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THURSDAY, AUGUST 25, 1870

SCIENCE AND MILITARY SURGERY

IT is matter of no small interest at the present time to know something of the scientific position of our Army Medical Service. The question has two aspects—first, the purely professional and technical; and second, the general and scientific. In former times sick and wounded soldiers in all services had inadequate care bestowed on them, but for many years past the advance of humane principles, and improvements in education and in all manner of appliances, have been gradually making way in different European armies; and at this time we are presented with the astonishing spectacle of distinct corps of men and women, many of them of noble and gentle birth, following the example first set by Florence Nightingale, leaving their families and homes to accompany armed hosts to the battle field—their lives considered sacred by both sides—with the single object of conveying away poor wounded men as speedily as possible to shelter and to surgical and nursing care.

It would not be difficult to trace this great movement to the disasters of the British army during the Crimean war; and to the same event we have been indebted for the striking scientific advance in our own army medical service. We have been led into making these remarks by a perusal of the Army Medical Department Report for 1868. This is the tenth volume of an interesting series of official documents, the commencement of which dates from the reforms introduced by the late Lord Herbert.

The present volume maintains the reputation already gained by its predecessors, and even for non-professional readers it affords information of much general interest. A brief sketch of its contents will be sufficient for the object we have in view.

In turning over its pages we find in the first place the medical statistics of the whole British army. Wherever Her Majesty's troops are stationed, there the statistical officer is at work collecting and registering facts, which show not only the state of health at each station, but the diseases incidental to countries and climates the most diverse.

The death rates, which for foreign stations include deaths among invalids, show a large reduction over those which ruled in former years, but in many cases they are considerably too high, and indicate the necessity for increased sanitary precautions. The greatest reductions have been effected in India, where for the first half of the present century the rates averaged no less than 69 per 1000. In 1868 the death-rate was 21·7 per 1000.

The reports from stations are accompanied by sanitary notes, in which the reasons for these death rates are more or less discussed, and there are valuable reduction tables showing the influence of age, locality, &c., on the rates.

The net results of the Abyssinian expedition are given as follows:—The aggregate strength of British troops sent to Abyssinia at various dates was 4,208. There were 42 deaths in Abyssinia, and 12 among invalids in England, making 54 in all; equal to 12·8 per 1000. There were 12 admissions but no deaths from wounds. The total loss arose from disease and accident, the latter cause occasioning 14 deaths.

Among the scientific papers is one by Dr. Wright, giving an account of experiments on the ventilation of a barrack-room, and affording an insight into the nature of solid particles floating in impure air, which particles formed the subject of Prof. Tyndall's lecture on "Dust and Disease," at the Royal Institution, last spring.

The presence of dust particles in the air of the Royal Institution was shown by their reflecting a strong light thrown on them. In Dr. Wright's experiments made at Netley Hospital, 26 cubic feet of air were drawn through an aspirator, and the suspended matters in this air were condensed, and gave the following results under a $\frac{1}{8}$th inch object glass:—

Cotton fibres.
Starch granules.
Crystalline substances, sand, or dust.
Vegetable tissues of various sorts.
Pollen.
Amorphous Molecules (? Detritus of epithelium).
Indefinite filaments.
Minute moving particles (? Zoospores).

It is important to point out that these substances were detected in the air of a sleeping-room occupied by 11 men, where each man had 828 cubic feet of air space, the air of which was renewed upwards of four times every hour. The carbonic acid ratio in the outer air was ·393 per 1000 volumes, and in the room air, ·643 per 1000 volumes. The practical result being that for some reason the actual ventilation of the room was very defective, although the quantity of air ought to have been more than sufficient.

Dr. Parkes has supplied an interesting paper on Dr. Hassall's Flour of Meat, giving an experimental account of its effect as a diet on two healthy persons. The object was to ascertain whether it could be used by soldiers, and to what extent. The results arrived at are what might have been expected, viz., that nitrogenous foods of this class are, by themselves, insufficient for purposes of health and nutrition; while, as Dr. Parkes tells us, "the effect on each gentleman of the addition of other articles of diet (vegetables, fat, and a little more starchy food) was described by both as perfectly marvellous." This result gives the clue to the proper manner of using prepared foods of this class.

Dr. Parkes likewise furnishes a report on the progress of hygiène for the year 1869, in which a useful digest is given of the leading contributions made to this important subject in various countries. One important scientific result of painstaking inquiries into the relation of cattle diseases to specific fungi, carried out in America, is stated as follows:—"It will thus be seen that the authors trace all the forms of fungi seen in the blood and fluids in the pleuro-pneumonia, or splenic disease of cattle, to common forms, and that they entirely differ from Hallier on this point."

Hallier has fared no better with his theory of specific cholera fungi at the hands of Drs. Lewis and Cunningham, the two observers appointed by the Indian Government to examine into the question in India. These gentlemen furnish a paper on this subject, in which they state that up to the time of report the fungi supposed to be peculiar to cholera belong to common forms.

There is a curious paper by Dr. Smith on the notorious Delhi boil, in which he goes a long way in connecting this disease with impure water used for ablution purposes by the troops. He shows that dogs who drink this water get boils on their noses, while human beings are affected at the points where the skin is rubbed in the process of ablution. Microscopic preparations of the boil appear to show the presence of ova of distomata similar to those detected long ago in London waters by Dr. Hassal.

Professor Longmore furnishes some valuable remarks on the Prussian arrangements now in actual operation for transport of wounded in time of war. These remarks have a special interest at the present time, and they are illustrated by Professor Longmore's own personal experience. Ordinary railway-carriages and goods-waggons have been selected by the Prussians for the conveyance of wounded by rail. In ordinary fourth-class carriages hooks are screwed into the opposite sides of the carriage, and the field-stretchers with wounded are carried inside and suspended by elastic rings on the hooks. The operation is facilitated by the lower class carriages having a door at each end. When goods-waggons are used, the stretchers are either suspended or, which is far better, they are placed on poles laid on semi-elliptical steel springs inserted in the floor of the waggon. Professor Longmore prefers the arrangements in the fourth-class carriages, as being easier in practice.

There is in the Prussian army a complete organisation of medical officers, bearers, stretchers, field ambulances, &c., for collecting the wounded, dressing them on the spot, and conveying them either to the railway or to hospital, where, as we are glad to learn, they are now meeting with every care and kindness at the hands of humane men and women, whose motto may well be that adopted by one of the societies—" Point d'ennemis pour nous." * After describing the exercises he witnessed, Professor Longmore very properly suggests whether we in this country might not do something in the way of organising a suitable ambulance corps? This was one of Lord Herbert's proposed reforms, but we are afraid little has been done in giving effect to it.

Another subject discussed is the method adopted for identifying the bodies of the killed by means of tickets attached to the clothes or worn round the neck.

There are several other papers, including monthly meteorological abstracts for stations scattered over the whole British Empire, which we should have gladly noticed had our space permitted. But we have said enough to show that, in scientific advantages, the Army Medical Department, with its efficient school at Netley, stands second to none in Europe. It is for those who have the direction of the army to see that there is an organisation provided to give practical effect to it in the field where its services are most required.

THE ANNUAL REPORT OF THE ROYAL COLLEGE OF SURGEONS

FOR some years past it has been a custom at the College of Surgeons for the Conservator to collect the various specimens that have been mounted during the preceding twelve months into one room; enabling not only the Museum Committee, but the members of the medical profession, or visitors introduced by them, to see at a glance the additions that have been made during that period. We consider the plan to be an excellent one. It is a powerful incentive to the Conservator to work so that each year's results may surpass the previous one; whilst it calls forth gifts from those who have the opportunity of obtaining rare or valuable specimens, when they see what loving care and diligence are spent on their preparation and exhibition, and to how large a number they afford instruction. We had recently an opportunity of minutely inspecting these additions, and must express our warm admiration at their number and beauty. The Museum, as every naturalist knows, was commenced by the genius of Hunter, who, recognising the value that would attend the comparison of the same organ in the different groups of animals in enabling us to acquire precise knowledge of its function, and to penetrate the mysteries of disease, collected from all quarters typical specimens which he carefully dissected and described; but worker as he was the preparations he left have constituted but landmarks for the direction of succeeding observers. Although neither his time, strength, nor opportunity permitted that he should bring home more than a few examples displaying the wondrous fertility of the new region he had discovered, his success stimulated others to do their utmost. Preparation after preparation of every organised being that could be obtained by purchase or gift was rapidly added, and many times it has been found necessary to enlarge the receptacle for the sake of the new and important preparations that had been obtained, till at length it has attained its present lordly dimensions, and stands without a rival in the world. Nothing, perhaps, could give such an idea of the vast increase it has undergone —which would surely have well pleased its founder, could he have seen how his small though valuable beginnings had increased and multiplied—as the fact that a roomful of preparations that would handsomely furnish forth an entire country museum, is year by year absorbed into it, and scarcely appreciably augments its size.

The additions are divided into six classes—1, The Pathological Collection; 2, The Osteological; 3, The Physiological; 4, The Teratological; 5, The Dermatological; and 6, Anatomical preparations. The first of these has received many additions, and in particular one very important one, in which the carotid and subclavian arteries were tied by Mr. C. Heath for aneurism, and in which life was preserved for four years, and would probably have been considerably prolonged but for the extremely unsteady habits of the patient. The duration of life after the operation has permitted the collateral circulation to be fully established, and all the parts have been beautifully dissected out by Mr. Mosely.

In regard to the osteological collection, a large collection of ancient and modern Italian and Greek skulls has been purchased from the well-known Italian ethnologist, Dr. G. Nicolucci, of Isola di Sora. The number of these skulls was 166, and the entire number in the museum now amounts to 795, the great proportion of them being well authenticated and characteristic examples.

It is one thing, however, to have fine specimens, and another to display them to the best advantage; and often the chief value of a specimen, or even of a collection, is spoiled by the slovenly manner in which the mounting is effected,

* Contributions in aid of this great work may be sent to the National Society for the Aid of Sick and Wounded, 2, St. Martin's Place, Trafalgar Square, S.W.

or the imperfect way in which they can be examined. The difficulties which have hitherto lain in the path of osteological investigation of the skeletons of different animals, have been admirably overcome by the workmen under Mr. Flower's direction. The skeletons are mounted upon very light frames of iron, and the limbs are so articulated with the body as to be removeable on the extraction of a single rivet, and their several segments can be detached with equal facility. The head can be removed, and even its interior be examined, whilst the several vertebræ can be separately taken off without disturbing the position and arrangement of the skeleton generally. The advantages of this mode of mounting for the purposes of comparison and investigation to the real worker are simply incalculable. The mode in which the preparing has been done reflects the highest credit on Mr. Mosely and those who assisted him. We must call attention in particular to a wonderful skeleton of a pike, weighing 32lb., in which every bone has been cleaned and re-attached with wonderful dexterity. The fish was presented by Mr. Petre, of Westwick, Norwich, at the instance of Mr. Frank Buckland. The council of the Zoological Society have given a very fine adult specimen of the recently discovered long-tailed Chinese deer (*Elaphurus davidianus*), with one of the very rare and remarkable South African "Aard wolf," or *Proteles*.

Mr. Flower is gradually performing a great service to all comparative anatomists by carrying out the original idea of Hunter, and placing side by side the same organ as it presents itself in a great variety of animals. By such a method many points are seized in a moment, which it is impossible for the most careful describer to render into words, or for the most diligent reader to grasp, whilst likenesses and correspondences hitherto unrecognised everywhere make themselves apparent. This year we observe that a large number of specimens of the intestinal organs and of the larynx have been mounted, the plan pursued with the latter organ being similar in all; on one side the bones, cartilages, and ligaments being displayed, whilst on the other the muscles are exquisitely dissected.

The Teratological Division, or that treating of malformations and monstrosities, has scarcely received the scientific attention it deserves, whilst the specimens that have accumulated in the College are very numerous, and we are glad to observe that the work of their arrangement has been entrusted to so laborious and intelligent a worker as Mr. B. T. Lowne, whose work on the Blowfly is, we have no doubt, in the hands of many of our readers.

In regard to the Dermatological collection it may be remarked that the past year has been signalised by the institution of what may be termed an entirely new department of the collection; for such illustrations of diseases of the skin as the Museum formerly contained were very limited in number, and were incorporated in the general Pathological series. Moreover, the great majority of the morbid appearances presented by the skin cannot be shown in an anatomical museum by actual specimens, but recourse must be had to models and drawings to perpetuate and illustrate their characters, and no collection of such objects had hitherto been formed in the College.

When the Professorship of Dermatology was founded and endowed last year by Mr. Erasmus Wilson, it appeared necessary that the means of illustrating the lectures should also be provided; and for this purpose, as well as for the general advancement of the study of the subject, Mr. Wilson has presented to the College an extensive collection of drawings, casts, and models of cutaneous diseases, the greater proportion of the latter having been recently executed with great artistic excellence and fidelity by M. Baretta from patients in the Hospital St. Louis at Paris.

In order to provide space for the exhibition of this collection, and for any further additions that may be made to it, the council determined upon the erection of a set of rail-cases around the upper gallery of the western museum, on the same plan as those put up in 1863 in the lower gallery. Their cost will be defrayed out of the proceeds of the Endowment of the Chair of Dermatology, so that the cases as well as the collection must be looked upon as the gift of Mr. Wilson to the College.

Since the completion of the cases, Mr. Wilson has been engaged in arranging the preparations in systematic order, and in preparing a descriptive catalogue of the whole collection, the manuscript of which is now ready for the press.

PSYCHOLOGY IN ENGLAND

La Psychologie Anglaise Contemporaine (Ecole Experimentale). Par Th. Ribot. (Paris: Ladrange, 1870.)

THIS book expounds to French readers the psychological doctrines of Mr. Jas. Mill, Mr. J. S. Mill, Mr. Herbert Spencer, Professor Bain, Mr. G. H. Lewes, and (more briefly) of Mr. S. Bailey, Mr. Morell, and Mr. Murphy. It ends with a short summary of general results won in the course of the great English psychological movement marked by these names, and is prefaced by an introduction giving the author's view of the development of the sciences, and particularly the science of psychology. For the English thinkers, also, of another type (Hamilton, Whewell, Mansel, Ferrier), he seems to promise to do next what he does here for those whom he classes together as making, after the proper tradition of English thought, an experimental school.

The appearance in France of such a work, at the present moment, has a real significance. Taken along with M. Taine's new and weighty contribution to psychological science (*De l'Intelligence*), and with another work or two, it means that the tide of thought is there turning, if it has not already turned. Between the contempt of M. Comte and the airy attentions of M. Cousin, it has fared indifferently with psychology in France for more than a generation. At a time, when in England, a number of active inquirers, continuing the work of last century, have been pushing forward psychological research in a spirit of strict science; when in Germany a number more, reclaimed from high priori roads of speculation to habits of careful introspective search, or starting from a physiological base, have been vying with their English compeers in efforts to resolve the subtle complicacy of psychical states, and thence to explain the most obscure and varied o all growths; the philosophical mind of France has been mostly turned to the history and criticism of opinion, content to retail the cut-and-dried psychology of an earlier day. From this state of things the original scientific inquiry of M. Taine is a refreshing departure, and M. Ribot's work, though in the main expository merely, has its face also set away. The younger French minds are again coming under the influence of English thought, as more than a century ago their forefathers came; and yet far otherwise than then. For, whereas then the triumph of Lockian ideas in France was, in truth, the overthrow of one national system of thought by another, now that mental philosophy in England bears the cosmopolitan character of science, it is but a case of one nation being guided by another into the path of progressive inquiry. Lighting the way in this work, M. Ribot expounds and summarises with all the arts of a Frenchman, and, for the most part, with good insight. Nor, though evidently in accord with the direction of thought which he makes known, is he a slavish expositor: serious gaps in the work both of individuals and of the school he does not fail incidentally to note. His very art, however, may be thought to lead him somewhat astray, when he seeks at the close to strike a general balance of scientific results, presuming upon the idea of a community of thought among so many inquirers. It is no reflection upon the English thinkers, and hardly even upon the scientific value of their labours, that in a matter so great and difficult, their work thus far is more distinguished for the many fruitful lines of inquiry that it has fairly opened, than for the number of questions that it has finally and unanimously closed.

The author's introductory chapter deserves more particular notice, having a lesson not for Frenchmen only. In England, where the cast of philosophical thought has all along been psychological, and well, as even Germans have come to see, where, also, psychology has first and most conformed to the conditions of science, there is yet a certain tendency, and not only in the minds of common people, to think and speak slightingly of mental inquiries. Philosophy (meaning mental philosophy, not, of course, *natural* philosophy in the land of Newton) is opposed to science, chiefly in the sense of being quite unscientific, and "metaphysics," vaguely supposed to be the same thing or the same nothing, is even a time-honoured term of abuse. This is a state of opinion on which M. Ribot's remarks bear so directly, that there may be an advantage in shortly giving the point of them; and perhaps they may suggest an observation or two not unseasonable at the present moment.

Philosophy, according to M. Ribot, was originally the name for science universal; at present, it is a name indefinitely and irregularly applied to an aggregate of several sciences, having relation chiefly to mind; in the future, it will again have the character of universality, but not be science. In other words, it was once the sum of human knowledge, such as that was; it is now, in part at least, a special kind of knowledge, real and scientific, but vaguely defined; it will become (under the name of metaphysics strictly understood) an extra-scientific, but necessary, complement of knowledge. The sciences, such of them as have not grown out of mere arts, have, in fact, detached themselves from philosophy as a great trunk; mathematics as early as the third century B.C., physics as late as the last three centuries, and not, perhaps, completely until the last. Detached, these have a being quite apart from what was called philosophy; they advance, and grow ever more special, untroubled by philosophic questionings about their foundation; indeed they advance because, and from the moment when, they have left all such aside. And this is now not more true of these than of other sciences concerned less with external nature than with man, and has become true even of sciences like psychology, still confusedly spoken of as philosophy. For already in England, and in Germany also, there is an investigation of mind conforming to all the conditions of scientific progress. It deals with actual phenomena, and attempts to explain them by discovering laws; troubling itself no more about an ultimate essence of mind, than mathematics or physics about the ultimate nature of space or motion, and only labouring by every resource of scientific method—observation of individuals, external as well as internal, and of masses through history and statistics, comparative study of the lower animals, investigation of all abnormal mental conditions, and artificial experiments as far as possible—to master the exceptional subtlety and complexity of the phenomena. For the rest, in philosophy proper, or metaphysic, there must ever remain to nobler minds a boundless sphere of consideration and mental endeavour. The underlying questions, which the sciences must ignore in order to advance, are nevertheless there, and will be answered somehow by all but narrow intellects. Speculation on the first principles and last reasons of things, so far from being superseded, is rather more deeply stirred as the sciences become greater, which is to say, more special. Only, verified science such metaphysical speculation can never be. Like poetry (and no more to be got rid of than poetry) it must always have a certain personal and subjective character. In truth, the metaphysician differs from the poet just in this, that in reconstituting the synthesis of the world, he works with abstract ideas instead of concrete pictures. So far, M. Ribot.

There is much that is noteworthy in the view thus roughly sketched. Some things, regarding the origin of the special sciences, could not easily be said better than by M. Ribot; and, in particular, his whole excursus on the question of the conditions, sources, and method of scientific psychology—a question that has perhaps been less considered by English than by German psychologists—may be commended as highly suggestive. In point of actual achievement in psychological science, distinguished from metaphysical speculation, this country is frankly placed first. It seems time, then, that we should cease to be blinded by any mere associations of language to one of our best titles to national fame. Nay, it even becomes our duty, if philosophy is no more than M. Ribot (to say nothing of others) declares, to lift the shadow of the name from off an arduous line of inquiry, sharply enough defined, clearly enough admitting, as it requires, scientific treatment, and already carried to no mean length in spite of popular misapprehension and the graver indisposition of physical inquirers to recognise in it a true branch of science. There is a science of mind, call it by whatever name, that has come into being like other sciences; and it is a natural science too, unless we are prepared to assert that man, on the most characteristic side of him, is an unnatural object.* Still there is likely to be some reason why, to this

* In the newly-constituted Faculty of Science in University College, Psychology, under the name of Philosophy of Mind, is included along with Logic. Already for some years the two subjects have been recognised in the science-programme of the London University; the Bachelor of Science must pass in both, and the Doctorate of Science may be taken for special proficiency in them, along with certain subsidiary subjects, such as Political Economy. A knowledge of them is required also for the degree of M.D.

science of mind in particular, the name of philosophy should have clung, and if the reason be good, philosophy may not be on the road to become the mere poetry of abstracts that M. Ribot foresees. Let us look a little way into this matter.

Psychology is a natural science if it deals with a definite class of phenomena constantly occurring in nature, deals with them on approved principles of scientific method, and marches steadily from old to fresh results: and that it does conform even to the last of these conditions, M. Ribot often in the course of his exposition has occasion, as he always is properly anxious, to show. What, then, is peculiar in the natural science of psychology? The phenomena dealt with are, beyond all others, complex, subtle, and obscure, requiring a finer tact and a larger scientific vision to single them out with any effect; but this, if it explains why psychology has lagged behind the other sciences, gives it no claim to stand apart. The phenomena, however, are quite peculiar, in being, as it were, two-faced, in having not only a side by which, like all other phenomena of nature, they (or, at least, many of them) fall under external observation, but also a side by which, unlike any other natural phenomena, they fall under so-called internal observation. This is, indeed, a peculiarity; and, further, let this go with it, that, as amongst such double-faced phenomena are all facts of human cognition, the subject of psychology extends, in a sense, to all things known or knowable; viewed, namely, as they are or may be known. Nothing to the same degree, nothing of the same kind, can be said of any other science; for though the general sciences, going backwards from biology, have an ever wider and wider sweep, extend, that is, to more and more objects viewed in the special aspects that each considers, psychology in this respect surpasses the most general of them all more than any of them, and in a way that none of them surpasses another. The science of mind does, therefore, stand on a certain level of its own. It has a place among the general sciences, and a place far down, namely after biology, from dealing with phenomena as much more complex than vital phenomena, as these are more complex than chemical phenomena. But it also has a place before all the sciences, from dealing with the growth of consciousness, and specially the laws and limits of those mental processes whereby all knowledge, scientific or other, must come. So that, if as a science it ought to be studied in its place among the sciences, in the light of their results as far as these bear on its subject, and in the spirit of rigid inquiry which they are best fitted to engender, its subject is still such that its results, when thus obtained, are not as theirs. Its results have not only, like theirs, a value in themselves and a forward reference, but they have a backward reference also. From the psychological stage, once reached, all the science that went before is seen over again in a new light. The true sense of the very language of the sciences—of such a word, to take but one instance, as "phenomenon"—is then first understood; and what before was mere practical assumption is turned into intellectual conception. Or, may we not say that there is gained a certain *philosophic* insight? A multitude of questions, M. Ribot truly said, were left unsolved at the root of the sciences, at the root of psychology itself among the rest. But some of them can be solved psychologically, and such of them as cannot are perhaps not all real questions. Where it is possible, the deeper psychological reading of an objective physical fact may not without reason be called *metaphysical*. It would seem, then, that there may be a metaphysic that does not break with science, and that one kind of science still, in some sense, deserves to be called philosophy. Psychology, in short, is Science in its method and Philosophy in its scope.

G. CROOM ROBERTSON

OUR BOOK SHELF

Dictionary of Scientific Terms. By P. Austin Nuttall, LL.D., editor of "The Classical and Archæological Dictionary," "Standard Pronouncing Dictionary," and numerous Educational Works. (London: Strahan and Co., 1869.)

WE are thankful to be able to say that we know nothing more of Dr. Nuttall than we learn from his title-page. We never even heard of him till we read his book, and we most sincerely hope that, as an author of scientific works, we shall know him no more. What the "numerous educational works" that he has published are we cannot tell, but if they are at all like his "Dictionary of Scientific Terms," the sooner they are consigned to the trunk maker and the butter-man, the better will it be for the welfare of the unhappy youths for whose benefit they were composed. These may seem hard words to apply to a writer who hopes to "receive every indulgence from a generous public" (p. xi.); but when that writer outrages all our better feelings by stringing together a series of idiotic absurdities, and calling the result a "Dictionary of Scientific Terms," how are we honestly to deal with him, except by exposing a few of his blunders? We will begin by testing his chemical knowledge. It will hardly be believed that he regards black-lead, brass, magnet, ochre, pewter, and steel as constituting "a few of the principal metals" (p. xviii.); that nitrogen is "unrespirable" (p. 230), although he has previously told us at p. 12 that it forms about 80 parts of atmospheric air); that oxygen "generates acids" (p. 239); that alum is "an earthy chalk, a sulphate of alumina *or* of potash" (p. 18); and that "culinary, rock, or sea salt, is chloride of soda" (p. 277). His natural history is as peculiar as his chemistry. We will merely put his zoology to the test, assuring our readers that in so far as accuracy is concerned, his zoology, botany, and mineralogy are much on a par. "Zoology," he tells us, "embraces an account of all animal creation, the principal classes being the *Mammalia*, *Aves*, *Reptilia*, *Pisces*, *Invertebrata*, and *Insects*." The first class is subdivided into nine orders, of which one is "*Edentata*, or animals wanting some of the teeth of other animals" (p. xiii.) Being anxious to learn more of these covetous, commandment-breaking creatures, we turned to *Edentates*, and found that they are "an extensive order of the class Mammalia, comprehending those unguicolated quadrupeds which have no front teeth, and divided into three tribes, the Tardigrada, the ordinary Edentata, and the Monotremata." We leave our zoological readers to decide how far this description is an accurate definition of the order, according to recent views, such as our author might have learned by consulting the works of Owen, or of Huxley.

"Invertebrate animals are divided into *Mollusca*, *Articulata* and *Radiata*" (p. xiv.) We had hoped that by this time the "Radiata," having done their work, had modestly withdrawn themselves from their old position, and had been replaced by other classes; but Cœlenterata, Hydro-medusæ, &c., are terms unknown to Dr. Nuttall. "The Mollusca is (*sic*) so called from the body being soft and molluscous. It is divided into four classes, the *Mollusca*, *Conchifera*, *Tunicata*, and *Cirripeda*" (p. xiv.) How this marvellous division is accomplished we are unfortunately not told. In the next page we find that the molluscs or soft animals are composed of radiata, starfishes, &c., polyps, corals, &c., naked molluscs and testacea or shell-fish. Need we carry our investigation further?

The terms which the author supposes are used by surgeons and physicians are of the most astounding nature, and many of them, although possibly used a century or two ago, are perfectly new to us. We only confine ourselves to the letter A. Do any of our readers suffer from acatharsia, acratia, acrisy, acropathy, acropy, acroteriasm, acrothymion, adenopharyngitis, aerophobia, agalaxy, agennesia, agrypnocoma, anagogy, anopsy, antispasis, antritis, apagma, apolepsy, apolysis, apotrepis, or arthropuosis? Let them have recourse to such remedial agents as acidulum, acopica, adipson, alborga (a kind of sandal wood made of mat weed), aldehydic acid (which "is a solution of oxide of silver in aldehyde"), alloxan (which our readers will be surprised to learn is "the action of nitric with uric acid"), amylum (which we are told is "a preparation of starch"), anacathartics (which are "any medicines that operate upwards; a cough attended with expectoration;" it is of course the "medicine that operates upwards" and not the cough, that we recommend as a remedial agent), antephiatic medicine, or arrowroot (consisting of starch, albumen, volatile oil, chloride of calcium, and water), which we presume may be obtained at an antidotarium. Should surgical aid be required, an arthrembolum may prove of service. We can only account for this appalling list of medical terms and for the information regarding alloxan, arrowroot, &c., on the supposition that Dr. Nuttall's medical attendant is an incorrigible wag, and that he took a most dishonourable advantage of his position.

Our readers will, we think, by this time be satisfied that our introductory remarks upon this discreditable production were not at all too severe. It is a disgrace to English science that such books should find a respectable publisher.

Das Gesetz der vermiedenen Selbstbefruchtung bei den höheren Pflanzen. Von Dr. O. W. Thome. (Williams and Norgate.)

WE opened this little pamphlet in the hope of finding in it a new contribution to the literature of the self-fertilisation and cross-fertilisation of plants, but were disappointed to discover that it consisted of little besides a *résumé* of the labours of others in this field. The instances in which the self-fertilisation of hermaphrodite flowers is prevented by the fact that the stigma and the stamens ripen at different times, are mostly taken from Prof. Hildebrand's "Die Geschlechter-Vertheilung bei den Pflanzen," and from that botanist's contributions to the "Botanische Zeitung." On the laws of dimorphism and trimorphism we have little but the examples so elaborately worked out by Mr. Darwin in the genera *Linum*, *Primula*, and *Lythrum*. It is singular that from the time that Sprengel first called attention to the provisions which favour cross-fertilisation in plants, now more than seventy years since, so little had been done in this field until the researches of the two eminent botanists above named, and even now they have so few fellow-labourers. There is no department of physiological botany more beneath the eye of every dweller in the country, or of any one who possesses a garden, none which presents so many points of interest even to the casual observer, and so many illustrations for the advocate of the doctrine of "design," and none in which a careful series of observations would be more fertile in results of importance. If country botanists would bestow a portion of the energy which has been wasted in mere collecting, and the eradication of rare plants from their native haunts, on systematic physiological observations, the gain to genuine science would be immense. A. W. B.

LETTERS TO THE EDITOR

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

The Gulf-Stream

As a note appended to Prof. Wyville Thomson's lecture "On Deep-Sea Climates," published in your number for July 28, may lead your readers to suppose the divergence of opinion between my colleague and myself upon the subject of the Gulf-Stream to be greater than it is, I shall be obliged by your placing before them a few observations which may put the question really at issue between us in a more definite form.

The term "Gulf-Stream" is continually used in two different senses. By myself it has been employed to designate the current issuing from the Gulf of Mexico through the "Narrows" between Florida and the Bahamas; and this I apprehend to be its true signification. My colleague's definition of it I give in his own words:—"The water of the North Atlantic thus consists first of a great sheet of warm water, the general northerly reflux of the equatorial current, the most marked portion of it passing through the strait of Florida, and the whole generally called the Gulf Stream." He thus distinctly recognises, with myself, the participation of a *Subsidiary Current* with the *Gulf-Stream proper* in the production of the two great temperature-phenomena of the North Atlantic, determined by the *Porcupine* soundings —(1) the elevation of the temperature, not of its surface-layer only, but of a stratum 800 or 900 fathoms deep, by a north-east movement of tropical water; and (2) the depression of the temperature of its deepest portions by a reflux of glacial water from the Arctic and Antarctic basins.

Now I have on no occasion, so far as I can recollect, spoken so disrespectfully of the Gulf-Stream proper as to "deny that it exercises any influence upon the temperature of the basin of the North Atlantic," nor am I aware of having expressed a "doubt whether it reaches the coast of Europe at all." That the Gulf-Stream proper, by raising the temperature of the portion of the Atlantic basin over which it can be distinctly traced, has a most important *indirect* influence upon the temperature of its north-eastern extension, I cannot doubt for a moment; and that its *direct* influence is traceable to the western coast of Europe, as far north as the Bay of Biscay, I accept on the authority of the recently-published Admiralty charts of its course and distribution. But I *have* expressed a doubt as to the extension of the Gulf-Stream proper to the channel between the North of Scotland and the Faroe Islands; and I have ventured to think it an open question whether the super-heating of the surface-water observed on a hot Midsummer day beyond the northern border of the Bay of Biscay was not as probably due to the direct influence of the sun as to the extension of the Gulf-Stream to that locality.

The main questions between my friend and myself are therefore as follows: What are the relative shares of the Gulf-Stream proper, and of the Subsidiary Current, in producing the elevation of temperature in the upper stratum of the North Atlantic to a depth of about 800 fathoms—and what is the motive power of that Subsidiary Current? These questions can only be answered, as it seems to me, by an appeal to certain general probabilities—definite data for their determination being still deficient, for, in the first place, all the calculations which have been made as to the quantity of water which issues from the Narrows, and the amount of heat which it conveys, are based (if I recollect aright, having here no access to books on the subject) upon the assumption that both its temperature and its rate of movement are the same throughout its depth as they are at its surface. Now, until reliable proof shall have been furnished as to both these particulars by our friends of the United States Coast Survey, I must claim a suspension of judgment, many probabilities leading to the suspicion that the bottom-flow may be considerably less rapid than the surface-current, and its temperature considerably lower. Secondly, even admitting in its full force the reputed "glory" of the Gulf-Stream at its exit from the Narrows, I fail to see the evidence that either its heat or its movement is directly concerned in the flow of the warm upper stratum of the north-east extension of the Atlantic towards the Hebrides, the Faroes, and Spitzbergen. For as the stream of superheated water, on its emergence into the open ocean, spreads itself out like a fan, it must necessarily become shallower as it extends instead of deeper, and this (if I remember aright) is what all observation indicates. That a large proportion of it is deflected back towards the Equator is universally admitted, and that the remainder can be gathered together after its initial velocity has been expended, and forced downwards so as to displace colder water to the depth of 800 fathoms whilst still moving north-east, seems to me in the highest degree improbable.

To what then is the north-east movement of the warm upper stratum of the North Atlantic attributable? I have attempted to show that it is part of a *general interchange* between Polar and Equatorial waters, which is quite independent of any such local accidents as those that produce the Gulf-Stream proper, and which gives movement to a much larger and deeper body of water than the latter can affect. The evidence of such an interchange is twofold—that of physical theory and that of actual observation. Such a movement *must* take place, as was long since pointed out by Prof. Buff, whenever an extended body of water is heated at one part and cooled at another; it is made use of in the warming of buildings by the hot-water apparatus, and it was admirably displayed at the Royal Institution a few months since in the following experiment kindly prepared for me by Dr. Odling:—A long but very narrow trough, with plate-glass sides, having been filled with water, a tube into which a steam-jet was conveyed was introduced vertically at one end, whilst a lump of ice was wedged between the sides of the trough at its opposite extremity. Some red colouring matter mixed with gum, of such viscidity as to be carried along by any movement of the liquid mass without mingling with it, was introduced into the water at the end of the trough warmed by the steam-jet, and a like mixture of a blue colour was introduced at the end cooled by the ice. The latter very speedily sank to the bottom along the side of the ice-wedge, and then crept slowly along the floor of the trough, towards its warm end, where it rose along the side of the heated tube until it reached the surface, and then slowly flowed back towards the cold extremity. On the other hand the red liquid passed slowly along the surface in the first instance from the warm to the cold extremity, then sank (as the blue had previously done), crept along the surface of the blue layer covering the bottom of the trough, and then rose (as the blue had previously done) along the side of the heated tube to the surface. Thus a circulation was shown to be maintained in the trough by the application of heat at one of its extremities and of cold at the other, the *heated* water flowing along the *surface* from the warm to the cold end, and the *cooled* water flowing along the *bottom* from the cold to the warm end: just as it is here maintained that Equatorial water streams on the surface towards the Poles, and that Polar water returns along the bottom towards the Equator, if the movement be not interfered with by interposed obstacles, or prevented by antagonistic currents arising from local peculiarities. So far is this from being the case with the general surface-movement in the Atlantic basin, that it will concur with and supplement the motion of the Gulf-Stream proper, which may thus be regarded as a portion of the general Equatorial-polar current, deflected in the first instance by the action of the trade-winds, but subsequently rejoining the great body of water having a north-east motion of its own and imparting to its surface-layer a higher temperature than it would otherwise convey.

Now that this hypothesis is at any rate deserving of consideration, and is not to be dismissed by the *ipse dixit* even of so high an authority as Dr. Petermann, though backed by my excellent colleague, I venture to maintain on the strength of the parallel case afforded by the temperature-phenomena of the Southern Indian Ocean. For, as Capt. Maury has shown, a definite current exists in the midst of it, carrying tropical waters far into the southern temperate zone, and not attributable to any such local peculiarities as those which produce the Gulf-Stream of the Atlantic. Conversely, the Hydra soundings in the Arabian Gulf have given evidence of a northerly reflux of glacial water from the Antarctic basin along the deep-sea bed of the Indian Ocean to replace the more superficial stratum which has moved southwards. This glacial water will in its turn be raised from the depths by the heating action of the tropical sun, and then return as the southerly surface-stream to the Antarctic basin, and would there sink by surface-cooling and again flow northwards along the sea-bed.

The facts of observation, then, being in the case last cited entirely accordant with physical theory, I submit that the same theory may be fairly applied to the explanation of those temperature-phenomena of the North Atlantic, which (as it seems to me) cannot be more than very partially, if at all, accounted for by the agency of the Gulf Stream proper. And I am content to leave it to the judgment of those who are competent to deal with the question whether the north-east movement of the vast breadth of water lying between the coast of Greenland and that of Northern Europe, usually extending to a depth of 5,000 feet, is more likely to depend upon an impetus derived from a portion of the comparatively narrow and shallow current which issues from the Narrows thousands of miles off, or to form part of a general circulation of oceanic water, the cause of which is quite independent of local accidents.

The readers of NATURE will, I am sure, join with me in deeply regretting that Prof. Wyville Thomson is prevented by illness from taking that share in the scientific exploration of the Mediterranean basin, now about to commence, which has conduced so greatly to the success of the two previous expeditions in which we have had the pleasure and advantage of being fellow-workers.

Gibraltar, Aug. 11 WILLIAM B. CARPENTER

Dr. Hooker's "Student's Flora"

ALL the reviews which I have read of the "Student's Flora of the British Islands" are, as they undoubtedly should be, appreciative, but your reviewer has done well in pointing out a few seeming discrepancies, which it would, perhaps, be well if attended to in a second edition; and, if you will permit space, I will endeavour briefly to add to your list of desiderata. In the first place I take it that a good glossary is an essential, if not an absolute necessary, adjunct to a students' manual; yet we look in vain for anything of the kind in Dr. Hooker's new "Flora." Dr. Hooker could scarcely have thought beginners in botany able to interpret many words used by him in his generic and specific descriptions. I am also sorry to see that little word "*sub*" used so extensively; for my own part I do not understand its meaning as applied in zoology and botany. I can quite understand its applied use in sub-contractor, sub-lieutenant, subterranean, &c., but who dares tell us that one tribe, or one family, or genus, or species is subordinate to another? I comprehend a "species" as a form of animal or vegetable life which differs slightly but materially and permanently from its nearest ally; such a form is, in my humble opinion, worthy to hold its own as a good species, not subservient or subordinate to any other form that can be so described, no matter how apparently closely related. Forms of this kind may have (I say it advisedly: we have no proof to the contrary) approached each other through natural selection, without being off-sets in a direct line from a common parent.

Again, why use the term "sub" at all, when a much simpler and less confusing arrangement may be employed in its stead. All naturalists are pretty well agreed that natural arrangements shall consist of orders, tribes, families, genera, species, and lastly, varieties. Beginning with "tribes" of any given order, we have—Tribe 1, consisting of certain families all agreeing in certain recognisable features or parts. Families which cannot be grouped under Tribe 1 would fall under Tribe 2, and so on numerically *ad libitum*, without one being subordinate to the other, which they really are not in nature. The same may be said of genera grouped into families, species into genera, &c.

Dr. Hooker has done well in making varieties (or, as he terms them, "sub-species") of some plants which certainly have no other specific claim. As an instance, I may cite the three almost equally common forms of *Aspidium*, all of which are included under *A. aculeatum*, Sw. This is decidedly a step in the right direction; but should not the forms have retained the name of *angulare* in preference to *aculeatum?* The latter, I believe, claims priority, but the form described under *angulare* is decidedly the most highly developed, having stalked pinnules.

Woodhay, Aug. 12 HENRY REEKS

On Supersaturated Solutions

MY friend Mr. Rodwell was so good as to forward to me a copy of NATURE for the 4th inst., containing an account of some interesting experiments by Mr. Grenfell on the action of fatty bodies on supersaturated saline solutions.

During the last two years I have made a large number of experiments in order to ascertain the function of oils and fatty substances in determining the crystallisation of such solutions. The results of my inquiry are included in a paper, the abstract of which was read before the Royal Society on the evening of the 16th of June last, to which I beg leave to refer.

I may, however, be permitted to make a few remarks arising out of Mr. Grenfell's paper.

According to my view, a *nucleus* is a body that has a stronger attraction for the gas, or the vapour, or the salt, of a supersaturated solution than for the liquid that holds it in solution.

Nuclei, with certain limitations, cease to be such when made *chemically clean*.

A body is chemically clean, the surface of which is entirely free from any substance foreign to its composition.

Thus oils and fatty bodies are chemically clean, if chemically pure, and containing no substance, mixed or dissolved, that is foreign to their composition.

The limitations above referred to are two: (1) the oils, &c., when chemically clean, do not act as nuclei while in the mass, such as a lens or globule; but these oils, &c., whether clean or not, in the form of thin films, act powerfully as nuclei; (2) a liquid, at or near the boiling point, is a supersaturated solution of its own vapour, and a porous body, such as charcoal, pumice, &c., whether clean or not, is a powerful nucleus in separating vapour.

I have on several occasions taken the liberty of opposing M. Gernez's views as to the action of nuclei. He supposes (1) that supersaturated gaseous solutions (soda water, seltzer, &c.) give off their gas to nuclei by virtue of the air that these latter introduce into the solution: in other words, gas must escape into air, and the function of the nucleus is to carry down air; hence rough bodies act better as nuclei than smooth ones. I have shown (Phil. Mag., August 1867) in a series of twelve experiments, that air is not a nucleus, and that rough bodies are inactive, if *catharised* or made *chemically clean*. A rat's-tail file, for example, is a good nucleus, because it holds between its teeth not air, but that filmy kind of matter that is powerfully *nuclear*, and it is not easy to clean a body of this kind; but when clean, it is quite inactive. So, a flint stone that has been exposed to the air, or handled, acts as a powerful nucleus, but when broken, the newly-fractured surfaces are inactive, because chemically clean. And such surfaces are inactive, because the gaseous solution adheres to them as a whole; whereas, if a clean body be handled or exposed to the air, it becomes covered, more or less, with filmy matter, to which the gas adheres more strongly than the liquid does, and hence there is a separation.

There is, I think, abundant proof that air is not a nucleus, its function, if it have any, in this class of phenomena, being that of a *carrier of nuclei*. Proof also is wanting, I imagine, that when a nucleus determines the crystallisation of a supersaturated saline solution, a salt of its own kind is present. When M. Gernez so laboriously prepared his nuclei, so as to free them from salt, he did not perhaps reflect that he was making them chemically clean. Of course I fully admit that, in general, a salt of the same kind as the solution, acts as a powerful nucleus; but in order for it so to act it must adhere more strongly to the saline than to the liquid portion of the solution. It may even happen that a crystal of the same kind, and of the fully hydrated salt, has no nuclear action, because it is in a perfectly catharised condition. And here I must refer to the objection raised by Dr. De Coppet, that in one of my forms of showing this experiment, the hydrated crystals, say of magnesic sulphate, being introduced into the neck of the flask while the solution was boiling, and so left in the covered flask while the solution cooled, such crystals become so changed by the heat as no longer to represent the normal salt, so that when lowered into the solution they formed a different salt, and hence were no test of the point in question, as to whether a salt of the same kind may be rendered inactive as a nucleus. I admit the criticism to be just, but in my original account of the experiment (Phil. Trans., 1868, p. 665) I did not rely upon one form only. Highly supersaturated solutions in clean tubes, plugged with cotton wool, were put, when cold, under the receiver of the air-pump, and left for some time *in vacuo*, over sulphuric acid, the effect of which was to produce crystalline crusts of the normal salt on the surface, and these by shaking fell through the solutions without acting as nuclei; whereas on removing the cotton wool in the presence of air, the solutions crystallised immediately into a solid mass. So also by keeping supersaturated solutions during some months, water escapes through the cotton wool, and a crystalline crust of the normal salt creeps up the air-filled portion of the tube, and this has no nuclear character, because the adhesion between it and the solution is perfect.

So necessary is the action of a nucleus in determining crystallisation in these solutions, that, if care be taken to exclude nuclei, highly supersaturated saline solutions may, by reduction of temperature to 0° F., or from that to – 10° F., be made solid, and by placing the tubes in snow and water at 32° F., the solids rapidly melt into clear bright solutions, without any separation of salt. These effects may be shown any number of times; but whether the solution be solid or liquid, if the cotton wool be removed, crystallisation always sets in, in the case of the solid during the melting, while in that of the liquid the effect is immediate.

With respect to the editorial note that the solutions of hydrated salts contain the anhydrous salt, I have shown in the paper last quoted, and with still greater elaboration in the *Chemical News* for Dec. 10th, 1869, that such is the case with respect to sodic sulphate. I insist on this point, as it is one of first-rate importance in considering the theory of supersaturated saline solutions. I endeavour to prove that it is the anhydrous salt in solution, by showing that at various points of the scale a sudden lowering of temperature produces a shower of the well-known octahedral crystals of the anhydrous salt. I also explain in my original memoir, that it is necessary for these crystals to be deposited before the modified 7-atom salt can be formed, and that even when there is a copious deposit of this salt the liquor above it is not, as Löwel supposed, the mother liquor of the 7-atom salt, but it is still a solution of the anhydrous salt. And more than this, when the sudden change in the curve of solubility takes place at 33° or 34° C., and there is, according to Gay Lussac's supposition, a change in molecular condition, it is still the anhydrous salt that is in solution.

There are several other points that might be enlarged on, but that I fear to trespass further on your valuable space.

Highgate, N. CHARLES TOMLINSON

Astrology

THE belief in astrology which still prevails among the English lower classes to a much larger extent than is supposed, will derive a fresh impulse from the happy guesses which have been made by the editor of "Moore's Almanac" in his issue for the current year. The hieroglyphic with which it is illustrated is less vague than usual, and represents two eagles fighting in the air, and on the plains beneath them hosts of armed men (in decidedly foreign uniforms) engaged in a bloody struggle. Lest the point should be missed, the prophet begins the forecast of the year with the distinct assertion that there will be war between France and Prussia, and that the month of July will be especially disastrous to the Emperor Napoleon. Thus far events have coincided with the voice of the oracle, and seem to confirm the poet's view that

"The warrior's fate is blazoned in the skies."

But we have yet to see whether "in October the King of Prussia (if living) will meet with defeat, and the ex-King of Hanover recover some of his prestige, if not his throne also." M. Comte would have us deal tenderly with astrology, because it was, in his opinion, the first systematic effort to frame a philosophy of history out of the apparently capricious phenomena of human actions. In theory we may do so, but astronomical science is hardly likely, for the sake of sentiment, to treasure up the discarded swaddling clothes which for so many centuries impeded its onward progress.

Norton Canon, Weobley C. J. ROBINSON

On Volcanoes

HAVING only last night returned from Norway, I was not aware before to-day that No. 40 of NATURE (August 4) contained "an outline" of a lecture on volcanoes delivered by me in St. George's Hall, Langham Place, on the 19th June (not 9th as therein stated) last.

Although I cannot but feel highly flattered at the length of this notice, I must regret that the author of this "outline," who, strangely enough, signs himself by my name, has, as will be seen upon reference to the text of my lecture as reported in the *Geological Magazine* for July, omitted every word which could convey to the reader the remotest idea of the object of the lecture itself, or the conclusions arrived at from the evidence brought forward. Just as a man without life is but a corpse, neither can a mere string of facts be called even the "outline of a lecture," when we have only the body without the spirit.

The object of my lecture was to institute a comparison between the relative magnitudes of the operations of internal and external forces in determining the main external features of our globe, and the conclusion arrived at was, to "grant the first rank to the internal, volcanic, or cataclysmic agencies, since, had it not been for their operations, our globe would still have remained a comparatively smooth sphere, surrounded by its external envelope of water, with no visible land for the rivers to traverse or the rain and ice to disintegrate and wear away," &c.

In order that your numerous scientific public may not be led to judge of the lecture by this outline, I trust to your good will in asking you to insert these remarks in your next number.

DAVID FORBES

11, York Place, Portman Square, Aug. 22

A Vivid Mirage

THE illusion known as the mirage is, I believe, not unfrequently observed in the British Isles; but the vividness with which it was displayed on the present occasion will, I trust, be a sufficient apology for troubling you with this letter.

The land bordering the River Nene is protected by banks of from twelve to fifteen feet in height, enclosing a space called the "Wash," which receives the flood waters. It was from one of these banks that the appearance in question was observed, nothing unusual being seen from the level of the fen. I may mention that the Wash at this season is as dry as any other portion of the land.

The day (August 12) was hot, the sky cloudless, and a strong N.E. wind was blowing. About eleven o'clock the phenomenon was first noticed. To the eastward a dark line of trees, some eight miles distant, stood out in bold relief against the clear sky, and in front of this a shining line of silvery brightness was seen, which gradually widened until about twelve o'clock it presented the appearance of a broad expanse of water, ruffled into waves on its near side, but perfectly calm and clear toward the horizon where the line of trees was beautifully reflected on its surface. As I had been approaching the scene all this time, the expanding of the lake appeared perfectly natural, and I could scarcely help thinking the river must have overflowed during the night and drowned the "Wash." This, of course, I knew to be quite out of the question, but the semblance was so perfect that it required an effort to believe that it was but an illusion. Its shores were clearly defined, little bays dimpled it, tiny headlands jutted out from it, and the waves were seen rising and falling with life-like exactitude. The whole appeared quite stationary, and as I approached the spot it gradually faded away, until nothing but a thin blue haze beneath the trees remained, and this at length dissolved.

On looking behind me (*i.e.* westward) another mirage seemed forming, which increased in apparent extent as I went farther from it. In this case the illusion was, if possible, more perfect than in the last, and the comparatively high land of Whittlesea rose like an island from the shining sea. Vehicles passing along the road seemed floating on its surface, their dark drawn-out reflections showing vividly against the sun-lit water, which, in this instance, was quite calm. How long this illusion lasted I know not, but when, about two o'clock, I quitted the bank it was still very distinct.

The dead level of the fen, and the bright sunlight falling upon the parched land, from which the heated air rose tremulous as from a hot plate, render this district peculiarly favourable to the production of such effects. For the accuracy with which the appearance of water was simulated it was quite equal to any mirage I have witnessed on the African deserts.

SYDNEY B. J. SKERTCHLY

Geological Survey, Whittlesea, Cambridge, Aug. 12

Mirages made Easy

THE very interesting account of a mirage in this week's NATURE induces me to send a few observations. The mirage phenomenon is by no means so uncommon in England as many think. Three or four summers ago, on a strip of sand three miles long at Morcambe Bay, I was able to see one almost every hot day, by simply stooping until my eyes were about a yard above the ground. The further part of the sand then appeared as a lake of water, with objects reflected, &c. The nearer edge of this lake receded as the eyes were raised, the whole soon becoming invisible. I saw the same effects last summer off the Holderness Coast, but again only by stooping. At Cambridge I have lately seen a very good lateral mirage, by looking closely along the surface of a wall fifty yards in length, which had been exposed for some hours to a western sun. Objects near the further end of the wall were distinctly reflected.

CHAS. T. WHITMELL

Trin. Coll. Cambridge, Aug. 4

Science and the Government

THE announcement in your last number of a rumour that the Government is about to withdraw its promise of aid to the Total Eclipse Expedition, seems to bring to a climax the relations of the Government towards science. We can hardly forget that one of the prominent members of the present ministry, and the one considered to have the special control over the spending of the public funds, is member for the University of London. Mr. Lowe was sent to Parliament, irrespective of party considerations, as the representative of a body which thinks it has some claim to a leading place among the scientific institutions of our country. Is it not worth while to consider whether the views of the graduates of London University are represented in the present attitude of the ministry, and whether some representation might not be made to the Government, through the Chancellor of the Exchequer, of the manner in which the present relations between the Government and science are regarded by his constituents?

3, Park Village East, Aug. 20 ALFRED W. BENNETT

AROMATIC GLYCOL*

ALL chemists recollect the profound impression caused by the discovery of glycol in 1855 by M. Wurtz. Up to that time the bodies which were recognised as belonging to the group "alcohol" only included what we now call monatomic alcohols (common alcohol and its analogues), and M. Berthelot hesitated before venturing upon declaring glycerine a triatomic alcohol—an opinion to which Gerhardt never entirely adhered.

M. Wurtz showed that besides ordinary or monatomic alcohols, there are others which, when submitted to certain reagents where ordinary alcohols furnish only one, produce two derivatives. To these substances he gave the name of diatomic alcohols or *glycols*, and recognised that to each monatomic alcohol belonged a corresponding glycol, which only differed from it by the addition of an atom of oxygen. This new view became rapidly extended. It was admitted that belonging to each glycol there was, or might be, a triatomic alcohol or glycerine; that to each glycerine there might be a corresponding tetratomic alcohol, and so on; these alcohols only differing from one another by the number of atoms of oxygen which they contained, the number being always denoted by the atomicity of the alcohol.

Shortly before M. Wurtz's discovery of glycol, Signor Canizzaro, now Professor at the University of Palermo, but then Professor at Genoa, had announced the discovery of a new alcohol, which he called benzylic alcohol, having to benzoic acid the same relation as vinous alcohol has to acetic acid. He had obtained this substance by the action of potash in alcoholic solution, on the essence of bitter almonds.

Some time later the same chemist discovered that this alcohol might be equally obtained by means of toluol (*toluène*). The method he employed was to subject chlorinated toluol to the action of acetate of potash; and finally to decompose the acetate of benzyl thus obtained by means of potash.

This benzylic alcohol was the starting point of a new series of alcohols known as aromatic monatomic alcohols, and in fact soon afterwards cumylic alcohol was obtained, and Signor Canizzaro himself shortly afterwards published his discovery of tolylic alcohol.

It should, however, be observed that the process by means of which Signor Canizzaro had obtained his benzylic alcohol from toluol, succeeded ill with the homo-

* "Sur un Glycol Aromatique." Par M. Edouard Grimaux.

logues of this hydro-carbon, and gave, even with toluol, but small quantities of the alcohol.

Herr Beilstein, however, took up the matter at the point where others had abandoned it. He showed that when chlorine is made to act upon heated aromatic hydro-carbons, there is obtained a chloro-derivative, easily acted upon by acetate of silver or of potassium, and consequently admirably fitted to furnish the corresponding alcohol; whilst on the other hand when used cold, a very stable chloro-substitution compound is formed of the same composition, but furnishing no alcohol.

From this moment no difficulty remained in completing the series of the aromatic monatomic alcohols; but up to this time no diatomic alcohol, or aromatic glycol was known. It was, however, evident that the preparation of such compounds was possible, inasmuch as the knowledge already existed of such acids as formobenzoilic acid, and terephtalic acid, which bore the same relation to these unknown bodies as glycolic and oxalic acids to ordinary glycol.

M. Edouard Grimaux, after much long and careful investigation, has at length filled up the blank by the discovery of tolylenic or xylenic glycol, that is to say a glycol which presents in its composition xylol to which two atoms of oxygen are added without substitution.

To obtain tolyl-glycol M. Grimaux takes the xylol of commerce which he raises to the boiling point in a retort, surmounted by an inverted refrigerator, from which the condensed vapours flow back into the retort, the tubulure of which is closed by a cork, into which a funnel with a tap is inserted. He then introduces drop by drop into the boiling hydro-carbon half its weight of bromine. The bromine is at once absorbed with the production of hydrobromic acid, and on cooling a black crystalline mass is obtained which is first washed with ether, and its purification completed by crystallisation from chloroform. This substance is a bibromo-xylol easily acted on by re-agents.

Treated at a temperature of 150°, or in a closed vessel with an alcoholic solution of acetate of sodium, the bromo-product gives rise by double decomposition to bromide of sodium and to diacetate of tolylene, which takes the form of beautiful colourless crystals.

Subjected in its turn to the action of thirty times its weight of water at a temperature of 170° or 180° in a closed vessel, this acetate of tolylene is separated into acetic acid and tolylenic glycol, which, on the opening of the tube and by the evaporation of the liquid, is deposited in needle-shaped crystals.

The formation of tolyl-glycol may be represented by the following equations:—

1. $$C_6H_4 < {CH_3 \atop CH_3} + 2\left({Br \atop Br}\right) = 2\left({H \atop Br}\right) + C_6H_4 < {CH_2Br \atop CH_2Br}$$

Xylol. Bromine. Hydrobromic acid. Bromine of tolylene.

2. $$C_6H_4 < {CH_2\,Br \atop CH_2\,Br} + 2(C_2H_3O_2.\,Na) = 2\,Na\,Br + C_6H_4 < {CH_2.C_2H_3O_2 \atop CH_2.C_2H_3O_2}$$

Bromine of tolylene. Acetate of sodium. Bromide of sodium. Acetate of tolylene.

3. $$C_6H_4 < {CH_2.\,C_2H_3O_2 \atop CH_2.\,C_2H_3O_2} + 2\left({H \atop H}\right\}O\Big) = 2(C_2H_3O_2H) + C_6H_4 < {CH_2\,OH \atop CH_2\,OH}$$

Acetate of toluol. Water. Acetic acid. Tolyl glycol.

The path is now open, and nothing will be easier than, by following the method proposed by M. Grimaux, to prepare all the aromatic glycols, of which the hydrocarburets are already known to us.

ALFRED NAQUET

SPECTROSCOPIC NOTES *

SPECTRUM OF A SOLAR SPOT, APRIL 9, 1870, P.M.

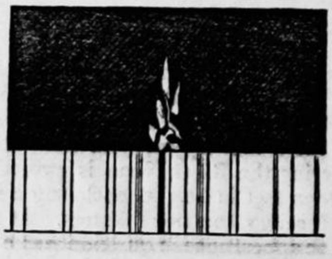
EXAMINED the spectrum of a large group of spots a little north and east of the sun's centre.

The nucleus of the most southerly member of the group reversed the C line finely, turning it into a conspicuous bright line for about 20″ of its length, without any distortion, however, such as is common upon this (dark) line in the neighbourhood of spots.

F was also reversed, but rather faintly.

D_3 could not be made out at all in the nucleus spectrum; neither were 2796 (the numbers refer to Kirchhoff's map) nor *h* reversed. I thought, however, that they were somewhat *thinned*.

The reversal of C and F continued through the whole afternoon.



On the other hand, many of the dark lines were widened and deepened in this nucleus spectrum in the manner which the description and figures of Mr. Lockyer have made familiar. Many also were unaffected. Among these were notably *a*, B, E, 1474, the four lines of *b*, 1691 and G.

The two sodium lines D_1 and D_2, and 850 (Fe) were distinctly, but not greatly, widened.

The effect was most marked upon the following: 864 (Ca), 877 (Fe?), 885 (Ca), 895 (Ca and Li), 1580 (Ti), 1599 (Ti), 1627 (Ca), and 1629 (Ti). I have marked 877 doubtful, because there lies very near it a line whose origin is unknown, and I am not sure to which of the two the thickening was due. The Titanium lines are identified as such by reference to Ångström's Atlas. I was greatly surprised at the prominence they assume in the spot-spectrum, as they are inconspicuous in the normal spectrum; and a similar remark applies to the calcium lines.

I do not intend to convey the idea that the lines mentioned were the only ones that were much deepened; there were many others, mostly faint, affected to nearly the same degree, but I had not time to identify them.

There was at the same time an exceedingly brilliant protuberance on the south-west limb of the sun (position angle 230°), near but not over, a large spot which was just passing off. At the base of this prominence, which was shaped like a double ostrich plume, the C line was intensely brilliant, so that the slit could be opened to its whole width in studying the form above described, but it was not, so far as I could see, in the least distorted. On the other hand, the F line, also very brilliant, was shattered all to pieces, so that at its base it was three or four times as wide as ordinary, and several portions of it were entirely detached from the rest. The figure, without pretending to exact accuracy, and for the sake of distinctness a little exaggerated, gives a fair idea of the nature and extent of the "shattering" alluded to.

Since the C line was not similarly affected it is hardly possible to attribute this breaking up of F to cyclonic motions in the gas from which the light emanates, and it becomes very difficult to imagine a cause that can thus disturb a single line of the spectrum by itself. Possibly this appearance may be the result of local absorptions acting upon a line greatly widened by increase of pressure or temperature.

It continued unchanged for more than half an hour, and until the sun passed out of sight behind a building. The observations were made with the 5 prism spectroscope.

C. A. YOUNG

Hanover, New Hampshire, May 20

* Communicated by the Author.

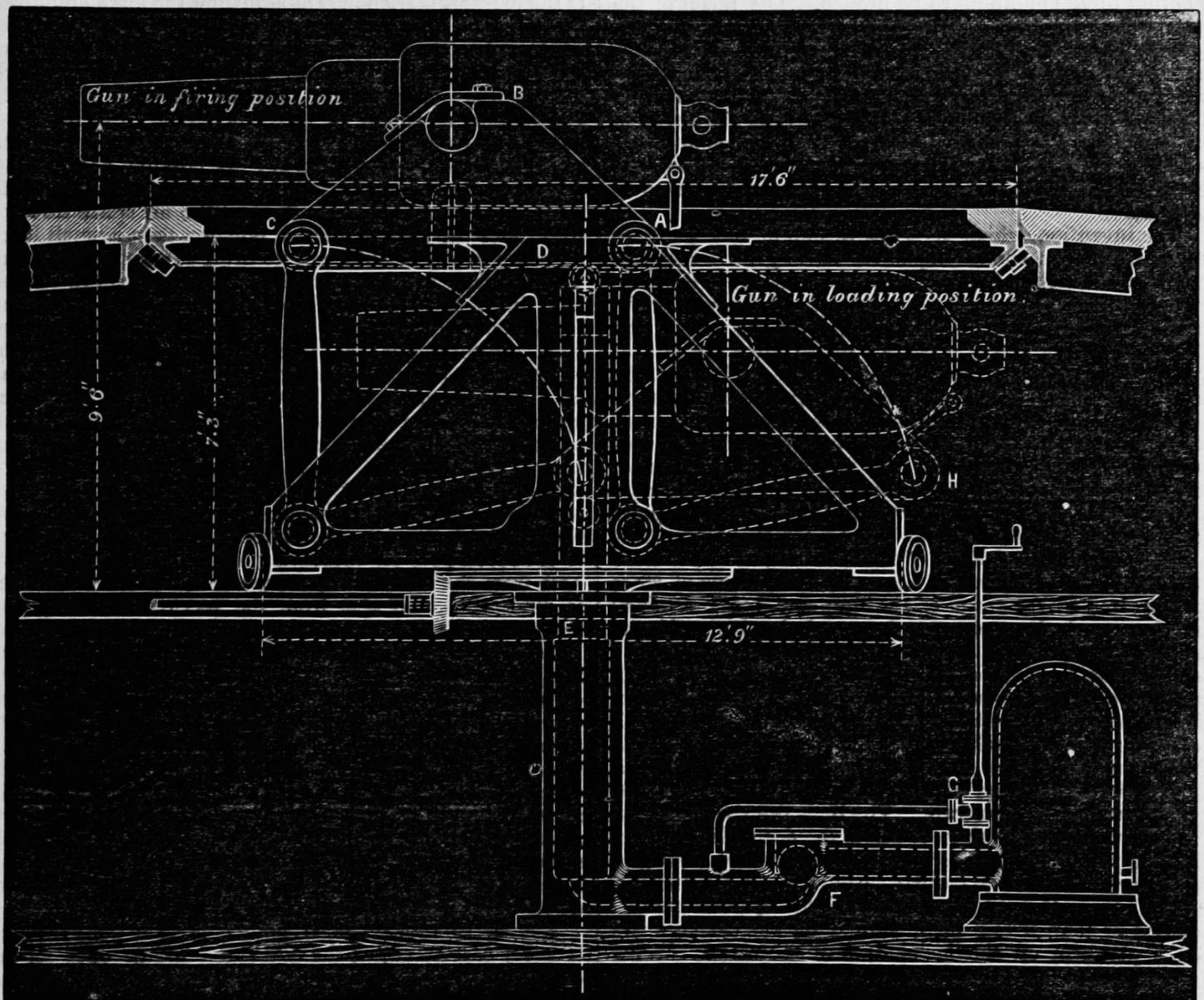
THE SCIENCE OF WAR

I.

CAPTAIN MONCRIEFF'S HYDRO-PNEUMATIC GUN-CARRIAGE FOR SEA SERVICE

SOME apology is needed for venturing to trouble the quiet of NATURE with an account of military engines. The desolation that war is now spreading over some of Nature's fairest scenes, and the waste caused thereby of her bounteous annual gifts, may account for these jottings, which have, perhaps, strangely found their way into her note-book; such topics have been suddenly and violently forced of late upon her attention.

But a further and more substantial reason for finding a place for a subject of this kind within NATURE'S domain is that the action of Nature's forces is in some ways best displayed in warlike engines. In them we use, examine, and experiment with force in sudden and violent action. To produce and also to control and direct the instantaneously created power of explosives has taxed the ingenuity, and also enlarged the knowledge of both the chemist and the mechanician. But for the necessities of war we should know little of Nature's forces in this aspect. The arts cf peace only in a very limited form make use of explosive agents. The wonderful progress made of late years in military engines—a progress whose rapidity surpasses the



advances of any mechanical inventions for other purposes—has called an amount of attention to those forces and agents which the modern artillerist employs, that has not failed to bring out many special facts in relation to them. Nature's territories are everywhere so rich that he who diligently ploughs any corner, however remote, seldom fails to be rewarded, not only by the crop which he seeks to cultivate, but also by some unsuspected fragments of truth which his plough-share has, as it were, accidentally turned up. For instance, some of the most remarkable examples of conservation of energy are to be found in the action and effects of the mighty projectiles of modern times.

The inventions of the gentleman whose name stands at the head of this paper, afford several important illustrations of the foregoing remarks. It is not more than two years since his Protected Barbette Gun-Carriage for land defence was tried with an instantaneous success that filled the public with astonishment—an exceedingly rare occurrence in inventions so entirely novel in their principles. Having previously existed only in the inventor's mind and in small models, when applied to a 7-ton gun (a monster unknown so recently as the Crimean war), it was found to work with perfect exactness and to realise all that had been promised for it. It may be well to recall briefly to the reader's mind what this carriage effected, and the means by which it acted, as the new carriage is designed to effect a somewhat similar object, though by a wholly different agency.

The purpose which the Protected Barbette Carriage accomplishes is the utilisation of the recoil. This force, which in modern heavy ordnance is a very considerable one, was previously known only as a destructive force. It strained racers and pivots almost beyond the endurance of iron, and shook the granite foundations on which they rested; and artillerists sought to coax it to waste itself as harmlessly as they could in friction. The Protected Barbette Gun-Carriage utilised this force by causing it to raise a counter-weight, while the gun descended below the parapet into safety and concealment from the enemy. This was effected by interposing between the gun and counter-weight a *moving* fulcrum. Any fixed fulcrum, such as a pivot, was found, no matter how strong, incapable of resisting the almost inconceivably rapid action of exploding gunpowder; it was torn from its position before it had time to move. But in the moving fulcrum there is nothing to be broken. The recoil of the gun rolls back the elevators, which raise the counter-weight, and this is retained in its position when the recoil is exhausted, and when released and allowed to fall restores the gun to the firing position again. It should be further observed that the gun commences to move in the direction of the recoil, gradually descending on a cycloidal curve, and thus the force of the recoil is not suddenly checked, but guided. This is one of the conditions essential to its success.*

The invention, which it is the design of this paper to discuss, effects a similar object for naval gun-carriages to that accomplished on land by the Protected Barbette Gun-Carriage. By it the gun is gradually lowered in its recoil below the surface of the deck of the vessel, and the force of the recoil is stored up to raise the gun at pleasure to its firing position above the deck. But the means by which it is accomplished are wholly different. There is no counter-weight and there is no moving fulcrum. It is manifest that at sea the fall and rise of a counter-weight could not be used. The direction of the force of gravitation is fixed and invariable, but the platform of a ship's deck is not always horizontal, and is often rapidly changing its inclination. In the Hydro-pneumatic Carriage, advantage is taken of the elasticity of air to store up and utilise the force of the recoil. A volume of air is compressed by the recoil of the gun, and being retained at pleasure in its compressed state, it is able to lift the gun to the position it occupied before the discharge; and as the moving fulcrum transferred the force of the recoil to the counter-weight without any check or jar, so in this naval carriage a like office is performed by water, which smoothly and effectually conveys the force of the recoil to compress the air in its reservoir. This is accomplished in a very simple manner, which can be easily understood by the accompanying diagram. The lines represent the gun and carriage in the firing position, the dotted lines in the loading position, showing the effect of the recoil. The gun is carried in a small triangular carriage (A, B, C), and this moves down through a quarter circle by the parallel motion of four strong bars, jointed on the carriage and on a platform on the lower deck of the vessel. In the firing position this part of the apparatus is supported by a plunger (D, E) or piston, and by the descent of the carriage this plunger is forced into a cylinder filled with water. This cylinder communicates with an air vessel or reservoir; consequently by the recoil a volume of water equal in bulk to the cubic content of the plunger is forced into the air reservoir; the volume of air is diminished by that amount and the pressure increased. The valve at F is self-acting in one direction only; it allows the water to flow into the air reservoir, but not to return. Consequently, when the recoil has exhausted its force in compressing the air, the gun remains in the loading position. When the valve G is turned, the water is driven from the reservoir by the compressed air, rushes into the cylinder, raises the plunger, and with it the gun and its carriage into the firing position. It should be observed that there is a circular portion of the upper deck, which, with the platform on the lower deck, to which the parallel bars are attached, traverses round on the plunger as a pivot, and so enables the gun to be pointed in any direction. In this rotating circular portion of the upper deck there is a rectangular opening which opens and closes by a pair of self-acting shutters with the rise and fall of the gun. A minute description of these minor arrangements is not here necessary.

One of the most remarkable features of this invention is the extraordinary power of adjusting the force employed to meet the recoil of the gun. By the descent of the plunger the air space is reduced by the cubic content of the plunger; and as the air space can be varied by admitting more or less water into the reservoir, so can the elastic force be varied to meet the recoil. For instance, did the air space in the reservoir equal the volume of the plunger, then the plunger could not possibly descend entirely into the cylinder, as that would compress the air to nothing. On the other hand, were the air space three or four times the volume of the plunger, then a small force of recoil would be sufficient to bring it completely down. The resisting force may thus be adjusted within almost any limits to meet the force of the recoil. It will be further observed that as in the Protected Barbette Carriage with counterweight, the recoil is met by a very slight resistance at the commencement, and is allowed to start in motion in its own direction. The first backward motion of the gun depresses the plunger very slightly, but as the recoil goes on it causes an increasingly rapid descent. For instance, the rollers must travel over two-thirds of the quadrant A H, to send the plunger half way down into the cylinder; the remaining one-third would send it down to the bottom. Thus the resistance to the recoil goes on increasing in a double progression, both from the increased pressure of the air as its volume is diminished, and also from the fact that the motion of the gun produces an increasing diminution of that volume.

Let us go through the process of adjusting the machine into working order. The reservoir and cylinder are both empty, the plunger is at its lowest descent, the gun lies down in the loading position. By a pump communicating with the reservoir, water is driven into the reservoir until the air space is reduced to one-half or one-third, as the case may be, of the volume of the plunger. This will raise but very slightly the plunger and its load. Now air must be pumped in till its pressure in the air space is sufficient to raise the plunger with the gun and its carriage into the firing position. The gun may then be brought down to the loading position.

This entire process need not be literally gone through in every case to adjust the machine. When once (if the expression may be borrowed) the "constants" of the carriage have been determined, *i.e.*, the amounts of air and water required in the reservoir, those quantities can be pumped in, keeping the valve G closed, and the gun remaining quiescent in the loading position. Water should be pumped in so as to leave a fixed air space, and then an amount of air, such that, with the added volume of the plunger, the pressure would still be sufficient to sustain the gun in the firing position. For a twenty-five ton gun the weight to be raised, including that of the plunger and the moveable part of the carriage, would be about thirty tons. Supposing the sectional area of the plunger to be two square feet, this would require a pressure of air of a little over 230lbs. on the square inch, or a little under sixteen atmospheres. When once adjusted, the carriage would remain in complete working order for days or weeks, in fact, until the water was allowed to run off.

While the main object and purpose to be accomplished

* While this article was going through the press, an attempt to make a gun descend an inclined plane by recoil and raise a weight, and so to form a protected Barbette carriage, was tried in the Royal Arsenal, and failed for this reason: The horizontal force of the recoil was not met in its own direction, but at an angle. The gun would not descend the inclined plane beyond a foot or two, and the violent concussion destroyed the elevating gear at the second shot.

by the hydro-pneumatic gun-carriage has been sketched, it is evident that all the applications of the principle of utilising the recoil as embodied in this engine have not been exhausted. The force of the recoil which must be exhausted in bringing the gun down to the loading position is very much greater than the force that would be required simply to raise the gun again to the firing position. The recoil takes place very rapidly, much more rapidly than it is desirable that the gun should rise again. If in the Protected Barbette Carriage it was allowed to return freely to its firing position, it would come up with an inconvenient or even a dangerous violence. The superfluous energy of the recoil stored up in the counter-weight must, therefore, be controlled and exhausted by friction bands. In the hydro-pneumatic carriage the return of the gun can be completely controlled by the valve or stopcock G, so as to bring it to the loading position as gently as desired, and the superfluous energy of the recoil will take the form of heat developed in the compressed air of the reservoir. But this superfluous energy may be seized and utilised. If a second and smaller plunger is attached to the cross head of the main plunger, which supports the gun and its carriage, with a cylinder and reservoir of its own, the power there accumulated may be used for any other purpose, as training the gun and carriage. In this case also, though the pressure produced and the heat generated in the main reservoir will not be so great as if there was no second plunger, still it alone will contain an ample store of force to bring the gun again into its firing position.

To discuss the military advantage of this invention, as a substitute on board ships of war for a turret weighing 300 tons of wrought iron, affording more complete protection to gun and gunners, and not weighing for a twenty-five ton gun more than sixteen tons altogether, would be travelling out of the realm of NATURE.

We have only endeavoured to show in this example with how great efficiency and docility Nature obeys those who understand how to direct her forces, and that all her work is not only efficient but instructive. If we can persuade her to undertake a new task she will teach us a new lesson. In the hydro-pneumatic gun-carriage a means supplies itself for measuring the exact amount of work done by the recoil. The compression of the air in the reservoir, and the heat generated in the process, will give accurate data for measuring the force exerted, and by this a step will be made towards measurements of the power of explosives with a precision hitherto unattainable.

Nature, like the great ancient fabulist, if she is compelled to be our slave, is resolved also to be our teacher.

NOTES

THERE is one part which neutrals may take in the Continental war. With no sympathy for those who have caused the war on either side, our sympathy is all the more due to those who innocently suffer from it on both sides. The following appeal, posted on the walls of every *mairie* in France, will touch other hearts than those of Frenchmen :—"*Appel à la France.*—Au nom de Dieu, au nom de la patrie, au nom de nos fils, de nos frères, de nos braves soldats tombés avec honneur sur le champ de bataille, et toujours héroïques quoique vaincus aujourd'hui, nous faisons un appel à tous les cœurs français. De grâce, donnez-nous de l'argent, du linge, des chemises, des couvertures, des vêtements, de flanelle, etc. Là-bas, sur nos frontières, l'élan des villes, les offrandes touchantes des villages ne suffisent déjà plus à nos chers blessés.—Les besoins sont immenses.—Le temps presse.—Donnez, oh! donnez vite! Envoyez les dons en nature et en argent au siége de la société à Paris, Palais de l'Industrie, porte No. IV." Here is a work in which all may unite—French, Germans, and neutrals, men of science, men of literature, men of business; and above all, our women. Nobly already have English, Irish, and Americans, surgeons, nurses, sisters of charity, come forward in the good work, but still it can only be as a drop in the ocean. To offer succour to the wounded and sufferers on both sides, to assuage as far as we can, the horrors of war, never exhibited on a more fearful scale than within the last few weeks, is now the duty of our more fortunate countrymen and countrywomen.

ANOTHER sacrifice of science to the war! The Congress of Alpine Geologists, the meeting of which we announced to take place on the 31st of this month, is adjourned to a more favourable time. It is probable also that the Congress of Anthropology and Pre-historic Archæology which it was proposed to hold at Bologna, and that of German naturalists to take place at Rostock, will not be held.

THE following sectional arrangements of the British Association are now announced :—A—MATHEMATICAL AND PHYSICAL SCIENCE (in the Crown Court, St. George's Hall): President—J. Clerk Maxwell, F.R.S. L. and E.; Secretaries—Prof. W. G. Adams; W. K. Clifford; Prof. G. C. Foster, F.R.S.; Rev. W. Allen Whitworth. B—CHEMICAL SCIENCE (in the Royal Institution, Moore Street): President—Prof. Henry E. Roscoe, PhD., F.R.S., F.C.S.; Secretaries—Prof. A. Crum Brown, F.R.S.E., F.C.S.; A. E. Fletcher, F.C.S.; Dr. W. J. Russell, F.C.S. C—GEOLOGY (in the Concert Hall, Lord Nelson Street): President—Sir Philip de Malpas Grey Egerton, Bart., M.P., F.R.S., F.G.S.; Secretaries—W. Pengelly, F.R.S., F.G.S.; Rev. H. H. Winwood, F.G.S.; W. Boyd Dawkins, F.R.S., F.G.S.; G. H. Morton, F.G.S. D—BIOLOGY (in the Reading Room and Lecture Room of the Free Public Library): President—Prof. G. Rolleston, M.D., F.R.S., F.L.S.; Vice-Presidents—John Evans, F.R.S., F.G.S., F.S.A.; Prof. Michael Foster, M.D., F.L.S.; Secretaries—Dr. T. S. Cobbold, F.R.S., F.L.S.; Thos. J. Moore; H.T. Stainton, F.R.S., F.L.S., F.G.S.; Rev. H. B. Tristram, LL.D., F.R.S. E—GEOGRAPHY (in the Small Concert Room, St. George's Hall): President—Sir Roderick I. Murchison, Bart., K.C.B., D.C.L., LL.D., F.R.S., F.G.S.; Secretaries—H. W. Bates, Assist. Sec. R.G.S.; Clements R. Markham, F.R.G.S.; Albert J. Mott; J. H. Thomas, F.R.G.S. F—ECONOMIC SCIENCE AND STATISTICS (in the Council Chamber, Town Hall): President—Prof. Jevons; Secretaries—E. Macrory; J. Miles Moss. G—MECHANICAL SCIENCE (in the Civil Court, St. George's Hall): President—Charles Vignoles, C.E., F.R.S., M.R.I.A., F.R.A.S.; Secretaries—P. Le Neve Foster; J. T. King.

THE Dutch Society of Sciences, of Haarlem, instituted last year, in addition to its ordinary prizes, two large gold medals, each of the value of 500 florins, one of which bears the name and effigy of Huyghens, the other of Boerhaave. These medals are to be awarded alternately, once in two years, to the *savant*, Dutch or foreigner, who shall have contributed the most, during the previous twenty years, to the progress of one particular branch of mathematical physics or of natural science. The Huyghens medal is to be devoted in 1874 to chemistry, in 1878 to astronomy, in 1882 to meteorology, in 1886 to mathematics, pure and applied. The Boerhaave medal is to be granted in 1872 to mineralogy and geology, in 1876 to botany, in 1882 to zoology, in 1884 to physiology, in 1888 to anthropology. The series will then recur. At their recent annual meeting the society made the first award of the Huyghens medal to M. Clausius for his discoveries in thermo-dynamics.

SIR FREDERICK POLLOCK, late Chief Baron, whose death is announced as having taken place on Tuesday last, in the 87th year of his age, was an amateur photographer of no mean ability, and had been President of the London Photographic Society; he was an occasional contributor of articles on photography to the Philosophical Proceedings of the Royal Society.

He received his education at St. Paul's School and Trinity College, Cambridge, and was Senior Wrangler and First Smith's Prizeman in 1806.

THE Duke of Argyll writes to the *Times* to say that a remarkable meteor which was visible in the north of England on the 15th inst., was also seen at Inveraray. "It burst," the Duke says, "about 50 degrees above the horizon in the N.N.W., and its great peculiarity was in the appearance presented by the luminous vapour which was the product of its explosion. This vapour was brighter than the tail of any comet—at first linear in shape—with sharp irregular projections. It was soon, however, curled up, as if by an atmospheric current, into the form of a horse-shoe, and in this form seemed to drift very slowly before the north-east wind in a south-west direction. It gradually, but very slowly, lost its brilliancy, remaining visible for more than a quarter of an hour." Two other correspondents of the *Times* describe a very brilliant meteor which was seen in Cambridgeshire on Saturday night.

A WATERSPOUT was observed off Calais on Saturday evening. From the edge of a thick black thunder-cloud two funnel-shaped projections were seen to depend, until they gradually reached the surface of the sea, on which they created a great disturbance, masses of foam rising up to a considerable height around the foot of each waterspout. It was calculated that the long streamers hanging down from the cloud to the sea were nearly a mile in length. The wind caused them to wave about gently and alter their form slightly from time to time. One of the waterspouts lasted about ten minutes, and the other about a quarter of an hour. During this time they moved rapidly along the sea.

ON Saturday evening, August 20, between 11 P.M. and midnight, a very beautiful aurora borealis was seen near Weobley, in Herefordshire, stretching from N.N.E. to N.W., and visible, with more or less distinctness, for about three hours.

THE *Engineer* states that an exhibition is about to be opened in Tromso, the capital of Finmark. The exhibition will contain the products and appliances used in the several fisheries, those of agriculture, and of mechanical and domestic industry, together with objects and products illustrative of the mode of life and state of civilisation of the inhabitants of those regions.

WE recorded recently the purchase by the Belgian Government of the Martius herbarium as the nucleus of a national collection. The same Government has now also purchased the Brussels Botanic Gardens from the Belgian Horticultural Society. The capital of Belgium has thus laid the foundation of a national establishment comparable to those of Paris and London.

THE Treasurer's report of the British Medical Congress, which has just been sitting for four days at Newcastle-on-Tyne, shows that out of an income of 5,000*l.* per annum it spends just 15*l.* on scientific research. It is stated that the greater part of the funds are required to keep afloat its own journal, and that a proposition from some of the members to publish an annual volume of Transactions found but little favour.

Two instances are recorded in *Les Mondes* of somnambulism being perfectly cured by the administration of bromide of potassium. In one case, a woman of the age of twenty-four who had been subject to attacks two or three times a week for ten years, was operated upon; the dose given was two grammes of the bromide in seventy-five of water per diem, gradually increased to six grammes; the attacks became at once less and less frequent, and entirely ceased at the end of two months. In the other case, a girl of eight was the subject; one gramme was given morning and evening, and the cure was complete and immediate.

WE have received a specimen of paper manufactured entirely from wood, which is at least equal in colour and texture to the cheaper kinds of ordinary printing paper. There is no doubt that the pulp from the fibre of the fir and some other kinds of wood makes excellent material for paper, which can be prepared at a low price, the only practical difficulty being the high temperature and consequently the high pressure required to decompose the non-fibrous matter. Another material now actually employed for the manufacture of paper, is the husk and seeds of the cotton-pod from which the oil has been expressed, the fibrous pulp resulting from this operation is said to be an excellent paper-making material. The larger portion of the cheaper printing-papers used for newspapers, magazines, &c., is now made entirely from the Spanish Esparto grass, a name given to two distinct species, *Macrochloa tenacissima*, and *Lygeum spartum*, both growing abundantly on the shores of the Mediterranean; but the comparatively high price of this material, more than double what it was a few years since, affords a favourable opening for the introduction of other paper-making fibres.

PROFESSOR ORTON does not give a very encouraging account of the intellectual condition of Ecuador. He says:—"Ecuador boasts one university and eleven colleges, yet the people are not educated. Literature, science, philosophy, law, and medicine, are only names: there is not a single book-store in the city of Quito, and there are only four newspapers published in the whole of the Republic. In the schools the pupils study in concert aloud, Arab fashion." Yet Professor Orton adds that Chile has thought it worth her while lately to sign a convention with Ecuador "for an exchange of literary productions!"

THE Government of Nicaragua has sent an expedition under Mr. Sonnenstern, a civil engineer, to examine whether the River Coco can be made navigable. The report of Mr. Sonnenstern, which is favourable, has been published in the *Gazette* of Nicaragua. The river has hitherto been little known. The Indians are stated to be indolent and docile, and might, by contact with settlers, be civilised.

THERE is a rumour in California that a large quicksilver deposit has been discovered in the coast mountains eastward of San José.

THE Ecuador Government has decreed that in the capital and suburbs no house constructed of cane and straw shall be permitted, and that three months after the date of the decree all those existing shall be demolished. There was a former decree to this effect, which is thus fully enforced.

THE old Palace of Government at Lima, in Peru, is condemned, and a new one, which is to be a stone palace from the designs of M. Zoiles, architect and engineer, is to be built. In preparation, the ministerial departments have been removed from the old building.

THE Federal Government of the United States of Columbia has paid a debt to the state of Panama by the transfer of house property in Panama, which is to be converted into a college for that city.

THE Rev. W. A. Leighton, of Shrewsbury, author of the "Flora of Shropshire," is preparing for publication "A Lichen Flora of Great Britain, Ireland, and the Channel Islands."

WE have to acknowledge the receipt of "Hogg's Secret Code for Letters or Telegrams," with instructions for converting a message into ciphers, and for converting ciphers into a message.

THE Rev. Prof. Haughton reprints from the *Dublin Quarterly Journal of Medical Science* his paper "On the Muscular Forces employed in Parturition, their amount and mode of application."

KARL FRITSCH'S "Phänologische Beobachtungen aus dem Pflanzen und Theirreiche" contains an immense mass of observations taken in the neighbourhood of Vienna and other districts of Austria, in the year 1857 (but now for the first time published), on what may be termed periodical natural history, that is, the period of the first flowering of plants, and the first appearance of migratory birds, insects, and other animals of the summer season.

THE last volume (XIX.) of the Transactions of the Imperial Zoological-Botanical Society of Vienna contains, among its more important articles, contributions to the flora of Greece and Crete, by Dr. E. Weiss; a monograph of the genus *Botrychium*, by Dr. J. Milde (reducing the thirteen species in Moore's Index Filicum to ten); anatomical investigation of *Pleurophyllidia formosa*, by R. Bergh; a second contribution to the flora of Lower Austria, by Dr. A. Neilreich: observations on the metamorphosis of insects in the light of the theory of descent, by F. Brauer (a thoroughly Darwinian article); contributions to Hymenopterology, by Dr. J. Kriechbaumer; descriptions of several Myriapods in the Museum of Vienna, by MM. A. Humbert and H. de Saussure; the Lichens of the Tyrol, by F. Arnold; zoological notes, by G. Ritter von Frauenfeld; contributions to the Fish-fauna of Trans-baikal, by B. N. Dybowski.

IN the "Arbeiten aus der Kiel Institut" we observe that Klünder has been making further investigations into the time occupied in muscular contraction. His experiments have been conducted with a pendulum chronoscope constructed by Hensen. The contraction is traced on a reddened glass plate attached to the arm of a tuning fork, with which it therefore vibrates when this is sounded. The curve described is consequently a sinuous line, its ascending and descending portion decussating. If a vertical median line be drawn on the plate when at rest, the measurements can be examined and compared. These give for the stage of latent excitation a value of $\frac{3}{400}$ths of a second, which, when the muscle is weighted or exhausted, may rise to more than 0·01 sec. Antecedent extension diminishes the duration of this period, as Helmholtz had already remarked. The proper curve of contraction exhibits itself in its middle part as a curved line modified by the elasticity of the muscle. The muscle is quite inactive towards the end of contraction, as shown by the form of the extremities of the curve. The greatest increase in rapidity occurs in the ascending portion of the curve, which corresponds to the greatest development of force in the muscle which is between the 3rd and 4th 1-400 of a sec., the absolute greatest rapidity of the ascent is in the 8th 1-400 sec. The form of the curve is, considerably changed if a heavy weight is appended to the muscle, the period of elevation as well as the fall being both longer. The retardation occurs principally at the commencement of the elevation, at which period the rapidity only slowly increases, as compared with its usual rate.

THE COMING TRANSITS OF VENUS*

TRANSITS of Venus over the disc of the sun have more than any other celestial phenomena occupied the attention and called forth the energies of the astronomical world. In the last century they furnished the only means known of learning the distance of the sun with an approach to accuracy, and were therefore looked for with an interest corresponding to the importance of this element. Although other methods of arriving at this knowledge with equal accuracy are now known, the rarity of the phenomenon in question insures for it an amount of attention which no other system of observation can command. As the rival method, that of observations of Mars at favourable times, requires, equally with this, the general co-operation of astronomers, the power of securing this co-operation does in itself give the Transits of Venus an advantage they would not otherwise possess.

Although the next transit does not occur for four years, the preliminary arrangements for its observation are already being made by the governmental and scientific organisations of Europe. It is not likely that our Government will be backward in furnishing the means to enable its astronomers to take part in this work. The principal dangers are, I apprehend, those of setting out with insufficient preparation, with unmatured plans of observation, and without a good system of co-operation among the several parties. For this reason I beg leave to call the attention of the Academy to a discussion of the measures by which we may hope for an accurate result.

In planning determinations of the solar parallax from the Transits of Venus, it has hitherto been the custom to depend entirely upon the observations of the internal contact of the limbs of the sun and planet proposed by Halley. It is a little remarkable, that while astronomical observations in general have attained a degree of accuracy wholly unthought of in the time of Halley, this particular observation has never been made with a precision at all approaching that which Halley believed that he himself had actually attained. In his paper he states that he was sure of the time of the internal contact of Mercury and the sun within a second. The latest observations of a transit of Mercury, made in November 1868, are, as we shall presently see, uncertain by several seconds. It is also well known that the observations of the last transit of Venus, that of June 1769, failed to fix the solar parallax with the certainty which was looked for, the result of the standard discussion being now known to be erroneous by one-thirtieth of its entire amount. One of the first steps to carry out the object of the present paper will be an inquiry into the causes of this failure, and into the different views which have been held respecting it.

The discrepancies which have always been found in the class of observations referred to, when the results of different observers have been compared, has been generally attributed to the effect of irradiation. The phenomenon of irradiation presents itself in this form: When we view a bright body, projected upon a dark ground, the apparent contour of the bright body projects beyond its actual contour. The highest phenomenal generalisation of irradiation which I am aware of having been reached is this: A lucid point, however viewed, presents itself to the sense, not as a mathematical point, but as a surface of appreciable extent. A bright body being composed of an infinity of lucid points, its apparent enlargement is an evident result of the law just cited.

[The speaker here drew a number of diagrams for the purpose of illustrating his theory.]

The following diagrams show the effect of this law upon the time of interval contact of a planet with the disc of the sun. The planet being supposed to approach the solar disc, Fig. 1 shows the geometrical form of a portion of the apparent surface of the sun, or the phenomenon as it would be if there were no irradiation immediately before the moment of internal contact. Fig. 2 shows the corresponding appearance immediately after the contact. To indicate the effect of irradiation, or to show the phenomenon as it will actually appear on the theory of irradiation, we have only to draw an infinity of minute circles for each point of the sun's disc visible around the planet to indicate the apparent phenomenon. The effect of this is shown in Figs. 1*a* and 2*a*. The exceedingly thin thread shown in Fig. 1 is thus thickened as in 1*a*, and the sharp cusps of Fig. 2 are rounded off as shown in Fig. 2*a*. The apparent radius of the planet is diminished by an amount equal to the radius of the circle of irradiation, and the radius of the sun is increased by the same amount. Comparing Figs. 1*a* and 2*a*, it will be seen that the moment of internal contact is marked by the formation of a ligament, or "black drop," between the limbs of the sun and the planet. This formation is of so marked a character that it has been generally supposed there could be little doubt of the moment of its occurrence. The remarks of the observers have given colour to this supposition, the black drop being generally described as appearing suddenly at a definite moment.

Examining Fig. 2*a*, it will be seen that the planet still appears entirely within the disc of the sun. The geometrical circle which bounds the latter, and that which bounds the planet, instead of touching, are separated by an amount equal to double the irradiation. And, when they finally do touch, neither of them will be visible at the point of contact. The estimate of the moment of contact must therefore be very rough, the means of estimating being far less accurate than those afforded by a common filar micrometer. In the actual case the eye has to continue the two circles to the point of contact by estimation, through a distance depending on the amount of irradiation, while measures with a micrometer are made by actual contact of a wire with a disc. Such estimates have, therefore, been

* Substance of a paper read before the Thirteenth Annual Session of the American Academy of Sciences, held at Washington, by Prof. Simon Newcomb. (The original paper was illustrated by diagrams.)

generally rejected by investigators, not only from their necessary inaccuracy, but because the time of "apparent contact" depends upon the amount of irradiation, which varies with the observer and the telescope. If there is no irradiation at all, the time of apparent contact and that of true contact will be the same, as shown in Fig. 2, while, when the cusps are enlarged by irradiation, apparent contact will not occur until the planet has moved through a space equal to double the irradiation.

Let us return to the phenomenon at actual contact. According to the theory as it has been presented, the formation or rupture of the black ligament connecting the dark body of Venus with the dark ground of the sky is a well-marked phenomenon, occurring at the moment of true internal contact. This was, I believe, the received theory until Wolf and André made their experiments on artificial transits in the autumn and winter of 1868 and 1869. They announced, as a result of these experiments, that the formation of the ligament was not contemporaneous with the occurrence of internal contact, but followed it at the ingress of the planet, and preceded it at egress. In other words, it appeared while the thread of light was still complete. They furthermore announced that with a good telescope the ligament did not appear at all, but the thread of light between Venus and the sun broke off by becoming indefinitely thin.

The result is not difficult to account for. Irradiation has already been described as a spreading of the light emitted from each point of the surface viewed, so that every such point appears as a small circle. The obvious effect of this spreading is a dilution of the light emitted by a luminous thread, whenever the diameter of the thread is less than that of the circle of irradiation. In consequence of this dilution, the thread may be invisible while it is really of sensible thickness, a given amount of light producing a greater effect on the eye the more it is concentrated. Since the thread of light must seem to break when it becomes invisible at its thinnest point, the formation or rupture of the thread marks, not the moment of actual contact, but the moment at which the thread of light becomes so thick as to be visible, or so thin as to be invisible. The greater the irradiation, and the worse the definition, the thicker will be the thread at this moment.

An interesting observation, illustrative of this point, was made by Liais at Rio Janeiro, during the transit of Mercury of November 1, 1868. He had two telescopes, one much smaller than the other. He watched the planet in the small one till it seemed to touch the disc of the sun, then looking into the large one, he saw a thread of light distinctly between the planet and the sun, and they did not really touch until several seconds later.

Reference to the figures will make it clear that there is no generic difference between the phenomenon commonly called the rupture of the black drop and that of the formation of the thread of light. If the bright cusps are much rounded, as in Fig. 1*a*, the appearance between them is necessarily that of a drop, while if they are seen in their true sharpness, as in Fig. 1, the form of the drop will not appear. It has been shown that with different instruments the phenomenon of contact may exhibit every gradation between these extremes. The only well-defined phenomenon which all can see is the meeting of the bright cusps and the consequent formation of the thread of light at ingress, and the rupture of the thread at egress.

To recapitulate our conclusions—

1. The movement of observed internal contact at ingress is that at which the thread of light between Venus and the sun becomes thick enough to be visible.

2. The least visible thickness varies with the observer and the instrument, and, perhaps, with the state of the atmosphere.

3. The apparent initial thickness of the thread varies with the irradiation of the telescope.

Two questions are now to be discussed. The observed times varying with the observer and the instrument, we must know how wide the variation may be. If it be wide enough to render uncertain the results of observation, we shall inquire how its injurious effects may be obviated.

The first question can be decided only by comparison of the observations of different observers upon one and the same phenomenon. For such comparison I shall select the observations of the egress of Mercury on the occasion of its last transit over the disc of the sun. This selection is made for the reason that this egress was observed by a great number of experienced observers with the best instruments, while former transits, whether of Venus or Mercury, have been observed less extensively or at a time when practical astronomy was far from its present state of perfection, and that the transit in question would therefore furnish much better data of judging what we might expect in future observations. The comparison was made in the following way:—I selected from the "Astronomische Nachrichten," the "Monthly Notices of the Royal Astronomical Society," and the "Comptes Rendus," all the observations of internal contact at egress which there was reason to believe related to the breaking of the thread of light, and which were made at stations of known longitude. Each observation was then reduced to Greenwich time, and to the centre of the earth.

From these comparisons it appears that the contact was first seen by Le Verrier, at Marseilles, at two seconds before nine o'clock, Greenwich time. In one second more it was seen by Rayet at Paris, Oppolzer at Vienna, Lynn at Greenwich, and Kaiser at Leyden. The times, noted by twenty other observers, are scattered very evenly over the following fifteen seconds. Kam and Kaiser, at Leyden, did not see the contact until nineteen and twenty-four seconds past nine.

It thus appears that among the best observers, using the best instruments, there is a difference exceeding twenty seconds between the times of noting contact. This difference corresponds to more than a second of arc, so that really these observations were scarcely made with more accuracy than measures under favourable circumstances with a micrometer, and are not therefore to be relied on. But a great addition to the accuracy of the determination could be made by measures of the distance of the cusps, while the planet was entering upon the disc of the sun. It would tend greatly to the accuracy of the results, if the observers should meet beforehand with the telescopes they were actually to use in observing the transit and make observations in common on artificial transits. It would be a comparatively simple operation to erect an artificial representation of the sun's disc at the distance of a few hundred yards, and to have an artificial planet moved over it by clock-work. The actual time of contact could be determined by electricity, and the relative positions of the planet and the disc by actual measurement. With this apparatus it would be easy to determine the personal errors to which each observer was liable, and these errors would approximately represent those of the observations of actual transit.

Still it would be very unsafe to trust mainly to any determination of internal contact. Understanding the uncertainty of such determinations, the German astronomers have proposed to trust to measures with a heliometer, made while the planet is crossing the disc. The use of a sufficient number of heliometers would be both difficult and expensive, and I think we have an entirely satisfactory substitute in photography. Indeed, Mr. De la Rue has proposed to determine the moment of internal contact by photography. But the result would be subject to the same uncertainty which affects optical observations—the photograph which first shows contact will not be that taken when the thread of light between Venus and the sun's disc was first completed, but the first taken after it became thick enough to affect the plate, and this thickness is more variable and uncertain than the thickness necessary to affect the eye. We know very well that a haziness of the sky which very slightly diminishes the apparent brilliancy of the sun, will very materially cut off the actinic rays, and the photographic plate has not the power of adjustment which the eye has.

But, although we cannot determine contacts by photography, I conceive that we may thereby be able to measure the distance of the centres of Venus and the sun with great accuracy. Having a photograph of the sun with Venus on its disc, we can, with a suitable micrometer, fix the position of the centre of each body with great precision. We can then measure the distance of the centres in inches with corresponding precision. All we then want is the value in arc of an inch on the photograph plate. This determination is not without difficulty. It will not do to trust the measured diameters of the images of the sun, because they are affected by irradiation, just as the optical image is. If the plates were nearly of the same size, and the ratio of the diameters of Venus and the sun the same in both plates, it would be safe to assume that they were equally affected by irradiation. But should any show itself, it would not be safe to assume that the light of the sun encroached equally upon the dark ground of Venus and upon the sky, because it is so much fainter near the border.

If the photographic telescope were furnished with clock-work, it would be advisable to take several photographs of the Pleiades belt, before and after the transit, to furnish an accurate standard of comparison free from the danger of systematic error. There is little doubt that if the telescopes and operators practise together, either before or after the transit, data may be obtained for a satisfactory solution of the problem in question.

To attain the object of the present paper, it is not necessary to enter into details respecting choice of stations and plans of observation. I have endeavoured to show that no valuable result is to be expected from hastily-organised and hurriedly-equipped expeditions; that every step in planning the observations requires careful consideration, and that in all the preparatory arrangements we should make haste very slowly. I make this presentation with the hope that the Academy will take such action in the matter as may seem proper and desirable.

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS—MEETING AT GLASGOW

After having had an existence of some fifteen or sixteen years, during which it has done a large amount of scientific and thoroughgoing practical work, this North Country Institute has just deviated from its usual practice of holding its meetings in Newcastle-on-Tyne, and, with the co-operation of the Scottish Engineers and Shipbuilders' Association, has held a very successful meeting in Glasgow, the centre of the great Scottish coal-field, and the head-quarters of the mining and engineering industries of Scotland, and of the shipbuilding industry of the United Kingdom. The meeting began on Tuesday, the 9th of August, and extended over four days. On the opening day the Lord Provost of the City of Glasgow received and formally welcomed the members of the North of England Institute in name of the citizens and the Institution of Engineers and Shipbuilders; and thereafter the chair was taken by Mr. E. F. Boyd, President of the North of England Institute, and the business of the meeting commenced.

There were set down for reading and discussion no fewer than eighteen papers, the subjects treated of being all directly connected with mining and mechanical engineering. Only three papers were overtaken on the first day, when it was found that the time for adjournment had arrived. The afternoon was spent by the members in visiting various engineering and shipbuilding works, and other manufacturing establishments, which were freely thrown open to inspection by their respective proprietors.

We shall here briefly indicate the nature of the papers read and discussed at Tuesday's sitting of the Institute.

1. "On the Geology of the Coal Measures of Scotland," by Mr. James Geikie, district surveyor of the Geological Survey of Scotland. The author described, first, the calciferous sandstone series, which, when typically developed, consists of two groups of strata, the lower pointing to the prevalence of marine conditions during the deposition of the red sandstones and conglomerates, and the upper showing that during its accumulation marine and brackish water conditions alternated with the occasional appearance of land surfaces. Volcanoes were somewhat prevalent during the deposition of both groups. Second: The carboniferous limestone series, consisting of a lower group indicating marine conditions and occasional old land surfaces; a middle group indicating frequent land surfaces, and alternate brackish water and marine conditions; and an upper group pointing chiefly to lower marine conditions, with occasional brackish water deposits and a few old land surfaces: both submarine and subaërial volcanoes very active during the deposition of the whole series. Third: The millstone grit, deposited under almost exclusively marine conditions. Fourth: The coal measures, showing a prevalence of brackish or freshwater conditions, with abundant land surfaces, and speaking also of occasional inroads of the sea. No igneous rocks contemporary with the coal measures or millstone grit. Fifth: Intrusive rocks of three classes, namely, intrusive sheets, referable to close of "coal measures" group; bosses or pipes of tuff or agglomerate, probably of Permian age; and dykes of dolerite of Miocene ages. Sixth: Two systems of faults of different ages; the oldest striking N.E. and S.W., and the other, a double set, striking approximately E. and W. and N. and S. Mr. Geikie, in concluding, referred to the exceeding richness of the variety shown by the phenomena of the Scottish carboniferous formation, and said he had no hesitation in affirming that, when the palæontological and geological history of the carboniferous rocks of Scotland were worked out, there would be prepared one of the most important chapters in the physical history of the country.

2. "On the Magnetic Ironstone of Rosedale Abbey, Cleveland," by Mr. John Marley, M.E. This paper treated of the extraordinary deposit of magnetic ironstone which occurs at Rosedale West, and forms a very peculiar feature in the famous Cleveland ironstone, regarding which various papers have been published since 1857, when Mr. Marley first drew the attention of scientific men to it. The magnetic stone occurs quite isolated in two troughs, one of which is 90 feet deep, and it contains, in the best specimens, from 42 to 50 per cent. of metallic iron. In 1857 its extent was unproved, but it was believed to be very great, but this is now known not to be the case, from the results of recent borings and explorings which Mr. Marley fully detailed. The author explained the curious geological relationship which the magnetic stone bears to the top bed of the lias ironstone of Cleveland. The troughs lie east and west. Icebergs and glacial action were, in his opinion, in no way connected with the induction of the magnetic state, nor yet with the formation of the troughs. The deposits are not two beds of regular strata, nor are they veins, as no fissures have yet been found in the bottom of the troughs, although they have been diligently looked for. Mr. Isaac Lowthian Bell supplemented Mr. Marley's description by giving the results of a visit which he had paid to Rosedale, and stated that the magnetic ore could not be the result of volcanic action, as carbon was always contained in the analysis, as also water of hydration and a notable quantity of carbon.

3. "On the Duty of Cornish and other Pumping Engines," by Mr. J. B. Simpson. This paper was of especial interest on account of the subject treated of in it having a most intimate connection with the economy of fuel and the duration of the coal supply. After describing fully a Cornish engine recently erected in the Newcastle district, the author entered upon an examination of the details of twelve different kinds of engines, and compared their merits with those of the Cornish engine. In conclusion, he said that taking those engines into consideration, their average duty corresponded to a consumption of 14lb. of coal per horse-power per hour. Were a duty of 4lb. obtained, the saving in these engines alone would represent 40,000 tons of coal per annum, or, at 3*s.* per ton, 6,000*l.* The assumed total horse-power of pumping-engines in the Newcastle district is about 10,000, and from this the amount of the possible annual saving may easily be calculated. In many places coal may not be worth 3*s.* per ton at the pit mouth, but in the majority of cases its value is much greater. It is too much the practice to regard coal at the colliery as of little or no value, and that the extra 10lb. or 12lb. per horse-power per hour is not worthy of consideration. But fuel is not the only pecuniary part of the question, as extra consumption of coal means additional water, additional repairs, additional wear and tear, and additional manual labour—and these in the aggregate are very serious items of cost. The time does not seem far off when, in pumping and other colliery engines, the effective duty of 2lb. or 3lb. of coal per horse-power per hour will be considered as important as in the engines of London water-works and ocean steam-ships.

In the evening of Tuesday a *conversazione* was held in the Corporation Galleries. The east and west halls were occupied by numerous collections of objects—geological, palæontological, mineralogical, metallurgical, chemical, mechanical, engineering, mining, &c., together with a magnificent display of photographs, by Annan, of the Old Glasgow College, and various engineering works and Clyde-built ships. This exhibition was of immense scientific and industrial interest, and was at once the most extensive and valuable that has been held in Glasgow for many years. Advantage was taken of this evening's meeting to perform an interesting ceremony, namely, the presentation of a marble bust to Professor W. J. Macquorn Rankine, C.E., F.R.S., first president of the Institution of Engineers in Scotland, as a token of the appreciation and esteem of the members. A duplicate copy of the bust was also presented to the institution as a memorial of the Professor's labours in promoting the success of the institution. In the Large Upper Gallery there was an exceedingly interesting exhibition by means of the oxy-hydrogen light, of sections of fossil corals, by Mr. James Thomson, F.G.S., a gentleman who has of late years gone most extensively and enthusiastically into the study of fossil corals, and made it almost entirely his own; and so fully persuaded are palæontologists of the great value of his investigations, that Mr. Thomson is assisted by a grant from the British Association, at the forthcoming meeting of which he is to present a second report and exhibit his wonderful series of specimens.

On Wednesday morning the reading of papers was resumed, Mr. E. F. Boyd again presiding. The following is a brief notice of the papers overtaken :—

1. "On the Economical Advantages of Mechanical Ventilation," by Mr. D. P. Morison. The author stated that tabulated results of experiments recently made showed that the saving effected in the consumption of fuel varied in most cases from 40 to 80 per cent. in favour of mechanical ventilation as compared with furnace ventilation. The latter had other disadvantages, such as (1) the danger of an open fire in a fiery seam ; (2) in order to avoid that danger, the necessity and serious cost of constructing a dumb drift to convey the return air to the upcast shaft, and the fact that a large amount of fresh air is required to feed the furnaces, while it is of no value in the workings themselves ; (3) the serious fact that the upcast shaft, being usually heated to nearly its practical maximum, cannot, in cases of necessity (such as a sudden fall of the barometer, an unexpected occurrence of a large discharge of fire-damp, or a block in the air-ways), be made at once available for an increased duty ; (4) the inordinate wear and tear upon furnaces, arches, bars, and the shaft lining, whether brick-casing or tubbing, and in case of a coal-drawing upcast shaft, the deterioration of the ropes, guides, cages, and other plant. In no case could the furnace compete successfully with mechanical ventilation. Even in the deepest of English mines the advantage of mechanical ventilation is shown by the economy in fuel being from 35 to 40 per cent. over that required for furnace ventilation. Mr. Morison described various mechanical ventilators, including those of Struve, Nasmyth, Lemielle, Waddle, Guibal, and others. He expressed himself as most in favour of the Guibal ventilating fan, the one most in use both on the Continent and in this country. An interesting discussion followed Mr. Morison's paper, remarks being made by Messrs. Lupton (Leeds), Steavenson (Durham), William Cochrane and Simpson (Newcastle), Barclay (Kilmarnock), Marley (Darlington), Harvey (Glasgow), and others.

2. "On J. Grafton Jones's Coal-getting Machine," by Mr. Arnold Lupton, Leeds. After describing the machine in question, and specially dwelling upon its involving the use of the hydraulic wedge and a drilling apparatus, Mr. Lupton claimed for it the following advantages :—1st, The safety with which mines can be worked by it as a substitute for gunpowder ; 2nd, The superior shape of coal got by the wedge as compared with that got by blowing, and the less amount of slack made ; 3rd, The improvement in the health of the miners likely to ensue on the disuse of gunpowder ; 4th, The saving in labour by using the hydraulic wedge instead of hammer-driven wedges ; 5th, The saving in labour and diminution in the amount of slack made by using the hydraulic machine to push the coal out of the solid, in working those seams whose nature is such as to render it possible. Mr. Lupton stated that Jones's powerful machine is now in use, pushing coal out of the solid without any holing or natural breaks in the seam, at Kiveton Park Colliery, in South Yorkshire. The seam is five feet thick, and the coal is very hard, but by the use of the hydraulic wedge blocks are got four yards long and four feet wide—each about eight tons weight—at one application of the machine. In the course of the discussion which followed various other important and interesting facts were evoked.

3. "On an Expansive Double-cylinder Pumping Machine," by Mr. Andrew Barclay, Kilmarnock.

4. "On an Expansive, High-pressure, Cut-off Slide Valve," by the same.

5. "On a New Coal-getting Machine," by Mr. George Simpson, Glasgow. The author of this paper dwelt at some length on the working of coal on the "long-wall" system by machinery, and then explained the nature of the machinery which he thought most suitable for it. The essential feature of the machine, exhibited and described by Mr. Simpson, is a somewhat saw-like blade which works into the face of the coal seam in a horizontal manner. Mr. Simpson said it was indispensable that the tool to be used should be durable and easily removed and replaced in case of blunting or breakage, and he claimed that his cutter possessed those qualifications. He also showed an application of an endless chain for driving the proposed machinery, and which might be worked by an engine on the drawing road at the face of the coal, or from the bottom of the shaft or other convenient point.

6. "On the Utilisation of Blast Furnace Gases, Coal being used as the Fuel," by Mr. William Ferrie, Monklands, Iron and Steel Works, Lanarkshire. The author stated that it had occurred to him that if raw coal could be coked in the blast furnace as in a common gas retort, the difficulty of withdrawing the furnace gases for use would be overcome, and he immediately commenced experiments with a small blast furnace, one-fifteenth of the capacity of a 50-feet furnace. The upper part was divided into two compartments or retorts into which the coal, ores, and limestone flux were charged ; and the top of the furnaces was closed in by the ordinary bell and cone arrangement, as in the Cleveland district. The gases passed off into a main which communicated by two pipes, one to each side of the furnace, to the entrance of the flues at the bottom of the retorts, and were ignited by the aid of atmospheric air. These flues were spiral, in order that the heat from the burning gases might permeate the materials inside the retorts, while the exhaust gases were thrown off by chimneys at the top of the retorts. This small furnace was worked for about two months with raw coal only as fuel, and the results were highly satisfactory, notwithstanding that the furnace was so small in size. Being convinced that this plan of working a furnace was practicable, Mr. Ferrie had forthwith commenced the alteration of one of the ordinary furnaces at Monkland Works, which he said would be ready for operating with at the end of the month of August.

7. "On Mineral Oil Works," by Mr. David Cowan. The author referred to the manufacture of mineral oils as one of the leading industries of Scotland ; to the nature and extent of the oil yielding materials, namely, bituminous shales and cannel coals, distributed throughout the Scottish coal measures ; and to the quantity and quality of the produce from those materials. He afterwards described the mode of treating the raw materials, referring to the horizontal and the vertical retorts used in Scotland, comparing their advantages and disadvantages, and then described an arrangement of apparatus designed to combine the advantages of both kinds of retorts, and which would at the same time admit of improved facilities of workings. In order to improve the mode of firing, Mr. Cowan suggested that instead of coal the retorts should be heated with gas flame, and further, that the system of first converting the fuel into gas (as successfully worked out by Siemens) should be adopted. He estimated that the mode of heating by gas in this way would effect a saving of from 40 to 50 per cent. of the fuel.

The time allotted for reading and discussing papers having now arrived, the president announced that those papers which had not been overtaken, would become the joint property of the two institutions. They will doubtless be published along with the others in the transactions to be issued by each institution. The afternoon was spent in the same way as that of the preceding day ; and in the evening a grand banquet was held, at which the members of the North of England Institute were the principal guests. Thursday was occupied in visiting collieries, ironworks, engineering, ship-building, chemical, and other manufacturing establishments at a distance from Glasgow ; and on Friday there was an excursion on the saloon steamer Chancellor down the Clyde to Dunoon, and thence up Lochlong to Arrochar, from which the party walked or rode over to Tarbet, on Loch Lomond, a distance of about two miles. The visitors were then conveyed by one of the Loch Lomond Company's steamers to the top of that loch, "The Queen of Scottish lakes," where dinner was served. In the afternoon the whole length of the loch was traversed to Balloch, where the party took train and returned by the Dumbartonshire Railway to Glasgow. All the visitors were greatly delighted with the magnificent scenery along this route, as well as with the kindness, attention, and hospitality shown to them during their four days' sojourn in the "land o' cakes." Altogether, a very great degree of pleasure was experienced both by the members of the North of England Institute and by the members of the Scottish Institution. Not unlikely a return visit will soon be paid to the "Coaly Tyne."

JOHN MAYER

SCIENTIFIC SERIALS

THE *Revue des Cours Scientifiques*, for August 13, commences with a translation of Dr. Carpenter's lecture on the Temperature and Animal Life of the Deep Sea. This is followed by a report of Prof. Milne-Edwards's address in *comité secret* of the Academy in favour of the election of Mr. Darwin as corresponding member, the substance of which we gave last week. The last paper is M. Ed. von Beneden's very important and interesting article on *commensalisme*, or "fellow-boarding," as it has been termed, in the animal kingdom, extracted from the proceedings of the Belgian Academy of Sciences, a translation of which has already been published in this country. The current number for August 20 opens with an article *à propos* of the war, a translation of Prof. Shaw's address to the Military College at Sandhurst on the war establishments of Great Britain. We have then the continuation of M. Marey's paper on the Flight of Birds; and, in conclusion, under the head of "Bibliography," a translation of Mr. Wallace's review of Mr. J. J. Murphy's "Habit and Intelligence," which appeared in our columns.

THE *American Entomologist and Botanist* publishes a double number for July and August, which is occupied by short descriptive articles of interest and value principally to American collectors and students. The article of chief general interest is one on the "Origin of Prairie Vegetation," consisting of an able criticism of Prof. Winchell's theory that the prairies are of lacustrine origin, and that we must look to the source of the prairie vegetation from without,—probably the remains of a preglacial flora, the germs of which have remained stored up during subsequent epochs, and come again to life whenever the diluvial surface is again exposed. The writer of the article maintains that there is no need to go so far back as the diluvial period for the origin of the prairie vegetation. Dr. Hale, of Chicago, mentions the interesting fact that the *Ranunculus cymbalaria*, an abundant plant of the eastern sea coast and of the salt springs in the State of New York, is found in great abundance at Chicago, and for several miles along the shores of Lake Michigan, though nowhere else on the Great Lakes. It appears, however, that it also grows on the muddy banks of some of the western rivers.

THE *Geological Magazine* for the present month (No. 74), contains only three original articles, namely, one by Mr. D. Mackintosh on the Dispersion of Shapfell Boulders, and Origin of Boulder Clay; a second by Mr. John Hopkinson on the structure and affinities of *Dicranograptus* (with a plate), including descriptions and figures of the British species of that genus, two of which (*D. formosus* and *D. nicholsoni*) are described as new; and a memoir, with two plates, by Mr. T. Davidson, on Italian Tertiary Brachiopoda, with an important table of the species and their geological distribution. Among the abstracts and notices of memoirs, is a report of an interesting lecture on the Primæval Rivers of Britain, by Professor T. Rupert Jones.

Mittheilungen aus Justus Perthes' Geographischer Anstalt (vol. xvi., No. 8) opens with a remarkably interesting paper —illustrated by a map—by Dr. G. Nachtigal, on his travels in Tibesti. He says that, in spite of Barth's philological investigations, he regards the question as to the nature of the Tibbu as still undecided. They are of middle height, are very well built, and possess elegant yet muscular limbs. The majority of them are of a deep bronze colour, but without a trace of what is usually termed the negro physiognomy. On the whole, their physical and psychical peculiarities, their social and political arrangements, and their manners and customs, resemble those of the Berber infinitely more than those of the Negro. Amongst other things, Dr. Nachtigal records some careful observations of the rivers Zuar and Marmar, the former of which he regards as incomparably the finest river in Tibesti. In M. Lejean's article on his own travels in European Turkey in 1869, he corrects the existing maps in several points, embodying in an elaborate map the results of his investigations. He expresses the greatest contempt for the modern Turks, intimating that those who believe they have recently made real progress are deceived by mere appearances. He says he has gathered full materials for a work or works on the ethnography and archæology of the districts he describes. Professor Pellegrino Strobel describes a journey from the Planchar Pass to Mendoza; and the rest of the number is made up of "Geographical Notices" and translations of extracts from Mr. Robert Brown's "Physical Geography of the Queen Charlotte Islands," and from reports published in the "South Australian Register," on Mr. G. W. Gogden's Measuring Expedition to North Australia.

SOCIETIES AND ACADEMIES

BRISTOL

Observing Astronomical Society.—Report of observations made by the members during the period from July 7th to August 6th, 1870, inclusive:—*Solar Phenomena.*—Mr. Thomas G. E. Elger, of Bedford, reports that the sun spots observed in July exceeded in number those recorded during the previous month, but they were, with a few exceptions, small (less than 30" in diameter), and although pretty equally distributed between the two hemispheres, those to the south of the sun's equator presented a remarkable contrast, both in type and size, to those observed to the north of it; the former, as in June, included some large scattered groups and moderately sized spots of the normal class, while the latter consisted chiefly of solitary specks without penumbræ, and clusters of minute black punctures which frequently assumed very grotesque configurations. A striking feature of the large groups observed during the early part of the month was an evident tendency either to close up or to become dissociated upon reaching a certain position on the disc—about half way between the E. limb and the centre. On the 25th one of the largest groups observed this year appeared at the E. limb; on the 28th it measured nearly 5' in length, and consisted of a large preceding spot 1' 10" in diameter, followed by a straggling train of "wispy" penumbræ enclosing several small spots. This group dwindled away very rapidly after the 28th. Another large spot, about 50" in diameter, was observed from July 13th—25th.

Fresh groups observed in the sun's N. hemisphere during July	9
Fresh groups observed in the sun's S. hemisphere during July	12
Maximum number of groups on disc	12 (July 13, 5^h 30^m)
Minimum number of groups on disc	4 (July 28, 5^h 10^m)

Mr. Albert P. Holden, of London, says, "I observed a very interesting spot on June 21, at 7 A.M. The penumbra was unusually pale, and the umbra of a decided light brown hue. Four darker openings arranged in a square were observed in the umbra, and were readily seen with a very small aperture. A very remarkable circumstance in connection with the sun spots during the last two months has been their extremely light colour. The light brown tints of the umbra have been very marked, and totally different from the dark hues they usually present; while, at times, the penumbræ have been so light as to be scarcely visible. In most of them, however, the nucleus (which is ordinarily so difficult to detect) has been very easily seen, as in the case of the foregoing observation. The fact proves the phenomenon seen to be due to the actual lightening of the spots themselves, because if it were merely an optical or atmospheric effect, the whole spot would be lighter and the nucleus would be quite as difficult to detect as before. It is probable that these appearances may be a necessary result of the maximum of sun-spot activity, and are due (as suggested by Mr. Lockyer) to the thinness of the solar envelope at the present time. This would certainly account for the light hues of the umbræ and penumbræ, and also for the frequency and blackness of the nucleus." Mr. Henry Ormesher, of Manchester, writes, "On the 31st of July, from 2^h 15^m to 3^h 0^m, while looking at the sun with my 3 in. refractor, I saw a beautiful large cluster of spots occupying an almost central position on the disc. It occurred to me that the umbra in the largest spot appeared more dense on the western side. I therefore determined to examine it with my $5\frac{1}{4}$ in. refractor. I did so, using a power of 181. The result was that it resolved itself into a very fine nucleus of a somewhat oval shape. After making myself sure that the above was the case I examined the cluster generally, and was struck with the beautiful appearance of the brighter part of the sun's atmosphere. A very bright stream ran across the cluster, in a zigzag direction, separating the penumbra. Some parts of this stream, and particularly the upper part, appeared brighter than others, presenting a very mottled appearance."—Mr. William F. Denning, of Bristol, observed the sun, with his 3 in. refractor, on July 14, from 5^h 30^m to 6^h 10^m. He noticed nine large well-defined *maculæ* on various parts of the disc. A particularly large and interesting group of spots was visible in the N. hemisphere. On July 22, at 8 P.M., a spot was observed in the same hemisphere, which was divided by two bridges of light. He noticed that the penumbra was invaded by numerous minute lines of light, and that the bridges seemed to present the appearance of running matter. This observation was made with power 100 and $10\frac{1}{4}$ in. reflector by Browning.

The Lunar Eclipse of July 12.—The Rev. Ralph Prowde, of Northallerton, Yorkshire, observed this phenomenon, and has forwarded the following:—"I observed the eclipse of the moon on the 12th, but the only thing remarkable was the great contrast of shade between the darker and brighter penumbræ. I say penumbræ, for I suppose the real umbra of the earth's shadow falls within the moon's orbit. The darker interior cone of shadow obscured the edge of the moon and the object on its surface as it passed over them almost entirely, but its own edge did not seem to be nearly so regularly round as the lighter enveloping cone of shade."—The Rev. J. J. Johnson, of Crediton, reports:—"On the evening of the 12th I had a very favourable view of the lunar eclipse. The sky was clear at first, with a small amount of stratus near the horizon. I first caught sight of the moon at 8.41, but it was 8.49 before it got clear of the clouds. I paid particular attention to the degree of distinctness with which the eclipsed portion could be seen. When about four digits were covered I just noticed the copper tin through the telescope. I fancy this would be a little sooner than in the last eclipse I observed (September 1867) but in that of October 4, 1865, which was only of 4 digits, the copper tint was very decided in the telescope at the time of the greatest obscuration. When about six digits, or half the disc, was covered, the copper colour could be clearly seen with the naked eye. I could not make out any particular parts of the moon's surface until 9.35, when I noticed the *Mare Tranquillitatis* and the *Mare Serenitatis* showed with beautiful distinctness through the earth's shadow in the telescope. A few minutes after the total was attained, I was struck with the obscurity of the eastern side of the moon being so much more than I had expected. At 9.55 at least half of its surface was as if blotted out even when seen through the telescope, although I applied two different powers—70 and 150. Three of the *seas* at the western side were all I could make out. Possibly a thin coating of cirrus cloud which covered all the sky about this time might account in some measure for the invisibility of the moon. By 10.30 this had entirely cleared away, and the sky was everywhere covered with stars. The Milky Way very near the moon was about as distinct as it usually appears on a dark clear night. At this period, being the middle of the eclipse, the upper portion of the moon was the invisible part, all those regions lying round the margin of the disc being alone to be seen, except at the vertex, where the margin itself was not discernible. At 11.23 the first streak of light was breaking forth at the eastern edge. At 11.45 the red colour was nearly gone, and the eclipsed part appeared of a grey colour. At 11.58 I noticed there was no trace of the Milky Way; at 12.24 the lunar circle was again complete."—Mr. Oliver J. Lodge, of Hanley, reports that "the colour of the moon during the totality was of a most peculiar copper hue, giving very little light indeed. But during the egress of the shadow it was almost as white and silvery as it usually is, although still under the penumbra." Mr. Edmund Neison, of London, says:—"The colour of the eclipsed disc was during the whole time a dull, yellowish olive-green, both in the telescope and out, but was never dark enough to prevent many of the chief markings and craters being seen. From 10.44, when the lunar disc was fairly above the fog-banks, *Aristarchus* was quite distinct as a bright crater, and even before eleven *Grimaldi* was plainly discernible." At Bristol, Mr. William F. Denning observed the phenomenon, and remarks that even at the time of totality many of the most conspicuous objects on the disc were distinctly visible. The copper tint was also very evident. During a portion of the time the moon was overcast with clouds.

Venus.—Mr. Henry Ormesher, of Manchester, observed this planet with 5¼ in. equatorial refractor, on July 23, at 5^h A.M. "The definition was excellent. I observed three dusky spots on the disc, one of which was of very considerable magnitude."

Saturn.—Mr. H. Michell Whitley, of Penarth, writes:—"July 7th, $10^h\ 11^m$, power 208—the ball of the planet dull yellow colour. N. equatorial ruddy belt conspicuous, and another of same colour between it and pole; pole bluish grey; edges of disc fainter than centre; sky in ansæ much blacker than around planet; crape ring across ball nearly as dark as Ball's dension, pale purple; crape ring very easy in ansæ. No line of light between it and B."

Occultation.—Mr. J. C. Lambert, of Sleaford, witnessed the occultation of B.A.C. 5954 on July 10, and found the exact time of disappearance to be $12^h\ 40^m\ 41^s$ mean time.

Meteors.—Mr. J. C. Lambert "observed a very brilliant meteor at $11^h\ 40^m$, July 21. Course from a little below γ Cassiopeiæ to ξ Persei. Nucleus appeared as a star of 1·5 mag.; tail nearly 2° long; colour, yellowish white; duration 2^s. During the time of observation (11^h to $12^h\ 30^m$) observed no less than eleven small meteorites. The course of one of these was from ε Bootis to 43 Comæ Berenicis, and immediately afterwards one from a little below 43 Comæ Berenicis to η Bootis. Could this have been one and the same meteor describing an arc?"

Lunar Observations.—Mr. H. Michell Whitley has very carefully examined many interesting lunar objects, and the results he obtained have been forwarded to Mr. W. R. Birt.

Paris

Academy of Sciences, Aug. 16.—M. Yvon Villarceau communicated some remarks on the decimal division of angles and of time, in reference to M. l'Abbadie's communication of the previous week.—M. Sainte-Claire Deville made a final reply to M. Jamn on the subject of the sepecific heat of mixtures.—M. Wurtz presented a note by MM. Ad. Lieben and A. Rossi on normal amyl alcohol. The same authors recorded last year the manufacture of a new butyl alcohol differing from the alcohol of fermentation, and representing the fourth term in the homologous series of normal alcohols. Taking this alcohol for a point of departure, and applying the same synthetical methods, they succeeded in obtaining a new amyl alcohol, which they call normal, and bearing the same relation to the amyl alcohol already known as the new butyl alcohol does to the butyl alcohol of fermentation. In order to obtain it cyanide of normal butyl is first obtained, and the valeric acid corresponding to it made by the oxidation of ordinary amyl alcohol. The lime-salt of normal valeric acid is mixed with the formiate, and the mixture submitted to dry distillation. Valeric aldehyde is thus obtained, boiling at about 102°, and isomeric with valeral. This aldehyde, treated with nascent hydrogen, yields the alcohol. Normal amyl alcohol bears a strong resemblance to the amyl alcohol of fermentation. It is distinguished by its higher boiling point, 137°. By oxidation it yields valeric acid.—M. Wurtz also presented a note by M. F. Papillon on modifications in the immediate composition of bones, proving that the normal lime contained in the bones of animals may be partially replaced by alumina, magnesia, or strontia, by including these substances in their food.—M. Cave contributed a note on the formative zone of the foliar organs in monocotyledonous vegetables. This he found to occupy the same position as in his previous researches on dicotyledonous plants. In the leaves of endogenous plants the inferior tissue is the older; the layer nearer to the superior epidermis is the younger. In the fruits, also, the author has invariably found the formative zone occupy the same place in those belonging to the two divisions of flowering plants.—M. Jamin presented a note by M. W. de Fonvielle on the astronomical discoveries of the ancients.

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