THURSDAY, FEBRUARY 20, 1872

THE COAL MINE COMMISSION

MUCH misapprehension of facts, and much ignorance of scientific principles are, it is to be feared, the most prominent characteristics of the knowledge possessed by most people regarding the nature and mode of occurrence of colliery explosions. Pompous platitudes about the carelessness of the men, and windy panegyrics on the virtues of the safety-lamp have been freely pronounced times without number during the last two generations of mankind. Committees on accidents in mines have met, discussed the question, and separated; inspectors of mines have been appointed, stringent regulations have been framed and enforced which bind both employer and employed, the public have listened to the tale of woe, have wept over the fate of the hapless miner, and have subscribed hundreds of thousands of pounds in aid of his widows and orphans, and yet with all this, and more untold, the history of the past eighteen months would seem almost to indicate that we are as far as ever from a true solution of this much-agitated question.

Can science, then, do nothing? is her hand unable to save even a moiety of the lives that are being constantly cast away before her very eyes? To this question, which is very often asked, the reply is simple. Science can undoubtedly solve the question, but she must do it in her own way; she must approach it with the sap and mine of investigation and research; she must have her own time to do it, and above all, she requires to be encouraged. Scientific men have, no doubt, sometimes turned their attention to the subject without much apparent result, but their efforts have, as a rule, been of short duration, and they have too often met with discouragement, active opposition, and incredulity. We have only to point to Dr. Birbeck's letter to the South Shields Committee (1843) at p. 48 of their report, and to the report addressed to the committee of the coal trade by the special committee appointed to take into consideration the report of Lyell and Faraday on the Haswell Colliery explosion to exemplify what we mean. We wish we could say that there are no examples of the same kind at the present day, but unfortunately we are unable to do so.

Putting aside these gloomy thoughts, however, we are rejoiced to see science so well represented on the Commission just appointed to inquire into and report upon this matter. We had always imagined it to be a purely scientific question, having almost no relation to the art of mining in its stricter sense. We confess that ours is not the common view, but that, on the contrary, it is usually supposed that if practical men, including inspectors of mines, are unable to prevent explosions, nobody else need try to do so. We cannot accede to such a proposition; nay, more, we protest against it. If disasters of this kind could be stopped by hedging round the collier and his employer with an impenetrable palisade of instructions and restrictions, then we are bound to acknowledge that the practical man with a legal turn of mind could do it effectually. This method has been tried, however, or rather, it is now in force, and we see its results.

The new Commissioners will, no doubt, seek to acquaint themselves to some extent with the work of their predecessors and contemporaries; they will also weigh carefully the opinions that will be expressed before them, and take account more of the facts and reasoning that can be adduced in support of such opinions than of the age and position of those who express them. For example, they will not come to any conclusion regarding the influence of fluctuations of atmospheric pressure and temperature upon the issue of fire-damp from coal until they have obtained a sufficiently large and well-authenticated mass of information to enable them to arrive at sound conclusions. The data which have been collected and tabulated by Messrs. Scott and Galloway and others are amply sufficient to show that the matter is worthy of further careful consideration, but they do not extend over a lengthened period of time, and we venture to say that their weight would be greatly augmented by a further addition of similar facts. As to the use of fire-damp indicators (and by this we suppose are meant instruments for giving notice of the occurrence of outbursts of gas), we fear that their importance has been absurdly exaggerated and that they are brought forward by those who know nothing about mining. It will be for the Commissioners to inquire, however, whether there are any mines in existence in which they could really be of any service. The systematic observation of the air in mines may be taken, we suppose, to apply both as to its quality and quantity. As regards its quality, it will have to be determined whether observations of the height of the cap on the lamp-flame reduced to small dimensions, such as those described by Mr. Galloway in the *Proceedings* of the Royal Society, 1876, are sufficiently accurate and reliable, or whether it will be necessary or expedient to bring into use some kind of instrument like the *grisoumètre*, by means of which a rapid analysis of the air can be made. As regards its quantity, on the other hand, it may be suggested that if the velocity and drag of the currents could be continuously recorded in a manner similar to the pressure and temperature of the air at the meteorological stations, a check might be kept upon the ventilation, and changes in its efficiency could be ascertained by a mere inspection of the curves. Improved methods of ventilation and illumination are important objects. Powerful machines are now being erected at most new collieries, but these alone cannot prevent explosions, if we may judge by the case of Abercarne, which was thoroughly well equipped in that respect. The Commissioners must beware of being drawn into the belief that some advantage can be gained by forcing the air into the mines instead of driving it out by way of keeping the gas in the coal, as it were, and thereby escaping the effect of atmospheric influences. They themselves will be able to balance the slight gain of pressure that could be obtained in this way with the normal pressure of gas in the coal. It will be well worth their while, however, to consider the means that have been suggested of late years for producing an artificial barometric depression in the workings with the view of extracting the gas from the open fissures, old works, and even to some extent from the face of the coal, when the men are out of the mine, and then sweeping it out by admitting air freely through the downcast shaft, and at the same time continuing to work the

exhausting machine. As to ourselves, we thought the idea chimerical when it was first brought under our notice; but after reading a pamphlet on the subject by M. Francis Laur, of Saint-Etienne, we were forced to change our mind. The kind of safety-lamps that ought to be employed will form a subject of warm debate, but we can confidently assure the Commission that if they separate without recommending the universal adoption of lamps that will not continue to burn in an explosive atmosphere, and of more perfect locks than the present ones, they will have failed to satisfy one of the most important requirements of the time. We say this without prejudice to the means that may be thought best for examining the workings for accumulations of gas: we refer to the lamps supplied to the common workmen. The employment of explosive agents in getting the mineral, and other particulars relating to mines and mining operations include, we think, the most important of all the questions that will come before the Commissioners. What is coal-dust? and what bearing has it on the subject? If the presence of coal-dust is, after all, the cause of all these great explosions, and if, as has been once before asserted in these pages, great explosions never happen in damp or wet mines, but always in dry ones containing coal-dust, then surely the Commissioners would be but dallying with the subject if they omitted to carefully weigh all the facts that have been adduced in favour of this hypothesis. They will have to turn to other sources, however, than the reports of the inspectors of mines for information; and they might do worse than consult the report drawn out by M. Haton de la Goupillière of the doings of a similar commission appointed by the French Government in 1878, under the title of *Rôle des Poussières de Charbon*, in which they will find it alluded to, and an historical account given of the steps that have led to our present knowledge regarding it. Otherwise the literature of our own country is not quite so sterile in this respect as it was three years ago; but doubtless the Commissioners will provide themselves with all the most recent information.

The dangers due to the use of explosives in mines are of three kinds: firstly, the shot may ignite an accumulation of gas directly; secondly, it may effect the same thing indirectly by driving the flame of a safety-lamp burning in the accumulation through the meshes of its wire gauze cylinder; thirdly, the sudden rush of flame and the violent disturbance of the air caused by a blown-out shot (that is to say, one which expels its tamping without bringing down or even breaking the rock) may raise and ignite the coal-dust in front of it, and more especially if it is directed towards or parallel with and near to the floor. In the last case the flame has been often known to extend to a distance of thirty, forty, and even eighty yards from its origin, and such a disturbance taking place under favourable conditions is quite sufficient to initiate explosions such as those of Blantyre, Haydock, Abercarne, and Dinas, in which close upon a thousand lives have been lost within the last eighteen months. When we add that each of these mines was very dry and contained plenty of coal-dust, and was not known to contain more than insignificant accumulations of fire-damp, quite insufficient to account for a tithe of the extent and violence of the explosions, we have said enough, we think, to make it apparent how pressing is this matter.

Blasting operations can be safely carried out in any mine if the shots are not fired near explosive accumulations, if the lamps are of such a construction that they cannot burn in an explosive atmosphere, and if the mine is a damp one. It is easy enough to provide the two first requirements, and it is obvious that by plentifully watering the roadways we can turn a naturally dry mine into a damp one and avoid danger such as we have described from blasting, as well as localise explosions of fire-damp. We have seen it stated in a footnote at p. 661 of the last number of the *Bulletin de la Société de l'Industrie Minérale* that dusty mines, which are at the same time well ventilated, may be watered frequently without obtaining permanent humidity. Fortunately, however, we are in a position to point to an example which has come under our own immediate notice, of an extensive mine in which the workings are kept damp throughout their whole extent by a constant application of water. In the case to which we refer the daily output of coal is 800 tons, the temperature of the workings is between 70° and 80° Fahr., and the amount of air passing into and out of the mine is between 80,000 and 90,000 cubic feet per minute.

In conclusion we are eminently satisfied that science is so well represented on the Commission; and if its various members will pull together like a well-balanced team, we anticipate the happiest results from its researches and labours.

KINGZETT'S ANIMAL CHEMISTRY

Animal Chemistry; or, The Relations of Chemistry to Physiology and Pathology. A Manual for Medical Men and Scientific Chemists. By Charles Thomas Kingzett, F.C.S. (London: Longmans, Green, and Co.)

FOR many years the want of a good manual of physiological chemistry or animal chemistry in the English language has been a standing reproach to English science. The causes of this want are not far to seek. Physiology has not many votaries in England, and physiological chemistry, being in interest one step farther than physiology from the verge of medical practice, has still fewer followers. The number of possible writers of a text-book of animal chemistry has, therefore, been small; and, among them, the number of men whose capability and opportunities for such an undertaking might justly have led them to hope for a successful issue to their labours has, it is needless to say, been smaller still. The qualifications to be looked for in one who attempts the task of writing such a manual are indeed not slight. He must be a thoroughly trained chemist whose judgment has been much exercised in the appreciation of chemical questions; he must be a physiologist with a sound and direct knowledge of most of the practical methods of physiology; he must be an anatomist who is fairly well acquainted with the microscopic structure of animal tissues; and he should have some insight, exact if not special, into morbid processes and pathological states. We need not wonder, then, that the labourers have been few.

The absence of any very recent English work of the kind does not lighten the difficulty of writing one; but the disadvantage of this absence is not so great as it might at first sight seem; for on the Continent there are text-books which in case of need might have served as a standard or lay-figure.

The difficulties of the task have, therefore, without a doubt, been many; but the task itself should not have been hopeless or ungrateful. English workers in physiological chemistry have at present to betake themselves to Hoppe-Seyler, Kühne, Gautier, Gorup-Besanez, for the chemico-physiological facts they stand in need of. English students have to make do the brief sections on Animal Chemistry—admirable, but of necessity imperfect and categorical—contained in the English text-books of physiology. Hence an English book specially devoted to animal chemistry, if at all exhaustive, accurate, and modern, would be likely to bespeak for itself a hearty welcome, and a disposition to extenuate its shortcomings.

Such were the prospects, unfavourable and favourable, of an attempt to fill up the book-shelf of English workers in natural science by a manual of animal chemistry. We turn to Mr. Kingzett's book, and, after a careful and reiterated perusal of it, we can say that never was attempt so rashly undertaken. We had expected a sound, if modest, substratum of physiological knowledge, and we find slipshod notions and the speculations of the amateur. We had expected apposite illustrations from pathology, and we find, in most cases, trivial and meaningless references to disease. We had expected a complete and careful account of the more purely chemical portions, and we find a degree of imperfection which sends us back with thankfulness to the chemical sections of Foster and Hermann.

Nor is this all. The book is styled a book of animal chemistry, and we therefore expected animal chemistry; but in addition to the sections so called we find scattered here and there reflections on life, character, and the morals of scientific work which, even were they not mere platitudes, would be utterly out of place in a work like this.

These strictures may seem severe, but they would not be wholly unexpected by any one who had read Mr. Kingzett's preface. He says:—"For four years I was occupied with the practical study of subjects comprehended in the following chapters, and during the whole of that time there were no fluctuations in the success attending the labours in which my services were involved. . . . . It was therefore a matter of sincere regret with me that circumstances (which are said to be stronger then men) ultimately necessitated the discontinuance of my connection with work which had given me so much real pleasure." Then follows a page or so of reflections on the pleasure to be derived from original investigation; comparisons of the "scientist" and the "sentimentalist;" and so forth. "It was natural, then," he continues, "that, having experienced so much pleasure, I should be moved with equal regret in resigning the practical study of physiological chemistry; and in order to complete a well-remembered but brief connection with this subject, I determined to attempt a task which should prove of service to scientific men, namely, to collect and systematise, as far as could be, all the trustworthy work on record in relation to animal chemistry, so far as it concerns the human body." We submit that four years' practical work at a subject like animal chemistry, be the success of the worker never so unfluctuating, is hardly warrant enough to undertake that which taxes the matured judgment even of a master, viz., the making of a useful and comprehensive text-book. Nor do we perceive that Mr. Kingzett's desire to signalise his departure from the field of chemico-physiological research adds any urgency to the warrant. We hope to show in the sequel that this prefatory confession on the part of the author, of practical unpreparedness for the task he had set himself to do, is fully borne out by the internal evidence of the book.

Mr. Kingzett does not profess to have included any account of the practical methods of the science. This, while it much lightens the labour of writing the book, is, we think, doubly to be regretted; because the book is to be read by medical men, who are not supposed in every case to remember chemical methods, and by scientific chemists who cannot be expected to know, for example, the modes of practising fistulæ, or rapidly removing blood from brains intended for analysis.

Mr. Kingzett's haphazard preparation for his task is well displayed in his seeming ignorance—not of the latest, but even of the penultimate—advances of the chemistry of physiological processes. Thus, while treating of peptones, whether in this part (p. 63) or on p. 386, Kühne's well-known and suggestive researches on the action of the digestive juices on proteids are inexplicably omitted; and nowhere, indeed, is the formation of peptones and their relationship to the albuminous bodies attempted systematically or adequately to be discussed. In treating of pancreatic juice the beautiful and conclusive work of Heidenhain on the production of the active ferment—a subject surely of the first chemico-physiological interest—is not once referred to, and indeed, by implication, ignored. (Cf. p. 70, where the preparation of extracts of pancreas is briefly described without any caution being given as to the time the pancreas should be let stand before being used.)

The inaccuracy of the author may be illustrated by a reference to pp. 49 and 60. There the effects of alkalis and acids of various strengths in amylolysis and proteolysis are mis-stated, and the important inferences from the facts altogether ignored.

Let us now turn to the chapter on the blood in Part III. Here, if anywhere in the book, we should expect to find completeness and the traces of careful work. On the contrary, on turning up Coagulation (p. 144)—the much-investigated, if not best-understood, process of the blood—we find the phenomenon itself imperfectly stated, the retarding influence of alkaline salts described without any quantitative conditions being given, and the theory of A. Schmidt discussed so slovenly and unintelligently that the important *fibrin-ferment* is nowhere directly treated of, but only implied (p. 146), if, indeed, it is not confused with paraglobulin. (See p. 146, the first paragraph, and p. 144, the second paragraph: the various statements taken together will, undoubtedly, bear such an interpretation.)

The blood as a respiratory tissue fares no better (p.

165). What are we to think of a manual of animal chemistry in which the author treats of the gases of the blood in mere general terms without reference to quantities? or what of one in which the author, among the spectroscopical properties of hæmoglobin, forgets to mention the shortening of the spectrum and the situation of the absorption-bands, or even the chemical method of deoxidation? What are we to think of the judgment of an author of such a manual who refers only to Bert and Fernet among those who have studied the affinity of hæmoglobin for oxygen (p. 166)? And what of the erudition of one who considers the following statement (p. 167) a sufficient discussion of the liberation of CO_2 in the lungs?—"It is easy to understand how the free carbonic acid is liberated, but not so simple to explain the liberation of that part previously in combination with alkaline bases. Thudichum supposes that when the venous blood reaches the small breathing cells the hæmato-crystalline is partly oxidised into what he calls hematic acid, and this, passing into the serum at the same moment, decomposes the carbonates in the blood, setting free carbonic acid, which, with the watery vapour, escapes through the lung tissue into the respiratory passages."

The salts of the blood are dismissed with bare enumeration.

But it is in the section on Food and the oxidations of the body (in Part II.), that the author discovers the appalling inaccuracy of his physiology. In many statements he seems to assign great importance to oxidations occurring in the blood and even in the lungs. Thus on p. 152 he speaks of "alcohol which must be placed side by side with fat as a respiratory food or substance which admits of oxidation in the lungs." Again (p. 154), "From the fact that oxidation in the lungs is a process of combustion and the source of muscular power, the foods which undergo this process are termed heat-producers; but we shall see presently that it is by no means clear that blood oxidation is attended directly with the evolution of animal heat": (he is here alluding to certain views of a Dr. Hake to be immediately referred to). In other parts of the book, also, the same exaggerated importance seems to be attached to oxidations in the lungs and blood. Thus, at p. 321, he inclines to the view that "the cerebro-spinal system does not generate its own force, but derives it through the chemical changes of the lungs." See also at p. 463, where a similar statement is included in the chapter on "Character." And finally, on p. 198, speaking of the seat of production of urea, the author says that "more modern researches tend to show that vitality consists more in the changes occurring in the blood, and that these changes may result in the direct production of urea."

These statements are clearly made in the spirit of those who hold that the interior of the blood-capillaries is the arena of oxidations, if they do not indeed take us back to the view of Lavoisier, who considered the lungs to be the heating-furnaces of the body. The latter view, we need hardly say, was long ago given up: the former is not seriously advocated by any recent physiologist. The lungs and the blood, like most of the organised tissues, doubtless suffer oxidation in the performance of their functions; but the degree of it is unimportant as a source of heat compared with the universal oxidation of other active organs. Had the author adhered throughout to the view under the influence of which the above statements were set down, he would at least have escaped the charge of inconsistency. But this was hardly possible. In the course of his reading and extracting among modern papers for the purposes of this book, he could not but meet references, direct or implied, to the generally received doctrine of the origin of animal heat in the functional oxidations of tissue-cells; and we therefore find that, side by side with the false, the true doctrine is taught.

But, notwithstanding that Mr. Kingzett's physiology, even at a point which peculiarly affects the chemist, is unsound and wavering, he yet ventures to enlarge upon matters of mere speculative interest which have but a superficial connection with his subject. We shall quote the author's own words at the page where the subject is most fully dealt with, though by no means the only page where it is to be found. We are very sorry we cannot give the whole of it. The author is citing in his own words—and citing with approval—the views of Dr. Thos. G. Hake, M.D., F.C.S., which are contained in a paper entitled "On Vital Force: its Pulmonic Origin and the General Laws of its Metamorphoses," 1854 and 1867. "He (Dr. Hake) believes that the chemical changes as they occur in the blood system, and comprised in the act of oxidation, do not result in the evolution of heat, but force, which becomes electric by the agency of the blood corpuscles; and it is certain that this is perfectly consistent with what we know of cell-life. On this hypothesis, the blood-cells form chains and conductors for the electric current thus generated, and this is subsequently metamorphosed into heat at every point of the system. On reaching the cerebro-spinal centres it becomes vital force—another name for electric force—and this becomes eventually heat, namely, when it is transmitted to enable the consummation of vital acts, such as sensation, muscular motion, or secretion. Faraday and Du Bois Reymond, and hosts of other experimental inquirers, have insisted on the identity of electrical and vital force, and the experiments of Du Bois Reymond in particular, go to prove that nerve force is only electric force manifested through media not met with out of the living bodies." . . . "Our author even goes further, and with consummate skill, reasons that when this cerebro-spinal force is united in action within the same organic medium with other forces influencing us from without, viz., light, sound, heat, &c., new results are attained, and phenomena of sense and intelligence are observed." Why, he goes on to ask (whether the question is Mr. Kingzett's own, or only Dr. Hake's, endorsed by Mr. Kingzett, is not clear), why, in anæmia, does the brain lose somewhat of its intense vital force? "Because," he answers, "the source of vital force, viz., blood oxidation, is interfered with."

We have merely to add, before leaving this section, that, as a matter of course, the fine investigations of Prof. Hermann into the chemical changes in contracting muscle, upon which so much of our knowledge of cell-function in its chemical aspect is based, seems to have eluded Mr. Kingzett's eye altogether.

Part V. Mr. Kingzett heads "Chemical and Philosophical Subjects." We shall say nothing further respecting

the chemical part; for a treatise having the pretensions of the book we are reviewing, it is notably incomplete. English students and medical men who wish to inform themselves in the chemistry of the animal tissues will find far more to their purpose in Prof. Gamgee's annotated edition of Hermann, or Mr. Lea's Appendix to Foster, than they will find in Mr. Kingzett's Manual.

The last chapter but one of the book is devoted to a discussion of "Character." This, not being a chemical subject and not a physiological one, we presume Mr. Kingzett includes under the title "philosophical." Why Mr. Kingzett should select "character" out of the multitude of extraneous subjects; why "character" should be called specially a "philosophical" subject; and why it was deemed advisable to serve up scraps of philosophy at all in a "Manual of Animal Chemistry;" are difficulties which at once arise in our mind as we peruse the list of contents, and which are nowhere fully explained on closer inspection of the book. It is true that when we come to find that by "Character" Mr. Kingzett does not exactly mean character, but the whole mental and moral nature of man and its, at present, inexplicable connection with his physical nature, the difficulties recede if they do not diminish. They are certainly not entirely effaced. If the pure physiologist is content for the present to leave such subjects to the psychologist, the chemist must recognise, when he takes them up, that he does so quite gratuitously. But whether or not it is expedient to undertake discussions on psychology in chemical books, it is at least expedient, if they are undertaken, that they should be sensible and to the purpose; that they should not be encumbered by commonplaces or crude analogies; and that they should be got over as quickly as possible. Although it is a pity to disturb the order of Mr. Kingzett's reflections with the scissors, only space is granted us for a paragraph or so. They shall be neither worse nor better than the rest; and we strongly advise those readers who are in search of amusement to borrow the book and read the whole chapter.

He begins: "Character is almost universally regarded as something apart from the body of man himself; something for which man is individually responsible, something which, born with man, is developed and cultured into maturity by education and training, be that mature state one for evil or one for good." Mr. Kingzett does not appear to believe this, whatever it may mean; for he continues by way of antithesis, "Let first causes be what they may, and so also let us hide our face from the infinite future and regard man as an intelligent machine, complete, so far, in himself." This resolution having been taken, the difficulty of justly judging men's thoughts leads up to a magnificent simile: "And thus man never understands his fellow-man aright; he picks out a few crystalline threads of an individuality; he sees a few bright or black bands in the spectrum of his neighbour's life, and without touching the colloid mass which will not crystallise, and being blinded to those parts of the spectrum which are not revealed (*sic*), man judges his fellow."

The characteristic of man among living animals is then summed up in the following startling epigram: "In short, man is a cerebrating creature, as the cow is a ruminating creature;" and we immediately afterwards learn that he cannot help cerebrating. Nor, it appears, can he help being a genius—or the reverse—if his brain-cells are fitly formed and he has been judiciously trained,—"and it is quite true that brain-cells do differ in form and composition just in a similar sort of way (!) as lungs and hearts differ."

This naturally leads to the question of moral responsibility, and the difficulty of the materialist is thus stated: "Man, the result [*i.e.*, 'of a predetermining influence in the very fœtus'], steps on to the platform of life in some measure at least an automaton. He is born of others, and finds himself with a head upon his shoulders, but the quantity and quality of brain-matter in the head is not ordained of himself. He may be a genius; but, horror! he may prove a fool!"

We then reach what appears to be the *raison d'être* of the chapter, viz., a conclusion which however nowise follows from any premisses before stated: "Thus even mundane chemical science has a part to play in the *rôle* of what poor mortals call their souls; it has something to do with every poeism (*sic*) originating in the mind of the poet, with every transcendent hope of the philosopher, with the logic of a Mill, and the teeming intelligence of all."

Mr. Kingzett is then arrested by the thought that all the body, brain-cells included, are elaborated from food—a thought which leads him to exclaim, "Eat, drink, and be merry, for verily that which we eat and drink takes part in that with which we think!"

This is Mr. Kingzett's treatment of "character" as a philosophical subject! We can only say, as Dryden once said in a criticism of a play of Elkanah Settle's, "I am mistaken if nonsense is not here pretty thick sown." We challenge any one to find us five such pages of silly reflection and irrelevant twaddle in any other seriously-intended work.

At the end of the book there is an "Index of Authorities Quoted"—not, of course, the Index of the book. Turning up the K's, we find Mr. Kingzett's own name, and under it we discover that Mr. Kingzett is an "authority" on Character—the reference to the book being to p. 462, the very chapter we are discussing. As it nowhere appears that Mr. Kingzett has, in other places, treated of this subject, we have the happily rare spectacle of an author endeavouring to take time and the critics by the forelock by writing himself down an "authority" ere he knows his book will live. Sure self-complacency never touched a loftier pinnacle!

After this, a good anti-climax might have been regarded as hopeless; but Mr. Kingzett has achieved one. He closes his book with a list of "Suggested Matters for Research," in the hope and belief (as he tells us in his preface) that they may be a guide to the "scientific chemist." The "scientific chemist," if he has but a smattering of physiology, will know how to shrug the shoulder at such puerile, general, and useless suggestions as the following:—

"(1) The chemical composition and formula of ptyaline; its chemical relationship to albumin; a proper explanation of its ferment-power, and a better study of its general nature."

"(7) An explanation of the oft-recurring deposition of biliary matters near the pyloric end of the stomach."

"(18) The complete composition of lymph, chyle, and blood."

"(19) Particular studies of the blood-corpuscles."

"(40) Prolonged studies of the physics of the body directed particularly to work out the history of the force generated in blood oxidation."

OUR BOOK SHELF

The Patentee's Manual. By James Johnson and J. Henry Johnson. Fourth Edition. (London: Longmans and Co., 1879.)

THE law relating to letters-patent for inventions, as at present administered, has been the growth of one short sentence in a declaratory statute passed in the twenty-first year of the reign of James I. (A.D. 1623), by which the Crown was restrained from making extravagant or oppressive grants of monopolies. The history or details of patent cases may often form an interesting subject of inquiry for the scientific reader; for although men of the highest intellect may be content with the discovery of general laws, and may leave their useful application and development to the crowd of humbler followers whose only power consists in the exercise of mechanical ingenuity, yet it cannot be denied that the successive steps which have been made in the steam-engine, in the electric telegraph, in machinery for spinning, weaving, or sewing, for manufacturing paper, or for printing a newspaper, may each in turn afford matter of considerable interest to a philosopher whose imagination is wearied with an endeavour to trace the fantastic excursions of a molecule, or to carry his dynamical laws into new and unexplored regions.

A book which shows the manner in which the property in inventions is dealt with in our Courts, and which, in order to accomplish its object, must of necessity review the various cases in an historical and logical order, affords, in a small compass, an epitome of much valuable learning. It is remarkable that the first patent case of any importance involved the validity of Arkwright's invention of machinery for drawing out and spinning cotton (A.D. 1785), while the second occurred ten years later, and related to the invention of the separate condenser of a steam-engine by James Watt. Since that period a number of distinct steps in the useful application of physical or mechanical laws have successively passed the ordeal of judicial inquiry, and those who take up the volume before us will find a reference to such matters as Wheatstone's telegraph, the hot blast for smelting iron, the interlocking of railway points and signals, the operation of currents of air between the grinding surfaces of mill-stones, the combing of wool, the laying of submarine telegraph-wires, &c., and so on in a list which appears almost interminable.

But although the variety of subject-matter may be great, the principles which govern the cases are few and easily comprehended, and, in reading the statements of principles laid down by Chief-Justice Tindal and other judges who have moulded our patent law into a coherent form, the thought may arise that the purely scientific writer who is composing his manual for the use of students might with advantage borrow something of power of style and of clear logical exposition from the lawyer, who is popularly believed to be tied down and hampered by the jargon of technical phraseology.

The book now under notice has already passed through three editions, and the authors have enlarged it by the interpolation of recent cases, as well as by the addition of new chapters. It is not within the scope of this journal to examine such a treatise from a strictly legal point of view, but we should describe it as exhibiting abundant evidence of being the work of writers who are practically engaged in professional pursuits. One important appendix consists of a digest of the patent laws in force in foreign countries, and in the body of the work there is a chapter on the "oppositions to the grant of patents," which suggests many melancholy thoughts to the sanguine inventor, and leads one to hope that some improvement of the enactment of 1852 will be conceded at an early period. In conclusion we have only to say that the book has fairly earned the circulation which has carried it to a fourth edition.

T. M. G.

A Manual of the Carbon Process of Photography, &c. By Dr. Paul E. Liesegang. Translated from the German by R. B. Marston. With Illustrations. (London: Sampson Low, Marston, Searle, and Rivington.)

WHEN, forty years ago, Mungo Ponton discovered that a sheet of paper, moistened with a solution of potassium dichromate, became darker when exposed to the rays of the sun, he made the first of a series of experiments which have led to the discovery of a method of rendering photographic pictures as permanent as engravings made in printing ink, though the completion of the work to a point at which it could fairly be said to be capable of competing with the well-known silver chloride print was not made till nearly thirty years afterwards, when Swan, by an admirable series of inventions, made it a practical means of producing prints.

In the history of the long struggle with nature which has produced so great a result every Englishman has reason to be proud, for it may be fairly said that the world owes the process from first to last to English workers. The process is now worked on an immense scale in this country by the Autotype Company and others, while another branch of the same stem has developed into the well-known Woodbury-type system of press-printing. Notwithstanding, however, the success of the process in its original home, we are somewhat deficient in connected accounts of it, most of the English publications on the matter being, like the autotype manual, confined to working details of the methods in use. We therefore welcome Dr. Liesegang's work as attempting something more than this, and presenting what is really a most interesting account of the whole subject, interesting, indeed, to any one who has a taste for well-written scientific technology, and apart from its value as a manual for actual working details. In one respect, indeed, the carbon process has all through been singularly fortunate. It seems, from the first, to have fallen into competent scientific hands, and to have escaped the dreary round of mess and muddle experimenting which is so characteristic of the history of the collodion negative processes, and which reminds one of nothing so strongly as of the story ascribing the invention of a certain process for the purification of sewage to its inventor going into a laboratory and taking down bottles at random, to the number of some half dozen, adding their contents to a sample of sewage, and patenting the mixture. From this misfortune the carbon process has been free, and Dr. Liesegang has been able to make its history instructive and interesting; he has given clear and precise accounts of the processes in use, and we note that he has kept well up with the latest improvements, while the illustrations are well and clearly cut. The popularity of the work in Germany has caused no less than six editions to be demanded.

It would be unfair to close this notice without a word of praise to the translator, who, in a modest note, states that his share of the work was done in leisure hours. We can only wish that he will continue, as he has begun, to introduce sterling foreign technical works to the public in as vigorous and correct English as that in which he has dressed Dr. Liesegang's little book.

R. J. F.

LETTERS TO THE EDITOR

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

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

The Gulf-Weed (*Sargassum bacciferum*) a Means of Migration for Fishes and Marine Invertebrates

OWING to the October number of NATURE having been mislaid, I have not had an opportunity until lately of seeing Mrs. Merrifield's remarks upon Gulf-weed which appear in vol. xviii. p. 708, where the Bermudas are alluded to as a locality where this species grows *in situ*.

Having during my several visits to those islands of late years paid some attention to the Sargassum and its inhabitants, perhaps the few facts I am in possession of may prove interesting to botanists, and those who study the geographical distribution of marine animals.

The Bermudas, being situate within that somewhat circular area of the North Atlantic, formed by the currents of the Gulf Stream, the North African, and equatorial currents, within which exists that vast accumulation of weed known from the time of Columbus to the present day as the "Sargasso Sea," afford excellent opportunities for studying the plant in its floating condition, and also adherent in its natural state to the reef. During the winter months the prevailing gales, which are generally from south-east to south-west, bring to the islands large fields, as well as isolated patches, of the Gulf-weed, which prove a great boon to Bermudan farmers, who, but for this ocean waif, would often be minus manure sufficient to raise their root-crops with. To an observer a field of weed coming in from sea presents a somewhat variegated surface as regards colour, the major portion of it being of a dark brown, interspersed with spots and patches of light yellow. On closer inspection, these masses of floating weed are found to be inhabited by various species of pelagic and littoral crustaceans, particularly a small light brown crab, having a blotch of white on the carapace. Here and there the eye rests on a little pearly-white object, the well-known shell of that almost unknown cephalopod, *Spirula prototypus*, of Peron. The pretty purple shell of *Ianthina communis* is also to be seen, as are the singular forms of those truly oceanic acalephs, *Valella communis* and *Physalia pelagica*, which occasionally occur in large numbers, as they did during a heavy southerly gale on April 16, 1861, when countless myriads were literally wrecked upon the shores, together with the shells and rafts of Ianthinæ. About the margins of these floating fields, which are of some depth, may be seen various species of fishes, most of which have, no doubt, accompanied the fields, and lived in them, as game would do in a preserve where food and shelter are found. There is one species of fish which, above all others, seems to belong to the Sargassum, viz., the Marbled Angler (*Antannarius marmoratus*), which, from its peculiar arm-like pectorals, is specially fitted to rest upon the weed. Here it makes its wonderful nest amidst the mass, suspended by means of those silk-like fibres, which prove amply strong enough to support the large bunches of eggs, which hang like grape clusters within their orbicular case. These nests are occasionally to be found, but cannot be considered common; and only a few have been obtained from the weed on the Bermudan shore.

There is hardly a doubt that it is from this fish-preserve in mid-Atlantic that those tropical and semi-tropical forms which occur incidentally at the Bermudas, Azores, Canaries, Madeira, and also on the east coast of America, come, for I have frequently obtained from these masses of gulf-weed, species which are not recognised as Bermudan, and would probably never have visited the island waters unless under the friendly shelter of the weed. Moreover, I have observed even in heavy storms that the sea never breaks throughout these floating fields, but although heaving and swelling to the usual height, remains unruffled just as if oil floated on the surface. This absence of disturbance would of itself commend the field of weed to the fishes; but when we consider other suitable adjuncts, such as supply of food, and shelter from enemies, we cannot fail to realise the excellent means of migration which this common possession affords, not only to fishes, but to all kinds of those lower invertebrate forms, many of which have most certainly been brought to the shores of the Bermudas by this means. The isolated patches of weed, which follow the course of the Gulf Stream, and become broken into lesser fragments, are also accompanied by those tropical and semi-tropical fishes which are found almost every summer on the coast of Nova Scotia, and even as far north as Newfoundland; and it is evident that without some such agency we could never account for the abundance of certain southern pelagic fishes which annually occur in our high latitude.

In regard to the original habitat of *S. bacciferum*, as also the origin of that vast mass of floating weed which exists in mid-Atlantic, and is wholly composed of this species, I fear we must await further oceanic exploration. Although I am well aware that it grows in certain places on the Bermuda shores, those shores, even if they were wholly clothed with it, could not supply a tithe of the material which forms the vast accumulation of the weed existing in the Sargasso Sea. As to the allusion in Mrs. Merrifield's paper (quoting Agardh), made concerning the *S. bacciferum* being an inhabitant of the banks of Newfoundland, and other parts of the coast of north-east America, I can safely say that it is wholly unknown on this coast, save occasional sprays, which are brought north by the Gulf Stream, as are the fishes I have before alluded to.

Halifax, Nova Scotia, January 25 J. MATTHEW JONES

The Highest Tide on Record

IN Lyell's "Principles of Geology," tenth edition, 1867, vol. i. p. 494, occurs a statement, given on the authority of Admiral Sir F. Beaufort, to the effect that the tides at Chepstow on the Wye sometimes rise to 69 and even to 72 feet. The statement is familiar to all who have read Lyell's work. If it be correct then this tide of 72 feet at Chepstow is apparently the greatest in the world, that in the Bay of Fundy being given as 70 feet in the extreme. I can find no authority for a tide so great as 72 feet at Chepstow other than that above cited. The old "Bristol Channel Pilot" books of 1821 and 1839 say nothing of the matter, as I am informed by Capt. Tizard, R.N., and the latest published "Pilot" gives 56 feet as the extreme rise of tide at Chepstow. There is thus no official knowledge of so high a tide as 72 feet, and I can find no published account of Admiral Sir F. Beaufort's observations; Sir C. Lyell refers to none such.

I should be extremely obliged to any reader of NATURE who can refer me to any certain record of exceptionally high tides at Chepstow and confirmation of Sir C. Lyell's statement. There seems to be some uncertainty as to whether the highest tides on record occur in the British Islands or not.

Exeter College, Oxford H. N. MOSELEY

The Glacial Period and Geographical Distribution

PROF. ASA GRAY, in his very interesting lecture on the distribution of the forest trees of the northern temperate region (NATURE, vol. xix. p. 327), after pointing out the remarkable differences that exist between the forests of the eastern and western sides both of North America and the Old World, suggests that the great poverty of the European as compared with the Japan-Manchurian region in this respect was caused by the Mediterranean cutting off the retreat of the flora which then occupied Europe, as it retired, at the approach of the glacial epoch, before the ice from the north. This explanation derives considerable support from some other facts in geographical distribution. The most characteristic Alpine and Arctic butterflies of the Palæarctic region belong to the three genera, *Parnassius*, *Chionobas*, and *Erebia*. Of *Parnassius*, Dr. Staudinger, in his latest catalogue (1871) enumerates fourteen Palæarctic species, of which three occur in North and Central Europe, ranging as far south as the Balkans, but always in or near high lands, about a dozen occur in temperate Asia, ranging as far east as the Amur, and probably as many in North America, where they also are truly Alpine butterflies. Of *Chionobas* one species (*C. aëllo*, confined to the Alps) occurs in Central Europe, whilst six or seven others range from Lapland over Russia and Siberia, Mongolia, &c., to the Amur, and there are numerous species in Arctic and Alpine North America. Of *Erebia* there are forty-five Palæarctic species enumerated by Staudinger, and of these no less than twenty-five occur in the central Alpine chains of Europe. The genus likewise ranges all over temperate Asia, going as far south as the Himalayas and Moupin, and in North

America is represented by a dozen or more species. Now, though an *Erebia* (*E. Tyndarus*, var.) occurs as far south in Europe as the Sierra Nevada, *not a single species of any* of these three genera occurs in North Africa, although the Atlas Mountains would seem eminently well suited for such Alpine insects. In this case, then, it seems clear that the same cause—the barrier of the Mediterranean—which in the case of the miocene flora of Europe prevented any further retreat south, has operated to prevent any similar southerly spread amongst the victorious invaders from the north which pressed on the retiring host.

With regard to the general similarity in facies and richness between the East American and East Asiatic tree-flora, certain facts pointing in the same direction will at once occur to the zoologist. Thus the *Menopomas* of the Ohio and Alleghany have their only near relations in the gigantic *Sieboldias* of north-east Asia, one species of these occurring in Japan, the other being one of Père David's discoveries in Moupin. Similarly with the genus *Polyodon* amongst ganoids. Only two species of this genus are at present known, *P. folium*, inhabiting the Mississippi, *P. gladius* the Yang-tse-kiang. The recent discovery of at least two species of *Scaphi rhynchus* in Turkestan makes it probable that ere long species of that Americo-Asian genus will be found in the Chinese rivers as well. The parallelism in the case of the salamanders is particularly interesting, when one remembers the celebrated *Andrias Scheuchzeri* of the Œningen beds, and it tends to favour the view that at that time practical identity in the forms of animals and plants reigned throughout the northern temperate zone. W. A. FORBES

Cambridge, February 14

P.S.—The reported discovery (NATURE, vol. xix. p. 351) of a true *alligator* in the Yang-tse-kiang, will, if confirmed, add a still more remarkable case to those mentioned above.

Leibnitz and the Royal Society

PROF. TAIT and myself ought not to be at issue on this question. I suppose we both want to get at the facts; and, for my part, I have no more desire to whitewash a foul reputation than he can have to blacken a fair one. Where we differ appears to be, as to how far Leibnitz's reputation can stand the test of facts. The question, however, is not whether Leibnitz acted disingenuously in respect to Gregory's series, or any other subordinate matter, but whether he was indebted to something of Newton's, surreptitiously imparted to him, for his differential calculus. If the grounds upon which that charge was made are swept away, there is an end of it. But if, on the other hand, that is not found feasible, and evidence to character becomes a factor in the final decision, then it is right to examine into those subordinate matters. Till then, I, for one, decline to touch them. At the same time let me say that I never undertook to be bail for Leibnitz's impeccability. All I said or say is, that on the published facts I believe that Leibnitz was led to the calculus by his own honest speculations, and *had not the means* of stealing from Newton, had he been that way disposed. But there are so many relative papers still unpublished, but publishable, that it is impossible to arrive at a true decision till at least some of them have been submitted to an authorised tribunal.

Prof. Tait recommends me to repeat the fruitless attempt of Dr. Slowman. I decline to follow the example of that ominously surnamed *savant;* for it is contrary to precedent that the pursuer should ask the defender to show his hand; and I am quite sure that "the proper authorities" abroad have too much sense to take the initiative. So I appeal to the Council of the Royal Society of 1879 (not that of 1712, as Prof. Tait gives it), and I do so for these two reasons:—

1. The so-called *Commercium* of 1712, which was merely a statement, arriving at no decision on the principal question, contained several allegations (apparently inconsistent with known facts) which give colour to the charge against Leibnitz; it is then an obvious duty on the part of the Royal Society, who were on the occasion represented by the Committee, to give the proof, or make the reparation.

2. The first-published charge against Leibnitz, which was made by Wallis in 1695, was based on allegations said to have been derived from papers and letters in the possession of the Royal Society; it is but fair, then, that those papers and letters should be published.

I therefore once more respectfully urge upon the Royal Society to reopen the main question, and publish such of the relative papers, &c., in their possession as directly bear upon the original charge. C. M. INGLEBY

Athenæum Club, February 8

Ear Affection

THE experience of "P." as given in NATURE, vol. xix. p. 315, is physiologically interesting, and by no means usual. Before attempting an explanation it may be as well to assume that only one of "P.'s" ears was affected by the disorder, as by this hypothesis we get the greatest possible divergence from the healthy state. It would have been easy to ascertain which was the faulty organ at the time by requesting a musical friend to listen while "P." vocalised the note of the tuning-fork as conveyed to him by each ear separately. The discordant ear would then have been revealed.

The fault of hearing must have been due either to some mechanical misadjustment of the auditory apparatus, by which a wrong sensation was conveyed to the brain, or else to some deep-seated brain or nerve lesion, which led to a faulty conception of the original sound. Let us consider briefly the first of these cases.

From the exceedingly scanty description of his disorder given by "P." I gather that the discord was mostly conspicuous when the note was high pitched (such as when whistled). Now it sometimes happens from paralysis of the chorda tympani nerve, or even from occlusion of the Eustachian tube, that the tension of the ear-drum is preternaturally increased. Such affections, as aurists well know, frequently intensify to a distressing degree the hearing of high pitched notes, whilst they correspondingly diminish the sound of the lower tones of the chromatic scale. This result is probably obtained by the fact that the tense membrane responds more readily to the rapid vibrations of the higher tones than it does to those of a slower rate. We must also remember that the power of lessening the tension of the membrane is in such cases very seriously impaired, and, as a consequence, the power of adjustment also. I do not suppose that in "P.'s" case there was any actual paralysis of the tympanic muscles, but it is just possible that there may have been a certain degree of misadjustment of the drum of the affected ear due to a feeble and imperfect contraction of one or the other of the muscles referred to. If the disorder was, as I surmised, accompanied with great tenseness of the membrane, the laxator tympani would be the faulty muscle. We might, I believe, under such circumstances, expect the ear-drum to vibrate discordantly in response to a note, for Helmholtz's experiments with stretched strings would suggest that this is feasible within certain limits. As a matter of fact this discordance is rare, and therein rests the interest of "P.'s" case.

I can scarcely believe that in his case any of the deeper structures of the ear were seriously implicated, otherwise he would hardly have made such a rapid and complete recovery as he did.

Brighton, February 10 W. AINSLIE HOLLIS

YOUR correspondent "P." (NATURE, vol. xix. p. 315) desires an explanation of the phenomenon of alteration in the pitch of sounds, which he has experienced in his own person whilst suffering from temporary deafness. Your second correspondent on this subject, Dr. Wallich (p. 340), was under my observation at the time of his experiencing the same peculiar and comparatively rare aberration, and I was able myself to verify his statements.

I propose with your permission to give an explanation which appears satisfactory to myself, and hope it may be so to your correspondent "P."

Persons suffering in this way find that sounds heard by the affected ear appear to be sharper or flatter than their true pitch as heard by the other ear, and hence a sound may even appear double.

The internal ear, or labyrinth, must be the part affected, and in all probability it is the cochlea which is at fault. Now most authorities are agreed that the pitch of a sound is appreciated by the cochlea in the following manner. Each tone, or division of a tone, has its corresponding portion on the spiral lamina of the cochlea, which under ordinary circumstances can only be affected by that tone. So that the sound-wave produced by a certain tone passes along the keyboard (as it were) of the spiral lamina until it reaches its own key, which it strikes or so affects as to cause an impression to be sent from that portion of the lamina to the brain. Hence the appreciation of variation in the pitch of sounds.

This theory being accepted, for an explanation of the aberration in question we have only to suppose some slight physical alteration in the contents of the cochlea, which would cause the sound wave to strike or affect the wrong portion of the lamina spiralis, and thus a false impression would be carried to the brain.

URBAN PRITCHARD

NOW attention is drawn to the above allow me to give another experience.

On two separate occasions while playing the English concertina, and more particularly when single notes or simple chords were struck, I noticed that each was followed by a loud and distinct note an octave lower which appeared to be that of its fundamental tone. The musical tones of the voice of any person addressing me, also, had their deeper reverberations in a similar manner, these being numerous and of rapid succession; the confusion arising was very like that which is heard in a hall unsuitably constructed for sound.

The nuisance, for such it amounted to, I was troubled with for a couple of days each visitation, the abnormal state of hearing being peculiar to the left ear only.

JOHN HARMER

Wick, near Arundel

Intellect in Brutes

THE following case will perhaps interest those who believe that the reasoning faculty in man and animals differs in degree only, and is essentially the same in kind. Some years ago a plumber told me that he had, on several occasions, been called in to examine into the cause of leakage of water-pipes under the flooring of houses, and had found that the rats had gnawed a hole in the leaden pipe to obtain water, and that great numbers of them had made it a common drinking-place, as evidenced by the quantity of dung lying about. The plumber brought me a piece of leaden pipe, about $\frac{3}{4}$ inch in diameter and $\frac{1}{8}$ inch in thickness, penetrated in two places, taken by himself from a house on Haverstock Hill. There are the marks of the incisors on the lead, as clear as an engraving; and a few hairs and two or three of the rats' vibrissæ have been pinched into the metal in the act of gnawing it. This crucial proof of brute intelligence—a rat will not drink foul water—interested me so much, that I ventured to send an account of it to Dr. Chas. Darwin, asking his opinion on the means by which the rats ascertained the presence of water in the pipe. To this he replied: "I cannot doubt about animals reasoning in a practical fashion. The case of rats is very curious. Do not they hear the water trickling?" It may be conceded that this explanation is the most probable, and if it be the true one we have an example of an animal using his senses to obtain the data for a process of reasoning, leading to conclusions about which he is so certain that he will go to the trouble of cutting through a considerable thickness of lead. Obviously man could do *no more* under the same conditions.

ARTHUR NICOLS

OUR ASTRONOMICAL COLUMN

THE COMPANION OF ALGOL.—There are grounds for suspecting that the light of the small star about 80″ distant from Algol in the S.P. quadrant is also variable. Schröter in his letter to Bode, wherein he first drew attention to this object, mentions that he detected it with a 7-feet reflector on October 12, 1787, and although small it was distinctly seen. Soon afterwards he estimated its distance from Algol at 1′ 30″. On April 9, 1788, the star was not to be found, and he therefore concluded that it must be variable. In 1792, when he was in possession of a 13-feet reflector, which he describes as the most powerful instrument then available in Germany, he re-examined the vicinity of Algol, and on March 9 saw the companion much brighter than before, and compares its distinctness in the larger telescope with its faintness in the smaller one with which he had discovered it. But on April 5, in a state of atmosphere at least as favourable as on March 9, with the same instrument and magnifying power, not the slightest trace of the companion could be perceived; on increasing the power to 370, with the utmost straining of the eye, the faintest glimmering was now and then suspected in its position. Schröter then, in this second communication to Bode, expresses himself more confidently as to the variability of the small star.

In the early part of the year 1874 the writer of these lines made several ineffectual attempts to observe the companion, using various powers on a 7-inch refractor; though the skies were favourable enough, nothing could be glimpsed in its place. It was not therefore without surprise that upon re-examining the vicinity under similar conditions on September 9 of the same year, the companion was caught at once, and seen with great distinctness. It was measured with Mr. J. G. Barclay's 10-inch refractor at Leyton, by Mr. Talmage, on October 2 following, when the angle was found to be 194°·4 and the distance 79″·02; the magnitude was estimated 11·12. An observation by Smyth in 1835 is recorded, but his distance is much too small; it is not stated whether he found the companion himself or whether his knowledge of its existence was due to Schröter's communications to Bode. It does not occur amongst the objects in the "Bedford Cycle," which were re-measured by Secchi.

While upon the subject of variable stars we may just mention that ι Andromedæ, to which attention is directed in the last number of the *Monthly Notices* of the Royal Astronomical Society as "a new variable star," is no novelty: we referred to the star as almost certainly entitled to insertion in the catalogues of such objects, four years since (NATURE, vol. xi. p. 308).

"A MISSING STAR."—From a letter addressed by Prof. C. H. F. Peters, Director of the Observatory, Clinton, New York, to the Superintendent of the Naval Observatory, Washington, which Admiral Rodgers has communicated to the *Astronomische Nachrichten* (No. 2240), it appears that he has strangely misinterpreted a note with the above heading, which was lately printed in this column. We referred to an object observed at Washington, with *Hygeia* in 1850, and afterwards sought for at that observatory and elsewhere on the assumption that it might possibly have been a trans-Neptunian planet, and in view of the failure of a careful search on this hypothesis, we remarked: "the only likely explanation appears to be that there was a variable star in this position, and that the observations in right ascension were affected with greater error than might be expected, considering that on two of the days of observation several comparisons were made." Prof. Peters, however, explains the difficulty by referring several transits to the first instead of to the second wire of the movable plate of the micrometer employed, in which case the star is identified with Lalande 36613, and Prof. Hall has found, on examining the original observing-books, that Mr. Ferguson had altered several correct observations to correspond with erroneous ones, and Admiral Rodgers accepts the explanation as satisfactory. But Prof. Peters is alarmed about the matter now that NATURE "stirs it up again," and writes to the Superintendent of the Washington Observatory "in order that nobody thereby might be induced to spend months and years upon a renewed search," and to "stop any further perpetuation of the credence, that a trans-Neptunian planet is revealed by the Washington Observations." It will be seen that our suggestion was that a variable star might exist in the observed position, and was in no way connected with a renewed search for a trans-Neptunian planet. Prof. Peters must entertain rather odd notions as to the probable knowledge of his astronomical *confrères* respecting the contents of the ecliptical region of the sky, if he believes that any one would be induced, by remarks that we might offer, to undertake in these days a search for a distant planet close to the ecliptic amongst stars of the *ninth* magnitude!

COMET 1871 V.—Dr. B. A. Gould, with his usual energy, has secured an excellent series of post-perihelion places of the comet discovered by Dr. Tempel on November 3, 1871, which in a fortnight's time sank below

the European horizon. The discussion of these observations in conjunction with those made in the northern hemisphere, will lead to a much more precise knowledge of the orbit than we have at present.

OLBERS' COMET OF 1815.—In a recent note upon this comet it should have been stated that, acting upon the wish expressed by Olbers at the time, Triesnecker printed his observed differences of right ascension and declination between the comet and comparison-stars in *Zeitschrift für Astronomie*, vol. ii. The Vienna observations, therefore, admit of a new reduction, in addition to those previously named.

DIURNAL OSCILLATIONS OF THE BAROMETER

IN the "Meteorological Notes" which appeared in NATURE, vol. xviii. p. 198, some interesting results are referred to, which show marked differences in the diurnal variations of the barometer at places quite near to each other, as Greenwich, Kew, Oxford. It is remarked especially that the forenoon maximum in the months of May to July occurs near 9 A.M. at Greenwich, and near 8 A.M. at Kew; while at Falmouth and Valentia it is delayed to 11 A.M., or noon, and occurs in June as late as 2 P.M. at Helder.

Having made several investigations relatively to these questions (which I have not been able to publish as yet in detail), I think it may not be without advantage to give at present conclusions relating to the results above noticed.

It is obvious that it is of the highest importance with relation to the research as to the cause or causes of the remarkable semi-diurnal oscillations of the barometer, that we should have only real variations of atmospheric pressure to deal with, and not instrumental irregularities; and that, if there is any part of the mean diurnal variations which is due to local causes, we should be able to separate that part from any other which may be due to general or cosmic causes.

When it is remembered that the range of the mean diurnal variation with us is from two to three hundredths of an inch of mercury, and that the epochs of maximum or minimum may be shifted an hour by a difference of one or two thousandths of an inch, it will be seen how essential it is that the instruments, the observations, and the corrections shall be the best, in order to be sure that we have real variations of atmospheric pressure before us.

In order to obtain the best possible results, my investigations have been limited to observations made in first-class observatories with standard instruments. From observations made during several years at Makerstoun, Dublin, Greenwich, and Brussels, I have sought by the harmonic analysis the functions of sines which represent them most accurately. I give here the equations for the means of the three months in question—May, June, and July. The variation, v, is in ten-thousandths of an inch of mercury; the origin for each of the four stations M, D, G, and B, is mean midnight ($\theta = 0$):—

M, $v = 56 \sin(\theta + 355^\circ) + 68 \sin(2\theta + 143^\circ) + 21 \sin(3\theta + 171^\circ)$
D, $v = 51 \sin(\theta + 358^\circ) + 72 \sin(2\theta + 144^\circ) + 25 \sin(3\theta + 153^\circ)$
G, $v = 63 \sin(\theta + 346^\circ) + 88 \sin(2\theta + 143^\circ) + 25 \sin(3\theta + 154^\circ)$
B, $v = 43 \sin(\theta + 354^\circ) + 92 \sin(2\theta + 140^\circ) + 24 \sin(3\theta + 170^\circ)$

The terms on the right of each equation represent the oscillations, whose superposition completes the whole diurnal variation. We find—

From the 1st term that the epochs of the maximum and minimum were the same within a few minutes at M, D, and B (as shown by the arguments 355°, 358°, and 354°), differing at Greenwich from the others by about 40m.

From the 2nd term, that of the semi-diurnal oscillation, that the epochs were the same at all the stations within a few minutes.

From the 3rd term, that they agreed at D and G and at M and B, those for the former being about 23m. different from those for the latter.

When we consider the coefficients of the different terms, which represent half the ranges of the oscillations, slight differences are found for the 1st and 3rd terms; for the 2nd the *range diminishes regularly as the latitude increases* at the rate of 0·00101 inch for each degree of latitude.

The exact agreement in the epochs of maxima and minima and the regularity of the variation of range with latitude in the semi-diurnal oscillation show that this oscillation obeys a general law. Dr. Lamont has supposed that the 1st term, or single oscillation, is due to variation of temperature; this, I believe, is not the case. When we compare the terms for different *seasons* of the year, we find that for the *same place* the epochs of maximum and minimum may vary twelve hours in the single oscillation, while the epochs deduced from the same term for the temperature variations do not differ one hour. Not only so, I have found on the South Indian Ghats that the epochs deduced from the 1st term of the barometric equations vary seven hours in ascending 6,000 feet; while those shown by the 2nd term are absolutely constant.

For all these reasons I conclude that the semi-diurnal oscillation of the atmospheric pressure is due to a cosmic cause, independent of local influences, while the single diurnal oscillation shows that part of the solar action which is modified by atmospheric conditions yet to be determined. The results for the four stations just given are a few links in a long chain of facts which tend to prove that the semi-diurnal oscillation of the barometer is due to an action of the sun, which is repeated equally, twice in each day, like the solar oceanic tide.

It will be seen, I think, from the results obtained from the Brussels, Greenwich, Dublin, and Makerstoun observations that the differences noticed at the beginning of this article cannot be allowed to enter as data into the domain of meteorology without much greater study of all the circumstances on which they depend. The facts of atmospheric variations are very difficult of explanation, but if we begin to admit results which may be purely instrumental among these facts explanation will become impossible.

It is a fact that the true temperature of the mercurial columns has not always been obtained, and when we have to discuss observations with self-registering instruments, many sources of error, including those of temperature on the apparatus itself, have to be cared for.[1] At stations near the sea, such as Helder, Valentia, and Falmouth, we have also to remember that in the varying height of the partial base of the atmosphere, through the *solar* oceanic tide, there is a real cause of diurnal barometric oscillation whose amount and epochs should be ascertained and deducted before exact comparisons can be made with observations inland. At the same time I would remark that of the stations here considered Dublin is near the sea, while the others are more or less distant from it.

JOHN ALLAN BROUN

MAROCCO AND THE ATLAS[2]

THE expedition of which an account is given in this most interesting volume was undertaken by Sir Joseph Hooker and Mr. Ball in the spring of 1871, and lasted a little over two months. Many causes com-

[1] The observations here studied at the four observatories are all made by the eye.

[2] "Journal of a Tour in Marocco and the Great Atlas." By Joseph Dalton Hooker, K.C.S.I., C.B., Pres. R.S., Director of the Royal Gardens, Kew; and John Ball, F.R.S., M.R.I.A. With an Appendix, including a sketch of the Geology of Marocco, by George Maw, F.L.S. (London: Macmillan and Co., 1878.)

bined to hinder the publication of this journal until now, but the delay will, we feel sure, not in the least detract from either the novelty or value of its contents.

The coast-line of the territory of Marocco extends from the frontier line of Algeria on the Mediterranean, along through the Straits of Gibraltar to the Atlantic Ocean, nearly opposite to the Canary Islands. Inland it would seem to have no absolutely well-defined boundary-line except towards Algeria, but it is supposed to stretch far into the Great Desert on the southern side of the Great Atlas range. Of this great region, possibly as large in extent as Spain, and the chief ports of which are within a few days' steaming of Southampton, almost nothing, if we except the mere coast-line, is known; and a journey across the dark continent itself seems easier of accomplishment than one to the town of Tarudant, in the southern valley of the Great Atlas.

The distance from Gibraltar to Tangiers is scarcely thirty-five miles. The five peaks of the Beni Hassan are seen from the Rock, yet we have no records of their having been investigated, and when the authors earnestly desired Sir John Drummond Hay, the British Minister Plenipotentiary in Marocco, to assist them in exploring their recesses, he was reluctantly obliged to pronounce against the feasibility of any such excursion, and even when they started for a short excursion to Cape Spartel it was considered prudent to give them an escort of two soldiers.

Argan Trees.

With this excursion the botanical interest of this journal begins. Plants of many sorts were seen and collected. Where a little slender stream ran through some damp meadows they were charmed by the delicate tint of a pale blue daisy that enamelled the green turf. It was merely a variety of the little annual daisy (*Bellis annua*) so common in many parts of Southern Europe; but the blue tint does not seem to have been noticed elsewhere. The botanical district to which this northern corner of Marocco belongs has been called that of the cistus and heath. One very interesting plant to be often seen living in the Botanical Gardens of Kew and Dublin is thus described:—

"The most singular of these is the *Drosophyllum lusitanicum*, a plant of the sun-dew tribe, whose branched stem bears several large yellow flowers. The numerous slender strap-shaped root-leaves, nearly a foot in length, that are gradually contracted to the thickness of whip-cord, are beset with pellucid ruby-tipped glands, and present a peculiarity that appears to be unique in the vegetable kingdom. Any one who has remarked the growth of ferns must have seen that in the young state the leaves are rolled or curled inwards, so that in the process of unfolding the face or upper side of the leaf, which was at first concealed, is gradually opened and turned to the light. A similar process occurs in many other plants; but in *Drosophyllum* alone, so far as we know, the young leaf is rolled or curled the reverse way, so that the upper side of the leaf is that turned outwards. It appears to grow in many parts of Southern Portugal; reappears on the north side of the Straits of Gibraltar near Tarifa and Algeciras, and on the southern side about Cape Spartel and on the hills above Tetuan, where it commands a view of the opening of the Mediterranean, but extends no farther eastward."

Tetuan was visited from Tangiers. The season (April 10) was scarcely far enough advanced for the flowering of many of the sea-side plants, "but there was more than enough to rejoice the heart of a botanist, especially one escaping from the ghastly spring season of the north, where, when the days grow longer, they become only the more dreary, and where the bitter east winds parch and blast the young leaves and blossoms that are tempted to unfold themselves to their own destroying by the mildness of the winter weather." At Tetuan, Beni Hosmar was ascended. It was about 3,000 feet high, and had not been ascended by any European since Barker Webb's time. The season was still too little advanced, and the botanist who will follow the travellers' footsteps about the beginning of June is promised a much richer harvest. Ceuta, about thirty miles from Tetuan, was next visited, and in order to catch the steamer to Mogador, our authors had to cross over to Gibraltar, from whence they again departed on April 20, in the *Vérité*, landing for a brief moment at Casa Blanca. They were in the port of Mogador on the 26th.

Arrangements were soon made, through the goodness of the late Consul Carstensen, for the excursion to the Great Atlas. Mules were bought, the question of costume was decided, the interpreter of the Consulate, Abraham by name, was lent for the trip. The necessary escort consisted of four soldiers under the command of a captain. The necessary dinner at the Governor's was eaten, and about 7 A.M. on the morning of April 29 the cavalcade took its departure from Mogador for Marocco. Instead of following the direct road, a detour nearly at right angles was made, to enable the botanists to gain a fuller acquaintance with the great Argan Forest. Their course was first through a sandy soil, but as it rose and receded a little from the coast, the tertiary calcareous rock that underlies the sand cropped out here and there, and the first Argan trees appeared.

"As we advanced, the trees grew larger and nearer together, and as we approached our intended halt, at a place called Douar Arifi, they formed a continuous forest.

"The Argan tree is in many respects the most remarkable plant of South Marocco; and it attracts the more attention as it is the only tree that commonly attains a large size, and forms a conspicuous feature of the landscape in the low country near the coast. In structure and properties it is nearly allied to the tropical genus *Sideroxylon* (Iron-wood); but there is enough of general resemblance, both in its mode of growth and its economic uses, to the familiar olive tree of the Mediterranean

region to make it the local representative of that plant. Its home is the sub-littoral zone of South-western Marocco, where it is common between the rivers Tensift and Sous. A few scattered trees only are said to be found north of the Tensift; but it seems to be not infrequent in the hilly district between the Sous and the river of Oued Noun, making the total length of its area about 200 miles. Extending from near the coast for a distance of thirty or forty miles inland, it is absolutely unknown elsewhere in the world. The trunk always divides at a height of eight or ten feet from the ground, and sends out numerous spreading, nearly horizontal branches. The growth is apparently very slow, and the trees that attain a girth of twelve to fifteen feet are probably of great antiquity. The minor branches and young shoots are beset with stiff thick spines, and the leaves are like those of the olive in shape, but of a fuller green, somewhat paler on the under side. Unlike the olive, the wood is of extreme hardness, and seemingly indestructible by insects, as we saw no example of a hollow trunk. The fruit, much like a large olive in appearance, but varying much in size and shape, is greedily devoured by goats, sheep, camels, and cows, but refused by horses and mules; its hard kernel furnishes the oil which replaces that of the olive in the cookery of South Marocco, and is so unpleasant to the unaccustomed palate of Europeans. The annexed cut, showing an average Argan, about twenty-five feet in height, and covering a space of sixty or seventy feet in diameter, with another, where goats are seen feeding on the fruit, exhibits a scene which at first much amused us, as we had not been accustomed to consider the goat as an arboreal quadruped. Owing to the spreading habit of the branches, which in the older trees approach very near to the ground, no young seedlings are seen where the trees are near together, and but little vegetation, excepting small annuals; but in open places, and on the outer skirts of the forest, there grows in abundance a peculiar species of Thyme (*T. Broussonnetii*), with broadly ovate leaves and bracts that are coloured red or purple, and the characteristic strong scent of that tribe. It is interesting to the botanist as an endemic species, occupying almost exactly the same geographical area as the Argan. As we afterwards found, it is replaced in the interior of the country by an allied, but quite distinct, species. Its penetrating odour seems to be noxious to moths, as the dried twigs and leaves are much used in Mogador, and found effectual for the preservation of woollen stuffs."

Stopping at Shedma, Aïn Oumast, Sheshaoua, Misra ben Kara, Marocco was at last in view. From whatever side it be approached, this city presents an imposing appearance. The western side presented an outline about a mile and a half in length. Massive walls some thirty feet in height, with square towers at intervals of about 170 yards, completely inclose it, and on two sides at least it is girdled by a wide belt of gardens in which the date palm, the olive, and fig, are conspicuous objects. We must refer the reader to the volume for an account of the sojourn in Marocco. Some difficulties with the Governor were got over by the quiet determination of Sir Joseph Hooker, whose knowledge of the Oriental character acquired in Asia here stood him in good service.

The outline of the Great Atlas range was quite visible from the terraced roof of the house in Marocco occupied by the travellers, though owing to the prevalence of clouds they failed to secure a satisfactory sketch of these. Through the kindness of Sir J. D. Hay, they are, however, enabled to insert a copy of a drawing made in 1829 by Mr. William Prinsep, the correctness of which they endorse. On May 8 Marocco was left for the mountains. The cavalcade was a large one, consisting of thirty-seven souls and thirty-three horses and mules. The baggage formed a good load for nine mules. The route lay south-east, but the upward slope became hardly perceptible, when before sunset they were compelled to stop for the night at the house of the Kaïd of Mesfioua, at an elevation of about 2,400 feet over the sea. The next morning they were off pretty early, and soon began to ascend, often riding along hollow ways between high banks or lofty hedges formed of tangled shrubs and climbing plants, in which were mingled some familiar forms with several altogether new.

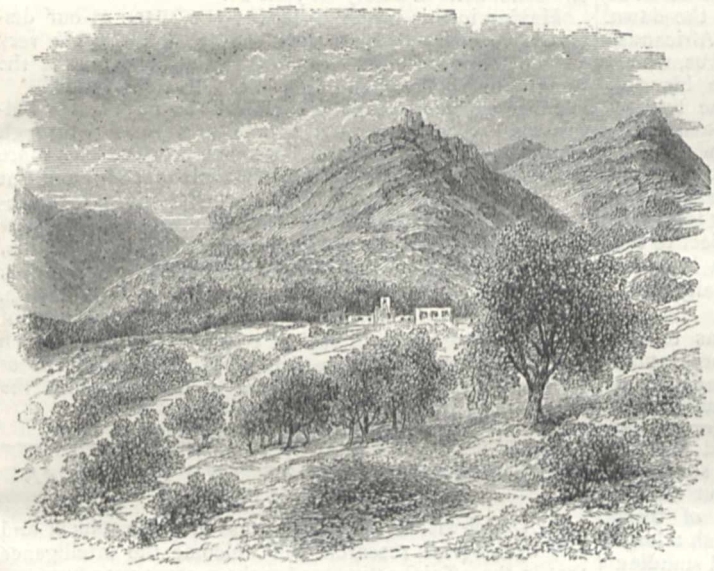
"The date-palm had disappeared soon after we entered the hills; here, and elsewhere on our route, it seems to be confined to the lower region, rarely attaining the level of 3,000 feet above the sea. Its place was here supplied by the palmetto (*Chamærops humilis*), which seldom forms a trunk, perhaps because it is not allowed to attain a sufficient age. As we advanced, the vegetation constantly offered a more varied and attractive aspect; and one of our first prizes was a new species of thyme (*Thymus maroccanus*, Ball), somewhat like the species of the Argan zone, but with oblong leaves and uncoloured bracts. Of comparatively familiar forms there were *Cistus monspeliensis* and *C. polymorphus*, the first species of that genus that we had seen in South Marocco, the pretty little *Cleonia lusitanica*, with many other Labiatæ. Of plants new to our eyes by far the most interesting was the curious *Polygala balansæ*. To those who know only the milkworts of Europe and North America it must seem strange to hear of a large shrubby Polygala, with branches that end in a sharp point, few small leaves, so quickly deciduous that it generally appears quite leafless, and large flowers of a showy purple-red colour. In truth, although there is great variety of form in this large genus, the species which is common throughout the lower valleys of the Great Atlas is very distinct from all its congeners. In Arabia and South Africa there are some species forming dwarf bushes with spinescent branches, but in other respects very different. When full grown this is six or eight feet in height; and the round, green, almost leafless stems give it, when the flowers are absent, much the appearance of *Spartium junceum*, the large broom of Southern Europe.

"After riding some way up a rather steep stony track, we reached a grove of very fine olive trees, and our escort came to a halt. We had reached Tasseremout. For some time we had seen a large pile of solid masonry which crowned the hill immediately above the olive grove. This seemed to deserve a visit; but, on the other hand, the attractions of the surrounding vegetation were irresistible to botanists. The matter was settled by Hooker proceeding to visit the castle with the Kaïd, while Ball botanised, and Maw secured living specimens of some of the more interesting plants."

The castle of Tasseremout is one out of a large number of similar buildings standing on the northern outworks of the Great Atlas chain that will afford interesting matter for inquiry to future travellers when the country becomes more accessible, and the lessened jealousy of the natives will make a thorough examination of them less impossible than it would be at present. The natives vaguely attribute their construction to Christians or Romans, the same word conveying either meaning; but the Jews often explain this to mean Portuguese. The general character of these buildings, as far as our information goes, is tolerably uniform. The walls are of great thickness and built of rough hewn stone: the arches are always rounded and the lower chambers vaulted; and they are evidently places of defence. There is little reason to believe that the Portuguese, who held at one time or other most of the Atlantic coast of Marocco, ever established a firm footing inland, and still less that they had such a hold on South Marocco as would be implied by the erection of a chain of forts along the foot of the Atlas. On the other hand, the history of Mauritania during the long period of the decline of Rome, and preceding the Saracen conquest, is an almost complete blank, save for a few apocryphal stories.

It is certain that the lower country was once completely subject to Roman power and Roman institutions, and it remains to be ascertained how far an organised government survived the weakening of the central authority. That the independent tribes of the Atlas may have been inconvenient neighbours to the half-Romanised inhabitants of the plain is more than probable, and that the forts should have been erected to hold the former in check seems the most likely conjecture as to their origin. Excavation, whenever that may be practicable, will scarcely fail to tell something of the original occupants of these buildings, and to diminish our ignorance of a dark period of past history.

At sunrise on April 10 (a misprint for May 10) the thermometer stood at 60°, and the travellers were in the best of spirits for undertaking the work that seemed ready cut out for them. They would explore the fine valley that led directly from their camp station to the heart of the great mountain chain, up until they reached the snow; but here comes the exciting portion of the narrative, and the record of how their progress was checked, how they were forced to return, what troubles they had with their escort, how they camped in Ait Mesan Valley, and how



Fort at Tasseremout.

from thence they stole up into the snowy regions must be read in the journal; no abstracts would do the narrative justice. On the highest summit reached a snow-storm was encountered, and the cold was intense; a thermometer carried in the pocket marked 25° F., and the height of the Tagherot Pass was determined to be about 11,484 feet above the sea. The snow continuing, all further advance was impossible, and they descended again into the valley, to the Plateau of Sektana, from whence there was a glorious view of the Atlas, which was sketched by Mr. Ball. Amsmiz was reached about May 19; the position of the town reminded them of some of the villages in Piedmont that stand at the openings of some of the interior valleys of the Alps, or still more of similar places on the Apennines of Central and Southern Italy; and from it they reached the poor village of Imintelli, where they sojourned for two days. From Imintelli a desperate and fortunately successful attempt was made to climb to the summit of Djebel Tezah.

"Hooker reached the summit about 2 P.M., and was rejoined by Ball nearly half an hour later. Excepting some light fleecy cumuli floating over the low country to the north, at a lower level than the eye, the sky was cloudless; but in some directions a thin haze obscured the details of the vast panorama. Our first glance was inevitably directed towards the unknown region to the south, and there, at a distance of fifty or sixty miles, rose the range of Anti-Atlas, showing a wavy outline, with rounded summits, and no apparent deep depression, rising, as we estimated, to a height of from 9,000 to 10,000 feet above the sea. The highest portion within our range of view, and the only part with a somewhat rugged outline, bore a few degrees west of due south, and corresponded in position with the Djebel Aoulouse of the French map. A somewhat darker shade traceable at some places on the flanks of this dimly seen range, possibly indicated the existence of forests, or at least of shrubs covering the slopes.

"When the first impulse of curiosity was partially satisfied, we began to take more careful note of our position, and to study in detail a view which had been so long denied to us. The first fact that struck us, was that the peak on which we stood lies a considerable way north of the watershed. The axis of the main chain, which here subsides into undulating masses from 2,000 to 3,000 feet lower than Djebel Tezah, lay between us and the central portion of the Sous valley, and, even if the prevailing haze over the lower districts had not veiled the details, would probably have cut off the course of the stream and the rich tracts that are said to fringe its banks. The higher strata of the atmosphere, above the level of about 7,000 feet, were, however, delightfully clear towards the east and west, and every feature of whatever portion of the main chain lay within our range was easily traced even at distances of thirty or forty miles. An extraordinary change had occurred during the three days since we had viewed the chain from Sektana, covered in deep snow down to the level of about 7,000 feet, and showing only a few crests of precipitous rock here and there protruding. The white mantle had now completely disappeared, and only long streaks of snow filling the depressions of the surface now seamed the flanks of the higher mountains, leaving the summit ridges everywhere bare. During the ascent of the northern face of the mountain, we had kept close to one of these long and comparatively narrow snow-slopes that extended through a vertical zone of over 2,000 feet, with a breadth of some 300 to 400 feet, and we now saw a still longer and wider strip of the same character, filling a shallow trough below us, on the east face of the peak. Near to the summit, and on the ridges leading to it, not a trace of snow was to be seen, even in the crevices of the rocks, where it would find partial shelter from the sun.

"We now proceeded to survey the field of view, in order, if possible, to fix the positions of any conspicuous summits. Looking due west, nothing approaching our level lay between us and the dim horizon. A succession of projecting spurs of the Atlas, dividing as many successive valleys, subsided into the plain; the most prominent, and that extending farthest from the main chain, being the mountain above Seksaoua. Turning the eye a little to the left, about west by south, we saw crowded together many of the higher summits of the western portion of the main range, which was here seen foreshortened, so that it was impossible to judge of their true relative position. The highest of these, seamed with snow, we judged to be about twenty-five miles distant, and higher than Djebel Tezah by 600 or 800 feet. In nearly the same direction, but only about ten miles distant, was a rugged projecting peak, rising some 300 feet above our level, and very many more of somewhat lower elevation were discernible in the space between us and the more distant points. Between

S.W., and S.S.E., the range of Anti-Atlas, rising behind the broad Sous valley, bounded the horizon.

"At our feet, and cutting off from view the course of the river Sous, the mountain mass that here forms the axis of the main chain presented the appearance of a troubled sea of a light ferruginous colour, declining gradually in elevation from W. to E. At a distance of about eight miles E.S.E. of Djebel Tezah it sinks to an estimated height of little over 7,000 feet, at the head of the main branch of the Oued Nfys, and offers the only apparently easy pass over the main chain which we had yet seen.[1] The rocky sunburnt flanks of the mountains were dotted with trees of dark foliage, doubtless some form of the evergreen oak, up to a height of about 8,000 feet above the sea, for the most part solitary, sometimes in clumps, but nowhere forming a continuous forest. The numerous feeders of the Oued Nfys had cut deep ravines in the flanks of the mountains, and were lost to sight, except where gleams of silver light shot upwards from the deeper valleys amid the walnut trees that fringed their banks. Numerous hamlets were seen, some perched upon projecting ridges, some lying in hollows and girdled with a belt of emerald-green crops.

"It was impossible not to speculate on the condition of these primitive mountaineers, who have since the dawn of history preserved their independence. Leo Africanus, speaking of the very district now overlooked by us, which he calls Guzula, says that the people were in his day molested by the predatory Arabs and by 'the lord of Marocco;' but they successfully resisted all encroachments, and no attempt is now made to assert the Sultan's authority among them, or to enforce tribute. Something they have doubtless gained in material, and still more in moral, welfare by stubborn resistance to alien rule; but the prosperity that is sometimes attained by tribes subject to the semi-feudal rule of chiefs, and among whom intestine feuds are rooted in immemorial tradition, is usually short-lived.

"Our hope of getting further knowledge as to the eastern extremity of the Sous valley, and the orographic relations between the Atlas and Anti-Atlas ranges was not to be satisfied. Djebel Tezah, as we found, stands some way north of the axis of the chain, while the great mass that rose over against us between E.N.E. and E.S.E., extending to the head of the Aït Mesan valley, sends out massive buttresses to the south, and by these our view of Anti-Atlas was cut off to the S.E. On one of these western projecting buttresses we could distinguish a large village belonging to the district of Tifinout, and standing at an elevation of nearly 7,000 feet. Turning our eyes to the north of true east, many of the higher summits of the chain were seen rising above the intervening ranges, the most distant probably belonging to the Glaoui group, east of Tasseremout. Once more we came to the conclusion that throughout the portion of the Great Atlas chain visible from the city of Marocco, between the easternmost feeders of the Oued Tensift and those of the Oued Nfys, there are no prominent peaks notably surpassing the average level. Many of them must surpass the limit of 13,000 feet above the sea, but it is not likely that any one attains the level of 13,500 feet. The last object that attracted our attention in the panorama, in a direction about east by north, was an isolated mass, forming a bold promontory on the northern side of the chain, of which a rough outline is here given.

"When the engrossing interest of the distant view had so far subsided as to let us pay attention to nearer objects, we were struck by the unexpected appearance of considerable remains of dwellings on a platform of level ground, only a few feet below the actual summit of the mountain. About a dozen rude stone dwellings, all in a ruinous condition, with chambers sunk a couple of feet below the level of the ground, and the roofs fallen in, had at some former period been here erected; but we saw no traces of recent occupation. It seemed most probable that they were intended as shelter for herdsmen, who had driven their flocks in summer to this lofty station.

"As we lingered on the topmost point of the mountain, the intense silence of the scene was broken by the distant scream of a large grey eagle that soared over our heads, and then sailed away southward over the Sous valley, making the deep stillness still more sensible than before."

No wonder that after the excitement of such a day, which only ended when their quarters were reached at half-past eight at night, the travellers let their collections rest in the collecting boxes and portfolios for the night, and after supper fell themselves to sleep.

Wars among the native tribes at last drove our authors to the necessity of returning to Mogador, passing through the wonderfully singular defile of Aïn Tarsil, which is like a trench some thirty to fifty feet wide and the same deep, running for a length of nearly three miles. Four days were spent on the occasion of the second visit to Mogador, and Sir Joseph Hooker reached London with his collections in safety on June 21.

Having in this notice exceeded the space at our disposal, we can only quite incidentally allude to the very valuable appendices to this volume, which treat of the geography, geology, and flora of the districts visited.

Since we some years ago closed the pages of "Palgrave's Personal Narrative of a Year's Journey through Central and Eastern Arabia," we have not perused a more delightful or instructive book of travels than this account of a tour in Marocco. From the well-known acquirements and great experience of the authors we expected much, and we have not been disappointed. The journal is, without doubt, especially pleasant reading to a botanist, but the geographer will find in it much to interest him, the politician will find in the description of the state of things now existing in such a country material for some serious thought, while the literary taste of every reader will be gratified by the excellent manner in which the narrative is written.

[1] This is apparently the pass spoken of by Leo Africanus as leading from near Imizmizi (Amsmiz?) to the region of Guzula (the northern branch of the Sous valley). He says it is called Burris, that word meaning downy, because snow frequently falls there.—See "Ramusio," vol. i. p. 17, B.

REORGANISATION OF THE AMERICAN SURVEYS

ALL well-wishers of the progress of geographical and geological research will welcome the intelligence that in the official estimates for the present year just presented to Congress the complete remodelling of the surveys carried on by the United States has been recommended to be immediately undertaken. The Report recently made by the National Academy of Sciences, to which attention was lately called in these pages (NATURE, vol. xix. p. 213), seems to have been adopted *simpliciter*. The Engineer Department is henceforth to be charged with no surveys save such as may be required for military purposes. The surveys of mensuration are to be placed under one organisation, and a new Geological Survey of the United States is to be instituted. Of course the changes are at present only recommended for adoption by the Committee on Appropriations, and there may be a struggle over some of the proposals. We hear indeed that the Engineers are leaving no point in their defence unguarded and are preparing for what is called a "heavy fight." For their own sakes as well as for the cause of scientific progress we cannot wish them success.

They object to the constitution of the Academy's Committee on the ground that only one of the members of it knows anything practically of surveying. And this objection will no doubt be urged with force and persistence in the debates in Congress. But surely they can hardly expect to throw dust in the eyes of the legislature by such a flimsy argument. The Committee, as we formerly pointed

out, was a thoroughly competent one. They might as well insist that nobody is competent to pass a judgment on poetry unless he has written an epic, or to criticise fine art if he has not painted a picture, or modelled a statue. The Bureau of Engineers has done such admirable work and deserves such thorough respect, that its best friends can only hope that it will not embitter a fruitless struggle against the inevitable. We have no fear that its scientific *prestige* will in the least be diminished by the projected revolution. The nature of the change will be best understood from the following extracts from the Bill of the Committee on Appropriations, which has been read twice and "committed to a committee of the whole House on the state of the Union and ordered to be printed":—

"For the salary of the Superintendent of the Coast and Interior Survey, 6,000 dollars: *Provided*, That the present coast and geodetic survey, with supervisory and appellate powers over the same authorised by law, is hereby transferred from the Treasury Department to the Department of the Interior, and shall hereafter be known as the Coast and Interior Survey, and shall have charge of all surveys relating to questions of position and mensuration of the coast and interior, except the special survey necessary for geological purposes, the survey of the northern and north-western lakes now under the direction of the War Department, and local surveys required for the improvement of rivers and harbours and surveys necessary for military purposes immediately connected with the operations of the army, in accordance with the plan reported to Congress by the National Academy of Sciences, under the Act of June 20, 1878, entitled 'An Act making Appropriations for Sundry Civil Expenses of the Government for the Fiscal Year ending June 30, 1879, and for other purposes:' *And provided further*, That the offices of surveyors-general are hereby abolished, to take effect on June 30, 1879; and the compensation of said surveyors-general, and all employees under them, shall cease on that day; and the duties pertaining to the offices of surveyors-general shall thereafter be performed by the Superintendent of the Coast and Interior Survey; and the parcelling surveys of the public lands shall hereafter be made by employees of the Coast and Interior Survey: *And provided further*, That the rectangular method with township and sectional units shall be retained wherever it can be appropriately and economically applied, but all surveying by contract shall be prohibited; and the Superintendent of the Coast and Interior Survey is hereby authorised to adopt such additional surveying methods as he may deem most economic and accurate; but the surveys of mineral claims shall be made by deputy surveyors, as now provided by law. And such of the archives and records now in the offices of the surveyors-general as may not be required for the office of the Superintendent of the Coast and Interior Survey shall be turned over to the governors of the several States and Territories, upon the same terms and conditions and in the same manner that the archives have heretofore been delivered to the State authorities in States where the public surveys have been completed and the offices of the surveyors-general closed: *And provided further*, That the Secretary of the Interior shall direct the archives and records of the surveyor-general's office of any State or Territory to be kept in the place where they are now located, if thereby the interests of the people of said State or Territory will be best subserved, such archives and records to be placed under the charge of an employee of the Coast and Interior Survey: *And provided further*, That hereafter surveys of public lands shall, at the discretion of the Secretary of the Interior, be made under the deposit system, on petition of not less than five persons for the survey of a township; the sum of money to be deposited for the survey of the township shall equal the cost of the survey at the present rates allowed for the several classifications of the land to be surveyed, including such sum as shall be estimated for office-work: *Provided*, That the excess of any deposit over and above the aforesaid cost shall be returned to the depositor; and all moneys so deposited and actually required for said survey and office-work, for the amount of land for the survey of which the petition is filed, shall be applicable, either in the hands of the depositor or his assignee, to pay for lands to which the said depositor or others may be entitled under the law. It shall be the duty of the Commissioner of the Land Office to make all needful rules and regulations necessary for carrying into effect the detail of this law, so far as relates to the new conditions established by it in reference to the public lands.

"For the salary of the Director of the Geological Survey, which office is hereby created, who shall be appointed by the President by and with the advice and consent of the Senate, 6,000 dollars: *Provided*, That this officer shall have the direction of the geological survey, and the classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain, in accordance with the plan reported to Congress by the National Academy of Sciences under the act of June 20, 1878, entitled 'An Act making Appropriations for Sundry Civil Expenses of the Government for the Fiscal Year ending June 30, 1879, and for other purposes;' and that the director and members of the geological survey shall have no personal or private interests in the lands or mineral wealth of the region under survey, and shall execute no surveys or examinations for private parties or corporations; and the Geological and Geographical Survey of the Territories, and the Geographical and Geological Survey of the Rocky Mountain Region, under the Department of the Interior, and the Geographical Surveys west of the 100th meridian, under the War Department, are hereby discontinued, to take effect on June 30, 1879; and all collections of rocks, minerals, soils, fossils, and objects of natural history, archæology, and ethnology, made by the Coast and Interior Survey, the Geological Survey, or by any other parties for the Government of the United States, when no longer needed for investigations in progress, shall be deposited in the National Museum.

"That all laws, parts of laws, and all departmental regulations relating or having reference to the coast and geodetic survey now in force and effect are hereby continued in force and effect, and made applicable to the Coast and Interior Survey until changed by competent authority.

"For the expense of a commission on the codification of existing laws relating to the survey and disposition of the public domain, and for other purposes, 20,000 dollars: *Provided*, That the commission shall consist of the Commissioner of the General Land Office, the Superintendent of the Coast and Interior Survey, the Director of the United States Geological Survey, and three civilians, to be appointed by the President, who shall receive a per diem compensation of 10 dollars for each day while actually engaged, and their travelling expenses; and neither the Commissioner of the General Land Office, the Superintendent of the Coast and Interior Survey, nor the Director of the United States Geological Survey, shall receive other compensation for their services upon said commission than their salaries, respectively, except their travelling expenses, while engaged on said duties; and it shall be the duty of this commission to report to Congress within one year from the time of its organisation: first, a codification of the present laws relating to the survey and disposition of the public domain; second, a system and standard of classification of public lands as arable, irrigable, timber, pasturage, swamp, coal, mineral lands, and such other classes as may be deemed proper, having due regard to humidity of climate, supply of water for irrigation, and other physical characteristics;

third, a system of land-parcelling surveys adapted to the economic uses of the several classes of lands; and, fourth, such recommendations as they may deem wise in relation to the best method of disposing of the public lands of the western portion of the United States to actual settlers.

"The publications of the Coast and Interior Survey shall consist of the annual report of operations, such geographic and topographic maps, and geodetic and coast charts, and such discussions and treatises connected therewith, as the superintendent shall deem of value. The publications of the Geological Survey shall consist of the annual report of operations, geological and economic maps illustrating the resources and classification of the lands, and reports upon general and economic geology and palæontology. The annual report of operations of the Coast and Interior Survey and of the Geological Survey shall accompany the annual report of the Secretary of the Interior. All special memoirs and reports of both surveys shall be issued in uniform quarto series. The style and scale of the cartographic publications shall be determined by the head of each organisation, so as to express the scientific results in the most effective manner. Three thousand copies of each shall be published for scientific exchanges by the heads of the surveys and for sale at the price of publication; and all literary and cartographic materials received by the heads of the surveys in exchange shall be the property of the United States, and form a part of the libraries of the two organisations; and the money resulting from the sale of such publications shall be paid into the Treasury of the United States."

HEINRICH GEISSLER

A YEAR since we were called upon to chronicle the death of Ruhmkorff, whose name is so closely identified with the history of electricity. In recording the death of Dr. Heinrich Geissler at Bonn, January 24, we regret the loss to the world of science of an equally important and esteemed worker. He was born in the village of Igelshieb, in Central Germany, in the year 1814. At an early age he mastered the art of glass-blowing—an industry which has long flourished in his native duchy of Sachsen-Meiningen—and for a number of years he led the life of a German *Handwerksbursch*, rambling from one place to another, accepting employment wherever it was offered. The German University towns offered to him the chief attraction, the preparation of the articles requisite for scientific research having for him a peculiar fascination; and his wandering life finally ended in a permanent settlement at Bonn. Here he developed rapidly. In the treatment of glass before the blowpipe he attained a degree of perfection hitherto unknown, and in his day unsurpassed. Despite the disadvantages of his early life, and the demands of his occupation, he succeeded in making rapid acquisitions in various departments of the natural sciences; and favoured by association with numerous leading celebrities, in physics and chemistry, he soon attained a remarkably comprehensive and intimate familiarity with scientific facts and principles. The union of this knowledge with his constructive ability and manual accomplishments was productive of the happiest results, and the past thirty years have witnessed a constant succession of novel and ingenious devices for the furtherance of scientific discovery, issuing from his *atelier*. Not only was he able to accomplish the practical realisation of the designs submitted to him, but in a multitude of cases, when simply the end in view was proposed to him, Geissler planned and produced apparatus of the most delicate construction, and exact precision, involving a mastery of physical laws to be expected only in one who had devoted his life to the solution of scientific problems. The impulse thus given by him to the march of original investigation is not easy to measure, for his name is rarely associated with the numerous discoveries where his fruitful ideas have contributed in a greater or less degree to the successful result. One of his earliest direct investigations was in companionship with the distinguished physicist, Plücker, in 1852. By means of a delicate apparatus, in which the expansion of the glass was exactly compensated by the introduction of mercury, they made a series of accurate observations on the expansion of water, and established the maximum of density at 3·8°. With an equal degree of accuracy the coefficient of expansion for 1° of ice between − 24° and − 7° was established at 0·0001585, and the coefficient of expansion for water when freezing at 0°, was ascertained to be 0·09195. In 1869, Geissler, in company with Vogelsang, demonstrated in an ingenious manner the presence of liquid carbonic acid in the cavities of topaz and quartz. The minerals were decomposed by means of a galvanic current, the resultant gases were collected in a vacuum, and the presence of CO_2 was shown by the electric arc. They succeeded, likewise, in producing a precipitation in lime-water, and established beyond doubt the character of the liquid present. Shortly after Geissler succeeded in changing ordinary phosphorus into the amorphous state by the action of the electric current.

The apparatus with which Geissler's name is most popularly associated consists in the famous *tubes* arranged for the exhibition and study of the phenomena accompanying the electric discharge in various gases and vapours. Their ingenious disposition has contributed much to the progress of research on the nature of the electric light and the condition of matter in the gaseous state. Scarcely less important are his inventions of the vaporimeter, the mercury air-pump, as well as the balances, normal thermometer, and normal areometer, and other instruments of precision devised by him, which have rendered such incalculable service to those engaged in exact research. A few years since the University of Bonn rendered a fitting tribute to the varied merits of Geissler by bestowing on him the honorary title of Doctor of Philosophy.

The career of Geissler was in many respects similar to that of Ruhmkorff. Both advanced from the lowest ranks of life to positions of honour in the scientific world, both gave, in a quiet and almost unrecognised manner, an important impulse to the cause of physical investigation, and both have left their names as "household words" in the nomenclature of the science to which they were so faithfully devoted. T. H. N.

GEOGRAPHICAL NOTES

LIEUT. WEYPRECHT informs us, with reference to his proposed scientific expedition to Novaya Zemlya that the statements which have appeared are very inaccurate, nothing having as yet been decided. He and Count Wilczek certainly intend to go there and make one year's thorough scientific observation in some place on the northern coast; special attention will be given to cosmical physics. They would prefer, however, if in other places of the Arctic and Antarctic regions, others would make observations simultaneous with them. Before the war broke out they had the best hopes of seeing their proposals nearly everywhere accepted, but the disturbed state of Europe during the last two years has prevented them from taking further steps. In April the International Meteorological Congress, which was to have met in 1877, will meet in Rome. One of the questions to be decided there will be, in what manner the Congress can contribute to the realisation of the proposals of Count Wilczek and Lieut. Weyprecht. On the decision come to at that meeting will theirs mainly depend. The programme which it is intended to carry out will be found described in NATURE, vol. xvii. p. 29.

THE commemoration of the centenary of Cook's death by the Paris Geographical Society on Friday seems to have been thoroughly successful. Several addresses were given, showing the services done by Cook to geography, to humanity, to navigation, and to science. M. Huber gave an account of Cook's career, showing how he dispelled the tenacious notion of an Antarctic continent, gave England New Zealand and Australia, discovered a multitude of islands, simplified nautical astronomy, studied oceanic currents, the variations of the compass, and the "Aurora Australis," laid down principles of hygiene, still of value, and opened new horizons to civilisation and religion. He paid a tribute to Cook's care of his crews, his mildness and forbearance towards the natives, his resort to reprisals only when the interests of the expedition or the lives of his men were imperilled, his intrepidity and inventiveness. In connection with Cook's death, M. Huber briefly adverted to the native account of the tragedy, as published four years ago by M. de Varigny, fourteen years a member of the Sandwich Islands Government. It is in the shape of a poem on Captain Cook, attributed to Kupa, an eye-witness of what happened. It describes how two forests were seen gently floating on the waters; how Kupa and others were ordered to swim up to them; how they found Goords, who breathed out fire and smoke from their nostrils and mouths, had dazzling white skins and sparkling eyes, wore skins of various colours, with holes in the sides, into which they plunged their hands, and which appeared full of treasures. A god with his thunderbolt kills Kupa's father, whereupon the other swimmers take to flight. The priest declares that the floating island is the war vessel of the god Lono, who, after murdering his wife through jealousy, left Hawaii long ago to explore the seas, and had now returned, according to his promise, after six generations. He bids the natives take them bananas, cocoa-nuts, and oranges, which are accepted. At night Lono and his fellow-gods shoot hissing arrows of fire at the stars, making some of them fall into the sea. Flames of strange colours descending from the trees of the floating islands and extraordinary sounds alarmed the natives. Next morning Lono lands; is treated as a god, with sacrifices and prostrations; but whether from anger, or from having forgotten the language, he makes no answer. Several of his inferior gods seize on sacred fish destined for the altar. Others begin pulling up the palisades surrounding the sacred inclosure, the Morai, where the elders meet. King Kalaimano remonstrates, but they laugh and persist. Lono comes up, crosses the sacred boundary, and is about to enter the Morai. Kalaimano intercepts his progress, but Lono rudely pushes him away. Kalaimano takes Lono up in his arms, and, on his struggling to free himself, presses him lightly. Lono cries out with pain. "He cries, so he is not a god," exclaims Kalaimano, and kills him. The other gods, who were pulling up the stakes, fly, but the natives fall on them, and, strange to say, their blood flows like that of mortals. Kalaimano, however, while launching arrows from the shore is killed by the invisible fire. Thus your fathers, concludes Kupa, saw the death in one day of their god and their chief. In this song the two visits of the vessels are fused into one. This confirms the story we referred to last week, and the impression that it was not treachery but vexation and disappointment that led to Cook's death. Much surprise, the *Times* correspondent states, was expressed in conversation at the inaction of the London Geographical Society. In Paris not only was a special festival organised with collections, which remained on view till Monday, but the Society has inserted in its *Bulletin* Mr. James Jackson's catalogue of the 300 works published in various languages relating to Cook. Dr. Hamy referred to Cook's observation of the transit of Venus at Tahiti, the rivalry and attacks of Dalrymple, and the fate of Cook's collections in being buried in an Austrian museum. He described Cook as ranking with Columbus and Magellan.

WE understand that the forthcoming number of the *Monthly Record of Geography*, published by the Royal Geographical Society, will contain a full bibliography and cartography of Zulu Land.

THE Russian Geographical Society proposes to give its great gold medal to Prof. Nordenskjöld.—The Berlin Geographical Society has given its gold medal to M. Prjvalsky.

WE hear that Capt. Henry Sengstacke, who had intended to accompany Dr. Otto Finsch in his projected scientific expedition among the islands of the Pacific, is shortly about to proceed to Behrings Straits for the relief of Prof. Nordenskjöld. Capt. Sengstacke took a leading part in recent German Arctic expeditions, and had but lately returned from the west coast of America. At his special request the Council of the Royal Geographical Society have, we understand, undertaken to furnish him with copies of the sailing directions for, and the latest and best charts of, the part of the world which he is now about to visit. The latest information, however, with regard to the relief of Nordenskjöld's party seems to be contained in the following telegram received by the Russian Government from the Governor-General of East Siberia:—"Irkutsk, January 28.—Sibiriakoff telegraphs to me from Zurich that a steamer belonging to Bennett will, immediately after the opening of the navigation, proceed from San Francisco to Behrings Straits to assist Nordenskjöld. It is therefore not necessary to send a steamer from Nicolajefsk."

AT the last meeting of the Berlin Academy of Sciences an account was given of the programme of Dr. Finsch's journey, the cost of which will be defrayed by the Humboldt Fund, and which is estimated at about 13,000 marks (650*l.*). Dr. Finsch will direct his principal attention to Polynesia. He will proceed to Honolulu *viâ* New York and San Francisco; thence he will visit the Marshall and King'smill group, the Caroline, Mary Anne, and Bonin Islands, and he intends to return *viâ* Japan, China, and the Philippine Islands.

MOVING OF HEAVY ORDNANCE

MODELS of the poop and topgallant forecastle decks of H.M.S. *Iris*, and midship main deck of H.M.S. *Dwarf*, are now exhibited by Mr. George Fawcus at the floating dock, North Shields, to explain how naval ordnance can be traversed and trained round elliptical or circular sterns and parabolic bows of vessels, from side to side amidships, or from a point blank or direct broadside, to a fore and aft range of barbette or over all fire "all round" without any changing of pivots; and how muzzle-loading guns can be turned round to load in board, to avoid the inconvenience of loading in front, and thus obtain all the presumed advantages of breech-loading ordnance.

A simple and compact mechanical motion has been developed from the action of the trammel or elliptograph, and is communicated rapidly along the diameters or minor and major axis of an ellipse or oval, as a shorter road than slowly round the circumference, with a small elliptical circuit instead of a circular segment of a larger circle. Two moving pivots replace a single central one. These pivots mutually assist each other to produce a reciprocal compound lever movement, one good graceful turn being succeeded by another, and are kept each in its own track of two intersecting straight lined grooves, which may be adjusted, by various angles of intersection and varied distances of the centres apart from each other, to obtain any imaginable curvilinear movement, so that guns of all kinds can be worked in less space with greater ease of movement, and therefore with less labour and waste of time, than has ever yet been previously effected.

NOTES

MR. PREECE and Mr. Stroh, who have been working for the past twelve months upon the acoustic properties of the phonograph, have completed their labours as far as the vowel sounds are concerned, and their paper on the synthetic examination of these sounds will be read before the Royal Society probably on the 27th inst. Several new instruments of great novelty and marvellous ingenuity will be exhibited, including a new phonautograph, an automatic phonograph, a compound curve-tracer, a new syren, and a new musical instrument.

WE record with deep regret the death, at Luxor, in Egypt, on the 1st inst., of Dr. C. E. Appleton, the founder and editor of *The Academy*. Dr. Appleton was under forty years of age, and had been in declining health for the past two years. His name will be familiar to many of our readers in connection with the Endowment of Research, on which subject he frequently wrote, and a volume of essays on which he edited a year or two ago. Dr. Appleton was himself mainly a student in metaphysics, but he clearly perceived the value of physical science, and the immense advantages likely to accrue to its progress, to our universities, and to the country, by the appropriation of part of the great wealth of the universities, and of the funds of the state, to the encouragement of original research. He laboured earnestly to advance these views, believing that it was the country's duty and interest to encourage the discovery of new truths. He will be greatly missed by his many friends.

WE have to record the death of Mr. Bennet Woodcroft, F.R.S., which happened on the 7th inst. at his residence in Brompton. Mr. Woodcroft will be best remembered in connection with the Patent Office, which he may be said to have originated, and the working of which he so ably and zealously superintended from the time of its establishment down to within the last two years. He was born at Bennet Grange, near Sheffield, in December, 1803, and was consequently in his seventy-seventh year when he died. Early in life he studied science under Dalton, of Manchester, and in course of time joined his father in his business, which was that of a Manchester manufacturer. After a while Mr. Woodcroft came to London, and was appointed Professor of Machinery at University College, London, in 1847 ; he held that appointment until 1851, when he resigned it. Next year witnessed the passing of the Patent Law Amendment Act, and the then Lord Chancellor, Lord Cranworth, appointed Mr. Woodcroft as superintendent of the specifications, for which post his great experience in patent matters especially qualified him. He retired from office in March, 1876, and during his administration of affairs he carried out the provisions of the Act with efficiency and liberality. The establishment of the library in connection with the Patent Office was mainly due to Mr. Woodcroft, as was also the formation of the Patent Office Museum at South Kensington, to which he was a very liberal contributor, and which was made a free institution solely through his exertions. Among other mechanical improvements effected by Mr. Woodcroft was that of giving to the screw-propeller what is known as an increasing pitch. He was the means of rescuing from oblivion the first marine steam-engine ever made. Mr. Woodcroft was the author of several scientific treatises, and wrote a series of biographical sketches of inventors. He was elected a Fellow of the Royal Society about twenty years since. An excellent notice of Woodcroft appears in the *Engineer* of February 14.

WE regret to announce the death at Berlin on January 15 of Prof. Philipp Spiller, one of the most eminent of German philosophers. Prof. Spiller was born on September 26, 1800, at Einsiedel, near Reichenberg, in Bohemia, and has enriched scientific literature by many valuable publications. His recent work, "Die Urkraft des Weltalls nach ihrem Wesen und Wirken auf allen Naturgebieten" (Berlin : Stuhr, 1876), is a work of the greatest importance and worthy of the attention of all interested in philosophy.

RUSSIA has lost one more of her mathematicians, Prof. Popoff, of Kazan. His works on the integration of differential equations, on hydrodynamics, on the waves which arise from the motion of a body, on definite integrals, on the calculus of variations, &c., have given to the late professor an eminent place among mathematicians.

MR. COWPER'S new "Writing Telegraph" will be brought before the Society of Telegraph Engineers at their next meeting, on the 26th inst., at the Institution of Civil Engineers.

THE Anthropological Institute has just received a legacy of 1,000*l*., bequeathed by the late Mr. Sydney Ellis of Nottingham.

M. CHEVREUL, who although about ninety years of age, enjoying good robust health, has resigned the administration of the Jardin des Plantes. M. Jules Ferry, the new Minister of Public Instruction, has written him a letter eulogistic of his career, and appointing him Honorary Administrator. M. Jules Ferry has appointed to the post, for a term of five years, M. Fremy, the eminent Professor of Chemistry, Director of the Laboratory at the Gardens, the practical School of Chemistry in Paris.

THE people of Penzance have been attempting to celebrate in a mysterious, hole-and-corner way, the centenary of the birth of their great townsman, Sir Humphry Davy, two months after the actual date. What their notion of the "adjacent" world is we do not know, but we doubt if they have any adequate appreciation of the greatness of Davy, whose only merit in their eyes seems to be that he was born in Penzance. Why, if they wanted worthily to honour one of England's greatest scientific worthies, did they not take the Royal and Chemical Societies into their confidence? or how is it that the Royal Society, being aware of the occurrence of this important centenary (they seem to have contributed to the exhibition), have made no efforts to take part in the celebration officially? We leave it to a foreign nation to honour the memory of one of our greatest explorers, and to a petty provincial town to commemorate the birth of one of our greatest chemists. There are surely several screws loose in our scientific organisation.

THE Russian Physical and Chemical Society is now discussing the means of a thorough study of the surface of the moon, especially by means of spectrum analysis.

PROF. FAMINTZIN, of St. Petersburg, has been elected member of the Russian Academy of Sciences in the place of the late Prof. Geleznoff.

A MEETING of the General Committee of the Hanbury Memorial Fund was held in the rooms of the Pharmaceutical Society yesterday. The Sub-Committee reported that the nett proceeds of the one-guinea subscriptions collected from all parts of the world amount, after payment of the cost of the die for the medal, &c., to about 350*l*. The Sub-Committee have to recommend :—1. That the proceeds be invested in consols ; the interest to be expended in defraying the cost of a gold medal to be awarded biennially (or otherwise) "for high excellence in the prosecution or promotion of original research in the natural history and chemistry of drugs." 2. That trustees be appointed, who, from time to time, shall request the following gentlemen to award the medal :—The presidents for the time being of the Linnean Society, the Chemical Society, the Pharmaceutical Society, and the British Pharmaceutical Conference, and one pharmaceutical chemist, who shall be nominated by the two presidents last-named.

A ROYAL COMMISSION, consisting of Mr. Warington W. Smyth, F.R.S., Sir George Elliot, M.P., Mr. F. A. Abel, C.B., Mr. Thomas Burt, M.P., Mr. Robert Bellamy Clifton, F.R.S., Prof. Tyndall, F.R.S., Mr. Lindsay Wood, and Mr. William Thomas Lewis, has been appointed for the purpose of inquiring and reporting whether, with respect to the influence of fluctuations of atmospheric pressure upon the issue of fire-damp from coal, to the adoption and efficient application of trustworthy indicators of the presence of fire-damp, and generally to systematic observation of the air in mines, to improved methods of ventilation and illumination, to the employment of explosive agents in the getting of minerals, and to other particulars relating to mines and mining operations, the resources of science furnish any practicable expedients that are not now in use and are calculated to prevent the occurrence of accidents or limit their disastrous consequences.

MR. R. MCLACHLAN, F.R.S., writes us that he is informed from two independent sources that Italy has lost its head from dread of the visitation of the *Phylloxera*. The restrictions on the importation of plants of any kind whatever, *and from any quarter*, are most rigid. A consignment of the newly-discovered gigantic Aroid, from Sumatra, received in Genoa, was subjected to formalities and delays in permission to be delivered, of a nature that seriously compromised the welfare of the tubers. In some places gentlemen must dispense with the ordinary floral decorations in their button-holes. On the French frontier no one is allowed to gather a bouquet of wild flowers on foreign soil and take them across the border, for fear that the much-dreaded pest should exist in it. All scientific reasoning seems to be at an end in the minds of the Italian Government officials. But let us not forget that in 1877 we ourselves were almost in the same condition, owing to the panic spread among us with regard to the Colorado beetle. A knowledge of the rudiments of phytological entomology appears to be so universally deficient that it only requires some agitator to raise a panic in order to bring about the most absurd restrictive enactions. No one can blame the Italians for endeavouring by all means in their power to prevent the introduction of the *Phylloxera* into their vineyards; but they might show a little common-sense discrimination. A restriction on the importation of foreign vines would be sensible enough, and they might go further, and prohibit the discharge of earth-ballast taken in by vessels at ports in districts known to be infected. To stop the introduction of *all* vegetables and flowers is quite unnecessary.

ON January 4, at 11 P.M., and on the following day at 9 A.M. a strong earthquake was felt at Maikop (Russia); there were five shocks, at intervals of about fifteen minutes.

THE installation of objects sent in for the Anthropological Exhibition at Moscow will begin in the end of March. The interesting collections from Samarcand have already arrived, as well as very interesting objects sent by the East Siberian branch of the Russian Geographical Society. Those of stone implements and of quaternary mammals especially draw the attention of the organising committee, as well as several numismatic collections.

WE notice a communication made by M. Kontkevitch, at the last meeting of the St. Petersburg Mineralogical Society, on the recently explored iron mines in the provinces of Kherson, Ekaterinoslav, and Taurida. At the confluence of the Saksagon and Ingulda rivers there are no less than forty layers of iron from 35 to 200 feet thick and several miles wide, containing 58 to 70 per cent. of iron, and representing a store of two and a half milliard cwts. of iron.

THE Aosta section of the Italian Alpine Club proposes to celebrate this year the centenary of Saussure's travels in the Alps, which opened up quite a new world for science and for travellers. In 1779 he stayed for the first time in the Valley of Annecy, and the Club proposes to put a commemorative marble plate on the house he inhabited in the village of Dolonne, near Courmayeur. An inscription will probably be placed also on the Grammont Mountain, whence Saussure made his famous observations on Mont Blanc, the first ascent of which he made in 1787.

THE Indian Government *Gazette*, we learn from the *Times of India*, contains papers on the proposed Presidency Botanic Gardens, including a Government minute and the report of the Committee. The Committee's consideration was invited to the question whether Puna or Bombay should be chosen as the place for the principal botanic garden of the Presidency. They decided in favour of Ganesh Khind. They recommend, however, that a small branch garden, consisting of four or five acres, be established in Bombay, and that the Grant College compound be selected for the purpose. The Government highly approved of all the recommendations, which will be carried out whenever financial means may permit. The main scientific garden, which will embrace about forty acres, is to be laid out in the irregular picturesque style, with special reference to landscape effect, and the planting of the ground will be done gradually and without any undue haste. It may be mentioned here that the chief resources of the garden are to be devoted to the bringing together of the indigenous plants of Western India, and until this is satisfactorily accomplished no pains will be taken, except in special cases, to introduce foreign plants. An extraordinary expenditure of Rs. 22,037 will have to be incurred for the purpose of constructing roads and footpaths, excavating a ground, erecting houses and sheds, providing iron piping, &c., for water supply, fitting up rooms for the herbarium, library, and class-room, and for the purchase of botanical books and diagrams. The estimated annual expenditure is, in round numbers, Rs. 12,000.

AT the last meeting of the French Geographical Society a letter was read from the Abbé Desgodins, dated Yerkalo, August 27, 1878, in which he states that, contrary to the common assertion which represents the sheep as the beast of burden most used in Thibet, this function belongs in preference to the yak (*Bos grussiens*); the mule, ass, and horse are also made use of. The sheep, he says, is only employed as a beast of burden at one period, viz., when the parties of Thibetans quit the high plateaux to descend into the valleys at the approach of winter. The Buddhist pilgrims are sometimes to be met with sheep and goats carrying their baggage, but, as the Abbé Desgodins remarks, there is a wide difference between that and representing the sheep as the beast of burden of Thibet.

THE first fascicule of the sixth volume of the "Repertorium für Meteorologie," published by the Russian Central Physical Observatory, contains a memoir, by Prof. Wild, on the temperature of the soil at St. Petersburg and Nukus (Amu-darya); geographical, magnetic, and hypsometric observations, by M. Fritsche, made during his journeys from St. Petersburg to Peking in 1866 and 1877; photochemical measurements of the intensity of daylight in St. Petersburg, by M. Stelling; determinations of the coefficients of anemometers, and magnetic observations on the Amu-darya, by the late M. Dorandt; and researches, by M. Frölich, into the temperature of space.

THE German *St. Petersburger Zeitung* states that the cost of the bronze monument to be erected at Dorpat, in memory of Carl Ernst von Baer, is estimated at 15,000 roubles (about 2,300*l.*), and solicits subscriptions towards this sum.

THE use of a paper dome for an astronomical observatory is a novelty in modern architecture, although, according to Prof. Greene, of Troy, U.S., under whose supervision this has been constructed, it promises to answer a satisfactory purpose. The

dome is a hemisphere with an outside diameter of twenty-nine feet. The framework is of pine properly seasoned, and the covering is of paper, such as is used by Messrs. E. Waters and Sons for the construction of paper boats. The entire weight of the dome and appurtenances, as completed, is about 4,000 pounds. It can be easily revolved by a moderate pressure without the aid of machinery.

THE director of the Postal Telegraph Service of the French Republic has been made a member of the Cabinet and placed on the same footing as the Postmaster-General of the British Government. The present holder of that office is M. Cochery.

THE Royal Institute of Sciences at Venice offers three prizes of 3,000 lire each (about 115*l.*) for three monographs containing (1) an account of the advantages which the application of physics to medical science has brought about; (2) a summary of the most recent investigations made in the field of theoretical hydrodynamics, as well as a statement of the true and essential progress made by this branch of scientific mechanics; (3) a treatise on the commercial and industrial conditions of the city of Venice. Further particulars may be learnt by applying directly to the "Istituto Reale Veneto" at Venice.

THE petrified remains of a Dinotherium belonging to the miocene period have just been discovered at Schöneg, near Salmhausen (Swabia), at a depth of 13 metres in a sand-hill.

WE recently referred to the all-embracing scientific agency of Friedländer and Son of Berlin, and this week we have received the first three parts of a new fortnightly publication from that house, likely to be of the greatest service to students in all departments of science. It is entitled *Naturæ Novitates*, and is a fortnightly bibliographical list of current literature of all nations, methodically arranged, in the various departments of science. The publication deserves encouragement; it may be had through Messrs. Williams and Norgate.

THE first part has reached us of an important German undertaking, an Encyclopædia of the Natural Sciences, constructed somewhat after the method of the old "Encyclopædia Metropolitana." It is to consist of methodical treatises in the various departments of science, followed by an index, which will give it all the advantages of an alphabetical cyclopædia. Each department has a separate editor, and some of the best men in Germany are engaged upon it. The first part is an instalment of a "Handbuch der Botanik," edited by Prof. A. Schenk, and contains a treatise on "Fertilisation of Flowers," by our friend Dr. H. Müller, and another on "Insectivorous Plants," by Dr. O. Drude. Trewendt of Breslau is the publisher.

THE Rev. W. A. Leighton has nearly completed the printing of the *third* edition of his "Lichen-Flora of Great Britain, Ireland, and the Channel Islands," which, it is expected, will be ready for issue early in March. This new edition is rendered necessary by the recent important discoveries in the west of Ireland, the north of Scotland, and the author's own researches in North and South Wales, whereby the number of our lichens, in the former editions amounting to 1,156, has been raised to 1,706, thus rendering our lichen-flora quite equal in number, rarity, and novelty, to that of any country in Europe.

AMONG recent deaths is that of M. Chauffod, Professor of Zoology at the Paris School of Medicine. M. Chaufford during his whole career opposed M. Claude Bernard's determinism, and advocated the existence of a vital principle and final causes in a number of books largely circulated.

FOR some time past the well-founded fear of trichina has led to a microscopic examination of much of the meat, especially pork, sold in Berlin. Recently the occurrence of this pest there has been more frequent, and Dr. Luedtge (who claims the invention of the microphone) has consented to give a course of instruction in this branch of microscopy, which began February 17. The course, with practical exercises, will occupy five hours, and is open to ladies and gentlemen at the price of 5*s*. The instruction is to be given in the old Mint, at the Microscopic Aquarium, of which Dr. Luedtge is the director.

DR. AUB, one of the oldest Rabbis in Berlin, recently received from the University of Munich a new doctor's diploma, commemorative of his having received that degree there fifty years ago. It was conferred by Dr. Steinthal in the name of the philosophical faculty.

IT is stated in the *Diario de Manila* that a mine of amianthus, or earth flax, has been discovered in the Island of Luzon. Several specimens of the mineral have been taken to Manila, and have been pronounced by competent judges to be of excellent quality.

IN December last a convention between Spain and China was signed in Spanish, French, and Chinese at Peking relating to the treaty which regulates the emigration of Chinese to the Island of Cuba.

A CORRESPONDENT to the *Times of India*, who lately rode through the Kohat Pass, gives a somewhat curious description of an Afridee village, or, rather, an Afridee family home. The first thing seen is a mud wall oddly slit and pierced, and over its summit rise a number of mud and generally round-shaped projections, on the tops of which may be seen a few children and women. These projections are the roofs of the little rooms or mud inclosures in which the family live during the day; but what immediately strikes the attention on approaching is the loop-holed mud tower overshadowing the mud inclosure. The house proper is reached by passing through a very narrow entrance between the family fort and the mud inclosure. Inside are winding lanes between high mud walls, loop-holed at every turn. The writer found the inhabitants of the village he visited exceedingly hospitable. "The men around him," he says, "had a curiously frank, inquiring, and manly look. Nothing in their demeanour as they stood examining me and watching me eat, could have embarrassed the most sensitive stranger; but as I attentively watched some of their countenances, I could not help observing how often their expression changed, and how often there flitted across their faces a look that made one insensibly shudder." It is worth noting that the women of the Afridees, although Mohammedans, do not cover their faces.

WE understand that Mr. J. R. Gregory, the well-known mineral dealer, has several specimens of that extremely rare mineral, *Percylite*, of which the only known specimen, till quite recently, was the example in the British Museum; he also has, we hear, specimens of another rare mineral, named *Schwartzenbergite*, both from the same locality—a new one for these minerals—in Bolivia.

THE additions to the Zoological Society's Gardens during the past week include a Ring-tailed Lemur (*Lemur catta*) from Madagascar, presented by Mr. Thos. G. Mann; a Cape Hyrax (*Hyrax capensis*) from South Africa, presented by Mr. A. H. Jamrach; two Black-headed Gulls (*Larus ridibundus*), a Common Gull (*Larus canus*), European, presented by Mr. Harry W. Preston; a Wood Owl (*Syrnium aluco*), European, presented by Mrs. George Blagden; a Garnett's Galago (*Galago garnetti*) from South-East Africa, two Yellow-billed Sheathbills (*Chionis alba*) from Antarctic America, purchased; a Yellow-footed Rock Kangaroo (*Petrogale xanthopus*), born in the Gardens.

SIR JOHN LUBBOCK ON ANTS

SIR JOHN LUBBOCK read two papers on ants at the Linnean Society on February 6. The first gave an account of their anatomy; but from the extreme complexity of these interesting little creatures, it would be impossible to make this communication intelligible without the figures. The second paper was a continuation of his observations on the habits of ants. He mentioned that he had at first isolated his nests by means of water. This was effectual enough, but, especially in summer, the water required to be continually renewed. Kerner, however, had suggested that the hairs of plants served to prevent ants from obtaining access to the honey, and it accordingly occurred to him that strips of fur arranged with the points of the hairs downwards might answer his purpose. He had tried this, and finding it successful, he thought a similar arrangement might perhaps be found useful in hot countries.

It is generally stated that the queen ants alone lay eggs, but Sir John has found that in most of his nests some few of the workers are capable of doing so. It appears, however, that these eggs always produce males. In the case of bees we know that the queen is fed on a special kind of food. In ants it is not feasible to make observations similar to those by which in bees this has been established. It is, however, rendered more than probable by the fact that while males and workers have been bred by hundreds in his nests, no queen has yet been produced.

It is well known that ants keep other species of insects in their nests, which they use just as we do cows, &c.

The *Mat. p. l'Hist. prim. de l'Homme* for 1869 contains a short but interesting account by M. Lespes of some experiments made by him on the relations existing between ants and their domestic animals, from which it might be inferred that even within the limits of a single species some communities are more advanced than others. He found that specimens of the blind beetle, *Claviger duvalii*, which always occurs with ants, when transferred from a nest of *Lasius niger* to another which kept none of these domestic beetles, were invariably attacked and eaten. From this he infers that the intelligence necessary to keep *Clavigers* is not coextensive with the species, but belongs only to certain communities and races, which, so to say, are more advanced in civilisation than the rest of the species.

Sir John Lubbock, however, removed specimens of the curious blind *Platyarthrus* from one nest to another, but they were always amicably received. He even transferred specimens from a nest of *Lasius flavus* to one of *Formica fusca*, with the same result.

As regards the longevity of ants he has now two queens of *F. fusca*, which seem quite in good health and which have lived with him since 1874; they are therefore probably five years old. He has also workers of *Lasius niger*, *Formica sanguinea*, *F. fusca*, and *F. cinerea*, which he has had under observation since 1875.

In his previous papers he had given various instances which seem to show that ants do not exhibit such unvarying kindness to their friends as has been usually supposed. He wished to guard himself, however, against being supposed to question the general good qualities of his favourites. In fact, ants of the same nest never quarrel among themselves; he had never seen any evidence of ill-temper in any of his nests. All is harmony. He had already in previous papers given various instances of tender kindness. Again, in one of his nests of *Formica fusca*, was a poor ant which had come into the world without antennæ. Never having previously met with such a case, he watched her with great interest, but she never appeared to leave the nest. At length one day he found her wandering about in an aimless sort of manner, and apparently not knowing her way at all. After a while she fell in with some specimens of *Lasius flavus*, who directly attacked her. He then set himself to separate them; but she was evidently much wounded, and lay helplessly on the ground. After some time another *Formica fusca* from her nest came by. She examined the poor sufferer carefully, then picked her up tenderly, and carried her away into the nest. It would have been difficult, Sir John thinks, for any one who witnessed this scene to have denied to this ant the possession of humane feelings.

It is clear from the experiments recorded in the present and in Sir John's former papers, that the ants recognise all their fellows in the same nest, but it is very difficult to understand how this can be effected. The nests vary very much in size, but in some species 100,000 individuals may probably be by no means an unusual number, and in some instances even this is largely exceeded. Now it seems almost incredible that in such cases every ant knows every other one by sight; neither does it seem possible that all the ants in each nest should be characterised from those of other nests by any peculiarity. It has been suggested in the case of bees that each nest might have some sign or password. The whole subject is full of difficulty. It occurred to Sir John, however, that experiments with pupæ might throw some light on the subject. Although the ants of every separate nest, say of *Formica fusca*, are deadly enemies, still if larvæ or pupæ from one nest are transferred to another, they are kindly received and tended with, apparently, as much care as if they really belonged to the nest. In ant warfare, though sex is no protection, the young are spared—at least when they belong to the same species.

Moreover, though the habits and dispositions of ants are greatly changed if they are taken away from their nest and kept in solitary confinement, or only with a few friends, still under such circumstances they will often carefully tend any young which may be confided to them. Now if the recognition were effected by means of some signal, or password, then, as it can hardly be supposed that the larvæ or pupæ would be sufficiently intelligent to appreciate, still less to remember it, the pupæ which were intrusted to ants from another nest would have the password, if any, of that nest, and not of the one from which they had been taken. Hence, if the recognition were effected by some password, or sign with the antennæ, they would be amicably received in the nest from which their nurses had been taken, but not in their own.

He therefore took a number of pupæ out of some of his nests of *Formica fusca* and *Lasius niger*, and put them in small glasses, some with ants from their own nest, some with ants of another nest of the same species. The results were that thirty-two ants belonging to *Formica fusca* and *Lasius niger*, removed from their nest as pupæ, attended by friends and restored to their own nest, were all amicably received. What is still more remarkable, of twenty-two ants belonging to *Formica fusca*, removed as pupæ, attended by strangers and returned to their own nest, twenty were amicably received. As regards one Sir John was doubtful; the last was crippled in coming out of the pupæ case, and to this, perhaps, her unfriendly reception may have been due. Of the same number of *Lasius niger* developed in the same manner from pupæ tended by strangers belonging to the same species, and then returned into their own nest, seventeen were amicably received, three were attacked, and of about two Sir John felt doubtful.

On the other hand, fifteen specimens belonging to the same species, removed as pupæ, tended by strangers belonging to the same species and then put into the strangers' nest, were all attacked.

The results may be tabulated as follows:—

	Pupæ brought up by friends and replaced in their own nest.	Pupæ brought up by strangers. Put back in own nest.	Pupæ brought up by strangers. Put in strangers' nest.
Attacked	0	7[1]	15
Received amicably	33	37	0

Sir John intends to make further experiments in this direction, but the above results seem very interesting. They appear to indicate that ants of the same nest do not recognise one another by any password. On the other hand, if ants are removed from the nest in the pupæ state, tended by strangers, and then restored, some at least of their relatives are certainly puzzled, and in many cases doubt their claim to consanguinity. Strangers, under the same circumstances, would be immediately attacked; these ants, on the contrary, were in every case—sometimes, however, after examination—amicably received by the majority of the colony, and it was often several hours before they came across one who did not recognise them.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

THE Medical Faculty of the University of Zurich gave, last week, the degree of M.D. to Miss Draya Sjocie, from Shabats, in Servia, and the Countess Vilma Hugonai, from Teteny, Hungary.

THE success of the high classes for ladies at Odessa has exceeded all expectations. On the opening day, January 21, instead of the expected sixty or seventy students, 215 ladies were inscribed. The University has offered its rooms for the classes.

[1] Of about three of these Sir John did not feel sure.

We learn from the Annual Report of the Moscow University that the number of students at the University was, during 1878, 1,643, with 108 professors; 318 of them were in the Jurisprudence Faculty, 131 in the Philological, 240 in the Physico-Mathematical, and 954 studied Medicine. No less than 62 medical students have taken part in the last war; the majority of students are very poor, and 417 of them received pecuniary help which has reached, during the year, the sum of 11,500*l*.

SCIENTIFIC SERIALS

American Journal of Science and Arts, January, 1879.—Prof. Loomis's important paper in this number on storms on the Atlantic, &c., has been noticed elsewhere. Prof. Marsh (in an appendix) describes a new order of extinct reptiles (*Sauranodonta*) from the Jurassic formation of the Rocky Mountains; they closely resemble Ichthyosaurus (of which no remains have hitherto been found in America), but are without teeth. The same author continues his "Principal Characters of American Jurassic Dinosaurs."—Prof. Greene, of Troy, New York, describes a paper dome constructed from his plans for an astronomical observatory. The paper covering is in sixteen equal sections, the framework of each section consisting of three ribs of pine meeting at the apex. There are also a circular sill at the base and two parallel semicircular arch girders spanning the dome (all of pine). The entire structure weighs about 4,000 lbs. The dome is supported on six 8-inch balls rolling between grooved iron tracks by direct pressure.—Mr. Edison describes his tasimeter as applied to measuring the heat of the stars and of the sun's corona.—Mr. Fontaine writes on the mesozoic strata of Virginia, and Mr. Holden on the brightness and stellar magnitude of the third Saturnian satellite.—A list of fifty species of east coast fishes (many of them new to the fauna) is supplied by Messrs. Goode and Blan.—In the "Miscellaneous Intelligence" will be found the report of the committee appointed to consider the scientific surveys of the United States territories.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 23.—"On the Microrheometer." By J. B. Hannay, F.R.S.E., F.C.S., lately Assistant Lecturer on Chemistry in the Owens College, Manchester. Communicated by H. E. Roscoe, LL.D., F.R.S., Professor of Chemistry in Owens College, Manchester.

In this paper the author reviews the work done by chemists and physicists in determining the relation between the chemical composition of a liquid and its rate of flow through a capillary tube. Poiseiulle[1] ascertained, in a very accurate manner, all the physical laws relating to the rate of flow, as regulated by temperature, pressure, and dimensions of the tube; but on examining saline solutions he could make nothing of the numbers presented, because he used percentage solutions instead of solutions proportional to the equivalent of the body dissolved. Graham,[2] noticing that Poiseiulle had discovered a hydrate of alcohol by running various mixtures of alcohol and water through the tube, examined mixtures of the various acids with water, and found that the hydration proceeded by distinct steps of multiple proportions. Several others, notably Guerout,[3] have since worked on the same subject, but as they have only worked on organic liquids, and have done all the rates at the same temperature, the results throw no light on the phenomena. Thus water runs about five times as quickly at 100° as at 0°; and in a series of alcohols, such as Guerout experimented upon, the differences between their boiling points were very great, so that, their vapour tensions or molecular mobilities being quite incomparable while at the same temperature, the experiments do not admit of any real interpretation. The author reserves the organic part of the investigation, which requires the determination of vapour tensions, till a future paper, and in the present deals with saline solutions.

The phenomenon of the flow of liquids through capillary tubes has been called in this country transpiration, while in other countries no distinct name has been adopted; and as the English word is already in use in French for another purpose, and properly applies to gases (the laws relating to which are quite different), the author proposes to use for liquids the term "Microrheosis," from μικρός and ῥέω, the instrument being called the microrheometer. The form of apparatus which the author finally adopted is figured in the paper, and is so arranged that when the liquid is introduced, as many experiments as may be desired may be tried, and the pressure and temperature, as well as the atmosphere in which the experiment is conducted, may be varied, while the thermometer indicating the temperature is at the mean point of the system. The author gives a curve for water from 0° to 100°, the differences of rate being smaller as the temperature rises.

Various salts are then examined, being dissolved to form "normal" solutions; but as the solubility of some salts is too low for such solutions, the effect of the amount of salts dissolved is determined. This is found to be directly proportional to the amount of salt in solution. Values for many salts in solution are then given, each number being the mean of ten experiments, and the probable error of the mean is calculated in each case. The conclusions arrived at are these. The rate of flow does not depend on any of the "mechanical" features of the salt, such as crystalline form, specific volume, solubility, &c.; but upon the mass of the elements forming the substance and the amount of energy expended in its formation. Each element has a value of its own, which is continued in all its compounds. Thus all the salts of potassium and sodium formed by the same acids have a constant difference. In like manner each metalloid and acid radicle has a value which is continued in all its combinations. Then the greater the combining value of an element the quicker is its microrheosis; thus potassium has a higher rate than sodium, barium than strontium, strontium than calcium, and so on. The microrheosis also varies with the amount of energy in the compound; thus nitrates stand highest, as they contain most energy; then chlorides; and, lastly, sulphates, which are exhausted compounds.

The instrument, bringing to light as it does the fundamental relations of combining weight and energy in chemical action, will be of the utmost importance in chemical physics, as by its use not only will the amount of energy evolved in reactions be determined, but the mass combined; or, in other words, the chemical equivalent of the elements involved will be found.

February 6.—"On certain Dimensional Properties of Matter in the Gaseous State." By Osborne Reynolds, F.R.S., Professor of Engineering at Owens College.

Mathematical Society, February 13.—C. W. Merrifield, F.R.S., president, in the chair.—Sir J. Cockle, F.R.S., was admitted into the Society.—Mr. R. Hargreaves and Prof. W. E. Story were proposed for election.—Dr. Hirst, F.R.S., communicated a paper by M. Halphen on the number of conics which satisfy five independent conditions.—Sir J. Cockle spoke upon a construction for making magic squares. Messrs. Cayley, Harley, Henrici, Roberts, Hart, and other gentlemen took part in a discussion on the subject. Prof. Henrici, F.R.S., gave some properties of frames.—Prof. H. J. S. Smith, F.R.S., read two papers on a modular equation and on the formula for four Abelian functions.—Mr. J. J. Walker communicated a quaternion proof of Minding's theorem.

Linnean Society, February 6.—Prof. Allman, F.R.S., president, in the chair.—Mr. J. R. Jackson exhibited specimens from the tombs of ancient Thebes. Among these were fruits of the Doum Palm (*Hyphæne thebaica*) and of *H. aigun*, formerly, but wrongly, described as an *Areca*. Small berries also obtained were identified as those of *Juniperus phœnicea* as against those of *J. excelsa*.—Mr. J. G. Baker showed dried bulbs of *Buphane toxicarea*, which furnish a principal ingredient of the poison the Bushmen of South Africa tip their arrows with. Structurally, the numerous tunics of the bulb are a peculiarity. The range of this plant has been found to be as far north as Lake Tanganyika. In Sir C. W. Strickland's hothouse a plant flowered last year, and this for the first time in England.—Mr. W. T. Thiselton Dyer shortly described specimens of, and pointed out the special characters and probable advantages of, a new fodder grass, *Euchlæna luxurians*, and he also exhibited and made remarks on curious instruments used for weaving fibre of *Curculigo latifolia* by the natives of Borneo.—Mr. T. Christy drew attention to a sample of tea grown in Natal, and to a bottle of the milky secretion of the African Rubber Tree (*Landolphia*), the same having been freshly drawn from the living plant and immediately thereafter forwarded to this country; slight coagulation of the juice had nevertheless occurred.—The Rev. G. Henslow passed round for examination a specimen of female

[1] *Ann. de Chim. et de Physique*, [3], t. vii. 50.
[2] *Phil Trans.*, 1861, p. 373.
[3] *Comptes Rendus*, lxxix. p. 1201; lxxxi, p. 1025.

mistletoe bearing male shoots. The botanists present expressed opinion of its being an androgynous condition rather than a male parasitic on a female plant, as had been supposed.—Mr. R. Irwin Lynch exhibited and made remarks on parts of the Bull's Thorn Acacia (*A. sphærocephala*), the Imbauba Tree (*Cecropia peltata*), and on a couple of Orchids (viz., *Espidendron bicornutum*, and *Schomburghii tibicinus*), as exemplifying their economy in affording protection to, and food for, ants. Mr. F. Darwin has already described the two former (*L. S. J. Bot.*, xv. p. 398), but that orchids should furnish a nidus for ants is apparently a new fact.—A short paper on the position of the genus *Sequenzia* among the Gasteropoda was read by Dr. J. Gwyn Jeffreys. His opinion differs from that lately promulgated by the Rev. R. B. Watson, believing that it belongs to the Solarium group rather than to the Trochus family, where placed by the latter naturalist.—There followed two papers on the anatomy and on the habits of ants, the gist of which we give elsewhere.

Physical Society, February 8.—Annual meeting.—The President (Prof. W. G. Adams) read the Report of the Council, which showed that the papers had been more numerous during the past than in any previous year, and that their value and interest had been well sustained.—A copy of the collected papers of the late Sir Charles Wheatstone was laid on the table, and the work will shortly be issued to the members of the Society.—The President then gave a brief review of the physical work of the past year, dwelling more especially on the papers read at the meetings.—Votes of thanks were then passed to the president, to the Lords of the Committee of Council on Education, to the demonstrator, treasurer, secretaries, and auditors, and the following were elected as Council and Officers for the ensuing year:—President—Prof. W. G. Adams. Vice-Presidents—Prof. G. C. Foster, Prof. R. B. Clifton, Lord Rayleigh, Dr. Spottiswoode, Sir Wm. Thomson. Secretaries—Prof. A. W. Reinold, Mr. W. Chandler Roberts. Treasurer—Dr. E. Atkinson. Demonstrator—Prof. F. Guthrie. Other Members of Council—Capt. W. de W. Abney, Dr. Warren de la Rue, Major E. R. Festing, Prof. Fuller, Dr. Huggins, Prof. A. B. W. Kennedy, Prof. McLeod, The Earl of Rosse, Mr. G. Johnstone Stoney, Dr. Wormell. Honorary Members—Prof. G. R. Kirchhoff, Dr. J. Plateau.—The meeting was then resolved into an ordinary one, and Dr. O. J. Lodge read a short paper on a method of calculating the course of temperature in a rod along which heat is being conducted.—Mr. Shoolbred gave an account of electric lighting illustrated by diagrams of the most recent magneto- and dynamo-electric machines and examples of the lamps in vogue. The only surviving magneto-machine is that of De Meritens, which is incomparably superior to the older ones of Nollet and Holmes. The dynamo-electric machines described were the continuous-current machines of Siemens, Gramme, Wallace-Farmer, and the alternating current machines of Wilde, Gramme, and Lontin. Wilde's machine is the first of these, or parent machine, and Lontin's so resembles it that the latter cannot be used in England. In these machines the current from a continuous machine is passed through a second machine, which yields the alternating currents. In Lontin's machine also a number of distinct currents are generated in separate circuits, each of which is capable of feeding several lights. There is now one in use on the Western Railway of France which gives three distinct currents, each of which supplies four different lamps, making a total of twelve lights. The American Brush machine was also mentioned. The Dubosq lamp, which was the first regulator, is well adapted for laboratory purposes, but for practical purposes the Serrin is preferable. Rapieff's lamp is used in the *Times* office. The De Mersanne, which was highly spoken of at the Paris Exhibition, moves the carbons by bevelled gearing. The Wallace-Farmer lamp, though durable, is unsteady, perhaps because only inferior gas carbon has yet been used. Jablochkoff's candle was found to be defective from the solid insulator, such as plaster, used between the carbons. This made it very expensive also. Experiments in Paris had shown that whereas Jablochkoff's system cost 10*d.* per hour per light, the other systems only cost one half of that. In Wilde's candle the solid insulator was dispensed with, air taking its place, the arc always tending to keep at the tip of the candle by electro-dynamic repulsion. In the De Meritens' candle three strips of carbon were used, the intermediate one being a stepping-stone to the arc, which passes between the two outer ones. Werdermann's and Regnier's so-called incandescent lamps were also shown. Mr. Shoolbred, after alluding to the fact that the upper positive carbon takes a crater form, and hence becomes a reflector, shedding the light downwards, stated that experiments had proved the line of maximum intensity of light to pass downward at an angle of 60° to the axis of the vertical carbons. By giving the positive carbon a horizontal displacement behind the lower negative one, Mr. Douglass, of the Trinity House, had been able to raise this line till it became horizontal, an advantage in light-houses. He also pointed out that whereas in Paris the Jablochkoff waxed for a period, short compared to that in which it waned, in London it waxed for longer than it waned, which was, of course, an improvement, and Mr. Shoolbred suggested that it might be due to the fact that the engine worked at speed nearer to that of the machine, and that the machine was founded more solidly in London than in Paris. Mr. Werdermann said that it was a mistake to call his lamp an incandescent one, the fact being that all carbon lamps gave light from the incandescence of the positive carbon, and that a small arc was formed in his lamp between the two electrodes, which could be varied by the pressure between them. He maintained that it was as easy to produce 500 lights as 10 from the electric current by subdivision, as he hoped soon to show; and stated that the size of the carbons greatly controlled the intensity of the light. Prof. Ayrton held that the obstacle to the subdivision of the electric light was not an electrical one, but was due to the fact that the amount of light produced by the current is not in direct proportion to the amount of the heat produced. In contradiction to Prof. Ayrton, Mr. Werdermann stated that in the electric arc the opposing electromotive force was proportional to the original electro-motive force. Prof. Silvanus P. Thomson pointed out that residual magnetism in the cores of the bobbins of dynamo-electric machines lowered their efficiency, and hence short cores, as in the Wallace-Farmer machine, were an improvement.

EDINBURGH

Royal Society, January 20.—Prof. Kelland, president, in the chair.—Prof. Crum Brown gave the third part of a paper by him and J. Adrian Blaikie, B.Sc., on the action of heat on salts of tri-methyl-sulphine. They find that—I. the aqueous solution of tri-methyl-sulphine does not yield crystals when evaporated over sulphuric acid in vacuo, but only a thick syrup was obtained. On heating this at 100° it decomposes—water acetate of methyl and sulphide of methyl being given off.

$$CH_3{-}COO{-}S(CH_3)_3 = CH_3{-}COO{-}CH_3 + (CH_3)_2S.$$

II. The aqueous solution of benzoate of tri-methyl-sulphine cystallises in small thin plates which it is difficult to separate from the thick mother-liquor. On heating, the imperfectly dried salt yields at 110° water, sulphide of methyl and benzoate of methyl; the later boiling at 198°.

$$C_6H_5{-}COO{-}S(CH_3)_3 = C_6H_5{-}COO{-}CH_3 + S(CH_3)_2.$$

III. The dithionate of tri-methyl-sulphine is obtained by neutralising free aqueous dithionic acid with the hydrate. It crystallises readily in small clear cubes with one molecule of water of crystallisation. It is not hygryscopic. On heating at 220° sulphurous acid begins to come off, and afterwards along with it sulphide of methyl, leaving methyl-sulphate of tri-methyl-sulphine.

$$\{(CH_3)_3S\}_2S_2O_6{-}H_2O = \underset{H_2O.}{\{(CH_3)_3S\}CH_3SO_4} + SO_2 + S(CH_3)_2 +$$

—Prof. Tait then gave the result of some experiments he had been making to determine the electro-motive force of the Gramme magneto-electric machine at different speeds. The experiments were not completed but they seemed to show that the electromotive force varied approximately in the duplicate ratio of the rate of turning. He explained that the Gramme machine with an electromotive power of about 37 Bunsen cells could give as powerful an electric light as a battery of 60 Bunsen cells, for the resistance in the Gramme is very much less than that in the battery of Bunsen.—Prof. Tait gave a note on the law of cooling of bars. He mentioned that in his continuation of the experiments of the late Principal Forbes on the condition of heat in bars, he had been able to reproduce all Forbes's results with one exception. This was that the rate of cooling of the bar when exposed after being heated to a hig temperature, was found by Forbes to be rather slower at first than afterwards. Or if we express the temperature of the bar in terms of its excess of temperature above the air, he found that at first it grows till it reaches a maximum and then falls off. Prof. Tait found this phenomenon always at the beginning of his experiments, but by heating the bar to temperatures higher than was required for his experiments, this peculiarity vanished before

the temperatures were reached upon which the results were based. On trying to explain this phenomenon by Fourier's conduction of heat, he found that the difference between the true and the false law of cooling should not last more than a fraction of a second, whereas it lasted more than 10 minutes. He accordingly concluded that it must be due to the fact that the thermometers did not acquire at once the temperature of the bar, but that some minutes must elapse before the whole of the thermometer has the proper temperature. He tested this by heating a bar and placing a thermometer in it as soon as it was allowed to cool. The phenomenon appeared. After a few minutes, when the thermometer was indicating the true rate of cooling of the bar, a second thermometer was placed in the bar close to the first. The second showed the same phenomena, though the first was now following the usual law of cooling. In 5 or 6 minutes the first and second thermometers gave identical results, but a third thermometer gave the old phenomenon when newly inserted alongside the others. Other experiments confirming these were also made. —Mr. J. Y. Buchanan read a note on the distribution of temperature under the ice in Linlithgow Loch. He had made these experiments while testing a new deep-sea thermometer by Negretti and Zambra. His results showed that with the depths for abscissæ and the corresponding temperatures for ordinates, the curve so plotted was one of contrary flexure—the contrary flexure being at the temperature of 37·6° F., which he expected further experiments would show was the temperature of maximum density for the water of the loch. One remarkable fact was that the temperature rose as the bottom was reached, being about 40·1° there. This he thought was due to the oxidation of matter at the foot, and this idea was confirmed by the fearful stench of the water.—Dr. Alexander Macfarlane continued his paper on the principles of the logical algebra. He showed that $x^2 = x$ is of the nature of a condition imposed on x and that a more general form is $x^2 = \pm x$. He applied the principles of the logical algebra to deduce the general conclusion from data of certain common forms, and gave theorems on the number and nature of such general conclusions.

PARIS

Academy of Sciences, February 10.—M. Daubrée in the chair.—The following papers were read:—Last reply to M. Pasteur, by M. Trecul.—Fourth reply to M. Berthelot, by M. Pasteur.—On the existence of an apparatus prehensive or complementary of adherence, in parasitic plants, by M. Chatin. This apparatus is most commonly furnished by the parasite, sometimes by the sustaining plant, or both. More often the form is that of a bell, of which the sucker corresponds to the tongue. Sometimes the tissue of the supporting plant rises round and embraces the sucker; and sometimes both plants furnish uniting growths round the point of attachment of the sucker. The author shows how the prehensive arrangement is more or less strong according to circumstances, and he gives histological details.—M. de Lesseps read a letter from M. Roudaire, giving news of boring operations in the region of the isthmus of Gabes, which are so far encouraging. One fact stated is that fresh water was found at 4 metres depth at the highest point; this would be important in the case of cutting through the tongue of land.—Observations on the project of forming an interior sea in Eastern Sahara, by MM. Martins and Desor. Having visited the region in 1863 they disapprove of the project, on the score of mirage possibly falsifying observations, the water of the new sea and any change of climate ruining the date palm cultivation, on which the natives so largely depend, &c.—Researches on the formation of latex and laticiferous vessels, during germinative evolution, in the embryo of *Tragopogon porrifolius*, by M. Faivre.—On the determination of imaginary roots of algebraic equations, by M. Farkas.—Remarks on differential linear equations and those of the third order, by M. Combescure.—On a simple way of presenting the theory of potential, and on the differentiation of integrals in cases where the function under the sign $\int$ becomes infinite, by M. Boussinesq. —Hydroelectricity and hydromagnetism; experimental results, by M. Bjerknes. These relate to actions of two pulsating or two oscillating bodies with each other, or a pulsating with an oscillating body. In one set of experiments air columns in two bell jars immersed in water, were varied through tubes, by means of pumps, causing pulsations.—On green and phosphorescent light from molecular shock, by Mr. Crookes.—On the dissociation of hydrate of chloral (new method) by MM. Engel and Moitessier. The dissociation is effected at about 61° in an atmosphere of chloroform. (A mixture of hydrate of chloral and chloroform is submitted to distillation.)—Researches on the yeast of beer, by MM. Schützenberger and Destrim. They compare the modifications of yeast in presence and absence of sugar. Simple digestion of yeast at 30° for twenty-four hours made it lose 1·77 per cent. of solid matter. With yeast and sugar there was an increase of solid matter; about 11·3 per cent. of yeast, or 5·7 per cent. of sugar.—On the homologues of oxyheptic acid, by M. Demarçay.—Analysis of a honey of Ethiopia, by M. Villiers. This honey, called *tazma*, is gathered (without wax) in subterranean cavities by an insect resembling a large mosquito. It differs from other honeys by absence of cane-sugar.—On the banana, by M. Corenwinder. He points out variations in its composition. In the fruit, sound and ripe, the total proportion of sugar may rise to 22·06 per cent.—On a process of enriching phosphates of carbonated gangue, by M. L'Hote. He effects decarbonatation of the phosphate, by heating it to near a cherry red, and making steam act on it. The quick lime is separated by means of weak hydrochloric acid.—On various epizooties of diphtheria of courtyard fowls at Marseilles, and on possible relations of this disease with human diphtheria, by M. Nicati. Inoculation of a rabbit succeeded; and the appearance of the disease in the fowls seemed to occur along with an increase of human diphtheria.—On the sensibility of the eye to action of coloured light more or less diluted with white light, and on photometry of colours, by M. Charpentin. The chromatic sensibility remained constant provided the white light added did not exceed a certain pretty high maximum (in the case of red, ten or twelve times the intensity of the red). A very simple element of comparison (of white and colourless lights) is had in determining for each light used, the minimum quantity capable of causing the original sensation of colourless light.—Researches on the physiological properties and the mode of elimination of methyl-sulphate of soda, by M. Rabuteau.—On sub-periostic ossification and especially on the mechanism of formation of Haversian systems in the periostic bones, by M. Laulanié.—Researches on the liver of cephalopod molluscs, by M. Jousset de Bellesme. The liver in these animals is not analogous in function to the liver of vertebrates. It is a digestive gland, merely transforming albuminoid matters, and without action on fatty or amylaceous matters.—Observations on a shower of sap, by M. Mussel. This was observed in autumn from the leaves of *Abies excelsa*.—The death of M. Gervais was announced.

GÖTTINGEN

Royal Academy of Sciences, December 7, 1878.—On the ponderomotor elementary law of electrodynamics, by Herr Riecke.—The mean depth of the ocean and the proportions of land and sea, by Dr. Krümmel.

January 4.—The meteorite collection of Göttingen University on January 2, 1879, by Herr Klein.—Electrolytic friction compared with capillary friction, by Herr Kohlrausch.

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