie, ses Travaux de Chimie, et ses Etudes économiques et agricoles sur l'Algérie. Pp. 327. (London: Williams and Norgate, 1870.)

M. REISET, in the preface, tells us that after the death of Millon, his friends and pupils undertook the publication of a collection of abstracts of the numerous works of this illustrious chemist. The book commences with an interesting biographical notice of Millon, by Dr. Hœfer, in which the political questions which led to his long residence in Algeria are as slightly noticed as possible. The principal portion of the volume was arranged by M. Jules Lefort, with the assistance of MM. Coulier, Commaille, and the late Professor Nicklès. The book contains two hitherto unpublished papers, each extending over forty-three pages, one "on Fermentation" and the other "on the Economic and Agricultural problem of Algeria." The researches on corn also occupy considerable space. The other investigations of Millon are arranged in a very interesting manner, frequently in connected treatises. Opposite the title-page is a good photograph of a bust by M. Clément, and at the end of the book is a chronological list of the scientific works of the author, amounting in number to no less than seventy-nine.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

The Corona

HAVING been informed that my remarks at the meeting of the Royal Astronomical Society, on Friday last, have been interpreted otherwise than I meant, doubtless in consequence of my having spoken without preparation, I beg to repeat what I intended should have been the purport of my statement.

It seems to me beyond reasonable doubt that we have upon all the photographs, whether of long or of short exposure, a representative of *something which is at the sun*, since the contour of the radiance depicted upon all the photographs exhibits minima, in directions closely approximate to the extremities of the sun's axis of rotation. Furthermore, exterior to all this, and apparently masking it in a very great degree to the ordinary observer, is a much wider and more conspicuous radiance of very irregular outline, to which the name *Corona* has been ordinarily applied. The streamers and irregular projections of this latter corona appeared to me to vary in position during the period of totality in August last. They seem, moreover, to have no connection with the positions of the prominences, nor yet with that of the solar axis, and hence I infer that this phenomenon arises from something *which is not at the sun*.

London, June 15 B. A. GOULD

Euclid as a Text Book

I HAVE been waiting in the hope that Mr. Levett's letter (NATURE, No. 30, pp. 65, 66) would elicit a response from other members of the "rank and file" of mathematical teachers. No one having come forward, I venture to do so, lest the subject should again drop. Mr. Levett's suggestions appear to me at least worthy of some little ventilation, and I hope some leader will be induced to utter a note on the subject. Knowing that many of the leading geometers of this country are favourably disposed to the "reform" movement, I feel sure their silence is not attributable to indifference. In the meantime it is my opinion that no isolated efforts will bring about such a reform as will thrust out Euclid from our schools; united action is what is wanted, and then "a long pull, a strong pull, and a pull all together." I could easily select from the four Universities of Oxford, Cambridge, Dublin, and London, four geometers who could, I believe, if it be possible, bring out in concert a work which should be a fitting rival of the old-world geometry, command the attention which such a work ought to secure to effect the change desiderated, and convince gainsayers. A scheme might be drawn up in concert, the working out of the details committed to one, and the work appear under the united names of the body. Then as to the number of the "rank and file" willing to give their support to such a plan, possibly some mathematical master at one of our public schools (I could in this case also make a selection) could give much valuable information. I hazard the above remarks, not wishing the ball set rolling in the columns of NATURE to come to rest, until the change has been effected or its inexpediency irrefragably demonstrated, *valeant quantum valent*. R. TUCKER

University College School, June 11

The Interior of the Earth

UNDER the signature of Z., I find in your issue of the 16th inst., a short notice of "The Interior of the Earth." A clerical error made during the Epsom or Ascot races, such as F.L. instead of E.I., is excusable, though not comprehensible; a misquotation which he has made may be pardoned, but a misrepresentation purely from neglect of reading is quite unbearable. He tells your readers that I proceed "to explain the earth's heat and volcanic phenomena by a like action on buried vegetable matter." If he had read p. 33, he would have found that to the cause alluded to "I partly assign the changes which have taken place in the strata connected with our coal pits." Z. thinks that a perusal of Lyell's "Principles" would have stopped the writing of my book, I beg to tell him, that this work was the first that convinced me of the great geological error which I have exposed. Z. does not seem to have read my reasons for using Page as my text-book; I hope he is not hurt at being left out himself, but if I had quoted from all the books I have read on the subject, I should have been as unintelligible as some of them.

A sneer is not a review, but if Z., or any one else, can prove to me that an internal and inherent heat within the earth has caused, or does cause, the phenomena alluded to, I will with pleasure renounce my present creed; but, till then, I merely say that as I have controverted the theories of others, I shall be glad to read any controversions of my book, if written in the same spirit of inquiry. H. P. MALET

Prismatic Structure in Ice

THE enclosed letter, which has just reached me from Canada, seems to me so interesting that I venture to hope a place may be found for it in the columns of NATURE. I may, however, state that I still adhere to my conviction that the vertical chains of air bubbles are the consequence of the prismatic structure; since in all the cases I have seen they are too regular to have been formed as my correspondent suggests. Although I believe it is an established fact that, speaking generally, ice contracts with cold, I am not aware that its demeanour at a temperature of about 32° F. is quite so accurately ascertained; it seemed to me, when investigating what had been written on the subject, that further information was needed on this point. The prismatic structure appeared, and still appears, to me inexplicable on any other theory than that of contraction.

St. John's College, Cambridge T. G. BONNEY

"In one of the March numbers of NATURE I see a letter over your signature on the prismatic structure of ice, and as our climate gives us favourable opportunities of observing this and other curious facts respecting ice, I am induced to address a few words to you on the subject.

"The ice on our inland lakes is generally two or three feet thick. As the spring advances, an inch or two may be melted away from the lower surface, and somewhat more from the upper one, but the thickness is not materially reduced until its final disappearance. The first sign of the approaching break up is that the ice becomes dry, from the prismatic structure having commenced to show itself, allowing the surface-water to percolate through the interstices; it is then said to be honey-combed. In this state the lower layers of transparent ice are still solid, though if you cut out a block the prismatic structure is very evident; but the upper portion, which has been formed from a mixture of snow and water, readily breaks up under your feet into little granules of ice. The next stage is that the ice becomes black, showing that it is soaked as it were with water; and if at this time there is any open water, as where a river falls into the lake, and wind enough to create a swell, the whole surface of the ice may be observed to undulate. Even then, sometimes, a single night's frost may make all firm again, and you may even trust horses upon it. If the ice now breaks up prematurely with a high wind, it becomes a mass of spiculæ of ice which have not reached the melting point, and which I have seen accumulate to the depth of six or seven feet against the edge of the ice, which has not yet broken up. But if there is no wind, the whole surface of the lake may appear an unbroken sheet of black ice, still a couple of feet thick, till, in an astonishingly short space of time, sometimes not more than a few minutes, it disappears as if by magic. So sudden is this disappearance, that the ice is popularly believed to sink.

"I once had a very good opportunity of noticing this sudden disappearance. I had built on the ice during the winter a pier of logs filled with stones, and when the spring came, it settled down to the bottom, carrying with it a large cake of the ice. When the lake had opened, I went round the pier in my canoe to see if it had settled evenly. There at the bottom, in six or seven feet of water, lay the cake of ice it had carried down, with the chips still imbedded in it which we had made in building the pier; and, as I looked, blocks would break off of a foot or more in thickness, rise to the surface, break up into spiculæ, and almost instantaneously disappear.

"I quite agree with you that these prisms have no connection with the hexagonal form of ice crystals, but I doubt your explanation that they arise from the contraction of the ice as it approaches the melting-point. Does ice contract under such circumstances? Although water expands in freezing, and, *vice versa*, occupies less bulk when reconverted into water, yet, as long as it remains ice, I conceive that it contracts with cold and

expands with heat like other substances. It is certain that, after a night's hard frost, a surface of glare ice will be covered with a multitude of small cracks from the contraction; and larger cracks will sometimes extend through the whole thickness, with a report almost like that of a cannon. I knew a case of a railway bridge, built on piles over a shallow lake, which was entirely destroyed by the alternate expansion and contraction of the ice with variations of temperature. With a spell of cold the ice would be split up with innumerable cracks, into which the water insinuated itself and froze. With warmer weather the whole expanded, shoving the ice up on the shores. On a fresh contraction, the ice could not be withdrawn from the shores, but cracked again in preference. The consequence was, that there was a constant shoving from the middle of the lake towards both shores. The piles in the middle remained upright, but the nearer they were to each shore the more they were driven out of the perpendicular. The damage was great the first winter, but it was repaired. The next winter, by cutting up the ice with ice ploughs, and by making embankments from each shore, the damage was sought to be arrested; but every winter it got worse, till the bridge had to be altogether abandoned; and whilst the piles in the middle are still upright, those near each shore are now laid almost flat. It is to this constant motion in one direction, arising from alternate expansions and contractions, that I have always in a great measure attributed the downward progress of glaciers.

"The true explanation of the prismatic structure appears to me to be the lines of air bubbles, which you yourself notice. These are visible in all ice before any thaw has commenced, and in the process of freezing they seem to be formed in vertical lines. When the thaw occurs, these lines of bubbles form the centres, as it were, from which it penetrates in every direction through the mass. "JOHN LANGTERS

"Ottawa, May 25"

Etna in Winter

THE ascent of a high mountain always gives plenty of opportunities of observation and experiment, but that of the prince of the volcanoes of Europe, and at the same time one of the grandest of its mountains, must always be an undertaking of paramount interest to the student of the phenomena of Nature.

We leave the edge of a plain with a semi-tropical luxuriance of vegetation (the great plain of Catania, where Ceres taught mankind husbandry, and where common belief states wheat to be indigenous), and pass through a country so rich in its profusion of orange, lemon, fig, and olive trees, so-called American aloes, prickly pears, vineyards, peach trees in full bloom,* &c., that it would remind us forcibly of Algiers, did not the irregular surface of the numerous lava currents (on which the prickly pear is cultivated extensively) and the lava-built walls and buildings around bring back Auvergne to our thoughts.

Still higher above the sea level we find karouba trees, with umbrella pines and dwarf oaks in abundance; fields of flax and of wheat (a foot high) and other signs of a more temperate climate; nearer to Nicolosi (the village from which the ascent is made) in traversing the rugged lava current of 1536 we are struck by the peculiar appearance of the bushes of Etna broom which flourish on its surface. Even on the cones above Nicolosi up to a height of about 1,300 metres above the sea level, the vine is still cultivated and excellent wine produced.

After supper and a short nap we start at 10 P.M. with a guide, mules, and a muleteer, and well provided with provisions and wraps (taking with us a few thermometers, &c.); and passing by the Monti Rossi, which were formed during the remarkable and well-described eruption of 1669, we traverse various lava currents and fields of cinders, and find ourselves at last in a straggling wood of stunted oak trees succeeded by one of Italian chestnuts, in which latter we come upon the Casa del Bosco (a solitary house, uninhabited in the winter) after a rather rough ride of nearly three hours. Here we rest for half an hour, warm ourselves at a wood fire which is soon made, and take our supper; then at 1.15 we start for our laborious ascent; we come upon the snow in about an hour, and (having chosen a starlight night after a continuance of fine weather) find it dry and firm; now the work begins; leaving the mules and their driver, we toil on slowly and steadily, not speaking for fear of wasting strength or getting out of breath, and after a long, stiff climb up a very steep surface of almost smooth snow, which scarcely gives a hold to one's feet, we arrive at the Piana del Lago soon after 4 A.M. Here we have a comparative respite, and march merrily up the slight ascent, with the black summit of the cone in front of us, and looking so close that we can hardly believe the guide who says that it will take us nearly two hours to get up to it. At about five o'clock we arrive at the Casa degli Inglesi, where travellers sleep in the summer, but which is now all but buried in snow. On we go (as we have no time to spare before sunrise), the guide pointing out where we might see the Torre del Filosofo were it not entirely covered, and in a quarter of an hour, after crossing several fields of thin, broken ice, and nearly falling into sundry uncomfortable-looking holes, which one doesn't see until one has put one's foot through the crust of ice and snow which conceals them, we reach the foot of the actual cone, and look up its steep sides with some dismay, knowing, as we do by manifold experience, that the ascent of a cone of loose cinders 300 metres high, and at an angle of 40°, is no joke; our work is made somewhat easier by the snow with which the base is covered; but we soon get off this and hurry on to get to the top before the sun rises. Before we are half way up the cone we find the necessity of stopping to take breath so urgent, that we halt and look behind us at the inexpressibly magnificent colours in the sky; this we have to do several times, and were it not for Pietro's "Avanti!" we should go to sleep as we walk; besides which our legs have given way at the hip joints and seem no longer to belong to us; perhaps also some of us may feel a sense of nausea, and those least used to such excursions doubtless have a sharp pain in the knee joints. By screwing up our courage, however, we get gradually higher, and soon the fumes of sulphurous acid that arise around us tell us that we can't have much more to do. Five minutes more and we look down into the immense crater, and instantly turn round and see the sun rise above the horizon and light up the beautiful island at our feet.

Our ascent has been a capital success; we have had a fine starlight night, firm snow, and a good guide; there is not too much vapour, &c., and the brisk north wind drives it away from us. We soon find out that although the soles of our boots are being burnt by the hot cinders, our right hands (which held the alpenstocks) are frozen, and during ten minutes we experience excruciating pain in them. After a hearty breakfast we look around us, and see that the heated state of the ground is due to the continual slow oxidation of the sulphur contained in the ashes or lying about on the surface, and not to any internal action of the volcano. Far down in the crater, where there is less sulphur, the surface is covered with snow, and at the very bottom of it is a huge plug of snow also. With some difficulty we make our way through the suffocating vapour to the highest point of the edge of the crater, and thence look down upon the marvellous scene.

The effect is almost unique, from no other point, except perhaps the Peak of Teneriffe, has one so unbounded a view. We find ourselves at a height of nearly 11,000 feet above the sea level, with no other mountain of considerable height within the horizon at all: the "garden of Europe" stretched out at our feet, beyond its borders the sea, on all sides extending far away into the dim distance, and confusing itself with the sky; to the north of us Calabria, the "toe" of Italy, bounded by mist and looking like an island; we see yonder Monte St. Giuliano (the ancient Eryx), there the hills around Palermo; to the north, the point of Milazzo, very plainly indeed; beyond it, the chain of the Lipari Islands, apparently raised up into the sky (a rather striking phenomenon); farther east, the island seems to touch Calabria, and there are the Straits of Messina; here is Catania, from which we have come; there Syracuse, and in that direction Girgenti, the site of the famous Greek temples; farther west Marsala with its vineyards. All around us, at the base of the mountain, we see the secondary cones, and look down into their craters, while the distant hills look like slight irregularities on the surface of the island, although some of them are so high as to be covered with snow. What with feasting our eyes on the grand view, looking down into the immense crater, the deepest and steepest that we have ever seen, and collecting specimens of the variously-coloured cinders, &c., around us, we have spent two hours on the summit: it is eight o'clock, and our guide warns us that the heat of the sun will fast melt the surface of the snow, and render the descent more difficult and more dangerous. We could not walk round the edge of the craters on account of the vast quantities of stifling vapour that arise from some parts of it, even if we wished to spend another hour in doing so. Taking

* March 4th.

then a last look into the huge abyss, we run easily down the side of the cone, and are in a few minutes at the Casa degli Inglesi again. Here we turn off towards the eastern side of the mountain, and soon come upon the edge of the Valle del Bove, to enjoy perhaps the most remarkable spectacle in Europe. We find ourselves now on the summit of an almost vertical cliff, nearly 4,000 feet high, which constitutes the head of an enormous cleft or valley, about eight or ten miles long by four or five broad; it is as if a piece, constituting about one-sixth part of the mountain, had been cut out of it. On either side it is bounded by cliffs of from one to three thousand feet high, and consisting of layers of lava and ashes traversed by dykes of basalt, trachyte, &c.; several volcanic cones are seen in it, of which Monte Simone, to the northern side, with its lava of 1811, and Centennario, Calanna, and Giannicola to the southern side, with the barren black lava of 1852, are the most noticeable; this immense depression was caused, according to the opinion of Sir Charles Lyell and of Gemmellaro the great Sicilian vulcanologist, by the subsidence of an ancient felspathic volcano, which must, according to calculations made from the inclination of its lava currents, have been much higher than the modern pyroxennic one. (La Vulcanologia dell' Etna, del Professore Carlo Gemmellaro; Catania, 1858.) Such a subsidence is well illustrated on the small scale by the Cisterna, a round hole about 300 yards in diameter, and at least 200 feet deep, which was formed precisely in the manner just mentioned during the eruption of 1792, and which we can see on our way back to the Montagnola; indeed, when we consider how much material is ejected during the various eruptions in the form of lava and of ashes, &c., we see that it would be strange if subsidences, and great ones too, did not happen occasionally.

We now descend quickly, finding our last night's tracks behind the Montagnola, and by 10.30 are off the snow, and find the mules ready for us. In returning to Nicolosi we are able to observe the various lava currents, and to study their sections in the channels of the streams which rush down during the melting of the snow in the summer months, and also to notice the gradual change in the vegetation which the darkness prevented our remarking during the ascent.

We find the heat more and more oppressive, and are afflicted with very severe headaches; on arriving at Catania we find it covered by a dense fog (an extremely unusual occurrence there), and so the congratulations on our safe arrival are mixed with wishes that the weather had been more favourable.

In a future communication some remarks will be made on a few observations taken during this excursion.

W. H. CORFIELD

Paraplegia in Kangaroos

SOME time ago I obtained from Mr. Fairgrieve the bodies of two Kangaroos, male and female, which died during the visit of Wombwell's Menagerie to the West of Scotland. In the female, which I received first, there was extensive ecchymosis in the nuchal region strongly suggestive of bites inflicted by her cage companions. To this I was disposed to refer the softening of the cervical spinal cord, which struck me when removing the brain. On visiting the menagerie, however, I found that her male companion was completely paraplegic, and that he had exhibited the same symptoms. The paraplegia had been progressive, and at the date of my visit, respiration was markedly thoracic. The animal was excited, but I could not satisfy myself whether this indicated cerebral disturbance or arose from the contagion of fear, a younger specimen in the same cage being much alarmed at my approach. The animal died at some distance from Glasgow. I made a careful post-mortem, and found no lesion save in the spinal cord and medulla oblongata. The removal of the cord was difficult, on account of the thickening of the membranes, and their adhesion to the bony walls of the canal. The cord was not merely softened; it was semifluid as far up as the origin of the cervical plexus, and welled out like thick cream from an accidental puncture of the sheath. Dr. Joseph Coats who assisted me in the examination, failed to detect any fatty degeneration of the nervous tissue. Its disintegration was, however, very complete. The other organs were healthy, and the body was well nourished. The disease was manifestly of short duration, and I can only hazard this conjecture as to its cause, that the cage was placed at the angle of the square formed by the cars, and that its inmates were thus exposed to draughts and damp, giving rise to acute meningitis. As, however, an Australian sportsman informs me that something of the same kind has been observed in Kangaroos kept in confinement, and thus deprived, to a large extent, of their customary exercise, I ask space for this abstract of the case, in hope that some of your contributors may be able to throw light on an interesting pathological question.

JOHN YOUNG, M.D.,
Glasgow University Keeper of the Hunterian Museum

Geology and the Chatham Dockyard

BELOW the Alluvial deposit of St. Mary's Island is a very irregular surface of gravel, varying in thickness from 2 to 12 feet, and composed of flints but little rounded, and pebbles of Tertiary Sandstone; beneath the gravel is the Chalk. Now, the success of the Chatham Dockyard Works depends upon the stability of foundations that are built on piles driven into the underlying gravel, through which percolate considerable streams of water; this water must denude the chalk to an appreciable extent and form pot-holes, and the subsidence of the works can but be a matter of time. I can form no idea of the rate at which the Chalk would be denuded under the above conditions, as I am not aware of any experiments having yet been made on the "Action of Water on Chalk."

R. C. HART

Dust and Disease

PERMIT me to add my mite to Mr. Horace Waller's theory respecting the utility of mosquito curtains in warding off fever, generated by the miasma of decaying vegetation.

For the last twenty-five years I have held to this opinion, and acted on it in all my wanderings in the jungles of Ceylon, on the east coast of Africa, and in New Zealand, and I am convinced of its great utility. I have always likened it to Davy's "safety lamp," and I believe that over and above the "sieve-like" property, which a few days' use imparts to it, its value is great as warming the air which passes through its meshes, and keeping the temperature within it more steady and equal.

When the body is relaxed in sleep and the pores of the skin act freely, then is the time that the deadly miasma, cold and damp, even in the tropics, seizes on its victim. What jungle traveller does not know the feeling of the air an hour and a half or two hours before daylight? But the warmth from the body and breath within a well-secured mosquito net, I think effectually protects the sleeper.

This morning I compared the temperature outside and inside my mosquito net, and found it differ 8°, being 62° outside and 70° within, and even this was not a fair trial, for the bed is a large double one (two persons in it), exposing a large surface to the external air; the mosquito curtain being the largest sized *Net* that can be got (and not *Leno*) which I would advise for a travelling curtain in fever latitudes; and moreover, as our mosquito season is past, not tucked in all round as a well-secured curtain should be, yet with all these disadvantages the temperature inside was 8° warmer.

Then, again, who doubts that the body, invigorated by sound sleep, is not more able to resist disease in the day-time? Without a net in mosquito lands I find sleep impossible, and I suppose others do the same.

Let me therefore raise my voice in favour of the mosquito curtain, and advise all travellers in fever countries to look on it as their sheet anchor. E. L. LAYARD

Cape Town, Cape of Good Hope,
May 3

HEINRICH GUSTAV MAGNUS

IN giving expression to the sympathy generally excited by the loss of Magnus, Professor Tyndall has raised the interest of the British public in a philosopher's life, simple, yet most eminently useful. At the present moment a mere outline of it is all we can venture to offer. Unable to appease, it may yet prove sufficient to keep up the interest in Magnus's life until a fuller biography will do more ample justice to his merits.

Heinrich Gustav Magnus was born on the 2nd of May, in the year 1802. Four years later, Berlin, his native town,

had to resign its position as the residence of an independent kingdom. The French war raged with ever-increasing fury, and though Mr. Magnus, the banker, found the means of sheltering his children from the most severe consequences of the national calamity, their youth was naturally a severe one. It appears more than probable that the energy and ambition which raised all of them high above the level of mediocrity, may have originated in the stern impressions of their childhood. Thus one of the brothers, Edward, rose to the highest distinction as a historical painter, and is now one of the ornaments of the Berlin Academy of Arts. A younger brother distinguished himself as a physician; while the eldest, whose death preceded that of Gustav by some months only, continued and extended his father's banking business. A son of the latter became prominent during the last war in Mexico, where, representing Prussia at the Court of Maximilian, he showed great energy in his endeavours to save that misguided monarch's life.

The peculiar talents of Heinrich Gustav showed themselves at an early age. He exhibited a rare proficiency in mathematics when a mere child, and soon expressed a wish to devote himself to the study of nature. At the Berlin University, founded some years before, the Chair of Chemistry had passed from the hands of Klaproth into those of Mitscherlich, who was then at the height of his reputation. Young Magnus was twenty-three years old when he published his first paper on the pyrophoric nature of finely-divided metals. Two years later he received his Doctor's degree, and published a dissertation on tellurium. He subsequently passed twelve months at Stockholm, in the laboratory of Berzelius, who gave to Germany some of its greatest *savants*, of whom Wöhler, in Göttingen, and Gustav Rose, in Berlin, now alone survive. From Sweden he removed to Paris, returning to Berlin in 1831, and began there his university career as a lecturer on technology, a subject which he continued to teach till last summer.

HEINRICH GUSTAV MAGNUS

Nearly all his researches published during this time and up to 1833 were devoted to pure chemistry. A latent interest for natural philosophy can, however, be traced already in his earlier publications. Thus he determined the temperature at which oxide of iron is reduced by hydrogen, and analyses of several minerals were followed by determinations of the decrease of density which vesuvian and granite undergo in fusion. These determinations excited much interest at a time when the doctrine of isomerism was making its first appearance, and every two substances having the same composition and yet exhibiting different properties, were subjects of astonishment and of doubt. He even published papers on capillarity, and on the temperature of the interior of the earth and a thermometer fitted to register the same, as early as 1832. But the researches on which his early fame was founded are of a strictly chemical nature. A paper on the combinations of protochloride of platinum in 1828, contained the description of what is now called Magnus's salt, one of the first known of that important series of metallic ammonium salts, which acquired later an increased importance, as a support of the theory of substitution, and a link between mineral and organic chemistry. Five years later, in 1833, appeared his paper on the decomposition of ethyl-sulphuric acid, and on two new acids, ethionic and isothionic acids. These acids (together with the sulphobenzolic acid discovered by Mitscherlich in 1834) became the starting point of numerous discoveries. They increased our knowledge of isomerism; they prepared the way for the modern views on the constitution of natural bodies, and they enabled Strecker, in 1854, to form, artificially, a constituent substance of bile, taurin.

In the same year (1833) another important discovery concluded, so to speak, Magnus's career as a chemist. Together with Ammermüller, a doctor of medicine and head master of a public school in Würtemberg, he published his researches on periodic acid.

When Magnus appeared again before the scientific

world, it was in a new science. He was created Professor of Natural Philosophy in 1834, and no research of his was published during the following three years, evidently spent in qualifying himself for his new position. Researches on steel magnets and on the boiling of liquids reopened the series of his discoveries in 1836; still he had not escaped the sway that chemistry exercised over his mind. Papers on the composition of a fossil resin, ozokerite, on the gases contained in blood, and on the combination of ethylene with sulphuric anhydride (carbyl-sulphate) were published in 1837 and 1838, and even later researches on the formation of tar from ethylene, and on the allotropic modifications of sulphur (1856),* show how much chemistry lost when natural philosophy took possession of Magnus's talents and energies. Later his modesty urged him to disclaim the honours so largely gained through his chemical researches. When after the opening of a university laboratory by Prof. A. W Hofmann, the expanding scientific interest led to the formation of the German Chemical Society (in 1867), Magnus could only be prevailed upon with difficulty to become one of its vice-presidents, and although he worked on the committee with zeal, offering assistance and advice wherever it was needed, and publishing a paper on the diathermanity of chloride of potassium in the Reports of the Society, he pretended that he had lost all claims to be regarded as a chemist.

We have to revert, therefore, to the second side of his scientific work, his researches in natural philosophy. A determination of the expansion of air, instituted at the same time (1842) and in an analogous manner, by Magnus in Berlin, and by Regnault in Paris, and yielding all but absolutely the same numerical results, proved the exactness of both physicists. The most admirable conformity distinguished likewise researches on the tension of vapours, which both *savants* executed independently of each other in 1844, by entirely different methods. Relating chiefly to the tension of steam, the results thus obtained are as important for practical as for scientific purposes. Researches on the tension of vapours given off by mixtures of different liquids, and a comparison of the mercury thermometer and the air thermometer, preparatory to the great investigations just referred to, were published at the same time.

In 1855 Magnus investigated the form which jets of water assume when issuing from apertures of different shapes, and thereby opened to experimental study the surface-tension of liquids. His inquiry extended to the manner in which the motion of the aperture influences the form of the jet. Two years later he published detailed investigations on electrolysis. The discussion of this complicated question he founded on the theory of chemical substitutions. The temperature of vapours and the conducting power of gases formed the subject of his researches up to 1861. Until then gases had been considered as non-conductors. He proved that hydrogen conducts heat in the same way as do solid bodies, and thereby established a new and striking analogy between this element and metals.

During the last years of his life the radiation of heat formed the chief object of his researches. A paper on the polarisation of the dark rays of heat, the discovery of the diathermanous nature of native chloride of potassium, and lastly a full research on the emission, absorption, and reflexion of heat radiated at low temperatures, were the results of this protracted and fertile investigation. He showed that heat from different sources is refracted under different angles, and absorbed in different proportions by the chlorides of sodium and of potassium, by fluor-spar and other substances. He thus proved, that, if our eyes were able to distinguish different rays of heat, we should see the different substances glowing in the most varied colours at ordinary temperatures, just as we see them emit different rays of light when exposed to heat and observed with the spectroscope.

The receptacle of all his researches is the "Annals of Chemistry and Natural Philosophy" (*Annalen der Chemie und Physik*), published by his friend Poggendorff. He formed a fine collection of scientific apparatus, afterwards bought by the University and put under his control. As a lecturer, Magnus was a pattern of clearness. He loved teaching, and his diction, though plain, showed the high culture of his mind. While in his lectures he aimed at being comprehensible to the large number of students who wished to learn the rudiments of science, he instituted special classes for those who longed to enter into a deeper study of natural philosophy. Graduates and undergraduates assembled around him once a week, to enjoy what he called physical conversations. Here students in turn reported on investigations recently published, the master criticising the report and opening a discussion on those points which appeared to deserve a fuller explanation. Some favoured pupils were instructed in the methods of physical researches in his private laboratory, the master allotting subjects to them, urging them above all to exactness, and warning them against drawing hasty conclusions from their experiments. Many professors of natural philosophy, who have since obtained fame or reputation, have been educated in these classes. From a long list of names we will but mention those of Tyndall, Clausius, Wiedemann, Heusser, Quincke, Palzow, Villari, and Kundt. The laboratory joined his apartment, and he was thus enabled to watch from his sick-bed the investigations that occupied his thoughts. Magnus's health had been impaired for many months. He was suffering when he visited the last meeting of the British Association at Exeter. He was ill when he presided at the banquet given to Professor Hofmann on the 8th of January. Still he continued his work up to the beginning of February, when weakness and excruciating pain forced him to give up his lectures. He foresaw his death, and made the most minute arrangements, order being one of the characteristic properties of his mind. "I have written to you to ask for your advice," he addressed his physician, "but I foresee that my case will give you but little satisfaction."

Magnus married the daughter of M. Humblot, a well-known publisher. His wife, as well as two daughters and one son, survive him. The circle that assembled at his house was very large, and included the leading members of every profession, members of the university, merchants, statesmen, and artists. But he was equally accessible to every unknown youth who wanted his advice and assistance. Ever ready to help, he bestowed his aid, as if he received, not as if he conferred, a favour. Gentle-mannered, conciliatory, and persuasive, he was the mediating element of every society. Nothing can show better the kindness of his disposition than the love which, not his family or his pupils only, but even his domestics, bore for him. A faithful laboratory servant, who took care of his instruments and also nursed him through his last illness, bears witness that he could not endure to see unhappiness or unpleasantness around him. "Why," he would ask sometimes, "will you make life difficult to yourselves? Is it not sufficient your Master should make it difficult for you?"

His death is therefore felt, not only as a severe loss to science, but as a personal pain, by all who had the good fortune of approaching him. Numerous were those who, on the 8th of April, thronged the room where his coffin stood, hidden under palms and flowers. Some parting words were spoken by Dr. Müllensiefen, Professor of Divinity, and a song of Mendelssohn, sad, yet cheering, ascended from his grave.

A. OPPENHEIM

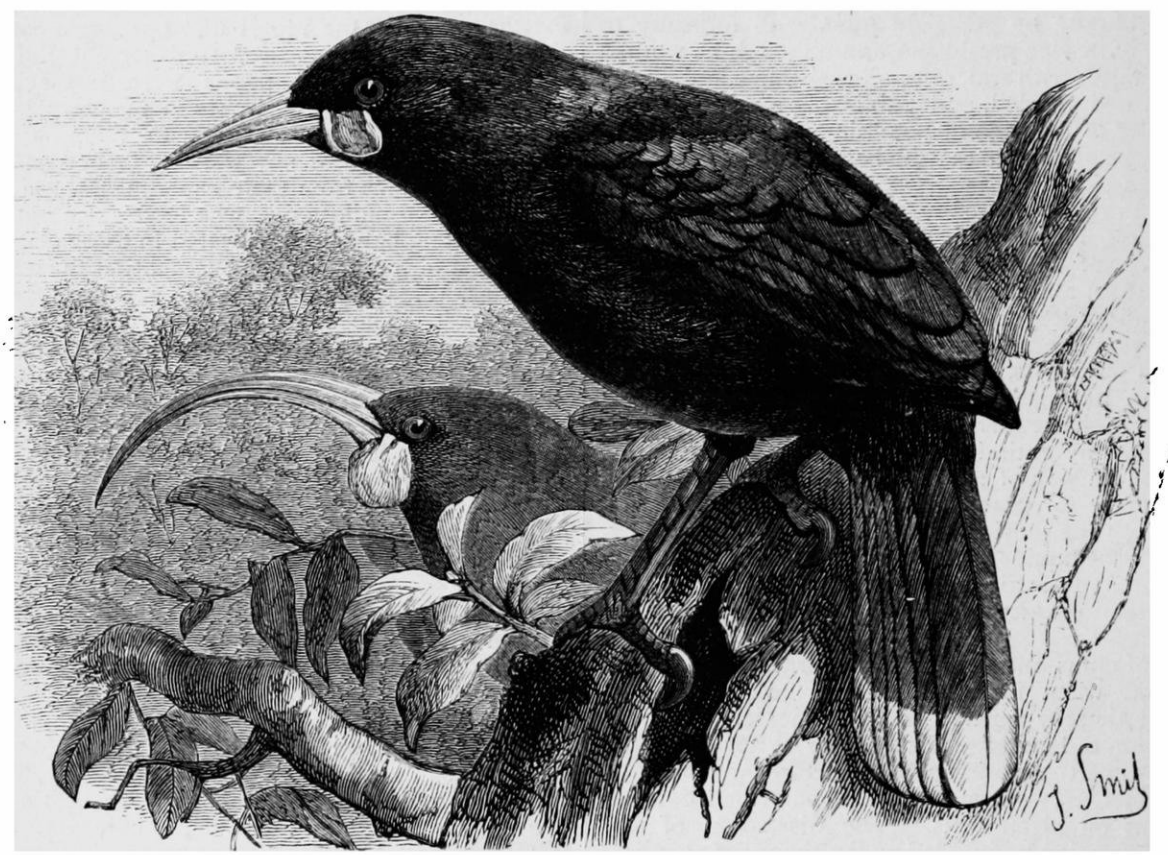
* The latter investigation contained an error which was afterwards corrected by its author, and originated a new discovery. Magnus found that sulphur acquired a deep red or black colour when fused with minute quantities of various organic substances. This change was at first ascribed by him to an allotropic modification of the element.

RECENT ADDITIONS TO THE ZOOLOGICAL SOCIETY'S GARDENS

IN April last the total number of additions to the living collection of the Zoological Society of London was 124. Of these, twenty-one were born in the Gardens, forty-four were acquired by presentation and fifty-two by purchase, while one was received in exchange, and six merely "on deposit." The "departures" during the same period, by death and otherwise, were ninety-one. Among the more noticeable additions were :—

1. A female of one of the smaller forms of Rusine deer, purchased by a dealer on the 13th of April, and stated to have been received from the Philippines. This animal is quite distinct in its small size and dark brown fur from any other member of the group now or lately in the Society's collection. If the assigned locality is correct it may probably belong to the Rusa deer of the Philippines, which was first named *Cervus mariannus* by Desmarest, as having been found living by the French naturalists during the voyage of the *Uranie* at the Marianne Islands. Here, however, it was stated to have been introduced from the Philippines. It would be very desirable to increase our knowledge of the deer of the Philippines. Probably there is more than one species that occurs there.

2. A Sooty Crow-Shrike (*Strepera fuliginosa*), purchased on the same day, is one of a peculiar group of Australian birds, of which the Society previously possessed examples belonging to two other species. These are all placed in the cages outside the "Parrot-house," which are devoted to the reception of the hardy species of crows (*Corvidæ*) and their allies, and at the present moment contain examples of several other species of great interest, such as the yellow-billed chough of the Alps (*Pyrrhocorax alpinus*), the chough of our own coasts (*Fregilus graculus*), the Chinese Jay-thrush (*Garrulax sinensis*), and the Australian crow (*Corvus australis*).



THE HUIA BIRD (*Heteralocha gouldi*)

3. A Vulturine Guinea-Fowl (*Numida vulturina*) presented by Dr. John Kirk, C.M.Z.S., H.B.M. Acting Consul at Zanzibar.

For many years this remarkable Guinea-Fowl, which is peculiar for having the head entirely devoid of feathers, and for the long ornamental hackles surrounding the neck, was only known to naturalists from a single specimen, formerly in the United Service Museum. This was figured in Mr. Gould's "Icones Avium," but its exact locality was unknown. More recently, since the eastern coast of Africa has been more thoroughly explored, it has been discovered that this bird is by no means uncommon on the southern part of the Somali coast, and in the adjacent parts of continental Africa. Dr. John Kirk, the well-known companion of Dr. Livingstone in the Zambesi expedition, who has been lately resident at Zanzibar, as acting Consul, has communicated several notices upon this Guinea-fowl to the Zoological Society, of which he is an active correspondent. In one of his letters he says that "it seems to be common at Lamoo, a port situated on the east coast of Africa, in about 2° S. lat. The officers of H.M.S. *Syria*, when lately there, saw several in the market, but used them for the table, not being aware of their great rarity." More recently Dr. Kirk succeeded in securing for the aviaries of the Society the present female example of the species. This fine bird was procured at Brava on the southern part of the Somali coast, just to the north of the equator, and was conveyed, along with a collection of other animals presented to the Zoological Society by Dr. Kirk, in the steamer, *Malta*, through the Suez Canal to Marseilles, under the kind care of Captain Mackenzie.

4. A jackal, stated to have been brought from the River Fernand Vas, south of the Gaboon, and to be the animal referred to in Du Chaillu's well-known "Explo-

rations and Adventures in Equatorial Africa" (p. 243), in the following passage :—

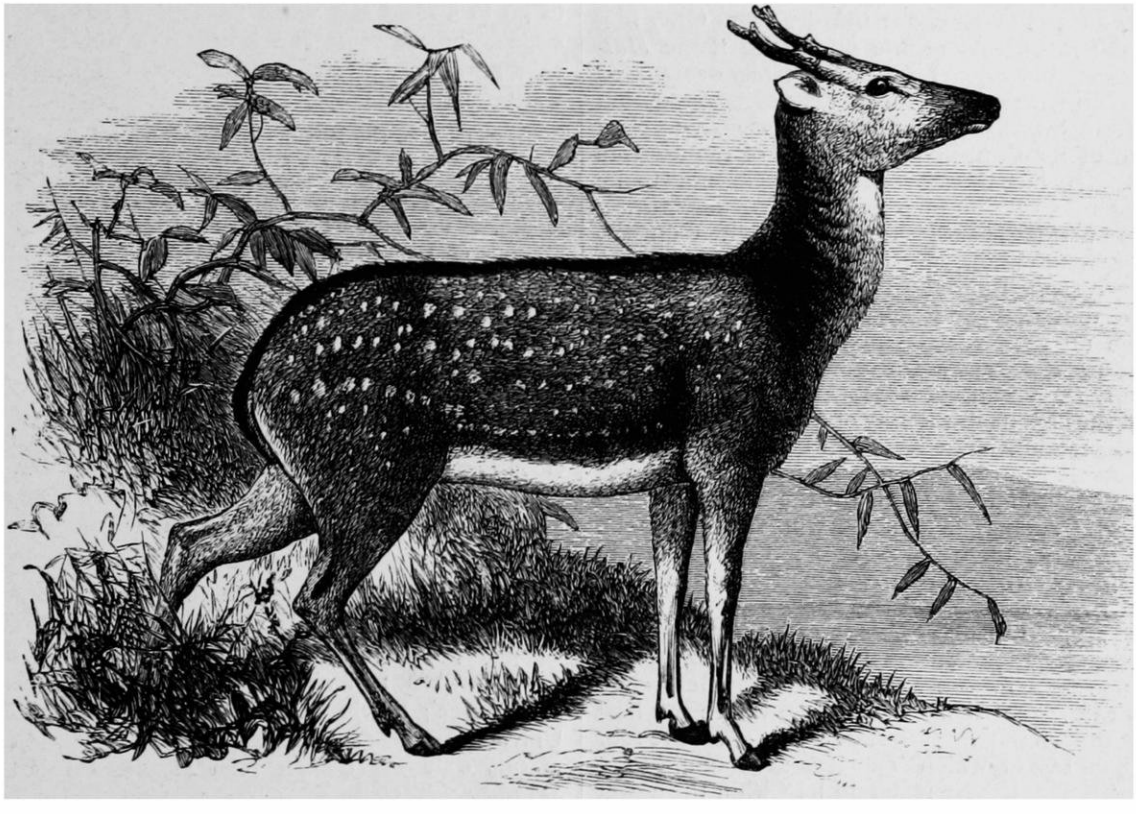
"Before we got to town again, I shot a *mboyo*, a very shy animal of the wolf kind, with long yellowish hair, and straight ears. I have often watched these beasts surrounding and chasing small game for themselves. The drove runs very well together, and as their policy is to run round and round, they soon bewilder, tire out, and capture any animal of moderate endurance."

Such is M. Du Chaillu's fragmentary notice of this animal, of which, however, he does not appear to have sent home specimens. After endeavouring in vain to find a name for this distinctly-marked species of *Canis*, which is readily recognisable by the black and white stripes along the flank, and the long black tail with a black termination, I proposed at the meeting of the Zoological Society, on May 12th, to call it *Canis lateralis*. Dr. Peters, however, has since suggested to me that it may be the *Canis adustus* of Sundeval, and this identification is probably correct, although our example does not agree very well with Sundeval's description. I may also remark that there is no example of *Canis adustus* in the British Museum, and that, without the aid of specimens, the differentiation of the various species of *Canis* is by no means an easy task.

In the month of May the number of additions to the Society's collection of living animals was still more numerous than in April, amounting altogether to 200. Of these fifty-four were received as presents and eighty-three acquired by purchase ; forty-five were bred in the gardens and eighteen were deposited for safe custody. The number of departures in May, by death or otherwise, was seventy-five.

Amongst the 200 acquisitions in May were several of great interest, viz. :—

1. A male deer, forwarded to the Gardens from Singapore by order of H.R.H. the Duke of Edinburgh. This is quite different from any other deer yet obtained living



PRINCE ALFRED'S DEER (*Cervus alfredi*)

by the Zoological Society. It is obviously allied to the axis or spotted deer of continental India, and may be the Malayan form of that species. It differs, however, in its smaller size and smaller ears, and in the dark coffee-brown colour of the fur. I have not been able to find any designation applicable to it, and, at a recent meeting of the Zoological Society, have proposed to call it *Cervus alfredi*, after the Prince, who has transmitted the present individual to us.

2. Three examples of the crested or bladder-nosed seal of the Arctic Seas (*Cystophora cristata*), purchased May 5, out of a whaling vessel, which brought them into Dundee. These are the first examples of this seal that have reached the Society's gardens alive, and are of much interest, as making us acquainted with the external form of a very distinct genus of the *Phocidæ*. The bladder-like excrescence on the forehead, which attains an extraordinary development in the adult male, is but very slightly shown in these young animals, but a look in the mouth at once shows their difference from the typical seals of the genus *Phoca*.

3. A huia-bird (*Heteralocha gouldi*), from New Zealand, purchased May 18th. This bird is remarkable for the great difference in the shape of the bill between the two sexes, as will be readily understood by reference to the accompanying illustration, in which the short-billed individual is the male and the long-billed the female. The figure of the male is taken from the Zoological Society" specimen, the head of the female is copied from Mr. Gould's plate of this species in the "Birds of Australia." Such a divergence in the structure of the beak of the two sexes is very uncommon and scarcely to be paralleled in the class of birds. It is difficult to guess at the reason of it, or to explain it on Darwinian or any other principles. The story is that the male employs his stronger instrument to hew away the wood that covers the grub, and the female her more delicate organ to extract the precious morsel. Unfortunately, we have as yet only one sex of

this bird living in the Society's Gardens, but it is so far certain that our male is evidently very fond of grubs, and will search for them with eagerness in rotten wood. He does not, however, seem obliged to wait for a female of his own species to extract them when discovered, but picks them out for himself. A somewhat parallel case of difference of the bill in the male and female occurs in the humming-birds of the genus *Grypus*.*

4. A Tuatera lizard (*Sphenodon punctatum*), purchased May 20th.

This not very attractive-looking lizard is really one of the most extraordinary reptiles now known to exist on the world's surface. In several important particulars of structure it differs from every other known saurian, insomuch that Dr. Günther, who has published an elaborate memoir on its anatomy,* has proposed to constitute it of itself a distinct order of reptilia, equal in systematic rank to the ophidians and saurians. It differs from all the known members of the latter order in having the quadrate bone firmly anchylosed to the skull, and in the entire absence of an intromittent copulatory organ. The vertebra are amphicælian, as in the Geckoid lizards. Dr. Gray first described and figured this reptile under the name *Hatteria* (!) *punctata*, and it has been so generally designated until lately, when it was most fortunately discovered that the generic term *Sphenodon* had been previously applied to a specimen of its skull in the museum of the College of Surgeons. It has thus become possible not to be obliged to employ so vile and barbarous a term as *Hatteria* for the name of this important animal. Dr. Günther, when he wrote his memoir, supposed that this reptile was extinct or nearly so. But one living example has reached England since that date, and more than one, I believe, in spirits. From an article published by Dr. Bennett, of Sydney, in the *Morning Herald* of that city, it appears that so recently as December 1851, this lizard was abundant in one of the islands in the Bay of Plenty, on the north coast of New Zealand. The island in question is one of four small volcanic islands, distant about eight miles from the coast, and situated opposite to the mouth of the Wakatane river. A party of officers, who visited it upon the occasion referred to, are stated to have collected in half an hour nearly forty of these lizards of different sizes, varying from two feet long to three inches. They stated that the island seemed to be swarming with them, and with another lizard called the moko-moko (*Tiliqua zeelandica*). In the day-time these lizards are seen basking themselves in the sun on the bare rocks. Noon is therefore the best time to visit the islands. It is stated that there are four small islands, on two of which Tuateras are found.

I mention this fact in case it should be within the power of any of the Antipodean readers of NATURE to visit these islands, and obtain examples of this reptile. For although the British Museum has a good supply of specimens of it, yet the animal is a great *desideratum* elsewhere, and I believe there are no examples of *Sphenodon* in any of the continental collections.

P. L. S.

NOTES

THE honorary degree of D.C.L. has been conferred, at the recent Commemoration, by the University of Oxford on the following scientific men:—Sir William George Armstrong, C.B.; Sir James Alderson, M.D., President of the Royal College of Physicians; John P. Gassiot, Vice-President of the Royal Society; Charles W. Siemens, F.R.S.; James Fergusson, F.R.S.; Sir J. Kay-Shuttleworth, Bart., the Rev Henry Moseley, M.A., F.R.S., Canon of Bristol; Professor Hermann Helmholtz; George Edward Paget, M.D., President of the General Medical Council; Edward Frankland, F.R.S.; Henry Bence Jones, M.D., F.R.S.; Warren De La Rue, Vice-President of the Royal Society; William Huggins, F.R.S., Secretary to the Royal Astronomical Society. The name of Charles Darwin, F.R.S., would have been included in the foregoing list (as stated in our last number) but he writes that his health is such "that he could not withstand the fatigue and excitement of receiving an honorary degree." We understand that Prof. Helmholtz has also been prevented from attending. There is a rumour that Science would have been even more brilliantly represented if the degree were the simple thing it is often supposed to be. It really stamps, it seems, a judicious mixture of celebrity and orthodoxy; *e.g.*, either much orthodoxy and a little celebrity, or a little orthodoxy and much celebrity, will qualify, but a dash of orthodoxy is *de rigueur*. The *imprimatur*, therefore, is of double value. In the present case, for instance, it is proclaimed to the world that Mr. Darwin, for example, is not only Mr. Darwin, but that Dr. Pusey, and others even more skilled in heresy than he, consider him orthodox. On the whole we should prefer the abolition of tests even here, and one has only to go to Oxford and watch the present scientific activity, the magnificent museums and laboratories which are growing or have grown, to predict that the Oxford of a few years hence will be of the same opinion.

MEETINGS of the Royal Commission on Scientific Instruction and the Advancement of Science have been held at 6, Old Palace Yard, S.W., on the 14th, 15th, 17th, and 21st of this month. Present:—The Duke of Devonshire, K.G.; the Marquis of Lansdowne; Sir John Lubbock, Bart., M.P., F.R.S.; Sir J. P. Kay Shuttleworth, Bart.; Mr. B. Samuelson, M.P.; Dr. Sharpey, Sec., R.S.; Prof. Huxley, F.R.S.; Dr. W. A. Miller, Treas., R.S.; Prof. Stokes, Sec. R.S.; and the Secretary, Mr. J. Norman Lockyer, F.R.S.

MR. E. J. STONE, F.R.S., first assistant at the Greenwich Observatory, has been appointed Astronomer at the Cape of Good Hope. This appointment will be hailed with the liveliest satisfaction by all scientific men, and we may hope that the fine Observatory there may soon take high rank among similar establishments.

THE examiners for honours in the Natural Science School at the University of Oxford, viz., Henry J. S. Smith, Edward Chapman, and Joseph F. Payne, have made the following award:—Class 1. Walter William Fisher, Postmaster of Merton College; Edwin Harding Lendon, Gunsley Exhibitioner, University College; Charles Samuel Taylor, Commoner of Merton College. Class 2. John Fleming Hartley, Commoner of Brasenose College. Class 3. John Richardson Burrow, Thanet Exhibitioner of Queen's College. Class 4. Nil.

WE hear with great satisfaction that the Government of India has ordered the adoption of the metric system of weights and measures.

A NEW Astronomical Observatory has been established by the Government of the Argentine Republic in South America, to be erected at Cordova, about the middle of the continent, on the margin of the Pampas, in lat. 31½° S. Dr. B. A. Gould has been invited to organise it, and is going out for the special purpose of extending through the southern hemisphere the system of zones, which Bessel and Argelander have already carried from the north pole as far as 30° S. He hopes also to obtain some photometric determinations of the principal southern stars. The undertaking has been instituted and carried out entirely by the Government of the Argentine Republic, at the instance of the President, M. Sarmiento, and of Dr. Avellaneda, the Minister of Public Instruction; but the various scientific institutions of the United States have aided the expedition greatly by loans of important and valuable instruments; and Dr. Gould expresses his obligation to the Coast Survey, the "American Nautical Almanac,'

* See Gould's Monograph of the Trochilidæ, Introduction, p. xxxvi.
† Phil. Trans. 1867, p. 595.

the Washington Observatory, the National Academy of Sciences, and the American Academy of Boston, all of which have afforded valuable assistance in providing him with instruments and equipment. This will be the second public observatory in South America, that at Santiago, in Chile, having been founded in 1851. Efforts are making to provide means for obtaining photographic impressions of some of the more prominent southern clusters of stars, analogous to those taken in the northern hemisphere by Mr. Rutherford; but the success of these efforts is still uncertain. Dr. Gould estimates that three years will suffice to complete the southern zones within the limits which he has assigned to himself. We look forward with the most sanguine hopes to the results of Dr. Gould's labours. In time we may hope to be almost as civilised as the Argentine Republic—almost as anxious to spread the knowledge of Nature.

WE learn from the *Academy* that the Philosophical Faculty of the University of Göttingen has announced for the 11th March, 1873, a prize of 500 thalers in gold, and a second prize of 200 thalers in gold on the Beneke foundation, for the best new determination of the atomic weights of the metals of the earths. The limits of error in the results obtained must be exactly fixed, and the investigation must be accompanied by a complete critical review of the existing scientific material connected with it. In his classical researches in this field, Stas ascertained the combining weights of ten elements, leaving those of five-sixths of the elements more or less unprecisely determined. It has been resolved, therefore, to subject some of the numbers to careful revision, and those attached to the earth-metals have been selected. The dissertation, written in Latin, French, German, or English, and distinguished by a motto, must be deposited with the Dean of the Faculty on or before August 31, 1872.

THE Lecture, next Sunday evening, at St. George's Hall, Langham Place, is on "Cruelty in Relation to Lower Animals," by T. Spencer Cobbold, M.D., F.R.S.

THE Anniversary Meeting of the Society of Arts will be held on Wednesday next, the 29th inst., at four o'clock.

THE indifference of agriculturists to scientific research has been again illustrated by the refusal of the Council of the Royal Agricultural Society to publish an account of the investigations which have established the truth of the old bucolic dogma, that berberries produce rust on wheat growing in their vicinity. There is now no doubt that the berberry-rust and the wheat-rust are two different stages in the genetic cycle of *Puccinia graminis*.

HER Majesty's Commissioners for the International Exhibition of 1871 have resolved to set aside one guinea out of every season ticket sold at three guineas, through the Society of Arts, for the purchase of works of art and industry, out of the exhibition, the same to be circulated throughout the United Kingdom.

THE *Pharmaceutical Journal* announces that a new series will be commenced next month, when it will appear in a new form, and as a weekly publication, the first number to be published on the 2nd of July. The *Pharmaceutical Journal* was originally established by the late Mr. Jacob Bell, as an organ of communication especially devoted to the interests of the Pharmaceutical Society, which was founded at the same time, and it has been published monthly during the last twenty-nine years.

AN industrial and technological museum has been recently formed in Victoria. It is connected with the Gallery of Art and the Public Library at Melbourne, and is governed by the same body of trustees. In the Library there are over 50,000 volumes, and in the Gallery of Art pictures by Goodall, Webb, Graham, Lee, &c., besides several pictures by colonial artists and a very large collection of casts from the antique. Before this museum was formed a Royal Commission had been appointed for promoting industrial instruction, and resulting from this movement we may add, that there are now no less than six schools of design open in Melbourne and the suburbs, with over 600 pupils in attendance.

THE statistics given in M. Bouley's course of lectures on "Madness in Man and Animals" confirm the statement that hot weather is not a cause of *rabies*; out of 302 cases recorded in six years, eighty-nine occurred in the spring from March to May, seventy-four in the summer from June to August, sixty-four in the autumn from September to November, and seventy-five in the winter from December to February. Male animals appear far more subject to the attacks of the disease than female animals. Out of 320 cases of bites from rabid animals, 284 occurred with dogs (male), twenty-six with bitches, five with cats (male and female), and five with wolves (male and female). No instance is recorded of any attack on man by a rabid herbivorous animal. Now that we are approaching the dog-days, we commend these facts to the notice of the chief commissioner of police, and trust we shall have no repetition of the cruel and senseless police regulations as to the muzzling of dogs; to be consistent they should be in force all the year round.

WE learn from the *British Medical Journal* that Miss Garrett has just passed her final examination for the degree of Doctor of Medicine in Paris. Her thesis has been read, and at the same time she received her degree from the Faculty of Medicine. Whatever opinion may be entertained, says our able contemporary, as to the desirability of ladies studying and practising medicine, everyone must admire the indomitable perseverance and pluck which Miss Garrett has shown in overcoming the many obstacles to obtain in the first place the qualification of the Apothecaries' Company in London, and, lastly, the Degree in Medicine of the University of Paris.

MR. CYRUS REDDING, who died recently at a very advanced age will, perhaps, be best known as the author of a "History and Description of Modern Wines," which was first published in 1833, and has passed through several editions, being the standard work on the subject. Among his MSS. he has left a "Wine-book of Europe." Mr. Redding has enjoyed for the last few years a government pension of 75*l.* per annum, which it may be hoped, will be continued to his aged widow.

THE patent for printing photographs by a permanent process known as the Woodbury type, has been purchased by Mr. Vincent Brooks, of Gate Street, Lincoln's Inn Fields, on behalf of a new company.

WE have just seen a bill-head or order to which we think it necessary to call attention. On a scroll at the top is a name which, together with the address, which is on another scroll, we suppress, as we do not wish to assist this person in his advertisements. On other artistic scrolls we find the occupations of the advertiser, dyeing and printing works being set forth on one of them. In the centre is a coat of arms and crest surrounded by a garter, on which is printed *Fellow of the Chemical Society, London*. We have no wish to infer that this gentleman is not a most eminent chemist, but we do most emphatically protest against the membership of a learned society being turned to account for advertising purposes. We hope that the Council will not allow this to continue unnoticed, for nothing could be more damaging to the welfare of a scientific society.

A RECENTLY published part of Baillon's "Histoire des Plantes" contains a monograph of the Papilionaceous section of *Leguminosæ* executed with his usual care and wealth of illustration. We are glad to hear that an English translation of the work is announced.

"MITTHEILUNGEN der Anthropologischen Gesellschaft in Wien," is the title of a periodical which the Anthropological Society of Vienna have begun to publish, with accounts of their

own proceedings and papers, of discoveries of ancient remains in tumuli and elsewhere, and papers in which questions in their special pursuit are discussed. Two numbers are out. The first contains an opening address by Rokitansky, and among the contributors we notice the names of F. Müller, Graf Augustus von Breuner, F. von Hauer, and Freiherr von Sacken. Austria is so rich in ethnological varieties and relics that interesting matter sufficient for a monthly periodical must, we should think, be always forthcoming. It will be an acceptable addition to the scientific libraries of this country, and we offer to the society our best wishes for its success.

KARL VON LITTROW'S "Zählung der nördlichen Sterne im Bonner Verzeichnisse nach Grössen" has been reprinted from the Sitzungsberichte der k. Akademie der Wissenchaften. He estimates the number of stars to the sixteenth magnitude (or more exactly to the magnitude 15·8) at 588 millions for the northern hemisphere, and about 1,200 millions for the whole heavens.

"NOTES AND QUERIES for China and Japan," which has just entered on a new series, is a monthly medium of intercommunication for professional and literary men, missionaries, and residents in the East generally, conducted by C. Langdon Davies. In the number just received we find an article on the Fung tree (*Liquidambar formosana* Hance), the leaves of which afford food to a species of caterpillar (termed the wild silkworm), which produces an inferior kind of silk.

THE "Proceedings of the Bath Natural History Society and Antiquarian Field Club" for 1870, are mainly occupied, as they should be, by papers of local interest, which well illustrate the great wealth of the districts to the naturalist, whether geologist, botanist, or antiquarian. Thus we have "The Mammalia and other Remains from Drift Deposits in the Bath Basin," by C. Moore, with copious lists of organic remains found in the prehistoric alluvium and gravel deposits; "Remarks on some of the Fungi met with in the neighbourhood of Bath," by C. E Broome (edible fungus hunting seems to be a favourite pursuit with local field-clubs since the Woolhope naturalists set the example); "Notes on the Chapel and Hospital of St. Mary Magdalene," by Rev. W. Stokes Shaw; and "Notes on a pair of Celtic Spoons found near Weston, Bath, in 1866," by Rev. Preb. Scarth. Of articles of a less local character, we have "Chemical Geology," by Charles Ekin, containing a sketch of recent spectroscopic researches; and a pleasant gossiping paper, by Rev. H. N. Ellacombe, on "The common English names of Plants."

A REPORT from Mr. R. S. J. Ellery, Government Astronomer, on the subject of the Equatorial Telescope at Melbourne, has been received by the Victorian Legislative Council. The telescope arrived in November 1868; its erection at the Observatory was commenced early in July 1869, and the building for its protection was not finished till the 1st June, the final fitting up of the telescope being completed early in July. Observations were attempted as early as April last year, but the telescope was not in working order till the middle of August, since which date observation has progressed more or less satisfactorily. The principal work has consisted in examination and mapping of nebulæ, but the very unfavourable weather throughout almost the whole season has prevented much progress of other work. Positive observations have been made of Winnecke's periodical comet. With respect to spectroscopic observations, Mr. Le Sueur, the astronomer in charge, says—The spectroscope furnished by Mr. Grubb has already proved of much service for nebulæ work. For star work, so far as I can at present judge, it is unsuitable; nevertheless, a very important observation has lately been made therewith, showing that the spectrum of the principal η Argo is crossed into bright lines. In his report to the Board of Visitors in April last, Mr. Ellery referred to the construction of the telescope, but could not at that time speak of its performance or capabilities; but during the several months' use since then Mr. Le Sueur has tested its performance most carefully, and although he has had no prior experience with reflecting telescopes of such dimensions as this, he has been enabled from frequent observations to form a sound opinion of its powers. With the large mirror first used the telescope certainly did not perform so satisfactorily as could be desired, and making all allowances for atmospheric disturbances, the definition was never good; but with the other mirror (supposed B) it became very much better, and Mr. Le Sueur speaks of its performance now as far more satisfactory. The building for the protection of the telescope is in most respects satisfactory. There are several arrangements and appliances yet required, before the telescope can be said to be properly provided, among which are more convenient observing seats, drawing stands, and the erection of a platform outside the telescope room for photographic operations. Some of these are already in progress, and, should sufficient means be available, will soon be completed.

IN the recently issued Colonial Blue Book ("Reports on the state of H.M. Colonial Possessions," part I., West Indies), the Governor of Jamaica reports as follows:—"The cinchona plantation is a most interesting experiment, which may now be pronounced a complete success. Cinchona plants were first received here in 1866. By the close of 1867 the number of young plants had so much increased, that it became necessary to provide land for their final establishment on a planter's scale. Six hundred acres of virgin forest in Blue Mountain were acquired early in the year, and were set apart for the purposes of a cinchona plantation, for which the place is in every way admirably suited. The elevation above the sea ranges from 4,000 to 6,000 feet. It is well watered, has the best aspects, and possesses a soil reported to be admirably suited to the requirements of the cinchona. Fifty acres were cleared, of which forty were filled with cinchonas in the course of the year; about 20,000 plants of five different species were planted. By the latest accounts all of these were in full vigour, and the plantation must by this time be doubled in extent. The plants have stood one of the dryest seasons that has ever been remembered on Blue Mountain, without suffering in the least. There is now no doubt that the cinchona can be successfully reared in Jamaica." The plants for sale, deliverable in the spring of 1869, were applied for to the number of about 2,000 only; but Sir James Grant expresses the hope that with the growth of the plants a spirit of intelligent enterprise will grow amongst the proprietors of mountain wastes, sufficient to induce them to turn some attention to such a highly promising experiment.

THE *Journal of the Franklin Institute* describes a new explosive which has been invented by Mr. Noble, the inventor of nitroglycerine and dymanite, and which he calls dualine. It consists principally of nitrate of ammonia and very fine saw-dust which has been acted on by nitro-sulphuric acid. It is said not to be decomposed by accidental contact with acids, and will not congeal or lose any of its properties during cold or hot weather. Its explosion does not produce any noxious gases, and it will burn in the open air without exploding.

THE *Architect* states that the North-Eastern Railway Company is forming a new line between Gilling and Helmsley, which passes through the Caulkless spur of the Hambletons, in a deep cutting near Stonegrave. Here, at a depth of nearly thirty feet, a large chamber in the Oolite rock has been discovered. It is as large as an ordinary room, and has three openings from it. The cave is on the same horizon as the famous Kirkdale cave.

MR. MELDRUM ON THE ORIGIN OF STORMS IN THE BAY OF BENGAL*

THE writer commenced by observing that in various papers published during the last ten years, he had stated, as the result of an examination of a large body of observations, that the tropical cyclones of the Indian Ocean, south of the Equator, originated between two contrary streams of air, viz., the N.W. monsoon and the S.E. trade-wind; and, in a paper read on the 10th of November last, he remarked that what had been found to hold good in that part of the ocean might be found to do so generally. As the observations collected by the Society only referred to the Indian Ocean, he could not directly test the matter with regard to the cyclones of other parts of the world. But cyclones also occurred in the Indian Ocean, north of the Equator, and as the Society possessed observations which had been taken there, he proposed to examine the records with a view of ascertaining whether these cyclones were formed, as he believed those south of the Equator were, between two oppositely directed currents of air which had pre-existed. It was to that point alone that he wished to direct attention at present. How the barometric depression in the heart of a cyclone was formed, whether owing to an ascending current, to condensation of vapour, or to other causes, why the air moved more or less round a central area in a particular direction, and why the cyclone had a progressive movement, were subjects upon which he would not then touch; for the question of the existence or non-existence of opposite winds, previously to the formation of the cyclone, had, in his opinion, an important bearing upon all the others, and should therefore be taken up first.

The cyclones of the Indian Ocean, south of the Equator, as was well known, took place during six months of the year, viz., November to May. During that period the N.W. monsoon prevailed from near the Equator to 10° or 15° S., sometimes stretching as far south as the tropic. Still farther south the S.E. trade-wind prevailed. The line or belt separating the two winds often ran obliquely across the ocean from 18° S., near Madagascar, towards the Straits of Sunda. It was in that belt of comparatively low barometer, calms, and variables, that the tropical cyclones of the Indian Ocean, south of the Equator, were formed. The N.W. monsoon was a continuation of the N.E. trade-wind of the northern hemisphere. This might be seen on almost any day from November to April or May, by laying down the directions of the wind at a sufficient number of points; and the daily charts which had been prepared for various periods showed it very clearly. On examining those for February, 1861, for example, which had lately been lithographed, it would be seen that the N.E. trade-wind prevailed over the Bay of Bengal and the Arabian Sea, that as it approached the Equator it became more northerly, and after crossing the Equator into the southern hemisphere it became the N.W. monsoon. The southern limits of the N.W. monsoon, and the northern limits of the S.E. trade, or, in other words, the position of the belt of variables between them, moved backwards and forwards according to the season. It was farthest S. when the southern hemisphere was warmest. As the temperature decreased, towards the end of March, this belt retreated northwards with the sun, came up to the Equator, and crossed it into the northern hemisphere. In whatever part, N. or S. of the Equator, the belt of calms existed, the prevailing winds on either side of it were from opposite directions. When it was S. of the Equator, the prevailing wind to the southward of it was from the S.E. or E. (the S.E. trade), and to the northward of it from N.W. or W. (the N.W. monsoon.) The latter extended at least as far N. as the Equator, and the N.E. trade, of which it was the continuation, prevailed over the Bay of Bengal. The former at the same time prevailed as far south as the parallel of 30° or 40° S. When the belt of calms was N. of the Equator, the prevailing wind to the S. of it was from S.W. or West, and to the N. of it from N.E. or E. The former was the S.W. monsoon, and the latter the N.E. trade-wind. In July and August, when the belt was far N., the S.W. monsoon prevailed over the whole of the Bay of Bengal, and was a continuation of the S.E. trade-wind, just as the N.W. monsoon in February and March was a continuation of the N.E. trade-wind. The belt of calms followed the sun, moving from one tropic to the other, and often passing them. Hence, when it was at its northernmost limit, the S.W. monsoon swept over the Bay of Bengal, and when at its southernmost limit, the N.E. trade-wind did so. But at certain seasons, when the belt of calms stretched across the Bay, the S.W. monsoon blew over one part of it and the N.E. trade over the other.

As, then, observation had shown that the tropical cyclones of the Indian Ocean, south of the Equator, were formed in the belt of calms between the N.W. monsoon and the S.E. trade-wind, and nowhere else, there was at least a presumption that the cyclones of the Bay of Bengal were also formed in that belt, at those seasons when it stretched across the Bay, and separated the N.E. trade wind from the S.W. monsoon; and this presumption was strengthened by the fact that most, if not all, of the cyclones that occurred there, did so at the change of the monsoons; that is, when two contrary winds prevailed in the Bay, and were more or less in conflict.

These general considerations rendered it possible, if not probable, that the cyclones of the Bay of Bengal were formed between two contrary and pre-existing winds. But that was not sufficient. It was necessary to bring the matter to the test of facts; and this could only be done by examining the observations taken in particular storms. He would begin with the destructive storm which visited Calcutta on the 5th October, 1864. On the 12th September in that year, the ship *Furness Abbey*, Capt. Roddock, in 19° 08′ N. and 88° 55′ E., had a fresh breeze from W.S.W. and S.W., and she carried that wind to 4° 44′ N. and 92° 38′ E. on the 21st. The *Victoria Nyanza*, Capt. A. J. Reed, had a strong wind from S.W. on the 21st. Sept., in 18° 17′ N., and 87° 46′ E., and she carried that wind to 0° 45′ S. and 91° 02′ E. on the 25th. The French barque *Leonide*, Capt. Martin, outward bound, approached the Equator with the S.E. trade-wind, which gradually veered to S. and S.S.W., and from 1° 59′ N. and 84 05′ E. on the 6th, to 19° 29′ N. and 88° 27′ E. on the 13th Sept., she had fresh and strong winds from the S.W. Moreover, he had prepared a chart for the 21st September, which showed that on that day eleven vessels, from the Equator to 20° N., in the Bay of Bengal, had the wind from W.S.W. and S.W., in moderate and fresh breezes. These observations proved that up to that date the S.W. monsoon prevailed in the Bay. But a change was at hand. On the 26th September, the wind in the northern part of the Bay was light from the northward, and in the southern part moderate from westward. On the 29th September there was a strong breeze blowing from the W.S.W., with squally rainy weather from near the Equator to at least 10° N., whilst in the northern part of the Bay the wind was light from the N. On the 2nd Oct. there were signs of a cyclone. To the S.W. of the Nicobars a strong breeze was blowing from the W.S.W., with squally rainy weather. In the Gulf of Martaban there was a gale from the S.E., with much rain and lightning. To the S.E. of Coringa the wind was increasing from N.E., with thunder and lightning. On the 3rd and 4th there was strong evidence of the existence of two contrary winds, the one from N.E. and the other from S.W., with a cyclone between them; but the S.W. wind was apparently overcoming the other. On the 5th, when the storm was at Calcutta, the S.W. wind had established itself over the greater part of the Bay. But this was only a temporary victory, for by the 8th the N.E. wind was blowing fresh over the northern portion of the Bay. The S.W wind, however, still prevailed farther south. By noon on the 15th the N.E. wind prevailed over the whole Bay.

He had not been able to examine the subject farther, but would return to it at next meeting. In the meantime, he thought that the evidence adduced went to show that the storm originated in the belt of calms between the N.E. trade and the S.W. monsoon.

* Paper read before the Meteorological Society of Mauritius, March 24, 1870.

CHEMISTRY

Specific Gravities of Aqueous Solutions

IN Gerlach's *Sammlung der specifischen Gewichte wässeriger Lösungen* is a large amount of information which will prove of great use to manufacturers and others who have to deal with aqueous solutions of acids, alkalies, and salts.

The first table consists of nine columns marked with letters. In column A are placed the formulæ and combining weights, according to the old notation, of the bodies dissolved, both in the anhydrous and hydrated condition. Column B contains the weight of the dissolved body in the hydrated condition, or with

water of crystallisation, which is present in 100 parts by weight of the solution. C shows the weight of the dissolved substance in the anhydrous condition. The numbers in this column may be calculated from those in the second column by multiplying by the combining weight of the anhydrous and dividing by that of the hydrated substance. Column D gives the weight of the body in the dry state, which is dissolved in 100 parts of water, and is calculated by multiplying the numbers in column C by 100 and dividing by 100—C :—

$$D = \frac{C \times 100}{100 - C}$$

Column E contains the number of atoms of the anhydrous salt in 100 parts by weight of water. The expression *atom* is here synonymous with *equivalent*. The atom of hydrogen is taken at $\frac{1}{100}$:—

$$E = \frac{D \times 100}{A \text{ (anhydrous)}}$$

F gives the volume of the solution ; 100 parts by weight of the water of the solution being taken as 100 volumes :—

$$F = \frac{D \times 100}{\text{spec. grav.}}$$

G indicates the specific gravities of the solutions. H contains the volumeter degrees, according to the scale of Guy Lussac, which correspond to the specific gravities :—

$$H = \frac{100}{G}$$

In column I are found the names of the observers, the temperature, and the references to the sources from which the numbers were obtained.

In this first table we find the various numbers corresponding to solutions of different states of concentration. In some cases the numbers are given for solutions at intervals of 1 per cent. of the salt, in others of 5 per cent., and in others of 10. The table commences with caustic alkalies, including ammonia, potash, and soda. Then follow the potassic and sodic carbonates, the chlorides of ammonium, potassium, sodium, lithium, aluminium, magnesium, calcium, strontium, barium, cadmium, and zinc, and stannous and stannic chlorides. The next section contains the bromides of potassium, sodium, lithium, magnesium, calcium, strontium, barium, cadmium, and zinc ; whilst under the iodine compounds we find potassic, sodic, lithic, magnesic, calcic, strontic, baric, cadmic, and zincic iodides. Next comes sodic hyposulphate, and the sulphates of ammonium, potassium, sodium, manganese, and iron, the double sulphate of iron and ammonium, magnesic sulphate, potassia-magnesic sulphate, and the sulphates of zinc and copper. This series is followed by sections containing potassic chromate and bichromate, hydric disodic, and trisodic phosphates ; hydric disodic, and trisodic arseniates ; nitrates of potassium, sodium, magnesium, strontium, barium, and lead ; chlorates of potassium and sodium ; bromates of potassium and sodium, iodates of potassium and sodium ; potassic ferrocyanide and ferricyanide ; plumbic acetate ; potassic and sodic tartrate ; and Rochelle salt. The remainder of the table is devoted to the acids, and includes the following :—Hydrochloric, sulphuric, sulphurous, phosphoric, arsenic, nitric, acetic, tartaric, and citric.

After the table follows a chapter discussing the relations existing between the specific gravities of equally concentrated solutions ; and three others : On the change of volume produced by solution of salts ; on the change of volume produced on the dilution of aqueous solutions ; and on the change of volume produced by mixing different solutions.

The pamphlet concludes with a table extending over 19 pages, and containing the specific gravities of solutions, in most cases from 1 per cent. to nearly the point of saturation, though in some few instances they are given at every 5 per cent. This table gives, in addition to those of the substances above enumerated, the specific gravities of solutions of sugar and alcohol. Dr. Gerlach deserves the thanks of chemists and chemical manufacturers for undertaking the tedious labour of collecting and arranging in tables the large series of numbers which are found in this pamphlet.

SCIENTIFIC SERIALS

THE *American Journal of Science* for May, 1870, contains a good article "On a simple method of Avoiding Observations of Temperature and Pressure in Gas Analyses," by Wolcott Gibbs, M.D., Professor in Harvard University.

In absolute determinations of nitrogen and other gases, accurate observations of temperature and pressure are, in the ordinary methods of analysis, necessary, and when made require subsequent calculations which, when the analyses are numerous, become rather tedious. By the following simple method these observations may be altogether dispensed with, and the true weight or the reduced volume of the observed gas, obtained at once by a single arithmetical operation.

"A graduated tube, holding about 150 cubic centimetres, is filled with mercury, and inverted into a mercury trough. Two thirds or three fourths of the mercury are then displaced by air, care being taken to allow the walls of the tube to be slightly moist, so as to saturate the air. This tube may be called the companion tube ; the volume of air which it contains must be carefully determined in the usual manner by five or six separate observations, taking into account, of course, all the circumstances of temperature and pressure. The mean of the reduced volumes is then to be found, and forms a constant quantity. The gas to be measured is transferred from the receiver in which it is collected, into a (moist) eudiometer tube, which is then suspended by the side of the companion tube, and in the same trough or cistern. Both tubes being supported by cords passing over pulleys, it is easy to bring the level of the mercury in the two tubes to an exact coincidence. The pressure on the gas is then the same in each tube. The temperature is also the same, as the tubes hang side by side in the room set apart for gas analyses, and are equally affected by any thermometric change. It is then only necessary to read off the volumes of the gas in the two tubes to have all the data necessary for calculating the weight of the gas to be measured.

As the observed volume of the air in the companion tube is to the observed volume of the gas in the measuring tube, so is the reduced volume of the air in the first—previously determined as above—to the reduced volume of the gas to be measured. This method of course applies to the reduction of any gaseous mixture whatever to the normal pressure and temperature. In practice, a companion tube filled with mercury will last with a little care for a very long time. Even when filled with water I have found that excellent results may be obtained, and that the tube will last for some weeks. Williamson and Russell, in their processes for gas analysis, have employed a companion tube for bringing a gas to be measured to a constant pressure, but the application made above is, I believe, wholly new."

SOCIETIES AND ACADEMIES

LONDON

Royal Society, May 19.—"A Ninth Memoir on Quantics." By Prof. Cayley.

It was shown not long ago by Prof. Gordan that the number of the irreducible covariants of a binary quantic of any order is finite (see his memoir "Beweis das jede Covariante und Invariante einer binären Form eine ganze Function mit numerischen Coefficienten einer endlichen Anzahl solcher Formen ist," Crelle, t. 69 (1869), memoir dated 8th June 1868), and in particular that for a binary quantic the number of irreducible covariants (including the quantic and the invariants) is = 23, and that for a binary sextic the number is = 26. From the theory given in my "Second Memoir on Quantics," *Phil. Trans.* 1856, I derived the conclusion, which as it now appears was erroneous, that for a binary quintic the number of irreducible covariants was infinite. The theory requires, in fact, a modification, by reason that certain linear relations, which I had assumed to be independent, are really not independent, but, on the contrary, linearly connected together : the interconnection in question does not occur in regard to the quadric, cubic, or quartic ; and for these cases respectively the theory is true as it stands ; for the quintic the interconnection first presents itself in regard to the degree 8 in the coefficients, and order 14 in the variables ; viz., the theory gives correctly the number of covariants of any degree not exceeding 7, and also those of the degree 8, and order less than 14 ; but for the order 14 the theory as it stands gives a non-existent irreducible covariant

$(a, \ .)^8(x, y)^{14}$; viz., we have, according to the theory, $5 = (10-6)+1$, that is, of the form in question there are 10 composite covariants connected by 6 syzygies, and therefore equivalent to $10-6=4$ asyzygetic covariants; but the number of asyzygetic covariants being $=5$, there is left, according to the theory, 1 irreducible covariant of the form in question. The fact is that the 6 syzygies being interconnected and equivalent to 5 independent syzygies only, the composite covariants are equivalent to $10-5=5$, the full number of the asyzygetic covariants. And similarly the theory as it stands gives a non-existent irreducible covariant $(a, \ .)^8(x, y)^{20}$. The theory being thus in error, by reason that it omits to take account of the interconnection of the syzygies, there is no difficulty in conceiving that the effect is the introduction of an infinite series of non-existent irreducible covariants, which, when the error is corrected, will disappear, and there will be left only a finite series of irreducible covariants. Although I am not able to make this correction in a general manner so as to show from the theory that the number of the irreducible covariants is finite, and so to present the theory in a complete form, it nevertheless appears that the theory can be made to accord with the facts; and I reproduce the theory, as well to show that this is so as to exhibit certain new formulæ which appear to me to place the theory in its true light. I remark that although I have in my Second Memoir considered the question of finding the number of irreducible covariants of a given degree θ in the coefficients but of any order whatever in the variables, the better course is to separate these according to their order in the variables, and so consider the question of finding the number of the irreducible covariants of a given degree θ in the coefficients, and of a given order μ in the variables. This is, of course, what has to be done for the enumeration of the irreducible covariants of a given quantic; and what is done completely for the quadric, the cubic, and the quartic, and for the quintic up to the degree 6 in my Eighth Memoir (*Phil. Trans.* 1867.) The new formulæ exhibit this separation; thus (Second Memoir, No. 49), writing a instead of x we have for the quadric the expression $\frac{1}{(1-a)\ (1-a^2)}$, showing that we have irreducible covariants of the degrees 1 and 2 respectively, viz., the quadric itself, and the discriminant: the new expression is $\frac{1}{(1-ax^2)\ (1-a^2)}$, showing that the covariants in question are of the actual forms $(a, \ \aleph x, y)^2$ and $(a, \ .)^2$ respectively. Similarly for the cubic, instead of the expression No. 55, $\frac{1-a^6}{(1-a)\ (1-a^2)\ (1-a^3)\ 1-a^4)}$, we have $\frac{1-a^6x^6}{(1-ax^3)\ (1-a^2x^2)\ (1-a^3x^3)\ (1-a^4)}$, exhibiting the irreducible covariants of the forms $(a, \ \aleph x, y)^3$, $(a, \ .)^2\ (x, y)^2$, $(a \ .)^3\ (x, y)^3$, and $(a, \ .)^4$, connected by a syzygy of the form $(a, \ .)^6\ (x, y)^6$; and the like for quantics of a higher order.

In the present Ninth Memoir I give the last-mentioned formulæ; I carry on the theory of the quintic, extending the Table No. 82 of the Eighth Memoir up to the degree 8, calculating all the syzygies, and thus establishing the interconnections, in virtue of which it appears that there are really no irreducible covariants of the forms $(a, \ .)^8(x, y)^{14}$, and $(a, \ ^8\aleph x, y)^{20}$. I reproduce in part Prof. Gordan's theory so far as it applies to the quintic; and I give the expressions of such of the 23 covariants as are not given in my former memoirs; these last were calculated for me by Mr. W. Barrett Davis, by the aid of a grant from the Donation Fund at the disposal of the Royal Society. The paragraphs of the present memoir are numbered consecutively with those of the former memoirs on Quantics.

"On the Chemical Activity of Nitrates." By Edmund J. Mills, D. Sc.

"On the relative Duration of the component parts of the Radial Sphygmograph Trace in Health." By A. H. Garrod.

Anthropological Society, May 19.—Dr. Berthold Seemann, V.P., in the chair. Mr. Henry F. Chorley read a paper on "Race in Music." The author, after remarking on the vast range of the subject for treatment in the compass of a single paper, proceeded to point out the difficulties that stood in the way of determining what is and what is not truly national music, one great difficulty consisting in the inaccuracies of notation. Notation being comparatively a modern art and the only means by which musical ideas can be transmitted, we are very much in the dark as to the advance made by the ancients in the art of music. Confining himself chiefly to the modern development of music, Mr. Chorley argued that new and original melody is far less common than is generally supposed. By the simple variation of *tempo*, implying some change in accentuation, a melody can be so entirely transformed as to lose its original character. Genuine, fresh, national music is, again, comparatively rare, and its character has always been most marked whenever intercourse has been the most restricted. Passing from the more limited subject of national music to the broader question of race-elements in music, the author illustrated the great distinction which exists between the Asiatic and the European development of the art; in the former it is confined to rhythm, and seldom includes beauty of sound or symmetry of form. In strong contrast to the Oriental ideas of music were cited those of the north of Europe, viz., Norway, Sweden, Denmark, and Russia. In the opinion of the author those people take the highest place as melodists. It should as a fact be noted that with few exceptions those northern airs are in minor keys, which might be taken as an expression of, rather than a protest against, the gloom of the climate and scenery, were it not that the same characteristic largely obtains among inhabitants of the torrid zone. The sense of musical rhythm seems as distinctly marked among different peoples as varieties of physiognomy; for instance, the Peninsular melodies are only characteristic when they are in triple time, the airs in common time being essentially mawkish and pointless, owing such individuality as they have to the sleepy, voluptuous delivery of the executant. On the other hand, the music of France lies essentially in the direction of squared music towards what is piquant as distinct from what is undulating. In treating of the subject of Race in Music the author could not but draw attention to a phenomenon which is of universal recurrence, namely, the demarcation not merely of race but also of sex in the art, be its stages of culture or civilisation ever so primitive, ever so mature. The absence of musical inventive genius in woman is most curious and inexplicable, and offers another signal illustration of the contradictions and inconsistencies which mark music beyond any other art. While women have achieved distinction and often great success in literature, painting, sculpture, architecture, and science, and while they are unsurpassed as interpreters of the drama and of the art of music, not a solitary female composer of originality or even of repute is known to the historical or critical observer. Mr. Dannreuther illustrated the paper by numerous examples on the pianoforte.

Entomological Society, June 6.—Mr. A. R. Wallace, president, in the chair. Mr. F. V. Jacques, of Bristol, was elected a member. A collection of insects sent to the Society by Mr. Henry Ansell, from Kinsembo, S.W. coast of Africa, was exhibited; and another collection from Tugela, Natal, was exhibited by Mr. W. Warwick King. Living specimens of *Ateuchus*, from Venice, were shown by Mr. S. Stevens; and a gynaniromorphous *Brachycentrus*, from Cheshunt, was exhibited by Mr. M'Lachlan. Communications were made by Major Munn, on the Honey-Bee, by Mr. A. G. Butler, on the possible identity of *Argynnis Niobe* with *A. Adippe*, and by Mr. G. R. Crotch on the Genera of *Coleoptera* studied chronologically (part 2, from 1802 to 1821.)

Ethnological Society, June 7.—Dr. A. Campbell, V.P., in the chair. R. H. Tiddeman, B.A., F.G.S., was announced as a new member. Professor Huxley, LL.D., F.R.S., President, read a paper "On the chief modifications of mankind, and their geographical distribution." After pointing out those physical characters which are of the greatest value in distinguishing the several modifications—such as colour, character of hair, and form of skull—the author proceeded to describe five distinct types of mankind: 1. The *Australioid*, with slender limbs, dark brown skin, black wavy hair, strong brow-ridges, and long skull; this type is found throughout Australia among the hill tribes of the Dekhan in India, and formerly in the Valley of the Nile. 2. The *Negroid*, with dark skin, black frizzled hair, and long skull; a group which includes the Negroes and Bushmen of Africa, and the Negritos of New Guinea, Tasmania, &c. 3. The *Xanthochroic*, with fair skin and blue eyes, distributed through Iceland, Eastern Britain, Scandinavia, North and Central Germany, and extending through Eastern Europe into Asia, as far as North-west India, and found also in the North of Africa. 4. The *Melanochroic*, a type with dark complexion, occupying an area situated between the Xanthochroic and Australioid peoples; and 5. The *Mongoloid*, a large and somewhat ill-defined group extending throughout Central and Northern Asia, the two Americas, and Polynesia. The paper was illustrated by a large coloured map, showing the distribution of these five groups and their sub-

divisions. Among those who took part in the subsequent discussion were Mr. George Campbell, Mr. A. R. Wallace, Mr. E. G. Squier, Dr. Ray, Mr. Luke Burke, and Mr. Dardy.—Mr. Squier exhibited a large collection of drawings, plans, and photographs of localities of interest in Peru.

Zoological Society, June 9.—George Busk, V.P., in the chair. The Secretary read some notices of the principal additions to the Society's menagerie during the month of May, and called particular attention to a deer sent home from Singapore by order of H.R.H. the Duke of Edinburgh. This animal appeared to belong to a new species, and was proposed to be called *Cervus alfredi*.—Professor Newton, V.P., exhibited a series of skins of the large falcon found in Alaska and sent to this country for examination by the Smithsonian Institution, and referred them to the *Falco islandicus* of Gmelin.—Mr. Gould exhibited and made remarks upon some skins of British water-ouzels.—Mr. R. Swinhoe read a series of zoological notes made during a journey from Canton to Peking and Kalgan. Mr. Swinhoe's remarks contained descriptions of several new species of mammals and birds, amongst which were a new hedgehog, proposed to be called *Erinaceus dealbatus*, and a new species of dwarf swan, for which the name *Cygnus davidis*, after M. le Père David, its discoverer, was proposed.—Mr. R. Swinhoe also read a paper containing notes on certain reptiles and batrachians collected in various parts of China.—Mr. R. B. Sharpe read a paper on the Ornithology of Madagascar, based upon a collection recently formed by Mr. A. Crossley, in the neighbourhood of Noce Vola, in the north-western portion of the island. Two new species were discriminated, and proposed to be called *Ceblepyris major* and *Corethrura insularis*. Two species—viz., *Bernieria crossleyi* of Grandidier, and *Ellisia madagascariensis* of Hartlaub—were likewise generically separated, under the respective names of *Mystacornis* and *Oxylabes*.—Dr. John Hawkes, F.Z.S., communicated a note on a case of *hernia ventriculi* in a common canary.—Mr. D. G. Elliot exhibited and pointed out the characters of two new species of pheasants from the province of Yarkand, proposed to be called *Phasianus shawii* and *P. insignis*; also a well-marked permanent variety of *P. torquatus* from the Island of Formosa, proposed to be called *P. formosanus*. Mr. Elliot also made remarks on the affinities of the known species of true *Phasianus*, and pointed out their geographical distribution.—A communication was read from Mr. A. Sanders, F.Z.S., containing notes on the myology of a Geckoid lizard, *Platydactylus japonicus*.—A communication was read from Mr. Gerard Krefft, C.M.Z.S., of Sydney, containing a preliminary account of the skeleton of a rare whale, probably identical with *Dioplodon sechellensis*, recently obtained in the Australian seas, near Lord Howe's Island.—Messrs. Sclater and Salvin communicated a synopsis of the birds of the family of *Cracidæ*. The authors proposed to divide this family into three sub-families—the *Cracinæ*, *Penelopinæ*, and *Oreophasidinæ*. Of the first of these twelve species were recognised, and of the second thirty-eight, while the third contained only one representative. One species of Guan was described as new, and proposed to be called *Ortalida erythroptera*.—A communication was read from Professor Barboza du Bocage, F.M.Z.S., containing a description of the young of *Pelecanus sharpii*.—Dr. A. Günther communicated an account of the species of tailless batrachians, recently added to the collection of the British Museum, amongst which was a new diminutive frog, recently discovered by Dr. Cunningham in Fuegia, and proposed to be called *Nannophryne variegata*.—Dr. J. Murie read a paper on the anatomy and osteology of the Saiga (*Saiga tartarica*), founded on examples of this mammal that had lived in the Society's Gardens. The conclusions arrived at by the author as to the systematic position of the Saiga were, that this animal cannot be well included in any of the subdivisions of the ruminants hitherto established, but constitutes a form intermediate between the sheep and the antelope.

Victoria Institute, April 25.—Rev. Dr. Thornton, vice-president, in the chair. A paper was read on "Comparative Psychology," by Mr. E. J. Worshead. The following gentlemen took part in the discussion:—Rev. C. A. Row, Rev. J. B. Ouran, Dr. C. Haughton, Mr. Reddie, Rev. Sir S. Marsh, Rev. C. Graham, and the chairman.

Brighton and Sussex Natural History Society, June 9.—Mr. Sewell, vice-president, in the chair. A paper on Diptera and their Wings, by Mr. Peake, was read, in the absence of that gentleman, by Mr. Wonfor, Hon. Sec. While wings are common to the whole order of insects, the Diptera consist entirely of two-winged flies; but instead of a second or hinder pair, they have little thread-like bodies, terminated by knobs and called *halteres*, originally considered balancers, supposed now by some to be *olfactory* organs and by others organs of *hearing*. From many points of resemblance he thought they were analogous to the hind wings of insects, and that at present their special use had not been ascertained. Besides the halteres they had also winglets (*alulæ*) which were thought to be only appendages to the fore-wings. Among the Diptera three classes of fliers were found, differing in the form of their bodies and shape of their wings; first, the slender flies, such as gnats, having long bodies, narrow wings, and long legs, but without winglets; secondly, those whose bodies, though slender, are more weighty, as the *Asilidæ*, having larger bodies, shorter legs, and very minute winglets; lastly, those like the house-fly, with short, thick, and often very heavy bodies, furnished with proportionate wings, shorter legs, and conspicuous winglets. From these circumstances it might be inferred that the long legs of the light-bodied flies acted as rudders, while the winglets of the heavier bodied flies assisted the wings in flying. The wings might be described as transparent membranous organs, consisting of two laminæ united by veins or nervures, and upon their arrangement and the form of the antennæ the distinguishing characters of the Diptera were formed. The several parts of the wings and nervures and their differences, as seen in the great groups *Nemocera* and *Brachycera*, were next pointed out, and the paper illustrated by drawings and microscopical preparations of wings.

TRURO

Royal Institution of Cornwall, May 17.—The annual meeting of this society was held in the Council-room, Truro, Mr. J. Henwood, F.R.S., president, in the chair. Mr. H. M. Whitley read a paper contributed by Sir. F. M. Williams, M.P.: "Recent Observations on the Subterranean Temperature of Clifford Amalgamated Mines." This gave the result of various observations made during the past fifty years, and, finally, those made by Captain Gilbert previous to ceasing the deep workings some weeks since. Then at 224 fathom level, being 279 fathoms from the surface, the highest temperature recorded was 123°·5; and at 245 fathom level, or 300 fathoms from the surface, the highest was 125°.

Mr. W. Pengelly read a paper, entitled "Notes on the Archæology and Geology of Devon and Cornwall." A difficulty formerly existed in relation to the Devonian series of rocks, for while in the northern part of the area over which it extended there were found fish, in the south there were only sponges and mollusks. The late Mr. Jonathan Couch discovered in 1843 some fossils which he thought fish, but which Professor McCoy in 1857 pronounced to be sponges. The matter dropped till in 1857 he himself submitted to Mr. W. H. Baily a fossil found at Hannafore point, near Looe, and it, with a number of the same kind collected, were pronounced, on the authority of Mr. Simmons and Professor Huxley, to be ichthyolitic. The next point to which he specially wished to direct attention was the rock joints, of which they had two series, one running east and west, and the other north and south, and of which the one that crossed the other was naturally the more recent. Of the age of these joints few indications had been observed. At the eastern shore of Torbay, however, where both these systems were to be observed, it was evident that they were in existence before the close of the New Red Sandstone era, because their fissures were filled with dykes of that rock. The east and west dykes were faulted and traversed by veins of carbonate of lime, which came up on either side to the north and south dykes, but did not cross them. This showed that a considerable time must have elapsed after the formation of the first system of joints before the second. He would commend this subject to the geologists of the county. Next he would refer to the lower Silurian fossils of the Dodman district. At Budleigh Salterton there was a remarkable collection of quartzite pebbles which contained fossils, of which the analogues were to be found in the rocks of Normandy. However, he objected to being beholden to Normandy if he could trace the pebbles to a source nearer home; and he should be delighted if some energetic young Cornishman would devote himself to the elucidation of these quartzite pebbles. Thirdly, whence were the flints on our western strand derived? There was no deposit of flints to the south of the Teign; the course of the shingle could be traced along the coast from the west to the east; and yet there was an abun-

dance of flints, not only in the present beaches all round Cornwall, but in the raised beaches. It would be a comparatively easy but valuable task to ascertain the relative abundance of flints at various points. It would be of still more value if any one would dredge in the Channel, and ascertain whether there were any submarine outliers of gravel from which the flints could be derived. Lastly, he would suggest an inquiry into the megalithic monuments of Cornwall. The origin of the "Hurlers" at Liskeard and the "Merry Maidens" at Penzance was unknown, and it would be interesting to collect anything relating to them which tradition yet retained.

CAMBRIDGE

Philosophical Society, May 30.—The president (Professor Cayley) in the chair. New Fellow elected, F. S. Barff, M.A., Christ's College. Communications made to the Society.—1. By Professor Miller, F.R.S. : On the Invention of the Camera Lucida by Wollaston. 2. By Mr. H. G. Seeley, F.G.S. (1) On the Frontal Bone in the Ornithosauria; with additional evidence of the structure of the hand in Pterodactyles from the Cambridge Upper Greensand. (2) Note on a new species of Plesiosaurus from the Portland Limestone.

DUBLIN

Natural History Society, June 1.—W. Andrews, M.R.I.A., in the chair. Dr. A. W. Foot read some notes on the different insects captured by him during the present spring. He remarked on the lateness of the season and on the paucity of insects coming to sugar; and in giving a list of insects taken at Kilkenny, expressed the hope that a large number of local collections would be made throughout Ireland, stating that if such were sent to the Museum of the Royal Dublin Society, they would be arranged in the cabinet of Irish insects in that collection, and thus in time material for a catalogue of Irish insects be obtained. Mr. A. Andrews took the chair, while Mr. W. Andrews read a paper on the Crustacea of the West Coast of Ireland. While it was his intention at an early meeting of the next session of the Society to give a complete list of all the Crustacea met with by him on this part of Ireland, including the minute forms, he wished for the present to mention the occurrence there of three species of *Nehalia*, of *Pagurus lævis*, *P. ulidianus*, the latter with ova, of *Pilumnus hirtellus*, *Portunus longipes*, this latter quite new to Ireland, and met with at the entrance to Dingle Bay in fifty fathoms of water, and on a shingly bottom, and of a species of *Galathea* which he regarded rather as a *Munida*. He had taken an immense number of rare minute Crustacea, also many Echinoderms, such as *Echinocyamus pusillus* living, *Spatangus purpureus*, *Ophiura alba*, and young *Echinus lividus*, or at least something very like it, at fifty fathoms depth. Further notices of all these species he would reserve for another occasion. Professor Macalister remarked on the interest of the paper, and said that from the sample of it given now, the paper promised for next session will be of great value, many of the species alluded to being rare. Professor Macalister exhibited a specimen of *Ommastrephes* from the Cape of Good Hope, which if not one of Le Sueur's species, was probably undescribed. A vote of thanks was then passed to the Royal Irish Academy for so kindly accommodating the Society with the use of their house during the past session, after which the chairman adjourned the Society until the first Wednesday in November next.

Royal Geological and Royal Zoological Societies, June 8.—John Barker, M.D., in the chair. The Rev. M. H. Close read a paper "On some Corries and their Rock-basins in Kerry;" the object of which was to demonstrate, if possible, what is still denied by some, the considerable erosive power of a corry glacier. On account of its smallness (its mean diameter being only 550 ft.) the well displayed basin in massive unfaulted rock, in the mountain hollow called Coom Keagh, a well-known glacier site near Dingle, peremptorily disclaims all the explanations hitherto suggested for such physical features, save that of glacial action. The water in the basin is 42 ft. deep, and the mean height of the rock-barrier above the water is 10 ft. The glacier must have removed at least 52 ft. of rock from the site of the basin, and doubtless more, since the rock basin is due only to the difference between the erosion at its middle part and at the rock barrier. The Rev. Professor Haughton and Professor Hull took part in the discussion on this important paper.—Professor R. H. Traquair, M.D., read a paper "On the scales of *Calamoichthys calabaricus*." He described the external hard parts of this fish, including the scales, fin-rays, and those cranial bones which have external "ganoid" surfaces, in this supplementing as well as somewhat correcting the description of Dr. Smith. Especial attention was given to the scales; their whole surface is covered with closely-set punctures, rather irregularly placed towards the centre and anterior superior angle, but assuming a regular arrangement in concentric and also radiating lines on the posterior inferior part of the scale. The microscopical structure of the scale corresponds with what is seen in *Polypterus*. The scales are of an osseous substance, with numerous lacunæ. Vascular canals enter from the attached surface, and then form a complex network which communicates by minute branches with the punctures in the external aspect. The form of the scales on different parts of the body was also alluded to, and some deviations observable on some specimens from the usual regular arrangement of the scales in oblique bands were also described.—Professor Macalister, M.D., then read some letters addressed to the late Dr. Croker respecting a singular mode of reproduction of the Marsupials. The writers were Mr. Williams, M.R.C.S., and Mr. G. T. Lloyd, of Geelong; and after asserting that all the knowledge at present existing on the subject of the reproduction of the kangaroo was erroneous, proclaimed as an important discovery that the young kangaroo was developed from a little mass of mucus which exuded at certain seasons from the nipple of the mother. The Chairman, in calling for a discussion on this correspondence, stated that the actual transit of the young animal from the uterine cavity to the maternal pouch had never yet been proved. [We cannot refrain from expressing our regret that the members of two learned societies could be found to listen to such absolute nonsense as was contained in these letters, and that a professor of zoology in an ancient university, himself a distinguished anatomist, could be persuaded to be the medium of presenting it to such or any audience. As to the remarks of the Chairman, who we think ought to have stopped the reading of the letters, need we say that they are in contradiction to the facts observed by the late Earl Derby's father, or by the present Professor Owen.]—Professor R. Ball read an interesting letter from a friend in Bristol referring to the birth in the Zoological Gardens of that city of a second litter of four tiger cubs. Of the first litter of four, only one survived; and of the present litter all the cubs were more or less malformed and delicate. In Dublin the tigress has never had any offspring, while the lionesses have been most prolific, and their cubs are uniformly perfect and healthy. The societies then adjourned to the next session.

Royal Dublin Society, May 23.—Prof. Dyer in the chair. Prof. R. Ball, M.A., read "An Account of Experiments on the Mechanical Efficiency of the Differential Pulley-block and Epicycloidal Pulley-block."—Dr. T. Emerson Reynolds read a paper "On a Series of Mineralogical Tables."

Royal Irish Academy, May 23.—The Rev. J. H. Jellett, B.D., president, in the chair. Dr. R. M'Donnell read a paper "On a New Theory of Nervous Action, as regards the Propagation of Sensation along Nerves." This memoir will be published in the Transactions of the Academy.—A paper by Mr. Hardinge was read, "On an ancient seal of the diocese of Ossory, and on some coins found near the Boyne."—The following were declared duly elected members of the Academy:—A. FitzGibbon, C.E., E. Hutchins, and John Kelly, of University College, Calcutta.

BERLIN

Royal Prussian Academy of Sciences, March 14.—Prof. Dove read a communication on the diffusion of heat in the Polar Sea, and on the cold of the early part of the present year, the latter accompanied by tables.

March 31.—Prof. Helmholtz communicated a memoir by M. N. Baxt on the velocity of transmission of excitation in the motor nerves of man, containing the results of several series of experiments.—Prof. Hofmann read a paper on substituted melamines, in which he described the following compounds—trimethylmelamine, triamylmelamine, and triphenylmelamine. He confirmed his previous supposition that the substituted melamines are not the direct products of the desulphuration of the sulphur-compounds of urea, but that this formation is preceded by that of the substituted cyanamides. Prof. Hofmann also communicated a memoir by himself and M. Otto Olshausen on the isomers of cyamuric ether, in which the authors describe the cyanætholine of Cloëz, and a series of experiments on the production of the cyanuric ethers of the methylic, ethylic, amylic, and phenylic series.—Prof. W. Peters read a paper on the affinity of the *Ctenodactyli* to the chinchillas and other groups of

rodents, in which he stated that the African genera *Ctenodactylus* and *Pectinator* differ in all essential points from the jerboas (*Dipus*), and agree rather with *Chinchilla*, and *Octodon*, or *Echinomys*, whilst they show some tendency towards the *Muriuæ*.

April 7.—Prof. Rammelsberg read a paper on the position of thallium in the series of elementary bodies. He described several salts of thallium, such as the iodates and periodates, the chlorides, bromides and iodides of thallium and their double salts, and referred to the isomorphism of the salts of thallium with those of potassium (rubidium and ammonium) as shown especially by the researches of Des Cloiseaux. He stated that although both physically and chemically thallium is a metal, it presents a combination of characters in its compounds which renders its precise location difficult. Prof. Poggendorff noticed a new form of electrical machine, upon which he promised full details at a future meeting of the Academy.

April 28.—A memoir by Dr. P. Groth on the relation between crystalline form and chemical constitution in some organic compounds, was communicated by Prof. G. Rose. The author remarked upon the failure hitherto experienced in all attempts to apply the theory of isomorphism to organic compounds, and stated that he adopted a new method of investigation, which consisted in ascertaining the nature of the change produced in a given crystalline form by the access of a definite atom or atomic group replacing hydrogen. He described a long series of experiments, which lead him to conclude that there are atoms and atomic groups, which, by substitution, alter the crystalline form of a body only in a certain direction. This change he proposes to call "morphotropism," and he indicates the different modes in which the "morphotropic force" may be modified in action.

German Chemical Society, June 13.—Prof. Hofmann has employed his method for taking vapour-densities, to control the formulæ of several organic compounds. Sulphuretted methylic aldehyde (or what has been considered as such) is $C_3 H_6 S_3$. The vapour-density taken in xylidine-vapour was found to be 70-72° instead of 69° required by the theory. The corresponding ethyl compound was found to be $C_6 H_{12} S_3$. It is more volatile than the methylic compound. Chinone (prepared from benzidine instead of aniline, the former giving a better result) has the formula $C_6 H_4 O_2$, and not the double formula which has been lately proposed for it. He then showed a fine specimen of anthrachinone prepared by Messrs. Hopkins and Williams of London.—M. Schlebusch has prepared some derivatives of camphoric acid, and of camphor, notably tetranitro-camphor.—W. Thomsen, who has lately published views on the connection of the basicity of an acid, and the heat developed by its combination with water, draws conclusions from this theory as to the basicity of silicic, hydrofluoric, and fluosilicic acids.—L. Henry described chloroiodides of ethylene, and of allyl.—A. Kekulé described the properties of crotonic acid prepared from aldehyde, from oil of mustard, and from cyanide of allyl; the latter two being identical. The former melts at 72°, boils at 184°·7 C., and crystallises in the monoclinoëdric system.—M. Daube has extracted the colouring principle of the curcuma-root. He gives to it the formula $C_{10} H_{10} O_3$, and the name curcumin.—W. Knop has published a preliminary notice of the action of sulphuric acid and alcohol on albumen.

GÖTTINGEN

Royal Society of Sciences, January 5.—A paper, by M. Max Nöther, on Algebraical Surfaces which may be represented by plane figures, was communicated by M. A. Clebsch.

January 19.—MM. W. Marmé and A. Creite communicated a paper on the Physiological Action of the Alcoholic Extract of *Cynoglossum officinale*. The authors deny that this extract acts in the manner of curare, as stated by some Russian writers; they describe its action as that of a narcotic, and state that it causes death by paralysing the respiratory centre. Dr. Rudolph Fittig communicated some further researches upon the constitution of piperic acid, in which he described several of its derivatives. Professor Wöhler noticed the analysis of the supposed meteoric iron of the Collina di Brianza, by Dr. Haushofer, who had stated that he found in it both nickel and cobalt, the presence of which was denied by previous analysts. The author had analysed a portion of this iron, and had also applied to Professor Rose for an analysis of the fragments in Berlin; no trace of cobalt or nickel was detected by them. Dr. Haushofer's analysis was probably made from a fragment of true meteoric iron.

February 16.—M. Clebsch communicated a memoir, by M. S. Lie, on the relations of reciprocity of Reyé's complex. Dr. Rudolph Fittig read a paper on Tetramethylbenzole, in which he described a new solid hydrocarbon, having the formula ascribed to tetramethylbenzole [$C_{10} H_{14} = C_6 H_2 (C H_3)_4$]. For this he proposed the name of *durole*, and he described two of its compounds, namely, *dinitrodurole* and *dibromodurole*.—Professor A. Enneper read a paper on an enlargement of the idea of parallel surfaces.

March 16.—Professor Kohlrausch communicated a memoir, by M. E. Riecke, on the replacement of a system of galvanic currents existing upon a surface by a distribution of magnetic masses.—Professor Henle communicated some zoological observations made at Naples by Dr. Alexander Stuart, of Odessa. The author described the development of new individuals in a colony of *Collozoum inerme*, which takes place by a process of gemmation, He confirmed his former statement that the cilia of *Coscinosphæra* are composed of calcareous crystals. With regard to the medusa-brood of *Velella spirans*, the author stated that all the tissues of the polypary take part in their formation, and that at an early period they possess a body cavity distinct from that of the stomach, which is afterwards filled up with connective tissue, so as to leave only the canals of the water-vascular system. He noticed the occurrence of something which he regards as a digestive passage in the *Gregarinæ* of the earthworms, and briefly described the nervous system of *Creseis acicula*, in which he found a ganglionic œsophageal ring and dorsal and ventral ganglia, each of the latter emitting nervous stems.

DIARY

THURSDAY, JUNE 23.

ZOOLOGICAL SOCIETY, at 8.30.—On the Walrus: Dr. J. Murie.—Catalogue of the Mammals of South China and Formosa: Mr. R. Swinhoe.—On a Collection of Birds from the Island of Trinidad: Dr. O. Finsch.

SUNDAY, JUNE 26.

SUNDAY LECTURE SOCIETY, at 8.—Cruelty in relation to the Lower Animals: Dr. T. S. Cobbold, F.R.S.

MONDAY, JUNE 27.

ETHNOLOGICAL SOCIETY (Extra Meeting), at 8.—On the opening of the Park Cwm Tumulus: Sir John Lubbock, Bart.—On the opening of Grim's Graves, Norfolk: Rev. Canon Greenwell.—On the discovery of Platycnemic Men in Denbighshire: W. B. Dawkins and Prof. Busk.

LONDON INSTITUTION, at 4.—Botany: Prof. Bentley, F.R.S.

WEDNESDAY, JUNE 22.

SOCIETY OF ARTS, at 4.—Anniversary Meeting.

BOOKS RECEIVED

ENGLISH.—Woolhope Naturalists' Field Club: Report for 1869.—Remarks on Synonyms of European Spiders, No. 1: T. Thorell (Williams and Norgate.)

FOREIGN.—(Through Williams and Norgate).—Bericht über die Fortschritte der Anatomie und Physiologie im Jahre 1869: Henle, Meissner und Grenacher.—Die Ophthalmologische Physik und ihre Anwendung auf die Praxis: Dr. H. Gerold.—Nouveaux éléments de Physique Médicale: Desplats et Gabriel.—Die Bierbrauerei und die Dickmaischbrauerei: P. Heiss.—Etude sur les Diatomacées: Ch. Manoury.—Die Land und Süsswasser Conchylien der Vorwelt: Dr. Sandberger.

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