THURSDAY, AUGUST 24, 1871

COOKE'S HANDBOOK OF BRITISH FUNGI

Handbook of British Fungi. By M. C. Cooke, M.A. 8vo., pp. 982, tab., fig. 408. (London: Macmillan and Co, 1871.)

THE study of Fungi in this country has gradually attained an importance which is sufficiently indicated by the appearance of the present much-needed work, comprising as it does the characters of no less than 369 genera and above 2,800 species. The works of Bolton and Sowerby at the latter end of the last and the commencement of the present century had laid a solid foundation for a study which, however, attracted but comparatively few students. There was, however, no genera treatise on fungi, in our own language, to which referencel could be made, till 1821, when Gray's "Natural Arrangement of British Plants" gave the English botanist an opportunity of becoming acquainted with the labours of Nees von Esenbeck and other continental botanists, a very important share of the labour having been undertaken by Dr. J. E. Gray. A storm of opposition was raised against it because of its recommendation of a natural system, a recommendation which was then thought sufficient to justify an exclusion from well-deserved honours; a virulent attack was made in the *British Critic*, and the work fell in consequence, notwithstanding its merits, almost dead from the press. Some ten or fifteen years later, Sir W. J. Hooker undertook the completion of the English Flora, which had not gone beyond the higher Cryptogams, his own "Scottish Flora," Greville's "Flora Edinensis," and the "Scottish Cryptogamic Flora" having already done much for fungi, when the preparation of the part of the work relating to those plants was entrusted to the Rev. M. J. Berkeley, who had made an especial study, especially of the higher Fungi, and had already discovered the true structure of the hymenium, which had, however, long before been indicated under *Agaricus comatus* in the "Flora Danica." From the time of the publication of his volume, continual accessions were made, especially by Mr. C. E Broome and Mr. G. H. K. Thwaites, who has since done so much for this interesting tribe as well as in the higher orders of plants in Ceylon, and which have been incorporated in a series of memoirs in the "Magazine and Annals of Natural History," either singly by Mr. Berkeley or jointly with Mr. Broome; nor must we omit Mr. Currey's very important contribution to the knowledge of our British Sphæriæ, of which it is scarcely possible to overrate the value as regards the characters of the fructification. It was then proposed by Messrs. Reeve to publish Outlines of British Fungology, confining, however, the description to those species which did not require much microscopic aid, but adding a list of all the known species so far as the existing state of information went. Mr. Broome and Mr. Currey, with several others, have persistently carried on the study of these plants, the knowledge of which is every day advancing, and as Mr. Berkeley's work was confessedly imperfect, we have great reason to be thankful to Mr. Cooke for undertaking the very laborious, and, we fear, scarcely remunerative labours which he has so successfully accomplished. No student of Fungi can be without the two volumes, and they certainly ought to have a place in every botanical library of the slightest pretension. The work has throughout been conducted in the most conscientious way, and infinite pains have been taken to verify the obscurer species, in which the author has had the ready assistance of those botanists in this country who have paid most attention to these difficult plants.

Mr. Cooke has very wisely been content to follow the more generally established systems without attempting any new arrangement, which at present would only entail needless obscurity. He has, we think, very judiciously given the characters of all species which, with any degree of justice, have been considered as autonomous; though more than reasonable doubts have been thrown on many of them by the labours of Tulasne, and the real nature of such genera as Cytispora, &c., had been long since previously indicated by Fries. When all the different stages of development have been thoroughly studied, the number of genera will doubtless be much restricted, as it has been already by the elimination of mere mycelia. It would, however, be premature to pass by numbers of Sphæronemei, Mucedines, &c., because some of them have been clearly ascertained to be mere conditions of ascigerous species. We are glad, too, that Saprolegniæ are included; though this very curious set of plants has been less studied in this country than on the Continent. The occurrence of zoospores is now no obstacle to their being considered as conditions of Fungi, since we have distinct zoospores in such genera as Peronospora, and the whole tribe of Myxogastres. It is but justice to state that Mr. Cooke has had some valuable assistance amongst the higher Fungi from Mr. W. G. Smith, who is so well known as a botanical artist, and whose communications cannot fail to have materially enriched the work, the execution of which throughout has been beyond all praise, in which should be included the copious index It is not to be supposed that in so extensive and difficult a subject a critical eye could not find a few errors, but they are few in number and of little importance. The gravest to which we might advert is that in the characters of several of the genera proposed by Tulasne, there is no mention of the secondary forms on which several of them are established, though they are not omitted where species are concerned. This is, however, a matter of comparative unimportance, and a few spots on which the finger might be placed do not detract from the general merit of the work, which we cordially recommend on many accounts to our readers, assuring them that the moderate price at which it is published could scarcely be better employed in any other scientific direction.

OUR BOOK SHELF

Matter for Materialists. By Thomas Doubleday. (London: Longmans, Green, Reader, and Dyer; Newcastle-upon-Tyne: Andrew Reid, 1870).

The Beginning: its When and its How. By Mungo Ponton, F.R.S.E. (London: Longmans, Green, and Co., 1871.)

THIS age is essentially a materialistic one, but few are found who adhere to systems of philosophy based on the assumption that matter has no real existence. Mr. Doubleday, however, is one of the few, and he has pub-

lished "a series of letters in vindication and extension of the principles regarding the nature of existence of the Right Rev. Dr. Berkeley, Lord Bishop of Cloyne." His argument is that our notions of time, motion, and magnitude are merely relative; that the idea of space in the abstract is entirely beyond the grasp of the human mind, and leads to a series of absurdities and contradictions. But without such a conception, our notions as to matter are untenable, and hence we are driven to seek for other principles to explain the nature of existence. These Mr. Doubleday believes are to be found in the system of philosophy which Bishop Berkeley founded, or rather the idea of which he indicated, although he did not live to bring it to perfection. This, the most purely idealistic system ever promulgated, entirely denies the existence of matter, and holds that there are only spirits, thinking beings whose nature consists of conception and volition; whose sensations are derived from one superior Spirit *in* whom they exist. Mr. Doubleday, after endeavouring to show that unless we adopt this view we are led into innumerable contradictions, asserts that materialism is the parent of scepticism, since a mind which finds itself involved in a hopeless struggle to reconcile inconsistencies, takes refuge in believing nothing. All this the author expresses clearly and concisely, so that even those who are not inclined to accept his views will read his work with pleasure, and are sure to glean some new ideas from it. At the same time, when opinions almost universally held are attacked, it is necessary that he who assails them should be scrupulously accurate even in matters of little importance. Therefore it is a bad fault that we find in this work chemical formulæ, given at the very outset, in which P is taken as the symbol of Platinum, and Ch as that of Chlorine. It is also astonishing to find any one who supports the "emission" theory of heat, and who does so chiefly by quibbling about the expressions used by those who have so conclusively shown that heat is a mode of motion.

"The Beginning," the other book at which we have to glance, is one of those volumes which seem a mere confusion of facts, which, though they may be interesting in themselves, lose their value from having no proper connection. or arrangement. Consisting of nearly six hundred pages, this work has in it a little of everything; but to find out what it all leads to, and what is the general drift of the whole, is next to impossible. Just at the end the author devotes a separate and comparatively small space to considering the possibility of reconciling the Hebrew records relating to the Beginning with modern scientific discoveries. In this more method is found than in the body of the work, and the conclusion arrived at, that we must "exclude all other suppositions save that of regarding the creative epochs as periods of indefinite and immense duration," is one to which few will be disposed to object. Yet in this also stray facts seem to lie upon the pages as if scattered indiscriminately from a pepper-box. The plates with which the work is illustrated are certainly very good; but we fear that it is one of those expensive books that find few purchasers.

Our Sister Republic. A Gala Trip through Tropical Mexico in 1869-70. Adventure and sight-seeing in the Land of the Aztecs, with Picturesque Descriptions of the Country and People, and Reminiscences of the Empire and its Downfall. By Colonel Albert S. Evans. With Numerous Engravings. (Hartford, Conn.: Columbian Book Company. London: Trübner and Co., 1871.)

THE author of this book accompanied the Hon. W. H. Seward in an apparently semi-official tour through Mexico, lasting from September 1869 to January 1870 The volume before us, in somewhat flowery and very "smart" style, tells what the author saw and a good deal of what he heard during the progress through that American battle-ground, of which we hear so much and know so little The author writes with much enthusiasm and hopefulness of the people, the products, and the progress of the country, where he was received with such exuberant hospitality; although, considering the short time he was in the country, and the conditions under which the tour was made, anything like a full and reliable account of the political, social, and commercial condition of the country was not to be looked for. We believe, however, most readers will know much more about the life-manners of the Mexicans after than before reading the work. The author has fervid Republican propensities, and we fear writes too often with red ink. He has nothing but little words for the Maximilian episode, and regards the unfortunate would-be Emperor as an unprincipled heartless adventurer. We are glad to see the author has paid considerable attention to the state of education in the country, and if we can at all rely upon his statistics, it is in a much more hopeful state than Europeans are generally inclined to believe. There appears to be plenty of funds set apart chiefly by the benevolent for educational and charitable purposes; indeed, according to Colonel Evans, the wealth and resources of Mexico are almost enormous, but, as might be expected in such a chronically revolutionary country, the management of them is wretched. The Colonel is evidently not a scientific man, and although he frequently alludes to the products of the country, it is generally either from a commercial or picturesque point of view. We commend the book as an exceedingly interesting and graphically written record of a four months' trip through Mexico, and as a work which affords a very fair notion of the present actual condition of the country and of its interesting antiquities.

Horses: their Rational Treatment and the Causes of their Deterioration and Premature Decay. In Two Parts. By Amateur. (London: Baillière, Tindall, and Co., 1871.)

IN Part I of this work the author tries to explain scientifically the errors of the present routine mismanagement (as he calls it), and how it is opposed to the natural system and health of the horse; and in the second part he considers and explains the practical management of the horse under what he calls the Rational System. The author advocates a return to the natural feeding of the horse, such as grass and similar soft food, and an abandonment of the present almost universal system of forcing with an abundance of dry food, on the ground that thus the horse would live to a much greater age, and perform a far greater amount of work. The subject certainly deserves the serious consideration of all who are interested in horses, and to all such we would recommend the perusal of this little book by one who has evidently given the subject long and serious study. In the second part both sides of the question are well stated in a correspondence between the author and Sir James Yorke Scarlett.

LETTERS TO THE EDITOR

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

Mr. Stone and Professor Newcomb

MR. NEWCOMB has reviewed Mr. Proctor's book on the Sun in your number of May 18, and Mr. Proctor has replied in the number for June 1. In each of these articles I find my work and name mentioned in a way that is scarcely satisfactory to me. Mr. Proctor's reply is, however, of course, only intended to defend his own work, not mine. In Mr. Newcomb's review I find the following very strong passage. Mr. Newcomb says:—"We find ligaments, black drops, and distortions sometimes seen in interior contacts of the limbs of Mercury or Venus with that of the sun described as if they were regular phenomena of a transit; without any mention of the facts and experiments which indicated that these phenomena are simple products of

insufficient optical power and bad definition, which disappear in a fair atmosphere with a good telescope well adjusted to focus." With respect to facts, I must be allowed to observe that I believe the facts are entirely the other way. This is a point which can only be tested by appealing to the facts themselves.

Wales and Dymond observed the Transit of Venus in 1769 in the Hudson's Bay. This is their account of what they observed:—"We took for the instant of first internal contact the time when the least visible thread of light appeared behind the subsequent limb of Venus, but before that time Venus's limb seemed within that of the sun, and his limb appeared behind hers in two very oblique points, seeming as if they would run together in a broad stream, like two drops of oil, but which, nevertheless, did not happen, but joined in a very fine thread at some distance from the exterior limb of Venus. This appearance was much more considerable at the egress than at the ingress, owing, as we apprehend, to the bad state of the air at the time. We took for the instant of internal contact at the egress, the time when the thread of light disappeared before the preceding limb of the planet, from which time W. W. took notice that he had told about 24^s, when the limbs of the sun and Venus were apparently in contact; a circumstance which he did not venture to attend to at the ingress."

The observers evidently saw these phenomena both at ingress and egress. From the detailed account at ingress the definition must have been very good. I have printed the whole passage, including the part which may be turned against my argument, that "the appearance was more considerable at egress, owing, as we apprehend, to the bad state of the air." That the appearance of such a ligament seen under great atmospheric tremor may have been more striking, I can well believe.

Again, Chappe writes:—

"A l'entrée totale de Vénus, j'observai très destinctement le second phénomène que avait été remarqué par la plus grande partie des astronomes en 1761. Lebord du disque de Vénus s'alongea comme s'il étoit attiré par le bord du Soleil. Je n'observai point pour l'instant de l'entrée totale celui où le bord de Vénus commençoit a s'alonger; mais ne pouvant pas douter que ce point noir ne fît partie du corps opaque de Vénus, j'observai le moment où il étoit à sa fin; de façon que l'éntrée totale ne peut être arrivée plutôt, mais peut-être plus tard de deux ou trois secondes. Le point noir étoit un peu moins obscur que le reste de Vénus. Je crois que c'est le même phénomène que celui que j'observai à Tobolsk en 1761." I might quote other extracts. The phenomena are noted at Wardhus at the egress. It is expressly stated by Cook and Green at Otaheite that the extinction of the thread of light between Venus and the sun was gradual, and that at Otaheite the observers did not note the end at the ingress and the commencement at the egress. Now, as a practical man, I would ask Mr. Newcomb are not these appearances observational facts? They appear to me so real, that, to admit their non-reality, would be the same thing as if we were to argue that if Wales, Dymond, and Chappe had put down in their observing books the times when the limbs of Venus first appeared in contact, instead of waiting until they could not see the slightest trace of any connection between the limbs of Venus and the Sun, they would not have given earlier times than those which now appear in their journals; or that if Cook and Green at Otaheite had given the times corresponding to the last appearance of any connecting ligament at the ingress, the times given would not have been later than those which now appear in their journals. It was from these considerations, which appear clear enough, that I have treated the Otaheite observations as referring to a different phase from those of the Hudson's Bay observers, and Chappe's ingress observations. Similar remarks apply to the egress observations. You cannot talk of such appearances being simple products of insufficient optical power and bad atmospheric circumstances. The appearances presented to and described by Wales and Dymond, even at the egress, took place according to their own estimation, which is the largest, within about a second of arc. Such appearances could not be discriminated amongst with insufficient optical power, and under very bad circumstances of observing. Chappe particularly uses the phrase "très-distinctement." This point appears to have been overlooked by many who have written much upon the subject. With respect to experimental facts, I should, indeed, esteem it a great favour, and I am sure that it would be important as bearing on our preparations for the Transit of 1874, if Mr. Newcomb can refer us to any experiments bearing upon this point. It will, however, be necessary to understand clearly the positions taken up.

First, I assume the existence under sufficient illumination of irradiation. Secondly, I assume that the illumination of the sun is so great that under the ordinary circumstances of telescopic observation the optical enlargement of the sun's disc due to this phenomenon is about 3″, the exact quantity will vary under different circumstances. The data upon which these assumptions are grounded are, amongst others, the experiments of Dr. Robinson, vol. v. Mem. Royal Astron. Society, and the eclipse discussions made from observations with the great equatorial of the Greenwich Observatory. Can Mr. Newcomb refer us to any experiments which have been made with a disc sufficiently illuminated to present under the circumstances of examination an optical enlargement of 2″, and in which sufficiently powerful optical means have been employed to discriminate between the changes presented within 1″ of arc, as a small portion of the illuminated surface near the limb has been cut off by an opaque body?

I know of no such experiments. I do know that experiments were made at Paris by Wolf, in which the illumination of the disc was such that no sensible optical enlargement was exhibited. The results obtained had, therefore, no bearing on the question of irradiation; they were simply experiments on the disappearance of a small portion of a feebly illuminated disc. The results are such as any one conversant with the subject would have predicted with such a disc. The diameter of Mercury is so small that the appearance presented in a transit would not be so clearly marked as in a transit of Venus. Of the reality of the appearance of a connecting ligament in the transit of Mercury of 1868 I have no doubt, for I saw it. I would, with all due diffidence, give here a word of caution respecting discussions of these results. The phenomena under discussion, whether real or supposed, are presented only within a second of arc from the sun's limb. It is perfectly useless, therefore, to appeal to upon this question any observations which have been made with insufficient optical means to subdivide a second of arc.

The optical enlargement by irradiation is a function of the brightness, and can be made insensible by sufficiently diminishing that brightness. Unfortunately, however, when this diminution of brightness is carried to a very great extent errors in an exactly opposite direction to those of irradiation will come into play, similar, in fact, to the results of Wolf's experiments. The observations of Mercury on the sun's disc in 1868 were made with very different optical means, and some very different methods were adopted for diminishing the sun's glare. If the observations are put together without any discrimination upon these points some curious results will appear. I am afraid that some gentlemen have been much misled by want of attention to these simple points.

E. J. STONE

Royal Observatory, Cape of Good Hope, July 19

On the Age of the Earth as Determined from Tidal Retardation

CONSIDERABLE discussions have taken place in the Geological Society and elsewhere in regard to Sir Wm. Thomson's conclusion that had the earth solidified several hundred millions of years ago, when it must have been rotating at a much greater rate than at present, its form ought to be different from what it actually is. That is to say, there ought to be a much greater difference than there is between the equatorial and polar diameters. I observe that the discussion on this point has lately been renewed at the meetings of the British Association.

Although I regard all the other arguments advanced by this eminent physicist in regard to the age of the globe, so far as I have been able to follow his reasoning, as unassailable, yet I never could agree to this conclusion deduced from tidal retardation. But, so far as I remember, I have nowhere seen stated what appears to me to be the real objection to the argument. The objection is as follows:—

As the rate of rotation decreases under tidal retardation, centrifugal force must decrease also. The consequence, therefore, is that the sea must be slowly sinking at the equator and rising at the poles (see *Phil. Mag.* for May 1868, p. 382) But denudation is also lowering the level of the land at the equator. Now the whole question concentrates itself into this, viz., will denudation lower the level of the land at the equator as rapidly as the sea sinks? This question, happily, can be answered. The method lately discovered of measuring the rate of subaerial denudation enables us to determine the rate at which the land at the equator is being lowered. We are enabled from

the principles of mechanics to determine the rate at which the sea is sinking at the equator. By this means it can be shown that the land is being lowered by denudation as rapidly as the sea is sinking, and that consequently, in so far as this part of the argument is concerned, we cannot infer from the present form of the earth what was its form at the time when solidification took place.

But it must be borne in mind that four years ago when Sir William read his paper on the subject before the Glasgow Geological Society, the method referred to of determining the rate of subaerial denudation was then accepted by scarcely any geologists. Taking the ideas which at that time prevailed regarding the slow rate of denudation, his conclusions were perfectly legitimate. JAMES CROLL

Edinburgh, August 21

Neologisms

THE word *prolificness*, though not a model, is not a monster. It is a hybrid; but so is vindictive-*ness*. The chief objection lies in the fact of the *ic* being not the ordinary adjectival formative, but the *c* in the *fac* of *facio* = *I make*.

The true compounds of this root *change* the vowel, where, as in *satisfaction*, *malefactor*, &c., we have *no* change. Here, the original combination was no compound, but merely a pair of words in contact with each other.

Now, if we lay aside the hybrid forms, and use the word *abstract* with a certain amount of latitude, we get the following real or possible series of analogies :—

1. *Prolifaction*, like *satisfaction*.

2. 3. *Prolificacity* and *prolificacy;* the former like *capacity* from *capax*, the latter like *efficacy* from *efficax*.

4. *Protificiality*. This implies an adjective in *alis*, from a substantive like *beneficium*, whence *beneficial*.

5. *Prolificality* suggests *prolifex*, *prolificis*, *prolificalis;* like *pontifex*, *pontificalis*.

6. *Prolificence*. Here we must look at the same time to *adjectives* like *maleficus*, and to *participles* like *sufficiens*, *-entis*, *-entia;* the rule being that, formally, the *adjectives* have no abstract of their own; but, instead of it, the participal form in *-entia*. Hence the numerous words like *benevolence*, *grandiloquence*, &c.

To this class the form under notice belongs; and it will, probably, be admitted that *prolificence*, along with its predecessor *prolificality*, is the least exceptionable, of the list.

Prolificality is the best abstract: *prolificence*, perhaps, the better word. None of them, however, are forms which need only be known to be adopted. There is something to demur to in all them. What this is would require a longer discussion than is here practicable.

Of the present short notice the result is that it is easier to either impugn or to excuse such a word as *prolificness* than to find a substitute for it. R. G. LATHAM

NOTES

WE are glad to be able to state that Her Majesty's Government has been pleased to accede to the request of the British Association with respect to the proposed Eclipse Expedition. We may therefore hope for a most important series of observations along a line extending from the Neilgherry Hills in India to Cape York in Australia. The observation in India will be entrusted to Mr. Pogson, Colonel Tennant, and Captain Herschel. Mr. Lockyer has been requested to observe in Ceylon. The observing stations in Java will be occupied by the Dutch Government, and possibly also by M. Janssen, while a strong expedition has been formed from Sydney and Melbourne. The necessary instruments will be sent out to Australia by the next mail, and those for India will follow shortly. As before, the Government not only help in money but in transport, camping, and the like. The handsome way in which the Government has at once responded to this appeal justifies all we have said regarding its good intentions towards science when the requirements of science are properly represented by responsible bodies. We may add that the Government have also agreed to undertake photographic observations of the approaching Transit of Venus.

OUR thanks are due to the *Times* for the article (reprinted in another column) in which it exposed the injustice which Mr. Cardwell attempted to perpetrate in the case of Prof. Sylvester's retirement. Prof. Sylvester being only a scientific man, was, of course, fair game for a placeman, but it is none the less amusing to see how the whole pleading of "precedent" and the regulations of the service was allowed to go for nothing the moment there was a question of a hostile vote, thus showing the injustice of Mr. Cardwell's appeal to justice. An Account-General with a taste for income-tax, to judge from the amount of retirement awarded in a recent notorious case, is a much more valuable public servant in the present most satisfactory condition of army matters than a professor of European reputation, who is emphatically the man to infuse that scientific method into our officers of which they are so much in need.

THE introductory addresses at the winter session of the London Medical Schools, which commences on the 2nd of October, will be delivered by the following gentlemen :—At Charing Cross Hospital, by Dr. T. H. Green; Guy's Hospital, by Dr. Oldham; King's College, by Dr. Rutherford; London Hospital, by Dr. W. J. Little; the Middlesex Hospital, by Dr. John Murray; St. George's Hospital, by Dr. John Clarke; St. Mary's Hospital, by Dr. Alfred Meadows; St. Thomas's Hospital, by Mr. Le Gros Clark; Westminster Hospital, by Dr. Basham. No introductory address will be given at St. Bartholomew's Hospital, The Lecturer at University College has not yet been appointed.

THE British Archæological Association has been holding its annual sitting at Weymouth. On Monday night, after the return of the congress from their tour of inspection in the villages of Preston and Osmington, the inaugural dinner took place at the Royal Hotel, under the presidency of Sir William Medlycott, Bart. On Tuesday the members and friends of the Association visited Maiden Castle, an immense earthwork fortification three miles from Dorchester, which was described by the Rev. Mr. Barnes. At the evening meeting of the Association the following papers were read: "On the Origin and Titling of English Laws;" "Report on the Municipal Archives of Dorset;" and on "The Cerne Giant."

WE learn from a correspondent in New Zealand that footprints of the Moa have recently been detected in a new district in the province of Auckland. The locality is at the mouth of the Waikenei Creek, near the settlement of Gisborne, Poverty Bay, near the Taruheru River. The slabs in which the impressions were found were about five feet below a deposit of silt and alluvium of different kinds which had been washed away by the action of the water, leaving the stone in which the footprints were found visible, very plainly indented and following each other in succession. On either side of this track were dents here and there, as though made by the bird's short beak in picking up food as he walked—the closeness of the stride favouring this belief. Hard by this spot Mr. Worgan picked up an old stone hatchet, which, from the signs of traces it bears, is doubtless as ancient as the tracks of the Moa. Casts of these footprints have been presented to the museum of the Auckland Institute. The length of the footmark from the heel to the tip of the centre toe was seven and seven-eighths inches; from the heel to the tips of the inner and outer toes, six inches; the distance of tips of the outer and inner toes was seven inches; the length of the stride was twenty inches from heel to heel, and there were eight impressions altogether.

THE account of the whirlwind at Chilton, Buckinghamshire, on July 30, is worth careful study. The correspondent, J. B., who writes to the *Times*, sends the following facts :—"The storm began about five o'clock in the morning, accompanied by terrific thunder, large hailstones, and a most violent and terrific wind. The piece of country devastated by this wind is about

a mile long, and perhaps 100 yards wide; and in that track just 300 large trees have been destroyed. In one field, thirty-six large trees were blown to pieces, trunks split down and broken off; and in another, eleven large trees lie side by side. The roof and side of a cottage were blown away. In one field four waggons were destroyed; one, loaded with nearly two tons of hay, was blown clean over a high hedge, hay and all. An old blind cart horse shared the same fate; while another waggon was blown about twenty yards, over two hedges, the four wheels being discovered in four different fields, and one-half the waggon, which was broken like firewood, was not found at all till Sunday evening. This is no exaggerated account, for we have seen the ruins, and the various places have been photographed."

MR. E. DICKENSON of Springfield, Massachussetts, asks us to request dealers in English birds' eggs to forward him their price lists.

A CORRESPONDENT throws out the suggestion that the tragical explosion of gun cotton at Stowmarket might have been occasioned by the fall of a meteoric stone.

M. ZALIOSKI, in an article in *Les Mondes* on the explosion of explosive compounds, asserts that the explosive properties of inflammable matter are not dependent on the normal temperature of the atmosphere, but upon its hydrometric state. Gunpowders, he adds, during a drought acquire spontaneous explosive qualities, even without any elevation of temperature, while they are also more ready to act upon and communicate the smallest spark.

THE *Revue Scientifique* appears to be starting into renewed vigour since peace and order have been restored in Paris. The last number is largely occupied with the proceedings of the British Association, including an admirable translation of the President's address.

ON the 19th June very slight earthquakes were felt at Simla at 9.40 P.M. The weather has been very sultry.

AN attempt to obtain European ice for India by the Suez Canal has failed. Out of ninety tons of Alpine ice shipped only four arrived. It is probable the parties did not know the business so well as the Americans. As it is the Alps do not at present supply the Mediterranean, many parts of which use frozen snow from Mounts Olympus and Tmolus.

THE troubles of the Indian Government about snakes are serious. The number of deaths by snake bites is great, but the number of snakes is greater, and when the experiment is tried of paying for snakes killed, the local treasuries are in danger of depletion, a fradulent trade in dead snakes springs up worse than that in sham tigers. Science seems to be the only mediator. In Bangalore rewards were paid in one month for 1,913 snakes, but Dr. Nicholson has found on examination that only 6 per cent., or 123, were really poisonous.

THE rise of the Ganges in the month of June was thirty-five feet.

DR. BARON EÖTVÖS, the son of the late eminent Minister of Public Instruction in Hungary, is now in this country inspecting our school arrangements for teaching science. We hope he may go back with a satisfactory story to tell.

A MEETING of the German Astronomical Society is fixed to be held at Stuttgard, on the 14th of September.

SUCH of our readers as were interested in the discussion carried on at the beginning of last year, by Messrs. Sylvester, Huxley, Lewes, Ingleby, Croom Robertson, and Monck, on Kant's view of Space and Time as Forms of Thought (NATURE, 9 to 15) may be glad to know that in the fourth edition of the "History of Philosophy from Thales to Comte," which has just appeared, Mr. Lewes discusses the whole question of the distinction between Sensibility and Understanding, and also that of mental forms, as understood by Kant.

THE "Birmingham Saturday Half-Holiday Guide," containing sixty-eight closely printed pages and a good map, for the price of sixpence, demands a word of notice. It is admirably arranged in every particular, the various districts being undertaken by those especially acquainted with them, and the whole brought together under careful editorship. Our attention is naturally especially directed to the portion—about one-third of the book—devoted to the natural history of the district, which is produced under the superintendence and by the members of the active Birmingham Natural History and Microscopical Society. The work is one of those peculiarly suited to such a body, and is well executed, chapters being devoted to the ornithology, lepidoptera, coleoptera, conchology, botany, and geology of the surrounding country. A more careful revision of the scientific names would have improved the appearance of the book; but, as it is, it is certainly the best, as it is the cheapest, work of the kind which has yet been issued. The suggestions of routes and indications of interesting objects are concise and yet complete. We hope that Liverpool and Manchester will not be slow to follow the example of Birmingham, and that the naturalists of the former towns will come forward as their *confrères* have done, and discharge as ably their portion of the work.

THE extreme heat experienced during the first fortnight of August is worth recording. Mr. H. Steward has published the following figures:—Monday, Aug. 7, solar maximum temperature in vacuo, 113° F.; maximum temperature in shade, 82° F.; Tuesday 8th, 113° F. and 81° F.; Wednesday 9th, 110° and 84°; Thursday 10th, 112° and 86°; Friday 11th, 119° and 89°, Saturday 12th, 115° and 89°; Sunday 13th, 125° and 91°. These high temperatures are far exceeded by those published by Mr. F. Nunes, of Chiselhurst, who, by means of standard thermometers (the one in the sun being in vacuo, and placed on the grass) has obtained the following figures:—

	Max. in Shade.	Max. in Sun.
August 1	78·1	147·0
,, 2	83·8	150·0
,, 3	83·7	150·2
,, 4	72·1	139·3
,, 5	77·3	148·0
,, 6	80·3	145·5
,, 7	81·8	148·0
,, 8	81·0	147·0
,, 9	85·8	151·5
,, 10	89·4	148·0
,, 11	91·7	150·7
,, 12	91·0	146·5
,, 13	91·1	147·0
,, 14	84·6	145·0

Surely there must be an error somewhere. The maximum temperature of Mr. S. or Mr. N. differ by 40° and 50°! Who is to teach or correct amateur meteorologists?

FROM the report of the special course of instruction in biology to science teachers at South Kensington, we learn that Prof. Huxley's recent course was attended by thirty-nine students, of whom thirty-two were present during the whole time occupied by the lecture and demonstrations, and have made all the prescribed reports. Miss Margaret A. T. Macomish heads the prize list.

ON Sunday, July 9, a magnificent waterspout was seen off Cork harbour. It did not last long, its breaking up being followed by a heavy downpour of rain, which extended for some miles round.

DR. PETERS, of the Clinton Observatory, N.Y., has discovered another of the small planets, making the 114th of the series.

THE severe storm, which one of our correspondents described in our last number, will make August 12 remembered in many parts of the South of England and South Wales. In one place in Dorsetshire, 100 trees in one orchard were completely blown down, and forty trees in another. In other places we read of cottages being unroofed, and large trees carried away; and at Cardiff, a police station is stated to have been struck by a "meteoric stone," and some damage done, whilst during the storm "a shower of small green frogs" fell.

PROF. NEWTON has sent us an account of the shock of earthquake experienced at Boston, U.S., on the 13th of last month. It occurred early in the morning, and though comparatively slight, was still so plainly perceptible that those who felt it had no hesitation in attributing their sensations to the proper causes. Some persons who were abroad were affected with giddiness and momentary nausea, clocks were stopped in houses, beds and windows shaken, and vessels upset.

THE GOVERNMENT AND PROF. SYLVESTER

PROF. SYLVESTER is one of our best mathematicians, and enjoys a European celebrity. He was, we believe, the first of the Jewish race to compete for the highest honours in the Cambridge Mathematical Tripos, setting an example which has since been followed by several distinguished men. Although he was Second Wrangler, his religious opinions disqualified him from obtaining at Cambridge the Fellowship for which he was *well fitted, and which was morally his due. He had to* leave the University, and after an interval, and in an evil moment for himself, accepted at the age of forty the post of Professor of Mathematics to the Royal Military Academy at Woolwich. Woolwich Academy, as our readers know, is the training school of officers for the Artillery and Engineers. It is one of those hybrid establishments, half regiment and half college, which are managed by well-paid officers in the Army who do not teach, and taught by ill-paid civilians who have nothing to do with the management. But, inasmuch as mathematics formed the principal of the studies, the Professor of Mathematics was an important personage, and corresponded more nearly than any one else to the character of Head Master. He had a house and a salary of six or seven hundred a year. In 1869 a Royal Commission was appointed to inquire into the condition of Military Education in this country, and much evidence was given by the Professor as to the working of the Academy. He advocated extensive changes in the system, many of which were recommended by the Commissioners, and have since been adopted. But there was one among their many recommendations which was not suggested by the Professor, and which assuredly could not have been intended by the Commission to work retrospectively, and without due consideration, upon the teachers then in office. In altering the government and organisation of the Academy, and proposing a change in the educational staff, it was suggested that "the Professors, Instructors, and other officials, if military men, should be appointed for seven years, at least, with the power of re-appointment. If civilians, their tenure of office should in no case continue after the age of 55, unless an extension be specially recommended by the Governor and approved by the Secretary of State." Acting upon the Report of the Royal Commission, the War Office informed Professor Sylvester on or soon after his 55th birthday that his services would be no longer required. They did not even let him stay a few weeks to complete his fifteenth year of servitude, but bundled him off with a profusion of compliments, and the Treasury at their instance awarded him a retiring pension of 278*l.* 1*s.* a year.

Two hundred and seventy-eight pounds one shilling a year—we may mark the precision of the calculation—is thus, according to the opinion of somebody at the Treasury, the proper compensation to be given on the abolition of his office to one of the first living mathematicians, who had spent the best fifteen years of his life—or, as they say at Whitehall, with pitiless accuracy, only fourteen years, ten months, and fifteen days—in the service of the nation. He was not told, when he entered the public service in the prime of life, that the tenure of his office would be thus terminable. On the contrary, the idea is entirely novel, and had never prevailed before in our military or naval schools. We believe that Professor Sylvester is the last man in the world to set his own private claims against the public exigencies of the Royal Military Academy. But he might fairly enough object to be the victim of an experiment in organisation without being properly compensated for the consequent change in his mode of life. The Royal Commission thought that too great prominence was given at Woolwich to abstract Mathematics, and recommended the union of the two Professorships of Mathematics and Mechanics, with a view to some modifications in the system of study. But if the reformation of the Academy required the abolition of the office, surely the holder of the office deserved to be duly compensated. It is not right for the State to treat a man of approved science and elaborate education, whom it invites into its service at the mature age of forty, on exactly the same principles of superannuation as are applied to an ordinary member of the Civil Service, who becomes a clerk, from whatever unambitious reason, at the age of seventeen. There is no parity of position between the two. If Professor Sylvester had completed his fifteenth year of service, his *minimum* rate of pension, according to the rules of the Civil Service, would have been 60*l.* a year more than he was at first awarded; but the War Office and the Treasury would not even grant him this. They offered him one shilling over and above his 278*l.* a year, and bade him God speed.

Fortunately for the Professor and for the public credit, Sir Francis Goldsmid took the matter up in the House of Commons, and gave notice that he would move an Address to the Crown that the Professor might receive as his pension, "two-thirds of the salary and emoluments enjoyed by him at the time of his removal, and humbly to assure Her Majesty that this House will make good the same." More, perhaps, he could not ask; less it would be shabby to offer. When the establishment at Greenwich Hospital was abolished, the members were pensioned off with lavish generosity. Men who had been there barely a couple of years received their full pay and an equivalent for their house and allowances. When Haileybury College was abolished by the East Indian Government, its Professors and teachers carried with them into private life two-thirds of their official salaries. It seemed to be a necessary conclusion that the men who manage these matters in the Government can be liberal, and even generous, at the expense of charity funds or of distant dependencies, but have a different measure to mete with in the case of a man of science who has given his ripe intellect to the service of this wealthy nation. We rejoice at last to hear that the First Lord of the Treasury has given the case his full, though somewhat tardy, consideration, and has removed the stigma which seemed to attach to the public conscience. A country whose wealth has increased of late so enormously, as the Chancellor of the Exchequer explained to us this Session, cannot afford to be niggardly in the treatment of its distinguished men. Any mistaken attempt in that direction would be sure to recoil upon its authors, as well as to discredit the very name of economy; and Mr. Gladstone has acted wisely as well as justly in thus rectifying at the close of the Session a lamentable departmental error.—*From the Times.*

SUGGESTIONS TO OBSERVERS OF THE SOLAR ECLIPSE OF DECEMBER NEXT

AN analysis of the observations made at the recent eclipse seems to show that it would be desirable that three or four observers should be stationed some 10 miles to the north or south of the limits of totality to watch for—

1. *Shadow bands* passing along the ground, and to note carefully the direction of their motion and their velocity. If possible this should be done upon any three planes at right angles to one another, say the ground, an east and west wall, and a north and south wall.

2. *Direction and velocity of the wind*, and also the direction and velocity of the drift of the clouds. This should be done by observers associated with those employed on (1).

3 *Rays or brushes of light* from the thin cusps of the sun, and whether they alter their position and intensity.

4. *Spurious red prominences* from the thin crescent, noting carefully their position and size.

The following instruments might be used with advantage for polariscopic observations :—

1. A polarimeter, consisting of a Savart's polariscope mounted behind four plates of crown glass movable on an axis, perpendicular to the plane of polarisation, which is furnished with a graduated circle and pointer, to register the position in which the depolarisation of the plates neutralises the polarisation of the object. This should be used with a telescope having a diaphragm in the common focus restricting the diameter of the field to about 10′. The attention of the observer should be confined to the centre of the field (when the bands are made to disappear by rotating the plates).

2. A plate of right and left-handed quartz attached in front of a positive eye-piece, so as to lie in the common focus of the telescope and eye-piece, with an analysing Nicol placed between the lenses of the eye-piece, which should have a field about 1° in diameter.

The bi-quartz should be fixed so that the line of junction marks the plane of polarisation, giving the two halves purple alike.

The following polariscopic observations are suggested :

1. To determine the plane and measure the amount of atmospheric polarisation at at least three points, about 8° or 10° away from the sun's place. The points to be chosen *round the sun*, say N., N.E., and E., considering the sun as a map. (It would be well if three observers could be appointed each to take one fixed spot for atmospheric polarisation and to note the changes which take place during totality—both in the plane of atmospheric polarisation and in its intensity.)

2. The intensity of polarisation should be carefully measured with the polarimeter at different points of the corona, the observer taking care to notice when the Savart's bands disappear in the *centre* of his field as before stated.

3. The dark moon and corona should be bisected by the line of junction of the bi-quartz polariscope, and the colours upon the corona should be carefully noted, not only near the line of junction, but also round the whole circumference of the dark moon. Any sudden transition from one colour to another should be especially recorded. Should any ray, or rift, or sector of colour with sharp edges be observed, it would be well to place the line of junction across such sector or rift, and note the colours upon its edges ; the telescope carrying with it the line of junction might then be slowly withdrawn along the sector or rift from the limb of the moon outwards until all indications of the rift or its edges are lost—the observer, of course, noting the plane of polarisation within the rift, and whether it differs from that of the air polarisation in the neighbourhood of the sun.

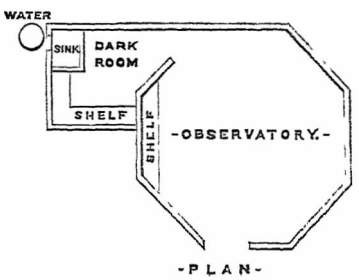
A. C. RANYARD

NOTES ON ECLIPSE PHOTOGRAPHY

ECLIPSES of the sun occurred in 1860, 1868, and 1869, when photography was employed chiefly to obtain evidence as to the nature of the red prominences, and in all cases a telescope of some kind was used, the image being taken at the principal focus.

It is, however, preferable that instead of a telescope an ordinary photographic lens of *long* focus be employed. Such a lens may be a portrait combination, or single or compound lenses, adapted for landscape or copying work ; the conditions are that the image shall be as large as possible, and the lens quick-acting. These requirements were found to be combined in the lens I used at Syracuse, and which was made by Mr. Dallmeyer, and lent to me for the purpose of the expedition. The lens is 4in. in aperture, and has a focal length of 30in, the image of the sun or moon being three-tenths of an inch in diameter. It is scarcely to be expected that there will be many lenses of this exceptional class available in India ; but no doubt, there are many good landscape lenses of long focus which may be used, and if the images they give are not so large as those taken by the 4-inch "rapid rectilinear," the pictures obtained may have scientific value, although small. It is an interesting fact that at Oran Dr. Huggins had arranged with a local photographer to attempt some pictures with a small lens, giving an image of about $\frac{1}{8}$th of an inch in diameter.

In all cases it is strongly to be recommended that the best instruments be used. Instead of Dallmeyer's 4 inch



lens, it is suggested that lenses of the "rapid rectilinear" make, of still larger aperture, be used, as the focal length will be increased, and consequently a larger picture will be obtained, allowance, of course, being made for the increased exposure required, if the focal length of the lens has been made greater in proportion to the aperture.

It will be convenient to assume in what I have now to say that a lens of at least four inches aperture and thirty inches focal length will in all cases be used, and that it it will be corrected for the chemical rays.

Now an instrument of this kind, if used to photograph the sun's corona, will be useless if not mounted so as to follow the sun's apparent motion. The camera must, therefore, be mounted on a stand having clockwork motion. The stand of an equatorial telescope is what is required. The telescope may be removed, and the camera fixed in its Place—this for convenience only—or the camera may be fixed on the top of the telescope. It will, however, be better to remove the telescope.

In the observatory and dark room as used at Syracuse, the framework was of wood, as slight as possible consistent with stability, and was covered entirely with waterproof cloth, the dark room being lined with yellow calico, in some parts double. The floor was also covered with the waterproof cloth to keep down the dust. Instead of the cloth for the sides and the roof I should prefer very thin boards, and the roof only need be made watertight, the edges of the wood being made, if necessary, to overlap. If wood be used, one thickness of yellow calico will be sufficient. The

cloth, if used alone for the sides and roof, is objectionable, owing to the possibility of wind tearing it away from the nails.

The importance of each photographic party being provided with a tent of the kind named cannot be too strongly urged. Residents in India will of course have no difficulty, but observers from England should prepare a tent at the nearest town to the place of observation, or, better still, take one with them. To unpack and erect our observatory and dark room required about a day, and to dismantle and repack it about three hours. To adjust and arrange the instruments will require about another day, and about two hours for the dismantling and packing. Much of our success at Syracuse depended on our being provided as described. The entire cost of the building, including waterproof cloth, yellow calico, and the fittings of the dark room was less than ten pounds. In the erection of a temporary construction of this kind, the shelter of a wall or building should be sought.

As these hints are for the practised photographer, and not for the tyro in the art, very little need be said about the process to be used. No dry process with which I am acquainted is adapted for the purpose. It may be suggested that the old *positive* process on glass would give good results, and I see no objection to using the negative process as well. Supposing six plates to be used, three of them could be developed as positives, and three as negatives, the exposures being timed to suit either. The negatives taken at Syracuse were not strengthened or intensified, and although they were developed as negatives they are almost as valuable as positives, as the detail is of so delicate a kind that very little of the outer corona can be seen when viewed by transmitted light. As positives, and viewed by reflected light, this detail is seen very perfectly. There is, however, detail of another kind in these negatives which can only be seen by transmitted light. The advantage of the positive process is that the picture is chiefly on the surface, but at those parts where the light has been most active, the detail would probably be visible when viewed as negatives by transmitted light.

The size of the camera will be determined by the dimensions of the plates to be used. Plates 5 by $4\frac{1}{2}$ inches will be quite large enough, and the camera will require to be slightly larger. The number of dark slides necessary will depend on the number of exposures to be made, and this again will be determined by the duration of the totality. In India, where the totality will be rather over two minutes, it will perhaps be better not to attempt more than six exposures, therefore six frames will be needed. In Australia at least twelve plates could be exposed, the totality lasting over four minutes. The single frames used at Syracuse were found to be so handy and convenient to use that I am undecided in my opinion as to whether any advantage would be gained by using double or sliding frames. This is a matter which must be left to the choice of the operator. The frames may be made in the ordinary way, but the corners of the carrier or frame itself should be fitted with silver wire or glass for the plate to rest upon; and as an extra precaution against defects likely to arise through some of the plates remaining in the frames half an hour, each corner may rest on blotting paper. In fixing on six as the number of plates to be used, I am assuming that they will all have to be prepared so as to be ready at the moment of totality; and I see no advantage to be gained by keeping an assistant in the dark room during that time; at most he could only prepare one plate, and I consider it preferable that every plate should be ready for immediate use. The preparation of these plates will require twelve minutes at least, and it is at this point and after the exposures are made that extra assistance would be valuable.

It was found at Syracuse that four baths of glass for the silver solution were sufficient; they were covered with brown paper to protect the plates from light. The dippers may be of glass, or varnished wood, and it is better to be provided with both, in case of accident. The glass should be the best patent plate, selected, carefully polished, each one being marked with a cross in one corner, and stored in plate-boxes with the marks all in one position; and in all the subsequent operations this mark should be to the left hand—the reason for this will be seen presently.

The image obtained with a camera as described is small, and it is therefore undesirable that any part of it should be disfigured by position wires. The necessity for using wires may be overcome in a very simple manner. Let the ground glass focussing screen (which should be of the finest possible kind, patent plate glass before it receives its final polish) have pencil lines crossed diagonally, and a single line horizontally across the centre of the plate. When the instrument is adjusted and stationary the image of the sun should travel parallel with this line. A plate should then be prepared, and a very small diaphragm being used in the lens, the instrument should then be moved quickly, so that the image of the sun leaves a trace which will appear after development. This will give the north point of the sun at the time of the eclipse, and serve as a key plate for all the pictures taken. The object of marking the corners of the plates will now be seen, and every plate used must be so held that in every operation the marked corner is touched by the forefinger or thumb of the left hand; then there will be no doubt about the orientation of all the pictures.

Up to this point two operators will be sufficient, one to attend to the arrangement of the instruments, and who ought to have some astronomical knowledge, so as to be able to adjust the equatorial stand, and the other for strictly photographic work. Help will of course be required in the erection of the observatory and dark room. At the time of the eclipse two other assistants will be required, one to count seconds from the clock or chronometer, and the other to hand the plate frames to the assistant at the camera. If a clock beating seconds or half seconds were used, the assistant at the camera could do the counting, but volunteers will readily be found.

The plan adopted at Syracuse could not I think have been improved. Mr. Fryer was at the instrument making the exposures, while I was at the other end of the camera changing the frames. At the word "ready" Mr. Fryer took off the cap and counted the prescribed number of seconds. At his signal "done" the plate was changed, and so on through all the exposures. Captain Speight handed to me the frames and took them from me after exposure, thus saving twenty-five seconds of the time. Sapper Gardiner counted seconds aloud. At the signal of totality given by Mr. Fryer the counting commenced. At the third second the first exposure was made, the three seconds being allowed to make sure of absolute totality. A table of the times for the exposure of each plate had been prepared by Mr. Fryer beforehand, and this was kept in view so as to avoid the possibility of mistake. The times were arranged in the following order:—3, 18, 30, 15, 8 (the 6th plate was exposed in the telescope camera, with three or four seconds to spare at the end). In India there will be time for the 6th plate to be exposed in the camera. On the day before and on the morning of the eclipse all the operators should be in their places to practise their different parts, as it will require the greatest possible care to avoid mistakes. Everything must be done deliberately and without the slightest hurry.

Previously to the last eclipse it had been supposed that the light of the Corona possessed very little actinism, and I had been strongly advised to give a full exposure. As, however, there was some doubt on the subject, it was determined to vary the exposures as stated; and unless the light of the Corona is not the same in all eclipses, I see no reason for suggesting any alteration in the time for exposing the plates to obtain different results, supposing the same kind of lens to be used. Allowance must

of course be made for the altitude of the sun and the state of the weather at the various stations.

The dark frames were numbered from 1 to 6, and the plates were exposed in the order in which they had been prepared, and the development proceeded in the same order.

Much of the delicate detail of the negatives is likely to be lost by varnishing. It is therefore preferable to cover them with glass, carefully binding the edges to exclude the air; the glass cover should not touch the film. Instead of using an ordinary plate-box for the negatives, I prefer that each plate should have a slight frame similar to an ordinary "carrier," and these frames are then placed flat on a box prepared for them.

In counting seconds it is preferable that the assistant should count consecutively throughout the totality. Supposing the eclipse to last 130 seconds, by counting from 1 to 130 the operators know exactly the point arrived at after each exposure; and this is most important towards the end, as the last plate might be spoiled by the least mistake in this respect.

Artificial light of some kind will probably be required during the totality—certainly in the dark-room. We used the ordinary railway reading lamps. Boxes open on one side were provided, and in them the lamps were fixed. These boxes effectually protected the lights—without them the candles would have been extinguished by the wind.

It is better to assume that nothing will be found at the place of observation but water, but as in India there may be some difficulty in obtaining that necessary article sufficiently pure for photographic purposes, it will be better to provide a small still, which will cost about 5*s*. At Syracuse we used rain-water, which was sufficiently pure for the purpose.

Those accustomed to photographic work in India will be aware of the necessary precautions to be observed to prevent the plates drying. At Syracuse we kept our observatory and dark-room well sprinkled with water; and the glass plates, when they were in the dark frames, were covered on the backs with wet blotting-paper.

Much disappointment will be avoided if proper care be taken in packing the apparatus. All bottles and other glass articles should be placed in separate divisions and packed with cotton wool or paper cuttings. Packing-cases should be made very strong and bound with iron plates. By attention to these matters the whole of the apparatus and chemicals were found on being unpacked at Syracuse to be altogether uninjured—the packing cases bear testimony to the rough usage they have undergone.

A. BROTHERS

CLIFTON COLLEGE SCHOOL OF NATURAL SCIENCE

WE have long insisted in NATURE on the extreme importance of science teaching in the higher grade schools in this country, and we are glad to find that at length its importance has begun to be recognised by the head masters themselves; so that, on the whole, the progress now being made in this direction is such that we may confidently expect that at no very distant future science instruction will be provided for in all our superior schools. Foremost, if not positively the first among the schools in which the sciences are thus taught stands Clifton College, under the able direction of the Rev. J. Percival, in which scientific study is introduced to the utmost, and keenly pursued by the boys, with the encouragement of all their masters, the latter a most important consideration, and which, we are sorry to say, we cannot assert in reference to other schools of equal pretensions. There are several points of interest about the method of teaching at Clifton, and we are glad to have the opportunity of laying before our readers a sketch of the way in which the work there is carried on, together with a sketch of the museum, which, may well become the model of all school museums. Science is much indebted to Mr. Percival for the magnificent example he has set in science education.

Natural Science at this College is not a voluntary subject, but forms a regular part of ordinary school work. The boys in the two highest classes on the classical side are allowed to choose between Science and German; throughout the rest of the school some branch of science is compulsory. In the Junior School Botany is taught, in the Upper School Chemistry and Physics. The boys on the classical side receive one lecture, those on the modern side two lectures a week on each of these latter subjects. The lectures are illustrated by experiments, accurate notes are exacted from the boys, and examinations are held every fortnight or three weeks.

The accompanying is one of these fortnightly papers:—

MAGNETISM

1. Soft iron can never be permanently magnetised, yet a piece of soft iron in contact with a magnet becomes a magnet. Why?
2. What do you understand by *coercive force*, and magnetic *saturation*?
3. How is magnetism influenced by heat?
4. Mention the substances which are attracted by a magnet in addition to iron.
5. State one or more of the methods by which steel bars may be magnetised.
6. What is the *declination* or *variation* of the magnetic needle, and the present extent of it?

CHEMISTRY

a. For First and Second Sets, Modern Side only.

1. Mention the oxygen compounds of phosphorus, and the action of water upon them.
2. Give an account of arsenicum and its chief characteristics.
3. What are the constituents and characteristics of arseniuretted hydrogen?
4. What is "white arsenic," and how may it be prepared?
5. You are given a liquid suspected to contain arsenic; by what means would you examine it?

b. For all other Forms.

1. Ammonia gas, and hydrochloric acid gas, are brought into contact: what is the resulting compound, and to what may it be compared?
2. What is *ammonium*? Describe the formation and appearance of ammonium amalgam.
3. What do you know of chloride of nitrogen?
4. What is nitric acid, and by what means may it be procured?
5. State the action of nitric acid upon metals,—copper, tin, antimony,—and the general tendency of the acid.

BOTANY

Third A. and B. only. (To be written on separate paper only).

1. Describe the following forms of roots:—*tap, napiform, premorse, tubercular.*
2. How are fluids absorbed by the roots?
3. Show clearly the true nature of the various forms of the bulb.
4. What is a "rhizome" (or root-stock)? Compare it with a "corm."
5. Give an account of the structure of the stem in a common potato.
6. Why is it that plants and animals have a mutual dependence on each other for their life?

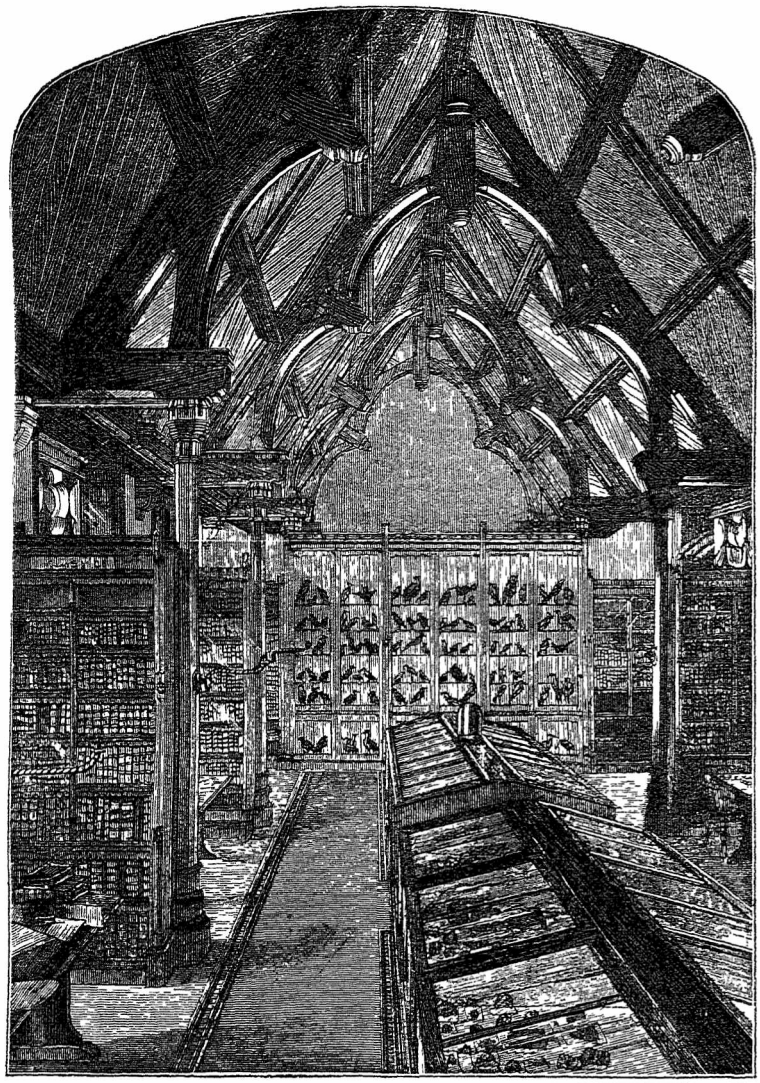
Special classes are formed for those who wish to go deeper into these subjects, or to take up others. Thus, there are special classes studying Chemistry, Physics, Zoology, Physiology, Botany, Physical Geography, and Civil Engineering.

Facilities are also afforded for learning science practically. In the Chemical Laboratory about twenty boys study analysis. A Physical Laboratory has been built and will be opened next September. It will accommodate about twenty pupils, and its arrangements will be based

on those adopted at King's College, London. A large workshop fitted up with carpenters' benches, vices, and lathes has been opened this term, and is exceedingly popular. There is also a physiological laboratory, in which a few of the elder boys receive instruction in Practical Zoology and Physiology.

Marks are given for work done in all the above-mentioned classes, except in the workshop. These marks affect a boy's position in his form from week to week, and thus afford a strong incentive to careful work.

Five masters are at present engaged in teaching science. The taste for natural history is developed by means of the Natural History Society, the School Museum, and the Botanic Garden. The society consists of about seventy members. Its meetings are held once a fortnight, they are fully attended, and there is never any lack of papers to be read. The society is subdivided into sections, which hold special meetings and make excursions for the study of different branches of science. The first number of the Transactions has just been published. The sections are engaged in preparing lists of the fauna, flora, and mineralogy of the district. The whole society makes an expe-



THE MUSEUM OF CLIFTON COLLEGE

dition annually in July to some place of interest in the neighbourhood.

A conversazione was given last month to celebrate the opening of the Museum and Botanic Garden. The former shares with the library the new room recently added to the school buildings by the head-master. Space being, of course, limited, it has been decided to make the collections essentially British; the local series to be as far as possible complete, and the general collections typical. Through the liberality of friends, considerable progress has been made already. Thus the museum already contains a fine series of British plants, another fine series of typical British fossils, nearly 1,000 specimens of minerals, the same number of British Lepidoptera, many British birds and their eggs, and a good typical collection of shells. The completion of the local series is left in the hands of the different sections.

The Botanic Garden is large, and is laid out in long narrow beds with grass walks between. Over 1,000 hardy herbaceous plants are here arranged according to the natural system; and new additions are being constantly made. There are also specimens of all the ornamental trees and shrubs commonly cultivated in England; and a rockery has been built for Alpine plants.

THE BRITISH ASSOCIATION MEETING AT EDINBURGH

SECTION A.

On Temperative Equilibrium of an Enclosure in which there is a Body in Visible Motion, by Prof. Balfour Stewart, F.R.S.—It is now several years since Prof. Tait and the author of this paper came jointly to entertain the belief that there is some transmutation of energy, the exact nature of which is unknown, when large bodies approach and recede from one another. It is desirable to vindicate an idea of this nature, both from the theoretical and the practical point of view—that is to say, we ought, if possible, to exhibit it as a possible deduction from those laws of nature with which we are already acquainted; and, on the other hand, it ought to be supported by observations and experiments of a new kind. In our case the experiments and observations have been of a difficult nature, and are yet in progress, it is therefore premature to bring them before the notice of this section. A theoretical vindication of the idea has been obtained by Prof. Tait, and more recently one has occurred to the author of these remarks, which he now ventures to bring before the section. Men of science are now sufficiently well acquainted with Prevost's theory of exchanges and its recent extension. We know that in an enclosure, the walls of which are kept at a constant temperature, every substance will ultimately attain the very same temperature as these walls, and we also know that this temperature-equilibrium can only be brought about by the absorption of every particle being exactly equal to its radiation, an equality which must separately hold for every individual kind of heat which the enclosure radiates. This theoretical conclusion is supported by numerous experiments, and one of its most important applications has been the analysis of the heavenly bodies by means of the spectroscope. Let us now suppose that in such an enclosure we have a body in visible motion, its temperature, however, being precisely the same as that of the walls of the enclosure. Had the body been at rest, we know from the theory of exchanges that there would have been a perfect equilibrium of temperature between the enclosure and the body; but there is reason to believe that this state of temperature-equilibrium is broken by the motion of the body. For we know both from theory and experiment that if a body, such for instance as a star, be either rapidly approaching the eye of an observer or receding from it, the rays of the body which strike the eye will no longer be precisely the same as would have struck it had the body been at the same temperature and at rest; just as the whistle of a railway engine rapidly approaching an observer will have to him a different note from that which it would have had if the engine had been at rest. The body in motion in the enclosure is not therefore giving the enclosure those precise rays which it would have given it had it been at the same temperature and at rest; on the other hand, the rays which are leaving the enclosure are unaltered. The enclosure is therefore receiving one set of rays and giving out another, the consequence of which will be a want of temperature-equilibrium in the enclosure—in other words, all the various particles of the enclosure will not be of the same temperature. Now, what is the consequence of this? The consequence will be that we can use these particles of different temperature so as to transmute part of their heat into the energy of visible motion, just as we do in a steam engine; and if it is allowable to suppose that during this process the moving body has retained all its energy of motion, the result will be an increase of the amount of visible energy within the enclosure, all the particles of which were originally of the same temperature. But Sir W. Thomson has shown us that this is impossible; in other words, we cannot imagine an increase of the visible energy of such an enclosure unless we acknowledge the possibility of a perpetual motion. It is not, therefore, allowable to suppose that in such an enclosure the moving body continues to retain all its energy of motion, and consequently such a body will have its energy of motion gradually stopped. Evidently in this argument the use of the enclosure has been to enable us to deduce one proof from the known laws of heat and energy, and we may alter the shape of the body without affecting the result; in other words, we should expect some loss of visible energy in the case of cosmical bodies approaching or receding from one another.

Observations on Water in Frost rising against Gravity, rather than Freezing in the Pores of Moist Earth, by Prof. James Thomson, LL.D., of Belfast. In this paper Prof. Thomson, in continuation of a subject which he had brought before the British Association at the Cambridge Meeting in 1862 on the Disintegration of Stones exposed to Atmospheric Influences, adduced some remarkable instances which he had since carefully observed. In one of these observed by him in February 1864, he showed that water from a pond in a garden had in time of frost raised itself to heights of from four to six inches above the water surface level of the pond by permeating the earth bank, formed of decomposed granite, which it kept thoroughly wet, and out of the upper surface of which it was made to ascend by the frost, so as to freeze as continuous columns of transparent ice rather than that it would freeze in the earth pores. From day to day during the frost the earth remained unfrozen, while a thick slab of columnar ice formed itself by new water coming up from the pond, and insinuating itself forcibly under the bases of the ice columns so as to freeze there, pushing them up, not by hydraulic pressure, but on principles which, while seeming to have been previously not noticed, appear to involve considerations of scientific interest, and to afford scope for further experimental and theoretical researches.

SECTION B.

A REPORT *On the Publication of Abstracts of Chemical Papers* was read by the secretary (Dr. Thorpe). The committee, which consisted of Profs. Williamson, Roscoe, and Frankland, having charge of the matter, said they were glad to be able to announce that regular monthly reports of the progress of chemistry have been published since April last by the Chemical Society. These reports have been rendered as far as possible complete, by giving abstracts, more or less full, of all papers of scientific interest, and of the more important papers relating to applied chemistry. The abstracts have been made by chemists, most of whom are members of the Society, whose zeal for science has induced them to undertake the work for the small honorarium which the Council has been able to offer. A numerous Committee of Publication has been formed, whose members gratuitously undertake the revision of proofs, and a comparison of abstracts with the original papers. The committee feel that their thanks are due to those gentlemen engaged in the work for having already so far succeeded in accomplishing a task of such difficulty and importance, and they confidently hope that their continued exertions will still further perfect the details of the scheme, so as gradually to increase the usefulness of the report. It is right to state that the funds of the Chemical Society, available for the purpose of the report, although so opportunely aided by a grant of 100*l.* from the British Association, were insufficient to defray the necessary expenses, and that voluntary contributions to the amount of upwards of 200*l.* have been received towards the cost of publication for the first year up to April 1872. There is good reason to believe that the expectations entertained of the usefulness of these reports will be fully realised by their continuance on the present system; and that they will be found largely to conduce to the progress of the science wherever the English language is spoken.

Prof. Williamson said it had long been felt in England that some equivalent was needed for those admirable annual reports which have long been published in Germany, and of which the value was so very great to workers in chemistry. To meet that want was the object the committee had in view.

A vote of thanks was given Prof. Williamson for his exertions in connection with the matter.

Dr. Thorpe read a paper *On Phosphorus Chlorides*. He said he had attempted to prepare the missing oxichlorides analogous to those obtained from vanadium by Roscoe, but without success. When the phosphoryl trichloride is heated with zinc in a sealed tube, the oxygen is withdrawn and phosphoric chloride is obtained. He had also prepared sulpho-chloride of phosphorus by the action of sulphide of phosphorus on the penta-chloride of phosphorus.

Mr. Pattison Muir made a communication *On an Antimony Ore from the Thames, New Zealand*. The specimen analysed was beautifully crystallised and almost chemically pure antimony sulphide, containing only traces of arsenic and antimony. Mr. John Dalzell communicated a paper *On Suphur Dichloride*. He has repeated Hübner's experiments, and finds that the compound actually exists at low temperatures. Dr. Wright gave a *résumé* of his researches *On the Derivatives from Codeia*. An account of these investigations has already appeared in our columns. Mr. Tichborne read a paper *On the Dissociation of Molecules by Heat*, and showed some very pretty lecture experiments on the subject. Mr. J. G. Buchanan read a paper illustrated by diagrams *On the rate of Action of Caustic Soda on a Watery Solution of*

Chloracetic Acid. He has determined the rate at which chloracetic acid suffers decomposition, when heated simply with water or with caustic soda in a sealed tube. The following papers were also read :—Prof. Apjohn, *Some Remarks on the Proximate Analysis of Saccharine Matters;* Dr. Gladstone, *On Crystals of Silver;* Mr. Braham, *On the Crystallisation of Metals by Electricity;* Mr. J. S. Holden, *On the Aluminous Iron Ores of Co. Antrim;* Prof. Maskelyne, *On Dafrenite and a New Mineral from Cornwall, and on Localities of Dioptase;* Rev. Mr. Highton, *On a Method of Preserving Food by Muriatic Acid;* Mr. Wanklyn, *On the Constitution of Salts;* Mr. Harkness, *On a Method of Testing Wood Naphtha.*

SECTION C.

MR. CARRUTHERS, F.R.S., read a paper by Mr. Grieve *On the Position of Organic Remains near Burntisland*, and also a paper by himself *On the Vegetable Contents of Masses of Limestone occurring in Trappean Rocks in Fifeshire*, and the conditions under which they are preserved. Large masses of plants which formed the coal had been enclosed in the trappean ash, and subsequently calcified by the large amount of lime contained in the rocks. Mr. Carruthers considered that these fragments were enclosed in a peaty condition, because the mass was penetrated in every direction by roots, showing the existence of vegetation on this soil. The attention of Mr. Grieve was first directed to the specimens by observing on the shore large masses of limestone which had been polished by the drifting sand. The action of this sand was well shown in the neighbourhood, even the hard basaltic rocks having been polished by it. Mr. T. M'K. Hughes said that after what had been brought out in regard to the action of the drifting sand, they must take care not to attribute the polishing of rocks in every instance to glacier action.

The second meeting of Section C. was opened by Mr. Pengelly, who read the *Seventh Report on the Kent's Cavern Explorations.* His clear and lively lecture drew together a good audience. Commencing with some general remarks on the history and working of the Cavern, in order to make the subject clear, he pointed out the usual section to be, in descending order :—1. Black mould, containing many objects of recent date, and some of Romano-British times; also remains of animals still living, or which lived in historic times. 2. Granular stalagmite, containing remains of extinct animals, and also a human jaw. 3. Cave earth, yielding a harvest of extinct remains, also flint implements. 4. Crystalline Stalagmitic floor, and Breccia formed of rocks from distant hills; bears only have been obtained from these. He then described the work done during the past twelve months, showing what new passages had been opened, and the number of species which had been obtained. They included hyæna, horse, rhinoceros, Irish elk, ox, deer, badger, elephant, bear, fox, lion, reindeer, rabbit, bat, wolf, dog, &c. Many of the bones were gnawed by hyæna, others were marked by rootlets encircling them. Altogether, about 2,200 teeth and bones and 366 flint implements and flakes had been obtained since the last year's Report was read.

The Contents of a Hyæna's Den on the Great Doward, Whitchurch, Ross, Herefordshire, were pointed out by the Rev. W. S. Symonds, F.G.S. He remarked that the section of the deposits was—1. Superficial soil and stalactitic matter with Roman (?) pottery and human bones. 2. Thin band of stalactitic matter. 3. Cave earth, containing flint flakes and chips, stone instruments, teeth and bones of numerous mammals either extinct or not now inhabiting the district, as the cave lion, cave bear, hyæna, mammoth, long-haired rhinoceros, fossil horse, &c. 4. Stratified sand and silt, with rolled pebbles. 5. Thick floor of stalagmite, and cave earth separated every few feet by layers of stalagmite, containing flint flakes.

Mr. Vivian, referring to the length of time during which man had existed on the earth, thought he might have existed for about a million years. Prof. Hull remarked that there was no evidence as yet to bring back man to the Glacial epoch, and therefore opinions about the high antiquity of man should be reserved. Mr. Prestwich concurred with Mr. Hull, but said there was no doubt that man followed very closely upon the Glacial period.

Mr. L. C. Miall read a paper *On Some Further Experiments and Remarks on the Contortion of Rocks,* describing results obtained by subjecting limestone, flagstone, slate, and plaster of Paris to forces of low intensity but of long continuance. Mountain and magnesian limestone proved to be indefinitely plastic; slate slightly elastic, but almost incapable of permanent deflection. Remarks on some cases of superficial and modern contortions were appended to the paper.

Prof. Hull and Mr. W. A. Traill, B.A., of the Geological Survey of Ireland, read a paper *On the Relative Ages of the Grantic, Plutonic, and Volcanic Rocks of the Mourne Mountains, Down, Ireland.* They first pointed out the presence of two varieties of granite, differing, as Prof. Haughton had shown, both in composition and origin; the soda granite of Slieve Croob (consisting of quartz, orthoclase, albite, and mica) being of metamorphic origin, and the potash granite of Mourne (consisting of quartz, orthoclase, albite, and mica) being eruptive. The relative, and as far as possible, the actual ages of these granites, remained to be determined, which the authors considered might be determined by a consideration of the basaltic and felstone-porphyry dykes, by which the district had on several occasions been invaded. The conclusions thus derived were that the granite of Mourne was newer than that of Slieve Croob by a long interval, and that while the former was probably Mesozoic, the latter was of Palæozoic age.

The third meeting of the Geological Section was held on Saturday August 5. The first paper read was by the Rev. Dr. Hume *On the Coal Beds of Panama,* in reference mainly to their economic importance. The author drew attention to the discovery of a series of seams in the Isthmus of Panama. Analysis proved the coal to contain about 75 per cent. of carbonaceous matter, the remaining portion being water and ash; it had a fair heating and a large illuminating power. There are four points where the coal reaches the surface of the thickness of 9ft., 12ft., and with intervening streaks of shale and clay 25ft.; it, however, improves in value at greater depths. He pointed out the great importance of this coal, in the event of a canal being made through the Isthmus.

The relation of health to certain geological formations was treated of by Dr. Moffatt. He remarked that the district in which he lived consisted geologically of the Carboniferous and of the New Red Sandstone system; that the inhabitants of the former were engaged in mining and agriculture, and those of the latter in agriculture chiefly. Anæmia, with goitre, was very prevalent among those persons living on the Carboniferous system, while it was almost unknown among those on the New Red Sandstone; and phthisis was also more prevalent among the former than the latter. He then gave some statistics as to the diseases prevalent among the counties of Chester, Flint, and Denbigh, and stated that the practical deductions to be drawn from the inquiry were, that all young persons living on a Carboniferous formation having symptoms of incipient goitre and anæmia, ought to be moved to a soil upon red sandstone, and persons of strumous habit ought to reside upon sandstone at an elevation of at least 800 or 1,000 feet above the sea. In the discussion which followed the reading of this paper Mr. G. A. Labour mentioned a Carboniferous district in Northumberland containing a thin bed of limestone where the people suffered from goitre. Sir Richard Griffith remarked that goitre was unknown in Ireland, although they had plenty of Carboniferous rocks. Professor Hall agreed with Dr. Moffat respecting the healthful character of the New Red Sandstone.

A paper was then read by the Rev. J. F. Blake *On the Yorkshire Lias and the Distribution of its Ammonites.*

Some relics of the Carboniferous and other old land surfaces were described by Mr. Henry Woodward.

SECTION D.

THE Committee for the Close Time for Birds, reported by the Rev. Canon Tristram, LL.D., that it had gone on year after year endeavouring, as well as it could, to influence public opinion on the question of the preservation of indigenous life in this country. At the time of its appointment there was no protection whatever for any creature not coming under the Game-laws. Anything not game was treated by law as vermin. A curious case had arisen in regard to Pallas's sand grouse. That bird made its appearance on the east coast of England, and if it had been allowed to breed on the sand-pits of Durham, Yorkshire, and Lincolnshire, no doubt it might have become an indigenous bird. He (Dr. Tristram) summoned some people for shooting it out of season in the spring of the year; but it was decided that, being sand grouse and not Scotch grouse, it was beyond the benefit of the laws. The committee had to congratulate the Association two years ago on having succeeded with very

little difficulty in steering a Bill safely through all the perils of Select Committees of both Houses of Parliament. That Bill, however, was shorn of its fair proportions; and although it went into the House a Bill for the Protection of Indigenous Animals, it came out an Act for the Preservation of Sea-Fowl. The sea-fowl had borne their testimony to the success of the Act so far, and it was something to have to say that within the last year the numbers of sea-fowl that had bred on the Yorkshire coast were, at least, three times as many as they were two years ago. That success was a great benefit, at the same time, to those who made their living by sea-fowl, because purveyors of feathers and eggs had found that the Sea-Fowl Act had actually very largely increased not only their profits, but their supply, in the same way as the improvement of the Salmon Acts had restored the salmon to rivers from which it had been almost extirpated. The committee, therefore, finding there was a unanimous verdict in favour of the Act regarding sea-fowl, strongly recommended the Association to endeavour to extend the Act in two ways. This they proposed to do next session by introducing amending clauses. One object to be aimed at was to extend the Act to all wading birds and all web-footed birds good for human food. It was desirable to protect the sandpipers, the plovers, the lapwings, and the whole of the duck tribe, which were being rapidly exterminated. Having succeeded in that, the committee should next endeavour to have British law on the subject assimilated to the sternly restrictive laws of every other civilised country, except Holland, Greece, and Turkey—those three being the only countries in the world professing to be civilised which had not a close-time for all creatures.

ORNITHOLOGY.—Prof. Duns, D.D., New College, Edinburgh, read a paper *On the Rarer Raptorial Birds of Scotland*; the four following propositions were stated:—1. That species occur in pairs, often at long intervals, in localities where they have long since ceased to breed, but where they have been at one time not uncommon. 2. The geographical range of stragglers seems to widen with the lapse of time. 3. Certain species have greatly increased in recent times over wide districts where they were comparatively rare. 4. Year by year the raptorial birds of Scotland are becoming fewer. These positions were all treated of in the paper, which, not giving specific characteristics or descriptive details, yet pointed out all the chief sources of information and enumerated all the localities. R. Sibbald's list in "Scotia Illustrata," 1684, and the many that intervened between it and the author's own lists collected during the last thirty years, were all referred to, and the conclusion come to was that most of the larger raptorial birds were rapidly disappearing from Scotland, and that even the smaller forms which were very common in the southern and central districts were yearly becoming rarer. The author also expressed his belief that both the farmer and the game preserver would lose much when between them they succeeded in destroying all the hawks and owls.

ICTHYOLOGY.—A paper was communicated by Colonel Playfair, H.B.M. Consul-General at Algiers, *On the Hydrographical System and the Fresh Water Fish of Algeria*. After describing certain interesting features in the physical configuration of the country, the paper went on to state that in the rivers flowing to the Mediterranean there were sixteen species of fish, only three of which were common to the whole region, one being the common eel. There were eleven species peculiar to the littoral of Algeria, among which was a small trout. The common gold fish, which was very common, was not a native of Algeria, but was supposed to have been introduced by the caprice of a certain Sultan many centuries ago. It was now, however, universal in the streams. The plateau had only afforded seven species, one of them being the same as a South African species. In the Sahara there were some peculiar species. The upper part afforded two species, one being the common eel, and in the lower region two species were found in the salt lakes, and had been frequently ejected by the Artesian wells. It had been concluded that these latter species inhabited a vast subterranean sea occupying the bottom of the Sahara depression. The question had been asked why they were not destitute of eyes, but it was to be remembered that their underground life was simply an episode in the voyages they made between one well and another. When they reached a well they were either forced up or by instinct came to the surface. Owing to the shortness of the rivers and their being extremely rapid in their upper portion, the physical conditions were not such as would admit of the introduction into them of the true salmon with any prospect of success.

Mr. C. W. Peach exhibited some apparently tailless trout which had been sent to him by Mr. Colin Hay, distiller, of Ardbeg, Islay. They were taken in Lochmaorichen, in Islay. That loch was about 1,000 feet above the level of the sea, and not above one acre in extent. It was so shallow that a man could wade through it, and had a stony bottom, with a few weeds. Although it was surrounded by other lochs, these tailless trout were found only in it. The whole of them were "docked," and Mr. Mackay, a keen sportsman, who has fished it often for thirty years, never caught one with a perfect tail. They are in excellent condition, being fed on the small crustaceans which are abundant in the loch. Mr. Peach further stated that Mr. Hay was about to add to his kindness by procuring a further supply of fish, if possible, from the fry to the adult state. He also intended to transport some of the "docked" trout to a loch at a short distance, in which trout had never been taken, and try to rear a stock from them, and see whether they would all remain "tailless.

Dr. Grierson said that, at the mines of Wanloch-Head, Dumfriesshire, and Leadhills, Lanarkshire, there were streams coming from the shafts in which trout without tails were frequently got, as also trout with deficient fins. The fish referred to were, moreover, frequently blind. Specimens of these fish were to be forwarded to Professors Turner, Traquair, and Dr. Günther for examination.

Mr. A. G. More exhibited some brown trout taken in salt water. It was not, he thought, generally known that the common or brown trout of fresh-water streams was an occasional visitant to the salt water. The salmon and the sea-trout, and the sewin or Welsh sea-trout, descended regularly to the sea after they had finished breeding in fresh water; but the common brown trout had seldom been observed under the same circumstances. In Scotland Mr. Peach, who had an extensive experience and knowledge of marine zoology, assured him that no instance of the kind had come under his notice, save once, when he found a river-trout in the stomach of a cod-fish. Possibly that trout was captured in salt water, but it might have been dropped by a cormorant, or have been swept down the river in a flood either weak or possibly already dead. In the west of Ireland—in the counties of Donegal, Sligo, Limerick, and Kerry, Mr. More had ascertained, partly through others and partly from his own observation, that the river-trout spontaneously frequented the salt water at the mouths of the rivers. The brown trout captured in salt water differed from their usual condition in having brighter and more silvery scales, something like those of the young salmon in the smolt condition. Mr. More would like it to be ascertained if these trout were brown trout "pure and simple," or hybrids.

Prof. Duns exhibited a specimen of the spiny shark, *Echinorhinus spinosus*, Blain, which had been taken at Earlsferry, near Elie, Fifeshire, in the February of this year. He also mentioned that a specimen had also been taken in January 1867 near Boness, Linlithgowshire.

Dr. C. Lütken described a new genus of fish belonging to the family of the sea-devils, allied to, and, in fact, almost intermediate between the curious genus Melanocetus discovered some years since by Mr. Johnson at Madeira and the monstrous Ceratias, which, until the discovery of Mr. Johnson, was the best known example of the Apodal Lophioids. Of the third genus of the almost blind apodal deep sea Lophioids, it was strange that the Greenland seas should have already possessed a species, *O. himantolophius*, described many years ago by the senior Reinhardt from a mutilated specimen, but which description had been almost forgotten by recent icthyologists. Among the characters distinguishing this genus Oneirodes, there is one both peculiar and suggestive, viz., the curious development of the head of the first dorsal fin-ray, which, with its tentacles, pigmental spots, &c., gave the impression of, as it were, a mimicry of the head, say, of a Nereis. It would not be very wonderful if it were really intended to allure other rapacious fishes, and if the old stories of the angling propensities of the "fishing frog" were found to contain more truth than is generally believed. The new species *O. eschrichtii* was taken at Greenland.

ENTOMOLOGY.—Mr. Roland Trimen, F.L.S., F.Z.S., read a note on a curious South African grasshopper,* *Trachypetra bufo*,

* Methuen's "Wanderings in the Wilderness," 2nd edition, 1848, App. p. 372, pl. II., fig. 3.

White, which mimics with much precision the appearance of the stones among which it lives.

He commenced by observing that some tendency existed to separate too widely those cases of mimicry where one animal imitated another from those in which an animal closely resembled either some part of a plant or some inorganic object; and expressed the opinion that these two sets of cases were wholly one in kind, the evident object in all being the protection of the imitator.

Describing a visit paid to the vicinity of Grahamstown in search of this insect, he observed that it was a work of considerable difficulty to distinguish the grasshoppers from the stones, and he was engaged for half an hour in careful search over a known station of the species before discovering an example. He noted the further most interesting fact, that, in certain spots (often only a few square yards in extent) where the stones lying on the ground were darker, lighter, or more mottled than those generally prevalent, the Trachypetra found among such stones varied similarly from the ordinary dull ferruginous-brown colouring in imitation of them.

It was pointed out that the close imitation of the stones was mainly effected by the modification of the dorsal shield of the prothorax, which is, with the whole thorax, much flattened and widened, and is further much produced posteriorly, and has its surface roughened or granulated in close resemblance to the surface of the stones.

In conclusion, he called attention to the bearing of the case of this insect on the question of the origin of species; and in putting the alternative whether the peculiar station of the Trachypetra had been specially prepared for it immediately before or simultaneously with the creation of the insect, or whether, on the contrary, the insect had been very gradually modified by natural selection in imitation of the stones for the purpose of concealment, he expressed his decided opinion in favour of the latter hypothesis.

Specimens of the insect were exhibited in association with some of the stones among which they were captured, and the very close resemblance between stones and insects excited general remark. Mr. Trimen observed that in nature the mimicry was more effective, the colours of the dead insects having faded considerably, and the shrinking of the abdomen having caused the hind-legs to be much more apparent than was the case in living examples.

Echinoderms.—Prof. Wyville Thomson read a paper *On the Structure of the Crinoids*, to which it would be impossible to do justice in a brief summary. He proposed to make as primary divisions of the family the Astomata and Peristomata. Dr. Lütken of Copenhagen remarked on the great interest of the paper, and referred to Prof. Wyville Thomson's earlier and excellent memoirs on the development of a species belonging to this family. In a paper *On the Palæontological Relations of the Fauna of the North Atlantic*, Prof. Wyville Thomson exhibited and described a remarkable new genus possibly related to the Diademidæ, in the corona of which the plates overlapped, and which, when taken out of the dredge, rolled about like a soft egg; this was called *Calveria hystrix*. The Pedicellariæ were most beautiful objects, and the species is one of the most remarkable of all living Echinoids. A beautiful recent species called *Purpuratus* of the genus *Porocidaris* was also exhibited, as also specimens of *Brissinga*, *Pourtalesia*, and *Rhizocrinus*. A choicer assemblage of rare and remarkable forms was probably never before exhibited to Section D, and it is not possible to refrain from mentioning that most of them will be described and figured in an early number of the Proceedings of the Zoological Society of London.

Cœlenterates.—Dr. Charles Lütken of Copenhagen, in introducing to the notice of the department a recent addition to the fauna of the Arctic region, said they would know that the progress of modern science had given an increased interest and importance to the knowledge of Arctic forms. Naturalists were now busily engaged in looking for the remains of the vegetable and animal kingdoms left in the sedimentary deposits from the glacial epoch in which an immense ice-field had covered a great part of the earth. One of the latest discoveries in Scandinavia was that of a fresh-water deposit at the bottom of a great bog, containing the relics of a truly Siberian vegetation. On the other hand, recent investigations, for which they were in part indebted to the British Government and British naturalists, had shown that many of the lower animals, hitherto thought only to inhabit the Arctic Seas, had a very great geographical distribution. For a long time the seas of Greenland had been one of the principal sources of our knowledge of Arctic life. It was about the only country, with the exception of the most northern part of Norway, within the Arctic Zone, where there was established a regular colony with a staff of officials, among whom there was always to be found one or more who were anxious to make their situation profitable to science, and the directors and officers of the Museum at Copenhagen always encouraged these efforts with the view of collecting at Copenhagen as ample material as possible for the study of Arctic life. These efforts have been in later times rivalled by those of the Swedish Government, but their own efforts were greatly promoted by the circumcumstance that the profits of the colonisation of Greenland were derived almost solely from the revenues got from the rich animal life, and that the Esquimaux were very acute observers of that nature from which they also derived their whole sustenance. He now submitted to the notice of the department a new species of Antipathes (*A. arctica*) found lately in the stomach of a Greenland shark; it belonged to a tribe of corals hitherto believed to be exclusively inhabitants of the warmer seas, not being previously found north of the Mediterranean or South Carolina. He was now informed by Prof. Wyville Thomson that species of that genus did come to the surface during his late dredging expedition in the North Atlantic. This discovery, in addition to that of the Lophioid fish described above, indicated that the treasures of the Arctic Seas were not yet exhausted, and ought to stimulate further attention to them. Prof. Wyville Thomson and others took this occasion to state their admiration at the perfect order and care with which the Scandinavian Museums were kept, and their estimation of the great kindness shown by the officers of these Museums to naturalists in this country in sending over for examination complete series of different forms of Arctic life.

Dredging.—Mr. W. Saville Kent sent an account of the zoological results of the 1870 dredging expedition of the yacht *Norna* off the coasts of Spain and Portugal.

Rev. R. B. Watson gave a very graphic account of the trials and troubles he had encountered in dredging at Madeira, and appended to his paper a list of the mollusca met with by him in Madeira.

Mr. A. G. More also submitted to the department some account of a recent dredging expedition which he had made to Bantry and Kenmare Bays.

SUB-SECTION.—ANTHROPOLOGY.

In the anthropological department on Monday, August 7, Prof. Turner presided, and there was again crowded attendance throughout the day. The first paper was read by Mr. J. S Phené *On the Manners and Customs of the Early Inhabitants of Britain, deduced from the remains of their Towns and Villages.* He drew attention to two prominent points, the universality of the circle, curve, or oval, in all the earliest British remains; and the similarity of the physics of the various localities where British remains are still traceable, arguing that though divided into tribes, yet the inhabitants at the time were one people. In alluding to the physical features of their settlements, he pointed out that a conical hill towards the east, with a stream between it and the settlement, seemed an indispensable condition in selecting a place of abode, and where hills did not naturally exist they had been formed with great labour, as the Castle Hill at Cambridge. He assumed the object of proximity of the hill was for facility of worship, and the separation by the stream was indicative of purity of sacred separation. He believed that our great cities had been founded on these places, chosen by our so-called barbarian ancestors, and quoted Edinburgh, with Arthur's Seat as the place of worship, and Holyrood as the site of habitation, in illustration of his views.

Mr. Phené also read a paper *On an Expedition for the special Investigation of the Hebrides and West Highlands in search for Evidences of ancient Serpent Worship*, and assigning to this worship the shape of many mounds he had examined in Scotland. This paper caused an animated discussion, in which Mr. Boyd Dawkins remarked that there was no invariable relation between the sites of ancient habitation and the neighbouring hills, such as Mr. Phené had inferred. The dwellers in Britain, before the arrival of the Normans, lived in hut circles, placed sometimes on the tops of hills and at others in the bottom of valleys, but in all cases they chose a soil though which the rain-water could easily pass. This was obviously the result of their not wishing to be flooded by the rains of winter. We know next to nothing, he said, of their habits and modes of life, but the remains of the animals round their habitations proved that

they lived on their flocks and herds as well as by the chase. The presence of querns, also, showed that they were pastoral. Besides the ox and horned sheep and the pig, they ate fox, wild cat, and horse, and even the dog, and, to speak in general terms, any other animal they could get hold of. About their religion or symbolism nothing was known.

Dr. Archibald Campbell said he had seen a great deal of serpent worship in India, and on returning to his native Highlands, he had made numerous inquiries as to the traces of serpent worship there, but none of the people he had asked could give any clue.

Dr. Grierson remarked that he did not consider Mr. Phené had brought forward any evidence to prove there had ever been serpent worship in Scotland.

Colonel Lane Fox observed that Mr. Phené had undertaken his expedition in regard to serpent worship with a foregone conclusion, and the result had been that he had rather disproved his case than otherwise.

The third paper was given by Mr. C. Wake *On Man and the Ape*. He opened his communication by referring to the physical agreement of structure between man and ape, and argued that the latter animal equally possessed the power of reasoning, and affirmed that man had no mental faculty other than the ape possessed. This paper also led to a hot discussion in which Canon Tristram, the Rev. Mr. Brodie, Rev. Mr. Goodsir, and others joined. Mr. Conway thought that Mr. Wake had been accused of using words such as "nature" and "evolution," which were incapable of definition, but, on the other hand, the department had heard bandied about such words as "creation," equally incapable of definition. The idea that something was produced out of nothing was just as vague an idea, he contended, as that of "nature" or "evolution."

Prof. Struthers, as a person accustomed to dissect men and quadrupeds, said that apes were very like ourselves. He had always regarded this man and monkey question as a very small one, he meant to say, it was only part of a much larger question. If similarity of structure was to prove origin, they must take in a very large portion of the animal kingdom, all made on the same general plan. He looked upon the theory of evolution simply as an hypothesis. He did not think that facts would at present warrant a belief one way or the other, though at the same time there were parts in the human body which we could not understand on the theory of man having been an independent and original creation. We had within our bodies structures which have no function, and which cannot be explained without going down to the lower animals. He did not say they had sprung from them, but he affirmed the question was not one to be bundled out of doors in the way desired by some reverend friends. He should like to say to his theological friends that scientific men did not, in the examination of these laws, shut the Creator out, it was only the *modus operandi*, the mode of proceeding, which was the subject of inquiry.

Mr. G. Harris read a paper *On the Hereditary Transmission of Endowments and Qualities*.

Dr. Charnock and Dr. Carter Blake contributed a paper *On the Physical and Philological Characteristics of the Wallons*, showing that the ordinary Wallons stood in a similar relation to Belgium to that which the Irish peasant did to the "Sassenach" of England. As evidence of their peculiar character, a Wallon would drag a pig from Namur to Ghent, or even to Bruges or Antwerp, in order to gain a few more sous than he could in his own district. The Spanish armies in the Pay-Bas were made up of Wallons. A special mental and moral character might be predicted of the Wallons of each district. The language was a spoken, not a written one, the pronunciation differing in different localities.

Mr. G. Petrie read a paper *On Ancient Modes of Sepulture in the Orkneys*. He said sepulchral mounds were there very frequent, generally on elevations. The skeletons were often discovered in a sitting posture. Mr. Flower remarked that the sitting posture of the skeleton was an interesting discovery, as it had been observed in every country in Europe, as well as in Peru, India, and Africa. Herodotus, in his account of the *Autocthones*, a people inhabiting what is now the province of Tunis, shows that they always placed their dying friends in a sitting posture to await their last hour, and it seems that they so buried their dead, as they were now found in the old African sepulchres in the same position.

The next paper was a communication received from Mr. J. Wolfe Murray, *On a Cross traced upon a Hill near Peebles*.

SECTION E.

Most of the papers in this section were purely geographical, having but little reference to Natural Science. Among the most interesting read on the first day, August 3, was one by Mr. Clements Markham on *The Somali Coast*, contributed by Captain Miles. The paper contained some interesting information in reference to the trade in gum and aromatic spices, as it has been carried on by the natives from ancient times. Mr. D. Hanbury, alluding to a statement in Captain Miles's paper, that in ancient times frankincense was held to have come from Arabia, and from the adjacent coast of Africa, said that, while this was the case, they were taught in all the books that had appeared on the subject in the latter part of the last century, and in the whole of the present till within the last few years, to believe that frankincense was a product of India. It was very desirable to have information on this highly interesting subject. With regard to the different species of gum trees, their information was very poor, and as to myrrh it was even more so. Much had been written as to cinnamon, early authors holding that it was a production of Africa and Arabia. It was a very interesting question, and one which required elucidation, whether the cinnamon mentioned in Holy Writ was the production of Africa and Arabia, or whether it was merely carried thither from India, or from the still remoter regions of Siam and China by way of commerce, and whether in that way the idea was promulgated that it was produced in the land and districts from which it was shipped, by way of the Red Sea, to Europe.

Mr. Clements Markham also read a paper contributed by Captain Elton, on *The Limpopo Expedition*. Captain Elton, who was formerly an officer on Lord Strathnairn's staff in India, undertook the expedition for the purpose of discovering whether the river was navigable to the sea—a point of great importance, on account of the discovery of gold on the banks of the Tati, one of the upper tributaries. Capton Elton's canoe was wrecked, and his journey, amounting to upwards of 900 miles—had to be completed on foot.

One of the most valuable papers in this section was one by Dr. J. D Hooker, descriptive of the botanical features of *The Atlas Range*, the main features of which we have already chronicled. Dr. Cleghorn stated in the discussion which followed, that, like everything else done by Dr. Joseph Hooker, this investigation had been carefully and thoroughly carried out, and a great desideratum of botanical knowledge had been obtained. The absence of primroses, gentian, and anemones was most remarkable. The observation on the exhausted condition of the forest was also noteworthy.

Commander A. Dundas Taylor, late of the Indian Navy, contributed a paper on *The Proposed Ship Canal between Ceylon and India*. With the Alderney and other British Parliamentary harbour discussions before the eyes of their understanding, permission, he thought, might perhaps be readily accorded to a student of thirty years in Indian hydrography to bring before the Association his views concerning the proposed scheme. After giving a sketch of the various projects that had been put forward for making a navigable passage between Ceylon and the Indian continent he proceeded to say that the project for deepening the Paumben Passage for large ships had been set aside by its own advocates in favour of the Port Lorne scheme, which had such remarkable advantages as to claim the attention of the Governments and mercantile communities of Bengal, Madras, Bombay, and Ceylon. An interesting discussion followed, in which the President and Sir E. Belcher joined.

The next morning the first paper was one by Mr. E. H. Palmer *On the Geography of Moab* A grant of 100*l.* was made by the Association last year, on the recommendation of this section, to promote the exploration of Moab, and though that grant had not been sufficient, and in consequence the exploration had been deferred, Mr. Palmer's paper explained what was already known of Moab, and what had been previously done in its exploration.

Captain H. R. Palmer, R.E., contributed a paper *On an Acoustic Phenomenon at Jabel Nagus*, in the Peninsula of Mount Sinai; and Dr. Ginsburg made a verbal communication in reference to a treatise *On Farther Disclosures of the Moabite Stone*. This treatise referred chiefly to the history of the stone.

On Saturday, August 5, a communication was read by Staff-Commander George, R.N., *On a New Artificial Horizon*. The old artificial horizon, with its roof, trough, and bottle of quicksilver, was bulky, heavy, and often very inconvenient to carry; while the

more convenient one with a folding roof is still open to the same objections as regards bulk, weight, and inconvenience. Yet an artificial horizon is an absolutely essential part of a traveller's equipment, so that any improvement in its construction is sure to be welcomed. Captain George's instrument is stated to combine all the advantages of the larger and more cumbrous horizon now in use, together with the additional property of securing observations at very low altitudes. The improvements are not confined to its reduced size and weight, but extend to its mechanical arrangements, form, and moderate price. The new horizon weighs 1¼ lb., while that now in use weighs 6¾ lbs. The self-replenishing horizon consists of two circular disc-like reservoirs, about 2½ inches in diameter, and three-quarters of an inch in depth, made of iron in one casting. One contains the mercury, and the other is the trough, fitted with a glass cover for observing. The discs are connected at their circumferences by a narrow neck, with a hole drilled through it, by which the mercury passes from one reservoir to the other, communication being opened or cut off by a stop-cock, without removing the glass cover, or running the risk of losing any of the mercury.

A paper by Major Basevi, *On the Minicoy Island*, was next read. Major Basevi, who is connected with the Great Trigonometrical Survey of India, visited the Island of Minicoy, with the object of comparing the intensity of gravity on an island station with that at inland stations in the same latitude. Minicoy is a small coral island, in shape somewhat resembling a crescent, and about 6½ miles long. The whole of the island is covered with cocoa plants, which are the chief source of wealth to the inhabitants, all of whom have their own trees—the rich as many as 2,000. The village of Minicoy is situated nearly in the middle of the island on the west side. It is half a mile long, and contains about 300 houses, built of coral rock, cemented with lime and thatched with palm leaves. The result of Major Basevi's observations on the Island of Minicoy was the conclusion that gravity on the coast is greater than inland, and at an ocean station like Minicoy greater than on the coast. It was already known that at inland stations gravity appeared to be in defect of that observed at coast stations in similar latitudes; and, by including the ocean station of Minicoy in Major Basevi's series, a confirmation of the law has been obtained.

Captain A. Pullan contributed some notes *On British Gurhwal*, where he had been employed for four years on the Trigonometrical Survey; and Mr. Samuel Mossman a paper *On the Inundation and Subsidence of the Yangtze River.*

Mr. Clements Markham read a report *On Badokshan*, by Bandit Manphul; and a description of a journey from Yassin to Yarkhand, by Ibrahim Khan. The most interesting feature in connection with these papers was that they confirmed the surveys of the country made in 1838 40 by Captain Wood of the Royal Navy. Captain Wood, who is a native of Edinburgh, discovered the river Oxus, and for doing so was awarded one of the gold medals of the Royal Geographical Society. His surveys were ignored by Prussian and Russian geographers, but were now confirmed by the native travellers who have devoted their attention to the parts of the country in question.

The Rev. F. O. Morris contributed a paper *On Encroachments of the Sea on the East Coast of Yorkshire.* It was stated that on the average there had been a loss of land of from two to three yards every year—probably about 2½ to 2¾ yards per annum. If looked at in round numbers, the waste of land, at three yards in each year, would be found to be about thirty-nine acres between Spurn Point and Flamborough Head alone, or in a hundred years of 3,900 acres, which, at a value per acre of 30*l.* or 50*l.*, would represent a serious money loss of grain or other crops; or, taking the waste, as had been calculated, at one mile since the date of the Conquest (1066), the money value in that interval, at 30*l.* per acre, would be equal to 691,200*l.*, or at 50*l* an acre no less that 1,152,000*l.* Mr. Morris concluded by saying there was no doubt whatever that a sea-wall of roughly-hewn, or even unhewn, stones, laid on an angle of about thirty-five degrees, would for ever protect the land from encroachment.

SECTION F.

THE papers and discussion in Section F are scarcely of a nature to come within the range of a report in NATURE. Occasionally, however, they may well find a place, as when on the first day Sir John Bowring read the *Report of the Metric Committee* of the British Association. The Committee were much gratified at the large amount of information the Royal Commissioners had collected in regard to the metric system, but regretted that the Commissioners had not recommended a bolder course than the permissive legislation of its use. The Commissioners assumed there was no immediate cause requiring a general change in the existing system of legal weights and measures of the country for the purposes of external trade, but they had not sufficiently taken into account the bearings of the question on education and scientific workmanship, and the general economics of the nation. The committee admit that the full realisation of the advantages of the system must be the work of time, but all the more necessary is it to make provision for the same by *inserting in* any measure on the subject clauses fixing a time when the use of the new system will become binding. Pending the final settlement of this important question, the committee are gratified in finding that the Educational Code of this year for the first time prescribes that in all schools the children in Standards V. and VI. in arithmetic should know the principles of the metric system. The committee are convinced that the school is the proper place for initiating this useful reform, and urge that teachers should at once commence to introduce this subject in the schools. The committee have represented to the London School Board the desirability of introducing the metric system into its schools, and will correspond in a similar manner with other school boards. In order to diffuse information on the subject, the committee suggest that they should be re-appointed, with a grant of at least 75*l.* from the funds of the Association. After some discussion, the report was accepted—it being understood that no opinion was expressed on the compulsory question. On the same day the *Report of the Committee for the Tabulation of the Census* was read by Mr. Fellowes. It stated that various suggestions had been made to Mr. Bruce, with the view of having the returns from the various parts of the kingdom tabulated in one uniform method, and the committee had reason to believe that the recommendation in their memorial would ultimately, to a considerable extent, be adopted by Her Majesty's Government.

After the reading of Mr. Fellowes's paper *On a Proposed Doomsday Book*, giving the value of the Governmental property, as a basis for a sound system of national finance and accounts, Mr. T. J. Boyd, master of the Merchant Company, read a paper *On Educational Hospital Reform; the Scheme of the Edinburgh Merchant Company.* The object of this paper was to illustrate, from what had been done by the Merchant Company in recent years, the manner in which similar foundations might increase their usefulness and extend the benefits contemplated by the founder.

On the following day Col. Sir J. E. Alexander read a paper *On Sanitary Measures for Scottish Villages.* Among the evils pointed out as existing in these villages were the overcrowding of cottages, the system of "box-beds," in which father, mother, and children might often be found huddled together, the built-in windows quite incapable of being opened, the general want of air and ventilation, and the proximity of cow-sheds and pig-sties. The writer showed how ministers, surgeons, schoolmasters, and employers might promote the welfare of the people by inculcating the laws of health, and promoting a taste for pure and innocent recreations.

One of the most interesting episodes in this section occurred on Saturday, when the reading of a paper by Mr. George Smith, *On Indian Statistics and Official Reports*, gave occasion to the following remarks on Indian education by a native Hindoo, Mr. A. Jyram Row. A great element in the success of the schemes for the better education of the Indian population was the nature of the education which must in future be given to the natives of India. At present it was certainly of a character calculated to do a great deal of good, but at the same time it was restricted to English literature and mathematics. Now, the mere reading of Shakespeare, and the mere cramming of a few propositions from Euclid, would never enable people to embrace large questions of speculative and scientific interest, which alone could be expected in the end to lead to any practical result. Without such an education these statistical schemes would seem at first sight to have nothing to do with anything that was practical, unless it were (as some people supposed) that they merely had reference to the imposition of a poll-tax or some such thing. They could not see (and it was not to be expected that people unaccustomed to scientific questions and the bearings of each department of science upon the solution of problems entirely unconnected with the department could see) that such schemes would be of the highest consequence towards the material welfare and progress,

not only of Hindostan, but of every nation on the globe. Therefore, he was of opinion that such an influential body as the British Association would do well to exert its influence in obtaining for the natives of India a more thorough scientific education.

The time of this section on Monday, August 7, was chiefly occupied by debating the administration of the Poor-law Reformatories and kindred subjects not suited to our columns. In a paper on the *Scientific Aspects of Children's Hospitals*, Dr. William Stephenson endeavoured to show how far their general management tended to promote the twofold object for which they were called into existence—namely, the relief of the children of the poor and scientific instruction in the diseases of children—and what external causes were at work to check the full development of the influences they exerted. He pointed out the importance of such institutions as the Sick Children's Hospital, in the way of extending the knowledge of the diseases of children among students of medicine, and also in the way of training nurses both for the hospital and for the family.

On Tuesday, the paper which excited the greatest interest and most animated discussion was by Miss Lydia Becker, *On some Maxims of Political Economy as applied to the Employment of Women and the Education of Girls;* and this was followed by one on *Naval Efficiency and Dockyard Economy*, by Mr. Charles Lamport, and by others on *Land Tenure and the Assessment of the Poor*, concluding the business of this section.

SECTION G.

On the opening day of the Association, Mr. Thomas Stevenson, C.E., in introducing the subject of a *Proposed Automatic Gauge for the Discharge over Waste Weirs*, said that in order to ascertain the amount of available rainfall, which was so important in questions of water supply, it was necessary to gauge the quantity of water which escaped at the waste weirs of reservoirs. Observations made only once or twice a day could not supply the information. He proposed to place a tube perforated vertically with small holes, the lowest of which was on a level with the top of the waste weir, so that whenever water passed over the weir, it also passed through the holes in the tube. The water was collected in a tank capable of holding the discharge for a certain number of hours. The quantity so collected was a known submultiple of what passed over the weir. The discharge through the holes was ascertained by experiment.

In the discussion which followed, different views were expressed as to the practical value of Mr. Stevenson's proposal, which was, however, favourably regarded by Prof. Rankine.

A paper on *A New Form of Salmon Ladders for Reservoirs* was read by Mr. Alexander Leslie, C.E. The new form of salmon ladders for reservoirs of varying level, a model of which was exhibited, contemplates that on all occasions the whole outflow required to run down the stream should be through only one sluice at a time, and over the top of that sluice, which would open by lowering, and shut by being raised, except in extreme floods, when, for the sake of keeping down the level of the lake, so as to avoid flooding the adjoining lands, or when from any other exceptional reason, such as an accumulation of ice, it may be necessary to provide a lower outlet or the means for a more rapid discharge. Assuming the rise of the lake to be 12 feet, and that it is full, or up to the level of the waste weir, the uppermost sluice is opened, so that the water may flow over it to the depth of, say, from 9 to 12 inches, and then run down the inclined plane of, say, 10 feet in width, composed of a series of pools formed by stops reaching quite across from wall to wall, the fall from surface to surface of those stops being 18 inches, and the depth of each pool being not less than 3 feet. The fish may then easily leap over the successive falls, seven in number, after which they must take the last leap over the sluice into the lake, the last leap being at first like all the rest, 18 inches, but diminishing in height as the level of the lake is lowered, till at last it is nothing, when the level of the lake comes to be the same as that of the pool. The paper went on to describe the process of the working of the machine when the lake gets too low to give the requisite supply of water over the top, and concluded by stating that it would be preferable not to make the ladder above 18 inches. On that point, however, the author did not offer any decided opinion, but left it an open question.

The next paper was by Mr. R. A. Peacock, C.E., Jersey, on *A Chain Cable Testing and proposed New Link*. The paper proposed to provide a new testing link, which, it was believed, would be found useful in various ways. The following is a description for a cable of which the metal would be one inch in diameter:—Let the cable manufacturer provide himself with a number of plates of rolled iron, of the same quality as the cylindrical bars of iron of which the ordinary links are made. The thickness of each plate is to be equal to the diameter of the bar from which it is provided. Eight links will have to be punched out of the plates by means of a steam punch. One new link, when filed half round, will be placed longitudinally at each extremity of the cable, with which it will be connected. A new link, after being filed as aforesaid, will be inserted longitudinally at every fifteen fathoms in each cable, so as to form a part or parts of the cable; and each cable being about 150 fathoms long, will require eight new links.

A paper *On Road Steamers*, by Mr. R. W. Thomson, Edinburgh, was read by Mr. Miall. In the outset, the paper alluded to the importance of road steamers and the difficulties which had been encountered in arriving at the present stage of perfection with these machines. A uniformity in the working of the engine having been reached, a thick carpet of india-rubber for the tires of the wheels was introduced, which much improved the running on roads. These india-rubber tires not only completely prevented hard shocks to the machinery, but saved the road from the grinding action of the iron wheels which was so injurious to by-ways. There had been serious objections made to the use of these engines by people interested in the roads, but the author could assure them that the india-rubber tires actually improved the roads. The paper went on to refer to rigid tires as used for road steamers, and stated that the amount of adhesion obtained by this tire was much less than by the india-rubber kind. The latter kind took a firm hold of the road, whatever might be the nature of the surface. The only ground upon which india-rubber tires did not work well was where the soil was extremely wet or of a very soft nature. For farm work the wheels of the engine required a much thicker coat of india-rubber.

Mr. Robert Fairlie read a paper *On the Gauge of Railways*. The author argues for the narrower gauge, and says:—Experience has shown that 3ft. 6in. can be made a highly economical and efficient width, but it does not by any means follow that it is the most serviceable and most efficient, any more than it follows that the accidental 4ft. 8½in. was all that could be desired, even though an Act of Parliament had made it an article of belief. On the contrary, as our knowledge and experience increase, we are enabled to approach more and more nearly to that happy mean on either side of which is error. While, on the one hand, there is every necessity for obtaining such a gauge as will afford a good and useful width of vehicles, on the other it is necessary to avoid such narrow limits as would necessitate the introduction of too great overhang on each side of the rails. The 3ft. gauge appears to me to comply with all the necessary conditions better than any other, and it is from no mere theorising that I lend all the influence I have towards its adoption. There is a certain amount of saving in first cost as compared with the 3ft. 6in., not a large amount, but worth considering. This, however, I leave out of the discussion for the present. The all-important matters are to place upon the rails a thoroughly efficient stock that shall possess a maximum of capacity and a minimum of weight, and to supply engine-power under the most economical circumstances, and I hold it to be easier to accomplish these objects on the 3ft. gauge than upon any other. I am led to this conclusion both by a comparison of the actual work done on the railways of the 3ft. 6in. gauge, with that which can be accomplished with the 3ft. gauge, and because, having in view the practical requirements of goods traffic, I find that I can obtain an ample floor area with less dead weight than can be secured by any other width; on a wider gauge the dead-weight increases, on a narrower one the capacity diminishes. He quoted figures to show that to carry 50 tons of goods on the Norwegian or Queensland 3ft. 6in. gauge, the proportion of one ton per waggon being preserved, 92 per cent. of the weight of rolling stock used on the 4ft. 8½in. would be required; as against only 43 per cent. on a 3ft. gauge, showing a saving of 47 per cent. on the latter as compared with the 3ft. 6in. Of course, if the waggons were loaded up to full capacity, these percentages would be very much changed. It is to this point especially that I wish to direct your attention, as upon it the economy of the 3ft. gauge rests. Whatever saving may be effected in first cost may be lost sight of, the great advantage lying in the saving effected in working expenses. Every ton of dead weight saved goes towards securing the prosperity of the line, and if we can obtain the ample platform which the 3ft. gauge gives, combined with so much saving in weight, nothing is left to be desired.

A paper *On a New System of Warming and Ventilation* by Mr. J. D. Morrison, was read. The main features of the system consist in so circulating fresh air through a warming chamber into the room, and foul air through the fire into the chimney, that all local currents are resolved into one, which forms an upper warmer current from the fire to the opposite wall, and an under colder current from the wall back again to the fire, when, after supporting combustion, the products escape up the chimney. The vacuum thus produced by the warmer current through the chimney creates the now colder current from the atmosphere, which, passing through the heating chamber, supports the respiration of any number of persons.

On Friday, August 8, Mr. A. E. Fletcher, F.C.S., read a paper *On the Rhysimeter*, an instrument for indicating the velocity of flowing liquids, and for measuring the speed of ships through the water. The principle on which it is constructed resembles that of the anemometer, recently brought into notice by Mr. Fletcher, by which he is able to measure the speed of hot air, flame, and smoke, contaminated with dust or corrosive vapours, as met with in furnace flues and factory chimneys. Both in the anemometer and in the rhysimeter, the impact force of the current, and also its tendency to induce a current parallel with itself, are measured and made to become indicators of the force and velocity of the stream. The apparatus is very simple. A compound tube with two orifices at the bottom, one of which faces the source of the current, while the other faces the opposite direction, is held in the stream, and communicates by tubes with the indicator where the pressure is measured by columns of ether, water, or mercury, according to the circumstances of the case. When used to measure the velocity of a brook or open stream of water, the speed at any depth or at any portion of its surface can be separately estimated. For taking the speed of water in pipes it is only necessary that there should be suitable cocks screwed into the pipes at the required places; through these the "speed-tube" of the rhysimeter passes without allowing any escape of water, whatever may be the pressure. A still more important application of the instrument is to measuring the speed of ships. Here the speed-tube pierces the bottom or side of the ship, and projects a few inches into the water outside. The indicator may be in the captain's cabin. It resembles in size and appearance a barometer. In it a column of mercury indicates continually the speed of the ship. The full effect of the velocity is imparted to the mercury, without loss by friction or otherwise, so that the indication must always be absolutely correct. The instrument may be made self-registering, showing by a dial the total number of knots the ship has run since she left port, and marking on a sheet of paper the speed attained at every portion of the time. This permanent register may, in many cases, be of the greatest value. The paper was illustrated by diagrams, and by tables showing the velocities in knots per hour, or in feet per second, for the various heights of the columns of water or mercury.

Admiral Sir Edward Belcher said the principle was very valuable, but he did not see the necessity of passing the tube down so far below the water. He thought one or two inches would suffice.

Prof. Rankine said the principle of the instrument was an old one, and the author, he believed, admitted this. Mr. Fletcher had overcome a series of inconvenient and difficult details, and had produced an instrument which had actually been applied to practice with satisfactory results. He belived that the instrument would be a good substitute for the old log system of ascertaining the speed of a ship.

This section did not sit on Saturday.

SCIENTIFIC SERIALS

THE article in the *Quarterly Journal of Science* for July which will be most read, is by the editor, Mr. Crookes, "Experimental Investigation of a New Force," on which we have already commented. "The Dawn of Light Printing" gives a sketch of the early discoveries in photography of Niepce, Fox Talbot, and Daguerre. Mr. F. C. Danvers gives an account of the present condition of inventions for Pneumatic Transmission, with mathematical formulæ for the power obtained. Under the title "Where are the bones of the Men who made the unpolished Flint Implements?" Mr. Pengelly argues that we know so little about the effect of various climatic and atmospheric conditions on the bones of man and the lower animals, that it is rash to conclude, because human remains are not, as a rule, found associated with flint implements and animal remains in the bone caves, that therefore they cannot have been originally deposited along with them. He also cites a number of unquestioned instances in which the bones of man have been found in such situations, to all appearance contemporaneous with the animal remains. Even were such evidence entirely wanting, Mr. Pengelly considers the flint implements themselves absolutely conclusive proof of the contemporaneity of man with the mammoth and the extinct cave-animals. One of the most valuable and interesting articles in the number, though a short one, is entitled "A New Mechanical Agent: A Jet of Sand." Mr. B. C. Tilghman, of Philadelphia, appears to have solved the problem of cutting or carving, mechanically, hard substances, such as stone, glass, or hard metals, in an expeditious, accurate, and economical manner. He has shown that a jet of quartz sand thrown against a block of solid corundun will bore a hole through it one and a half inches in diameter and one and a half inches deep in twenty-five minutes, and this with a velocity obtainable by the use of steam as a propelling power at a pressure of 300lbs. per square inch. The apparatus used for grinding or cutting glass or stone is described in detail. By covering parts of the glass surface by a stencil or pattern of any tough or elastic material, such as paper, lace, caoutchouc, or oil paint, designs of any kind may be engraved upon it. In his abstracts of the Progress of Science, the editor now confines himself entirely to the physical branches.

THE *American Naturalist* for August contains no one very striking paper, though several of considerable interest. Dr. J. S. Billings contributes a mycological paper on the "Study of Minute Fungi," and Mr. A. S. Ritchie one, entitled "The Toad as an Entomologist," showing the very large number of insects which that animal destroys. On one occasion the writer found thirteen perfect insects in the stomach of a toad belonging to nine species, besides one elytron each of two others, and other vestiges of legs and wings. He concludes that the toad is of great service to agriculturists.—Prof. Lesquereux has an article on the "Mode of Preservation of Vegetable Remains in the American Coal Measures," an important article on vegetable palæontology; and Alexander Agassiz a short paper on "Systematic Zoology and Nomenclature," indicating the great importance of a correct system of nomenclature as an item in the history of zoology.

THE *Western Chronicle of Science* for July 1871. Edited by J. H. Collins, F.G.S. Nos. 1—7. Falmouth, W. Tregaskis.—We have much pleasure in noticing the first seven numbers of this local scientific periodical, and sincerely hope it will not be allowed to drop from want of subscribers, of which the editor complains. It should be encouraged by all lovers of scientific inquiry, not only in the western district but throughout the country. Its low price, only twopence, puts it within the reach of all, while at the same time a large circulation is required to make it pay. The seventh number contains an interesting paper, valuable both to architects and geologists, on the ornamental rocks of Devon and Cornwall, counties abounding in beds of vari-coloured limestone sufficiently hard to receive the polish of marble. The second is a most sensible and judicious paper on the duties of local societies. If the suggestions here made were carried out in all societies, an interest in physical science would soon become universal. Besides other matters, the number contains the results of the May examinations in science, so far as these concern the classes in the West of Cornwall. A large proportion seem to have passed in the various subjects, the total number of successful candidates being 69.

SINCE the commencement of the *Revue Scientifique*, it has continued much the same course as its predecessor the *Revue des Cours Scientifiques*. Seven numbers are now before us, containing among others, the following articles, besides reports of lectures or extracts from the proceedings of various learned societies at home and abroad:—Van Beneden on Commensalism in the animal kingdom, Ancient Churches by M. Ch. Contejean, Geographical distribution of the Balænæ by Van Beneden, Physico-chemical researches or Aquatic Articulates by M. Felix Plateau, M. Chauveau's Report on Science and Legislation in relation to the Cattle-plague in France, M. Claude Bernard on the Influence of External Heat on Animals, Accounts of the Life and Writings of M. Claparède and Prof. Payen, M. Pasteur's address, "Why France did not find superior men in the moment of peril," the addresses delivered at the Liverpool meetings of the British Association by Huxley, Tyndall, and Rankine, and reports of some of the sectional proceedings.

SOCIETIES AND ACADEMIES

BENGAL

Asiatic Society, June 7.—"Memorandum on the Total Eclipse of December 11 and 12, 1871," by Lieut.-Col. J. F. Tennant, R.E., F.R.S. In December of this year we have a Total Eclipse visible in Southern India. The duration is short, but in some respects the circumstances are very favourable, as the Line of central Eclipse passes over the Nilgherry Hills, where, I understand, fine weather may be confidently expected. In order to be prepared, I have computed carefully the Central Line across India, and have added the extent to which errors of the Tabular place of the moon may be expected to shift it. I hope to have before the Eclipse a knowledge of what errors may be anticipated in the Tables, and thus be in a position to choose a central spot, if it is worth making a change. The figures, however, show that this is not probable, the principal result of an error in Right Ascension being to shift the centre of the shadow along its path, the deviation from which would be corrected by a small error in the declination which could hardly be foreseen. The duration of the Eclipse will be small. At the Nilgherries it will be about two minutes, but this cannot, so far as I know, be as yet accurately predicted, from uncertainty as to the real diameters of the sun and moon, when free from the enlargement by irradiation. If the value of the moon's diameter deduced by Oudemans from Eclipses, be used with that of the sun obtained in the Greenwich Transit Circle, then I find the duration in the Nilgherries just two minutes. The data of the Nautical Almanac give two minutes seven seconds, and if I may judge from the result I got in 1868 the real duration will fall between these. Short as this time is, it is enough with an adequate preparation to produce some results of value. It is long enough to allow photographs to be taken of the Corona, as to whose structure there is more to be discovered. There seems now no sort of doubt that the Corona is not only a solar appendage, but is, as I stated in my report on the Eclipse of 1868, the comparatively cold atmosphere of the sun. This should be further spectroscopically examined. Observers have differed about the number and position of the faint bright lines they have seen, but it does not seem that any one has connected the variations with the position of the part examined. To do this appears urgently necessary, and there have been additions made to the spectroscope which will allow more than one portion of the Corona to be examined, and its lines recorded during the short time it is visible. There is another subject, too, of spectroscopic examination. Kirchhoff, in his theory of the solar constitution, supposed it surrounded by an extensive atmosphere consisting of metallic and other vapours, as well as gases, by the absorption of which the dark Fraunhöfer lines were produced. It has long been clear that there was no such extensive atmosphere, and some physicists have been satisfied that there is none such. Mr. Lockyer and his collaborateurs, though they have detected a great number of bright lines at the bases of the prominences, have never approached, so far as I know, the number of even the conspicuous dark lines, whose origin has, therefore, not been satisfactorily made out. At the Eclipse of December 22, 1870, however, Prof. Young, at the moment of obscuration, and for one or two seconds later, saw, as far as he could judge, every atmospheric line reversed, and this was confirmed by Mr. Pye. I have but the scant information of this point given in the Royal Astronomical Society's Council Report, but it is sufficient to show me why this has not been seen before by observers looking out for it, and also to make me feel the importance of verifying the observation. To understand why it has not been seen before, it must be considered that the image of a bright object in the focus of a telescope when relieved against comparative darkness is enlarged by a phenomenon known as irradiation; the light encroaches on the darkness. The sun thus appears larger and the moon smaller than the real size. This continues till the real contact of the limbs internally; at this moment the thread of light, which previously had considerable width, appears suddenly broken and vanishes in a total eclipse; while in the transit of a planet or annular eclipse there appears the "black drop" of the observers of the Transit of Venus in 1769. At page 16, vol. xxix, of the monthly notices of the Astronomical Society will be found some figures illustrating this phenomenon in a planetary transit. When we are dealing with so thin a stratum surrounding the true photosphere, we cannot see it in sunshine, as it is lost in the irradiation (it *may* be partly visible in very large telescopes where the irradiation is very small), and we are very apt to lose it at the moment when the sun disappears, for it is found only between the places where a moment before the sun and moon's limb appeared, so that the observer following either of them might well miss it. In the search for and verification of this important observation, the duration of total phase can matter little. I have been in communication with the Home Secretary on the subject of observations of this eclipse, and my views, I may say, have been most cordially received. I am not yet in a position to submit a proposition officially, but I have great hopes of being able to do so in a few days.* I may just mention that in plotting the shadow track on a map it is necessary to allow for the error of its zero of longitude, a precaution often forgotten. The longitudes of the G. T. Survey require a correction of 3'-2·7", and those of the Atlas of India one of 4'-11" to adjust them to the accepted longitude of Madras.

The President was very glad to learn from Colonel Tennant that the Government is likely to sanction a scientific expedition to the Nilgherries on the occasion of the total eclipse in December next. The objects to which Colonel Tennant proposed to direct observation were, he need hardly say, of very great scientific interest and importance. The spectroscopic analysis of the Corona, so far as it had yet been effected, had been productive of no very certain results. The matter could not, however, be in better hands than those of Colonel Tennant. He only wished to suggest that those members of the Society, who might have the requisite leisure and opportunity, should, even with the unaided eye, endeavour to observe as carefully as possible the exact apparent shape and characteristics of the Corona. He believed that data of very considerable value might be thus obtained by persons who knew how to observe. Later in the evening Colonel Tennant kindly consented to draw up some short directions which might serve as a guide to members of the Society who might visit localities of the total eclipse.

PARIS

Academie des Sciences, Aug 7.—M. Faye in the chair. Notice was given of the death of M. Lecocq, a correspondent living in Clermont Ferrand, the author of valuable pamphlets and papers on the geology of Central France. M. Lecocq was, however, a very active and clever physicist, and started many theories of his own. He was a Professor in the University, and his loss will be very deeply felt by his friends.—Two different papers were sent describing a bolide which was seen on the 15th of August, and which is most extraordinary, as it was visible during twenty minutes by Marseilles observers. The course was most irregular and zig-zag. Leverrier supposed that two different bolides might have been seen at Marseilles and at the other stations, as the descriptions do not agree. The fact of remaining visible during so long a time at Marseilles is astonishing, and M. Leverrier is at a loss to account for it. The phenomenon will be more fully investigated. This is also the case with a paper sent by M. W. de Fonvielle, describing the fall of a thunder-bolt on August 3, $3^h\ 19^m$, on the kitchen of a convent situated in Paris, at 250 yards from the National Observatory, where the astronomers felt a great shock. A gas-burner was lit under very curious circumstances. The explosion was very long and very strong, and it is supposed the lightning was shaped like a sphere falling from the clouds. M. Dumas showed the interest of elucidating a phenomenon of so much importance for public safety, as ignition of gas may be the secret cause of many fires. The committee is composed of M. Dumas and M. Jamin, professor to the Sorbonne. Special experiments and inquiries will be made at the expense of the Academy. M. Fonvielle will be an auxiliary member of the committee.—M. Delaunay read a paper on the Observatory during his administration, and showing that observations of small planets will be made with greater zeal than on former years.—A letter was read from M. Angström, the Swedish physicist, maintaining that each gas has its own spectrum in spite of the differences exhibited by previous experiments. The learned physicist shows that in each case where differences were found, it is possible to explain it by extraneous matters, mixed with the substance submitted to the experiment. The importance of this memoir is obvious.—M. Bert, who was formerly the Prefect of the North during the investment of Paris, sent a paper on the death of fishes living in fresh water when immersed in sea water. These fishes are literally suffocated by a singular effect of desiccation, the exosmose is very active, principally when their skin is clothed with large scales. The phenomenon is quite extraordinary when observed on frogs, which lose the greater part of their weight, and are almost as much dried up as if they had been salted alive.

* This has since been done.

M. Bert will examine the action of fresh water on sea-fish, which is not so rapid. These sea-fish are too heavy for fresh running water, and are found generally to remain at the bottom of the water. On the contrary, fresh water fish always swim at the top of salt water.

NEW YORK

Lyceum of Natural History, Oct. 24, 1870.—In a paper read at this sitting the author observed:—In the sequence of events included in our Drift period there is a marked break, a middle period, during which, over most of the north-western states, no Drift deposits were made, and when most of this area was covered with a forest growth and sustained many and large animals. At a subsequent period, all parts of this area, less than 500 feet above the highest of our present great lakes, was submerged, and most portions of it covered to greater or less depth, with new Drift deposits, clays, sands, gravel and boulders, a large part of northern and remote origin. Nearly all the large boulders of the Drift belonging to this later epoch are sometimes of great size (100 tons) and have been *floated* to their present positions, as they overlie undisturbed stratified sands and clays, which would have been broken up and carried away by glaciers or currents of water, moving with sufficient velocity to transport these blocks. Hence they must have been floated from the Canadian highlands, the place of origin of most of them, by *icebergs*. This epoch of the Drift period I have therefore termed the Iceberg Epoch. During this epoch the submergence of the land in the interior of the continent, was greater than in the epoch of the deposition of the Champlain and Erie clays, and all the area north of the Ohio was covered with water up to a height of over 500 feet above Lake Erie, or 1,100 feet above the ocean level. The highlands of south eastern Ohio, and most of the country south of the Ohio river, were not covered by this flood, and now bear no drift deposit of any kind. Tracing out the line of ancient water-surface, we find that the depression was greater towards the north, so that the Alleghanies and their foot-hills, and also a wide area of comparatively low country in the Southern states, formed not only a shore, but a continental limit to the great interior iceberg-ridden sea of the later Drift Epoch. In the western reaches of this sea, which was of fresh water, in the later centuries of its existence, was deposited the Löes or "Bluff" which I have elsewhere designated as the later lacustrine, non-glacial drift. During the deposition of the Löes the interior sea was already narrowing and growing shallower by the cutting down of its outlets, or by continental elevation, or both. The descent of the water-level and decrease of water-surface have been going on perhaps constantly, but not uniformly, to the present time, when the area of the great lakes is the insignificant 85,000 square miles it now is. In the descent of the water-level, retarded at certain periods, terraces and beach lines were formed at various places by the shore waves. With these history ends. This then is the classification I would suggest of the drift deposits as they occur in the valley of the Mississippi, premising that here, as in other geological periods, the column is nowhere absolutely complete:—

PERIOD.	EPOCHS.	STRATA.	NOTES.
Quaternary.	Terrace.	Terraces, Beaches, Löes.	Sand and gravel beaches with logs, leaves, and fresh-water shells. Löes with fresh-water and sand shells.
		Iceberg Drift, Löes.	Boulders, gravel, sand, and clay, drifted logs, elephant and mastodon teeth and bones.
		Forest Bed.	Soil-peat with mosses, leaves, logs, stumps, branches, and standing trees, mostly red cedar. Elephas, mastodon, castoroides, &c.
	Glacial.	Erie Clays.	Laminated clays with sheets of gravel, occasional rounded and scratched northern boulders, many angular pieces of underlying rocks.
		Glacial Drift.	Local beds of boulders and rarely boulder clay resting on the glaciated surface.

From the above table it will be seen that the remains of elephant, mastodon, and the gigantic beaver, occur in the forest-bed and in all the succeeding drift deposits. It should also be said that they are found in still greater abundance in peat-bogs and alluvial deposits which belong to the present epoch. We have seen that the submergence of the later drift epoch, though so wide-spread, left a large part of the area lying between the Mississippi and Atlantic uncovered. This area the elephant, mastodon, great beaver, &c., inhabited during the continuance of the flood that covered the forest bed. From this retreat they issued with the subsidence of the water, following the retreating shore-line, till they occupied all the region now exposed about the great lakes. By what influence they finally became extinct, we cannot yet say. It has been claimed that they continued to exist down to the advent of man, and that he was an agent in their destruction. This statement may be true, but requires further proof before it can be accepted with confidence. The vegetation of the forest bed indicates a cold climate, thus confirming what we had otherwise learned of the habits of the extinct elephant. He was clothed with long hair and wool, was capable of enduring, and probably preferred a sub-arctic climate, and was associated in this country as in Europe, with the musk ox and the reindeer. We may therefore infer that a progressive increase in the annual temperature, drove most of the animals of the Forest-bed northward, and caused to gather on the shores of the Arctic sea, the herds of elephants whose remains so much impress all travellers who visit that region. This was probably the scene of the last vigorous and abundant life, and of the death of the species; an event consequent, perhaps, on the action of local causes, which we shall comprehend when we have opportunities of studying the record. One remarkable statement in regard to the Forest-bed requires notice. In more than one instance, parties digging wells in South-Western Ohio, have reported not only that they found a black soil and logs, but that "some of these logs bore marks of the axe, and were surrounded with chips." These stories I formerly rejected as pure fabrications; but in the light of recent observations, they seem to me to be in part true, and not difficult of explanation.

BOOKS RECEIVED

FOREIGN.—(Through Williams and Norgate)—Skandinaviens Coleoptera Synoptiskt Bearbetade, vol. x: C. G. Thomson.—Medicinische Abhandlungen: E. Reich.

PAMPHLETS RECEIVED

ENGLISH.—Journal of the Chemical Society, second series, vol. ix.—The Seat of the Soul Discovered: [J. Gillingham (F. Pitman).—Notes on the Antechamber of the Great Pyramid: Capt Tracy, R.A.—Proceedings of the Essex Institute, vols. i. to vi.—Bulletin of the Essex Institute from the commencement to August 17, 1870.—Instructions for the Prompt Treatment of Accidents, &c.: A. Smee.—Accident Insurance Company, a Year's Claims, 1870.—Journal of the Iron and Steel Institute, No. 3, vol. ii.—The Manufacture of Russian Sheet Iron: Dr. J. Percy (John Murray).

AMERICAN AND COLONIAL.—Transactions of the Entomological Society of New South Wales pt. 2, vol. ii.—The American Gaslight Journal.—Transactions of the Academy of Natural Sciences of Philadelphia, parts 9 and 10.—Proceedings of the Albany Institute, vol. i., part 1.—Memoirs of the Boston Society of Natural History, 1868-69.—Memoirs of the Peabody Academy of Science, vol. i., No. 2.

FOREIGN.—Les Mondes, Nos. 14 and 16.—Journal de Medicine et de Chirurgie, Nos. 3 to 6, 1871.—Giornale di Sicilia, No. 173.—Rendiconti, vol. iv., No. 14. Astronomische Nachtichten, No. 1856.—L'Institut, No. 1920.—Annals de Chimie et de Physique, vol. xxii., Jan. 1871.—Bulletin Hebdomadaire, 192. La Revue Scientifique, No. 8.—Allgemeine Bibliographie, &c., No. 32.—Sitzunsgberichte Gesellschaft der Wissenschaften in Prag, for 1870.—Zu Anatomie der Elephanten Schulderkrote: Dr. A. Fritsch.—Uber die Anzietung: Dr. A. von Waltenhofen

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