THURSDAY, OCTOBER 12, 1871

RECENT UTTERANCES

THE Oracle has spoken. In fact several Oracles have spoken. Let us take them seriatim. From the lips of two of the most enlightened members of the Cabinet we have had at last an authoritative expression of the desirability — nay more, of the absolute necessity — of scientific education for the country at large. Addressing his constituents at Bradford on Monday the 2nd inst. in a speech to which we have already alluded, on the occasion of the opening of the new Mechanics' Institute for that town, Mr. W. E. Forster, the Minister for Education, as he ought to be styled, made use of the following emphatic language :—" The old grammar-school teaching was almost framed upon the advantage that Latin and Greek well taught gave to the boys ; now, we find that the boys cannot do without the use of more general knowledge than is given by Latin and Greek ; that there must be a knowledge of modern languages. But there may be also a feeling that we ought to know something of the daily facts of life, and the rudiments of Science. There, again, I speak from a sense of my own want, and I have often thought how much more useful I might have been —at any rate, how much stronger I might have been—if I had had given to me a scientific education, such as I think we may now hope that our children will attain." And again : " We now believe that we have taken measures by which we may secure elementary education to all children of all classes in our borough, and throughout the country, and, consequently, those who attend this institution will have the foundation of a training that will enable them to fulfil the original idea of its promoters," that is, " to give mechanics scientific knowledge."

On the following day Lord Granville, the Secretary of State for Foreign Affairs, when presiding at the opening of the Dover College (intended to provide, at a very moderate cost, a first-class English and classical education), took the opportunity to make the following pertinent remarks :—" Then there is the study of Science in its different departments. I believe this to be eminently wise, and a matter to which parents in the present day attach very great importance. I believe the results of this branch of education are of considerable consequence; for after all, a mere smattering of education is of very little use in any department, but a really scientific mode of studying different branches of Science is one of the best and most useful instruments of education you can use. I remember reading a very remarkable speech, with most of which I agree, delivered by Mr. John Stuart Mill, on the difficulties of a comprehensive education. He said the study of Science taught young men to think, while the study of Classics gave them the power of expressing their thoughts. I own I have thought there is some little fallacy in the distinction drawn between the education taught in these two departments. I believe it is almost impossible for a man to study the ancient languages without himself acquiring great habits of thought, and I daresay you have all had opportunities of hearing some of the most distinguished professors, some now dead and others living, who have conveyed their thoughts to their audiences in such singularly clear and perfectly eloquent language, that I feel there is something in the study of Science which makes a man feel that in what he is talking about, he must eschew all redundant and irrelevant verbiage "

The significance of these outcomes is not to be mistaken, and Lord Granville's remarks are of none the less authority because he does not happen to be our Home Secretary. His knowledge of the state of education in some other European countries has doubtless made him all the more sensible to the lamentable defects of our own. Of the other leading members of the Cabinet, Mr. Gladstone is too far-seeing a man to oppose the manifest tendencies of the age, Mr. Lowe has shown himself ready to respond to every legitimate demand made on the public purse by the proper representatives of the wants of Science, and the Duke of Argyll is himself a writer on Science.

While we cannot but congratulate ourselves that our rulers are at length alive to the importance of making Science the base of all true education, a necessity we have so constantly and earnestly insisted on, we still cannot but inquire how it is that all this has been so long in making itself self-evident to our public men. In the same address from which we have already quoted, Mr. Forster pointed out that the original design of the founders of Mechanics' Institutes was to give a scientific education to the working classes ; but that they soon found that there was an almost universally spread absolute ignorance of even the most elementary facts on which a scientific education could be based. And yet all these years have been allowed to pass, and it is only yesterday, as it were, that any serious attempt has been made to provide a scientific education for the working classes. We are even surprised to find that the first advances made by teachers of science in this direction are met by an eagerness and enthusiasm which will soon outstrip the limited means at command to satisfy its cravings. In the higher strata of society it is the same; wherever the elements of science, natural or physical, are taught by a competent teacher, they are absorbed by boys and girls, and grown-up men and women too, with a zeal seldom bestowed on their Latin or Mathematics ; there is something in these studies which the human mind finds really to respond to its own instincts. If the next generation of Englishmen does not grow up with more than a smattering of the rudiments of science, it will be the fault of the present teachers of science themselves.

From men of high position but out of the Cabinet, who are clear-sighted enough to discern the wants of the age, we hear the same demands on every side. Sir J. Lubbock the other day, in addressing a meeting of working men at Liverpool, after delivering the prizes in connection with science classes, said that scientific men throughout the country unanimously regretted the manner in which the grants to elementary schools are distributed. Reading, writing, and arithmetic, although the foundations of education, are not education itself, and the schools will never be placed on a sound and satisfactory basis until they take a wider ground. And at the meeting of the Social Science Congress, held during the present week at Leeds, Mr. Joseph Payne, than whom no more practical authority could be found, read a paper on scientific teaching and the advantages of mental discipline for children, approving of the cultivation of the faculties of observation and experiment and direct training from nature. Science teach-

ing, and not literary teaching, he said, ought to be the basis of all other knowledge.

One of the best recent utterances on the relation of the State towards Science is contained in the address of Prof. Huxley, delivered at Birmingham on Monday last, as president of the Birmingham and Midland Institute. In this admirable discourse he spoke of the principles of governing, and the relation of the State to its members, in a manner which enables us to congratulate ourselves that Prof. Huxley is no longer among the advocates of the limitation of State functions. He repudiated the idea of the functions of a Government being confined to those of a protective constabulary. Adopting the definition that the end of Government would be the good of mankind, he said he took it that the good of mankind meant the attainment by everyone of all the happiness which he could enjoy without diminishing the happiness of his fellow-men. The pursuits in which pleasure and happiness could be enjoyed by all, with detriment to none, were those which ought to be smiled upon by the State. If it were beyond the province of the State to interfere directly in commerce and the individual relations of men, it might safely foster these indirectly. He urged that it was the duty of Government to take the initiative in promoting the teaching of Science, leaving local energy, as soon as it could be evoked, to develop the work. The State should understand that local scientific institutions such as those at Birmingham, Manchester, and Newcastle-on-Tyne do not benefit the locality alone, but the nation at large.

With regard to the effects of Government subsidies on private enterprise, Prof. Huxley clearly showed how baseless are the grounds of alarm on this head. There are those who maintain that the State has no right to do anything but protect its subjects from oppression, but even "accepting the proposition that the functions of the State might all be summed up in one great negative commandment, 'Thou shalt not allow any man to interfere with the liberty of any other man,' Prof. Huxley said he was unable to see that the consequence was any such restriction as its supporters implied. If his next door neighbour chose to have his drains in such a state as to create a poisonous atmosphere which he breathed at the risk of typhus and diphtheria, it was just as much a restriction on his just freedom to live as if his life was threatened with a pistol. If his neighbour were allowed to let his children go unvaccinated, he might just as well be allowed to leave strychnine lozenges about in the way of his (Prof. Huxley's) children. And if his neighbour brought up his children untaught and untrained to earn their living, he was doing his best to restrict his (the lecturer's) freedom by increasing the burden of taxation for the support of gaols and workhouses for which he had to pay."

There is nothing new in these utterances, nothing that was not obvious to thinking men years and years ago; but they are of the highest importance nevertheless, for we may now hope that their lead will be followed in our English fashion throughout the length and breadth of the land. It was wisely said not long ago, that one of the most certain ways to make the study of Science national would be to make Science itself fashionable. This is true, and we may now hope that this task will for the future fall on Cabinet Ministers and the like, for scientific men who attempt it are apt to become martyrs to the good cause.

THE LAWS OF POPULATION

1. *Population: its Laws of Increase.* By Nathan Allen M.D. (Lowell, Mass., 1870.)
2. *Physical Degeneracy.* By the same. (New York: Appleton and Co, 1870.)
3. *The Law of Human Increase.* By the same.

DR. NATHAN ALLEN, in three pamphlets, of which the titles are given above, discusses different aspects of a question of grave importance to American society, and indirectly to other societies also—namely, the comparative infecundity of that part of the population of the United States described as "native Americans." This fact, which seems pretty generally recognised, first came before Dr. Allen as a matter of personal observation, and he gives us more precise information from census returns. It appears that in the State of Vermont, for instance, the birth-rate even of the whole population, including the foreign element, is but three-fifths of what it is in England, while that of the strictly American population taken alone is estimated at only one-half of the English standard. This fact is the more remarkable, since, as Dr. Allen points out, "the comparison is between a people occupying the healthiest part of New England, engaged principally in agricultural pursuits, scattered in settlement, and a population situated as that of England is, living mostly in cities and thickly settled places, as well as composed largely of the extremes in society." Nor was it always so with the same race; for a hundred years ago the number of children under fifteen years of age was, relatively to the adult population, double what it is now. As regards the causes of this difference, Dr. Allen does not assign more than a secondary place either to emigration westward or to prudential considerations. He himself regards the physical weakness of American women, their inattention to the rules of health, and the over-straining of their nervous system, as the chief determining causes of the small number of children in a family. We have the usual complaints of tight-lacing, low dresses, in sufficient exercise, and so on, which have been urged by physical moralists in all countries; but more special evils are pointed out in "the excessive use of fine flour bread," and the overstrained intellectual education of girls. To the latter cause Mr. Herbert Spencer has already ascribed the same consequences. At all events the fact of general physical weakness in American women seems to be made out, and is curiously illustrated from one point of view by the estimate of a manufacturer, that more than seven million *feeding bottles* are annually sold in the United States. So many mothers are unable to nourish their offspring!

Dr. Allen further ventures on a general theory of population, which may be stated broadly thus:—That fecundity depends upon the perfect development or harmony of all the organs of the body. The principle thus stated is very vague, and the author cannot be called successful in his attempt to give it precision; but the subject is too large for discussion here. The practical counsels which he addresses to his countrywomen are valuable and judicious, but so long as large families are regarded with disfavour, advice in this direction seems little likely to meet with acceptance. More promising are his suggestions as to the origin of this sentiment. If it be chiefly due, as he implies, to

weakness of physical constitution, which causes women to dread the dangers of a large family, while "their delicate organisation breaks down in bringing into the world one, two, or three children," then undoubtedly greater physical vigour might remove some of the moral obstacles to increase of population. We cannot regard moral causes, or, in the words of an American writer, the "feeling that has grown up of late years with respect to offspring," as without importance. Is it possible, for instance, that certain circles of American society have come to resemble the Hungarians, in actually priding themselves on their small families? If any such feeling as this should exist, it is not likely to be expelled but by the supremacy of some stronger and nobler sentiment. Such might be found, one would have thought, in the sentiment of posterity, that pride in the destiny of their race, which occupies the popular imagination among Americans to a greater extent than in any other nation. Are the "native Americans" prepared to surrender the future of their country to foreign immigrants? This must be the case unless the tide should turn. At present, indeed, we hear only of a stationary not a diminishing population, and were such a community standing alone, it might do no more than realise the ideal "stationary state" of the Malthusian philosophers. But, unfortunately, the other elements of population are not stationary, and to stand still in the midst of growth is to be choked. Such a prospect can hardly be a matter of indifference to the race which is thus threatened with extinction; nor is it on several grounds without importance to the world at large. In the first place the New England Puritan stock is one possessed of many noble qualities which the world can ill afford to lose, and, secondly, it is hard to see where this process is to stop. If the influence of the *milieu* has reduced the descendants of a people so mentally and physically vigorous as the English colonists of the seventeenth century, to a state of infecundity and "physical degeneracy" (to use Dr. Allen's words), what are the prospects for later colonists, whether of English, Irish, or German descent? They will soon be "native Americans," and subject, as we must suppose, to the same laws of change. Is transplantation of a race, as Knox and others thought, impossible? This question is neither raised nor answered by Dr. Allen, but it is inevitably suggested by the gloomy pictures which he draws. His pamphlets, in spite of much repetition, and an occasional superficiality of treatment, are worth reading by those who are interested in the important problems which he discusses.

OUR BOOK SHELF

National Health. By Henry W. Acland, F.R.S., &c. (Oxford and London: James Parker and Co., 1871.)

DR. ACLAND'S pamphlet should be read in connection with the report of the Royal Sanitary Commission, of which he was a member, and some of whose recommendations have already been embodied in a Government measure. Not that it is intended as an exposition or defence of that report, but rather as an exposition of the general principles of sanitary legislation and reform. It would be impertinent to say that in knowledge and enlightenment Dr. Acland is on the level of his important theme, but we may point out as his special qualification for treating a subject of such complex relations, a certain comprehensiveness of mind, which does not allow him to leave untouched either the moral or the material, the scientific or the political, aspects of national health. We think it the more important to draw attention to this valuable quality because it is so often wanting in professional, perhaps especially in medical writers, and the want is so often a source of weakness. Dr. Acland does not forget, in treating of national health, the dependence of disease on poverty or of poverty on over-population; and insists strongly on the often-forgotten principles of Malthus. It is instructive to contrast the dangers he points out with the apprehensions of an entirely opposite kind entertained by Dr. Nathan Allen. On this side of the Atlantic we dread the results of too rapid multiplication; on the other side their fear is lest, among a certain class, this danger should have been too completely averted. But both would agree that the property of fertility does not always belong to those whom we should think best fitted to be the progenitors of the race to come. Dr. Allen laments the decay of the highly cultivated and intellectual New Englanders; while Dr. Acland, quoting Mr. Galton, points out the possibility of "the races best fitted to play their part on the stage of life being crowded out by the incompetent, the ailing, and the desponding," merely in consequence of a reckless system of early marriages. This very fact, we may remark, of the rapid multiplication of the "incompetent and ailing" is of itself fatal to the theory of population advanced by the American physician.

In his remarks on the regulation of public health, Dr. Acland shows the same breadth of view as in treating the more scientific aspect of the subject, and his wise, we might say, statesmanlike advice contrasts with the too absolute and inconsiderate claims put forward by some medical and sanitary reformers. It should never be forgotten that the power of seeing even the plainest evils cannot go beyond the general standard of public enlightenment, and that the power of removing them must be limited by the social and political conditions of the country in which we live. The following quotation appears to us to contain very sound advice:—

"Two things and two only remain to be done.

"First. To continue to interest intelligently the mass of the people in sanitary progress, and to interest them more systematically.

"England must rule herself in these as in all other matters. The time is gone when people can be dragooned into cleanliness and virtue. We hear that the middle class of England is inefficient, the guardians of the poor bad, and the working classes ignorant. If so they are still the people; they and their children pay the penalty of disease and of vice. Show them, truly and without exaggeration, the source of avoidable disease and of destructive vice; they will abate it. Bring the knowledge to their doors, they have heart and will; give the power by enactment, and the work is done.

"Second. To establish such a health department in the metropolis as shall with certainty appreciate the growing wants of the people, as shall bring in bills to meet their wants, and shall disseminate information and advice without stint to every part of the country."

LETTERS TO THE EDITOR

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

Local Scientific Societies

THE following statement appeared a short time ago in an article in NATURE. Throughout the country we find societies, field clubs, local museums, &c., all of which are more or less actively engaged in the pursuit of knowledge, local inquiries, or

explorations, &c., I fear this flattering description must have arisen from the writer not having a practical acquaintance with local societies.

In a society in the West of England, consisting of nearly 400 members, I know of but one who does anything for the local museum, or for the advancement of geological science. The society's principal results are archæological; geology and natural history are in the background. Another west country society is divided into innumerable sections, which have their excursions, and an occasional general excursion; but their results in the cause of science are as valuable as those of an ordinary picnic party. This description will, I fear, answer also very well for one with which I am acquainted in Sussex. In all these instances the local museums are such as might be expected from such apathy.

In too many instances the science of the scientific societies begins and ends with the name. There may, perhaps, be one or two members who are active, but feel little encouragement to do much for the public good, or in the way of contributing to the local museum. Of course these societies are composed in a great measure of members who take no interest whatever in science, and who join them without any definite object; but it is a pity that the public should be subjected to such a delusion. There are, of course, some few societies which are fortunately more active, and produce valuable results, but as yet I have seen no good local museum in connection with them, and that is a bad test of the practical nature of a society. I know of but one museum which at all answers the description of a local museum, and that is at Bath, which is due to the genius and energy of Mr. Charles Moore. But as long as members of local societies collect for themselves and not for the public good, their museums must remain at a stand still. Few have any idea of the valuable collections which are made, or the labour spent on their formation, by individuals who are indifferent as to what eventually becomes of them.

It is want of public spirit and self-complacency, which are the great hindrances to all progress. It is to be regretted that the Geological Society of London does not set more of an example to the provincial societies; it ought to exert an influence throughout the country, and take some interest in their progress. The state of the collections at Somerset House is certainly not an honour to any society.

The co-operation of local societies, and having their results published for the benefit of all, *might* have a great effect on the advancement of science A general contribution for the purpose of a weekly issue of British Journals of Science (in various departments), which should be common to all, would be a step of great importance. I know of no remedy for this state of ignorance and apathy as to the valuable results of which they might be capable, but such a co-operation, combined with a certain amount of union with the scientific societies of London, which might have the effect of keeping the provincial societies up to the mark. This must also be accompanied by a unity of object, as well as of system in the management and arrangement of their museums. F. G. S.

Newspaper Science

IN reply to the letter of "Medicus" in last week's NATURE, allow me again to state that the curious details as to Krupp's gun manufactory, with which the public were enlightened in the *Globe* of September 11, appeared in that paper as a leading article, and not as a mere "note-paragraph," as "Medicus," who "never writes articles," evidently desires to be understood. Had they been in the form of the ordinary newspaper paragraph, containing accounts of some wonderful discovery in zoology, chemistry, or mineralogy, such as, for example, some late ones on "the appearance of a gigantic lizard in North Wales," "the extraction of the fixed air from the pea sausage for use in the army," or the "abundance of platinum at Bathgate, in Scotland,' which I find copied into the *Times* of to-day, I should not have troubled the readers of NATURE with my letter of September 13.

When, however, we find such "blunders," to use "Medicus's" own word, whilst he admits at the same time that they "had passed the editorial eye," palmed on the public on the authority which should be due to the leading article of a highly respectable and largely circulated newspaper, I think it is high time to protest against technical science being popularised in this style; and *à propos* to style, the peculiarly pleasant and what would vulgarly but expressively be called the "chaffing" style of "Medicus's" communication to NATURE conveys to the reader the impression that its author is more at home in writing for penny newspapers than for scientific periodicals.

In conclusion, the perusal of the letter of "Medicus" will certainly remind metallurgists of the man who, when he felt his feet slipping under him in the water, brought himself altogether out of his depth by imprudent and convulsive struggles to extricate himself. The use of the French word "*creuset*" instead of the plain English "crucible," suggests a French source of information, and not the original German "Schmelztiegel" of Krupp's manufactory at Essen; and when "Medicus" corrects his text, and tells us it should read "the iron is alloyed in crucibles formed with certain clays and a preparation of plumbago" (!) metallurgists will still believe that it was steel not iron which is introduced into these crucibles, and doubt its being alloyed at all, but only melted in them; and will, moreover, be of opinion that if "Medicus" was at home in the subject on which he has been writing, he would have at once explained that when he unfortunately described the steam-hammer as "of the force of 25,000 kilometres" (in plain English, 15,532 miles), that the last word was simply a misprint for kilogrammes (so that the hammer was nearly 24¾ English tons), and not grasped at a straw in the shape of the far-fetched and in this instance equally misapplied term kilo*gram*metre! DAVID FORBES

11, York Place, Portman Square, London, Oct. 9

P.S.—If "Medicus" desires correct information as to the steam-hammers, &c., at Krupp's manufactory at Essen, he will find it in the recently-published official report of the Chamber of Commerce there, a short abstract of which is embodied in my fourth quarterly report (for 1871) to the Iron and Steel Institute, on the "Iron and Steel Industries in Foreign Countries."

The Cyclone in the West Indies

I THINK others besides me would be glad of an article in your paper on the Cyclone of the 21st of August in the West Indies. The narrow limits of the hurricane are noteworthy. I hear from the West Indies that Nevis, between Antigua and St. Kitts, has escaped, being a little to leeward. Has Saba escaped likewise? To windward Barbuda and Anguilla seem to have been also beyond the storm, as was also Virgin Gorda; the centre of the cyclone passing over St. Thomas (and, I presume, Tortola also) on its way to Porto Rico.

I have exact details only from St. Thomas, which I could, I think, put at the service of any one writing on the matter; but the principal fact in them is, that the main rush of wind, which did the damage, fell on the harbour from N.E. to N., destroying horribly all houses in the N.E. gully which slopes down to the harbour; but so turned right and left by the high hills above the town, that it was impossible for one in the harbour to discern the actual direction of the main current. This blast fell just before the central calm.

I trust that we shall have from some of your contributors somewhat which will throw more light on all hurricanes, from the lessons of this last.

Excuse the interest which one who knows those seas and islands—when he passed through them, blazing in beauty and repose—must needs take in the details of such a tragedy.

Eversley, Winchfield C. KINGSLEY

On the Solution of a certain Geometrical Problem

I REGRET that the work I referred to should have been so readily identifiable; still more, that Mr. Todhunter should think I intended to imply "signal geometrical weakness" on his part. I should imagine, on the contrary, that few living men surpass Mr. Todhunter in geometrical strength; though I may have inferred from some passages in his works that that special part of his mathematical strength had not been so fully developed by practice as his power in mathematical analysis.

It must be quite obvious to anyone who reads the whole of the appendix to Mr. Todhunter's Euclid, that sooner or later the series of problems on circle-contact (*i.e.* to Prop. 16) would require the introduction of the sixth-book method. This method is also very conveniently introduced in Prop. 7. But the omission of all mention of the third-book method* would certainly lead the student to infer that the sixth book must be employed. If it led me to infer that Mr. Todhunter happened not to know

* Especially as but three lines would be needed to indicate the method. Thus: From the given point A draw a perpendicular A D to the bisector of the angle between the given lines; produce A D to E so that D E is equal to A D; a circle described (by the preceding proposition) through D and E to touch either of the given lines will obviously touch the other also.

of the third-book method, I can readily show that such an inference was by no means so absurd as might be inferred from his remarks about the oldness of the problem. For I remember distinctly an occasion on which the solution of this problem was required during a lecture at King's College, London, at which my friends Baily (second wrangler in 1860) and Hudson (third wrangler in 1861) were present. Three of the students at once submitted to the lecturer the solution by the sixth-book method (which no one can well miss), and the lecturer (a second wrangler), while admitting that the solution was not very pleasing, was unable at the moment to suggest a better; he added, jokingly, that the best way to solve the problem would be to describe a parabola having the given point as focus and either of the given lines as directrix. Now, he had not been long engaged in teaching, and it may be perfectly true that one who had been so engaged "would certainly have in his memory one or more solutions of this problem;" but this would depend on the subjects he had been engaged upon. If he chanced to be one of the most eminent mathematical professors at Cambridge, it is probable that no problem in the higher analysis would be unknown to him, but the odds would be rather against than in favour of his being familiar with the best solutions of geometrical problems, just as the odds would be against his being proficient in the rules for "Barter," "Tare and Trett," and "Alligation Partial."

From letters which have reached me I find that the general purport of my letter has been misapprehended, since some appear to infer that I question the geometrical power of our University mathematicians. I meant nothing so unreasonable. We have geometricians who rival (and I believe more than rival) in power the best Continental geometricians. But their geometrical strength has not been attained during their University career; and no one who considers carefully the mathematical course at either University, can believe that it tends either to form geometricians or to foster geometrical taste.

I candidly admit that I do not speak of either course from personal experience. All I know of geometry was learned before my Cambridge time, and very nearly all I know of analytical mathematics was learned after that time. But I know quite well the nature of each course, and can sustain my statement that our universities do not encourage the study of geometry. Whether they should do so is a matter on which I have expressed no opinion. RICHD. A. PROCTOR

Brighton, Oct. 7

P.S.—Mr. Todhunter refers to the actual solution of the problem as a "matter of some interest, though of course unconnected with the theoretical solution." As I have had some experience in constructive geometry (having always made it a practice to solve astronomical problems constructively before proceeding to numerical calculation), I may be permitted to make some remarks on this point. First I would add to the compasses and parallel ruler (the only instruments mentioned by Mr. Todhunter) that most useful instrument the square. With this instrument (which would be needed in any case) the following construction would be as convenient as the one founded on the sixth-book solution. The problem, be it remembered, requires that a circle should be described through a given point to touch two given straight lines. Let P be the point, AB and AFCG the lines, AHDK the bisector of BAC (this bisector must be drawn in both methods, so that I leave its construction untouched); with the square draw CPD square to AK, and PE square to CD; with centre D draw circular arc PE; with centre C and distance PE draw half circle FLG; then FH and GK drawn square to AG (with the square) are radii of the two circles fulfilling the conditions.

Prof. Newcomb and Mr. Stone

IN Mr. Proctor's letter to NATURE of the 23rd ult., he remarks that Prof. Newcomb had stated to him that he was bewildered at having a discussion of the transits of Venus and the parallax of the Sun, deducible from them, prior to that of Mr. Stone, attributed to himself; and Mr. Proctor goes on to state that he was justified in his belief that such a discussion had been made because a writer, signing himself "P. S." had asserted that it had in a letter appearing in the *Astronomical Register* for December 1868. He further gives two reasons for the unhesitating credit which he had given to the assertion of "P. S." The first of them is that there is strong internal evidence that the writer was a distinguished astronomer having those as his initials (or a part of his initials, it would be more correct to say); of this it seems scarcely needful to say more, as the writer in question may prefer not to be unearthed. But of Mr. Proctor's other reason, may I be permitted to say a word? It is that the assertion of "P. S." was "permitted to remain uncorrected."

Had Mr. Proctor turned to the very next number of the *Astronomical Register* (that for January 1869) he would have found a letter signed also with initials "W. T. L." in which "P. S.'s" assertion that Prof. Newcomb had published any discussion of the transit of Venus in 1769, is most emphatically contradicted. "P. S.," it is true, made a rejoinder in the March number of the *Register* (page 65) but in it he neither denies "W. T. L.'s" contradiction, nor refers (as of course he could not) to any original investigation of the transit-of-Venus problem by Prof. Newcomb. He contented himself with the rather unintelligible remark that "W. T. L.'s" answer was not in "the spirit of the age we live in." The latter writer in the following number of the *Register* (page 88) pointed how, in all probability, the mistake of "P. S." had arisen from mi-understanding part of the title of a paper by Prof. Newcomb on the Distance of the Sun, and the matter dropped.

Now, as Prof. Newcomb was as likely to have seen "W. T. L.'s" contradiction as "P. S.'s" assertion, there would certainly seem no necessity for his further disowning himself what "P. S." had claimed for him. W. T. LYNN

Blackheath, Oct. 2

Note on the Cycloid

I DO not know whether it has been noticed that the cycloid is a projection of the common helix (thread-inclined 45°). I suppose the property must have long since been recognised, but have not seen it mentioned.

The proof is very simple, and may be thus presented:—

Suppose a vertical circle to have its plane east and west (a luminous point, for the nonce), the sun in the meridian and 45° high. Then the shadow of the circle on a horizontal plane will clearly be a circle; and further, if a point move uniformly round the vertical circle, the shadow of the point will move uniformly round the shadow-circle. Now, let the centre of the vertical circle advance horizontally towards the south, while a point moves round its circumference at the same uniform rate. The moving point will describe a right helix with a thread-inclination of 45°. Its shadow will move uniformly round the shadow-circle while the centre of this circle advances uniformly and at the same rate in a straight line. It will therefore describe a cycloid.

It is obvious that all the varieties of curtate and prolate-cycloids may be obtained as projections of helices, by changing the thread-inclination.

Also it is obvious that if the sun (or the point of projection) were in the zenith, the shadow (or projection) of the helix first dealt with would be the curve called "the companion to the cycloid." RICHARD A. PROCTOR

Is Blue a Primary Colour?

IN recent works on colour blue is called a primary colour. If blue is a primary colour a mixture of yellow and blue transparent pigments could not produce green, but would form an opaque combination. The colour produced by a mixture of yellow and blue pigments—if blue is an elementary colour—will depend on the colour reflected by the coloured layer itself, and not on the light passed through it from the white surface underneath. The brilliancy of the green produced by mixing yellow and blue pigment, is a measure of the transparency, to the green rays, of the blue pigment employed. Or in other words, there is as much green in the blue pigment employed, as there is green in the green produced by mixing that pigment with yellow. Blue must, therefore, be a compound colour, since the blue pigment passes the green rays.

Further. When the light reflected from blue substances is examined with a prism, it is found to be composed of green and violet. Again, when green and violet are combined by means of a rotating disc, blue is produced. By varying the proportions of green and violet any colour from green through blue-green or sea-green, blue, blue violet or indigo to violet, may be obtained. Again, when the solar spectrum is thrown on a blue surface, the green and the violet rays are reflected in the same way as a yellow surface reflects the red and the green rays.

The following is a simple way of showing that blue is not an elementary colour, and that violet is an elementary colour:—Take a piece of red, a piece of green, and a piece of violet

glass. Any two of these form an opaque combination—that is to say, the first glass stops all the rays which could pass the second and the second stops all that pass the first. But a green and a blue glass do not form an opaque combination, but pass the green rays. If we place the red, the green, and the violet glasses in a row close to each other, with the green in the centre, place a piece of yellow glass so as to overlap the junction between the red and green glasses, and a piece of blue glass to overlap the junction between the green and violet glasses, and arrange the combination so that white light can pass through it, it will be seen that the yellow glass passes the red and green rays, and the blue glass passes the green and violet rays; and that the only effect of the yellow and blue glasses is to deepen the colours when the light passes through them.

Darrock, Falkirk, Sept. 23 JOHN AITKEN

Anthropology and M. Comte

PERHAPS you will allow me to state that your report of my paper "On the Anthropology of Auguste Comte," read before the British Association at Edinburgh, is wrong in two essential particulars. First, I did *not* attempt to "expound the views of M. Comte according to the principles laid down by Mr. Darwin." Comte's views on man and his relation to the animal kingdom were published upwards of twenty years ago; Mr. Darwin's recently. Second, I did *not* "maintain that Auguste Comte's worship of humanity would be the great doctrine of the future." I may, and do believe this, but I made no reference to it whatever in the paper which you have so correctly mis-reported. The Positive religion was not the subject of discussion, and I limited myself to what my paper implied. J. KAINES

3, Osborne Road, Stroud Green Lane, N., Sept. 22

A Plane's ——?

IT is perhaps answering somewhat at cross purposes, but would not the word *aspect* meet Mr. Wilson's requirements? In reference to those important planes of every-day life, garden walls or house fronts, its use is well established; and there would be no violence to either custom or language in applying it to geometry. J. K. LAUGHTON

[Another correspondent suggests the term "slope."—ED.]

Meteorological Phenomenon

AMONGST some old memoranda I find the following, which I copy verbatim :— JOSEPH JOHN MURPHY

Old Forge, Dunmurry, Co. Antrim, Sept. 18

"Monkstown, near Dublin, about 3.10 P.M. 25th of July, 1858, saw, about opposite the sun, an appearance like the rainbow, but horizontal, and extending along a few degrees of the horizon. The red was above the sea-horizon, and the green below. I could not make out beyond the green, but this might be because the blue was blended with the colour of the sea. As I did not see it commence, I cannot say how long it lasted. It faded gradually but rapidly, without any other change in the sky that I saw. The day was alternate sunshine and heavy showers; the sun was shining at the time.

"This note has been made within half an hour after its disappearance."

Lunar Rainbow

A VERY perfect lunar rainbow was seen here last night. I noticed it first at 9.42. At that time the northern portion of it only was visible, but its intensity steadily increased, and by 9.45 the arch was complete. Both at the northern and southern extremities there was a peculiar glare, extending upwards about 20°, the apex of the arch being remarkably clear and well-defined. The rainbow faded away as rapidly as it had been developed, and at about 9.50 had entirely disappeared. At the time of the occurrence the western portion of the heavens was very clear, and the moon about 8° above the horizon. Temperature cold, with a biting wind from W.S.W. R. B.

Hinderton, Neston, Cheshire, Sept. 23

The Corona

MAY I suggest a method of observation which would possibly be a more delicate test than that which our own sight affords for ascertaining the outer limits of the corona?

It seems probable, from a discussion of former observations, that the polarisation of the sky is altogether changed during totality, and that instead of being radial to the sun as at other times, its plane is perpendicular, or nearly perpendicular, to the horizon. This appears at all events to be the case over a very large area about the eclipsed sun.

In passing along a parellel to the horizon through the sun's centre, we should expect to find, at some little distance from the limb, the pure atmospheric polarisation unaffected by any component due to the corona.

At such a point an observer using a Savart might therefore expect to find the bands disappear at an angle of 45° to the horizon. Having carefully turned out all trace of the bands upon the centre of his field, let him now pass onward towards the sun's limb (directing his attention all the time to the centre of his field only), when he there perceives the first trace of bands. He will know that the plane of polarisation has changed. If, on going backwards, the bands disappear again, while in passing onwards they continue to increase, he will know that that change is due to a component introduced by the corona; and he will be able to estimate the distance from the moon's limb at which such a component first became visible.

I feel disposed to think that by this method he will be able to trace the corona further than he could by the unaided eye; for it will be somewhat equivalent to making the corona shine upon a perfectly black back ground of sky; and much more than equivalent to accomplishing this with a Nicol only, for the Savart will detect less than one-eighth of the polarisation detectable by the Nicol.

The visible outer border of the corona is where our eye first distinguishes a difference between

The light of the sky

and

The light of the sky + the light of the corona,

while by this method the visible outer edge of the corona will be where we first distinguish a difference between an area of no polarisation and polarisation due to the corona.

In using a Savart with a large field, the central portion of the field might well be marked by fixing in the common focus of the telescope a plate of glass with a small circle etched upon it corresponding say to 8′ or 10′ of diameter in the field of view.

A. C. RANYARD

A Rare Moth

A FINE specimen of the rare moth *Deïopeia pulchella* (crimson speckled footman) was captured by R. Beck on the Moors near Scarborough on the 11th inst. Could any of the readers of NATURE inform me whether it has ever been taken so far north before? W. E. WALLER

Oliver's Mount School, Scarborough, Sept. 22

Meteorology in America

THE writer of the article on this subject may be interested in hearing that a meteorograph, similar in some respects to that invented by Prof. Hough, was sent to the International Exhibition just closed in London. It was invented and constructed in Sweden, and one similar is said to have been performing satisfactorily for nearly three years. In the Swedish, as in the American instrument, the height of the mercury in the barometer, and the wet and dry thermometers, is felt by steel wires descending the tubes; but in the Swedish instrument the levers to which these wires are attached are acted on by very fine screws, the revolutions of which, translated by a series of wheels into the language of barometers and thermometers, are printed every quarter of an hour on an endless roll of paper. The whole apparatus is set in motion by a galvanic battery, which even winds up the clock which regulates its own action. The barometer is tapped before it is registered, but there is no correction for temperature. The price is 350*l.*

The barometer invented by Prof. Wild seems to bear some resemblance to the barograph invented by Mr. King, and now used at the Liverpool Observatory. W. R.

Ruined Cities of Central America

IN the summary of the proceedings of the late meeting of the British Association, in the issue of NATURE for August 31, is an abstract of a paper by Captain L. Brine, R.N., *On the Ruined Cities of Central America*. The gallant captain is wrong in stating that the existence of these ruined cities was unknown

until within a comparatively recent period. All the early chronicles abound in allusions to them—Remesal. Vasquez, Cogolludo, Villagutierre, Juarrez, and others. Uxmal and Chichen Itza, which Captain Brine speaks of as "discoveries," were undoubtedly occupied places at the time Grijalva touched the shores of Yucatan. Copan, although then a ruin, was visited and minutely described by Dr. Palacios as long ago as 1576. Captain Brine would lead us to infer that these remains have been "discovered" since the expedition of Del Rio to Palenque in 1787.

That these Ruined Cities were built by the progenitors of the various families of the Tzeudal or Maya stock found in Central America at the time of the discovery, and who are still there, and that many of them were then occupied and flourishing does, not admit of doubt—is capable of demonstration.

Big-eyed Wonder should be eliminated from modern speculation!

E. GEO. SQUIER

New York, Sept. 14

The Dinnington Boulder

I HAVE been favoured with a letter from a geologist residing at Newcastle-upon-Tyne, who kindly informs me that he has inspected the "fossiliferous boulder," and pronounces it to be a block of carboniferous limestone.

This gentleman, from his knowledge of the district, says, that this limestone (underlying the coal measures) crops out about seven or eight miles to the west or north west of Dinnington, from whence probably it came. The question asked of its direction of travel is therefore satisfactorily answered.

J. BROUGH POW

Barbourne, Worcester, Sept. 21

Mechanical Drawing

IN the opening address of the President of the Mechanical Section of the British Association, descriptive geometry and geometrical projection are both spoken of as subjects of little value to the mechanical draughtsman.

Now, being interested in the matter, I would like to ask the nature of that special kind of mechanical drawing of which the President spoke, and which leads to mensuration and geometry. I suppose from the address, descriptive geometry and geometrical projection will be dispensed with, seeing, as he says, that it is no loss to the mechanical draughtsman to be ignorant of the latter. As an illustration of that *real* mechanical drawing which he advocates, would Prof. Jenkin be kind enough to show the method he would adopt in the construction of a drawing which would show the lines of intersection of the surfaces of a cone and sphere whose axes are not in the same plane?

I can assure Prof. Jenkin that a word of advice from him will always be a great boon to the hardworking student.

DRAUGHTSMAN

Fall River, Mass., Sept. 18

Ice-Fleas

I SHOULD have thought that the "ice-fleas" described by Prof. Frankland had been almost as familiar to Alpine travellers as their more offensive namesakes of the châlets. They are described by De Saussure (Voyages, § 2249), by Mr. Morell, "Scientific Guide to Switzerland," p. 275; by myself "Alpine Regions," p. 207, where references are given, chiefly to a paper by M. Nicolet in "Neue Denkschriften der Allg. Schweiz. Gesellsch." vol. v. (1841); and by other writers on the Alps.

T. G. BONNEY

St. John's College, Cambridge

Thermometer Observation

ONE very hot day last summer I exposed to the sun, in the same position, three thermometers; No. 1 was a new one mounted on box wood, No. 2 was similar, but very dirty from exposure to the weather; No. 3 is what is known as a bath thermometer, with a metal scale. In the shade they all agree to about 1°, but in the sun No. 2 rose about 8° above No 1, and No. 3 about the same above No. 2. Here we have a discrepancy of about 16°, caused no doubt by the different heat absorbing and radiating powers of the substances on which the thermometers were mounted. I think this may somewhat account for the various readings we see announced by different observers.

D. J. STUART

THE USE AND ABUSE OF TESTS

THE gradually increasing recognition of the claims of Science by the Government is cause for unmingled satisfaction to every one who is interested in the material and moral progress of the country. And now that the Government has set its hand to the work, it seems disposed to let no timorous counsels or half-measures prevail. The readiness with which the demands of astronomers have been met last year and this, the really admirable practical instruction recently given to science teachers at South Kensington, are evidence of the earnestness of the intentions of those in authority.

In the present attitude of the Government towards Science, however, everything is not yet as it should be. Much of the practical value of this earnestness consists in the manner in which details are carried out, and there is one department of the administration in which a spirit of mischief appears to delight in neutralising all efforts at improvement. The recent movement to compel all candidates for employment under Government to submit themselves to an educational test is in the main a good one; but it may be carried to an excessive, even to a ludicrous, extent. Tests are in themselves valueless, unless they are so contrived as to test the possession by the candidate of those qualifications which will best fit him for the office he aspires to fill.

There are at the present time vacancies in one of our Government scientific establishments for two junior assistants, and the principal of the establishment was desirous of appointing two young men who possessed the needful qualifications of neat and orderly habits, punctuality, and obliging demeanour, and a love of Science for its own sake. The establishment in question has, however, the misfortune to be under the control of the Board of Works; and when the authorities of this department heard of the vacancies, they insisted, notwithstanding the remonstrances of those most interested, in announcing them for public competition. The consequence will be that the posts will, in all probability, be given to those who display the best acquaintance with English History or French, but who have not proved themselves possessed of a single qualification for these particular posts. This Procrustean system of measuring all men by the same standard will not answer. The inevitable result will be to fill all the square holes with round men, and all the round holes with square men. As reasonably might we require all the clerks in the Foreign Office to be acquainted with the properties of the chemical elements, or every assistant in the library of the British Museum to be able to name the bones in the human skeleton; for these are as essential to the liberal education which every gentleman ought to possess, as a knowledge of English History or French. The system pursued in the British Museum, which is fortunately under the control of another department of the administration, would satisfy all reasonable requirements: that the principals of all establishments should have the right to nominate candidates to vacancies, subject to a qualification-test of their general acquirements. It is but fair that in departments where the efficiency of the subordinate officials depends so much on their willingness to co-operate heartily with their superiors, and on the possession of qualities which no examination can possibly test, the principals should have some voice in the appointment of those who may probably succeed to the offices they themselves occupy. An opportunity is thus also given for the encouragement of young scientific aspirants, who may be known as earnest and careful workers, but who would otherwise stand little chance of Government employ.

We make these strictures in no carping spirit, but simply with a desire that the good work now commenced may not be marred by errors of administration. The only object of the system of competitive examinations, and of compelling all candidates for Government posts first to submit

themselves to a qualification test, is in order that these offices may not be the refuge for genteel incompetence, but may be bestowed on the most fitting aspirant. We fear the above facts will show that the present system is not calculated in all cases to secure this end.

THE GIBRALTAR CURRENT

MR. CROLL having stated (NATURE, August 17) that, taking my own data, and having "in regard to the Gibraltar current and Dr. C.'s general oceanic circulation, determined the absolute amount of those effects on which his circulation depends," he has satisfied himself by mathematical investigation "that the work of the resistances greatly exceeds the work of gravity, and that consequently there can be no such circulation as that for which Dr. C. contends,"—I think it well to point out that the question of the existence of such a circulation is not to be disposed of by the calculations of even such an expert computer as Mr. Croll, but must be decided by the collection and comparison of facts ascertained by observation and experiment.

Now, as it happens that an opportunity has been recently afforded me by the Hydrographer to the Admiralty of carrying out, in conjunction with Captain Nares, of H.M.S. *Shearwater*, a series of further researches on the Gibraltar current, which place beyond all doubt the outflow of dense Mediterranean water into the Atlantic, over the "ridge" or "marine watershed" between Capes Trafalgar and Spartel, and beneath the surface-inflow of Atlantic water, I would submit (1) whether there must not be some fundamental fallacy in Mr. Croll's computations in regard to the Gibraltar current, and (2) whether this fallacy should not destroy all confidence in the infallibility with which Mr. Croll credits himself in regard to the general oceanic circulation.

No one can be more ready than myself to admit that this last doctrine is at present only a hypothesis, resting on a very narrow basis of fact. But as this hypothesis has been accepted as probable by such great masters in physical science as Sir John Herschel and Sir William Thomson, and as the means of putting it to the test will be supplied by the Scientific Circumnavigation Expedition, which (I have every reason to expect) will be fitted out by Her Majesty's Government next year, I would venture to suggest whether prudence does not dictate to the opponents of that doctrine, that they should either drop further discussion of it for the present, or that at any rate they should refrain from attempting to demonstrate its impossibility.

The number of NATURE which contained Mr. Croll's letter, having also given an account of the discussion which took place in the Physical Section of the British Association on a communication I made to it with reference to this subject, I may mention that my especial purpose in that communication was to obtain the judgment of the able physicists there assembled, as to a fundamental question at issue between my friend, Prof. Wyville Thomson, and myself, namely, the *cause* of that flow of polar water over the deepest parts of the ocean bottom, bringing down its temperature even under the equator to 33°·5, as to the fact of which we are in entire agreement. By my excellent colleague it is considered* that this flow is due to an indraught of polar water, occasioned by the surface efflux of equatorial water resulting from the action of the Trade Winds. To myself (not professing more than an elementary knowledge of physics) it seemed probable, on the principle of "least action," that the surface-water so removed would be replaced by an inflow from some other part of the oceanic surface, that is, by a horizontal circulation, rather than by an uprising of the whole subjacent mass, so as to draw in polar water at the bottom, and I have pointed out that such a surface-replacement is known to take place in the case of the Gulf Stream, one portion of which directly returns into the equatorial current, completing the shorter circulation, whilst the other has its complement in the Greenland, Labrador, and other polar surface-currents, of which the principal is traceable southwards nearly as far as the exit of the Gulf Stream from the Narrows, thus completing the longer circulation.

The correctness of this "common-sense" judgment was most emphatically affirmed, on the basis of profound physical knowledge, by Sir William Thomson and Prof. Stokes. It was agreed by these high authorities that in the open ocean the action of wind on the surface can never produce any other than a surface movement; the water propelled onwards from one part of the oceanic area being replaced by a surface inflow from other parts It is, therefore, for my opponents to explain how, otherwise than by gravity, it happens that polar water finds itself at the depth of 2,000 fathoms under the equator. That the bottom-temperature of the equatorial area, if there were no movement of polar water towards the equator, would be at least 20° higher than it is, may be asserted without the least hesitation; the temperature of the Mediterranean, which is cut off from communication with the lower stratum of the Atlantic, being 54° at corresponding depths.

It was agreed by Sir William Thomson and Prof. Stokes, that when a wind blows continuously into a loch or fiord, so as to produce a rise of water at its head to the amount of 6, 8, or 10 feet, such an excess of vertical pressure produces an outward under-current; the evidence of such outflow being afforded by the continuance of the surface in-current at the rate of three or four miles per hour, without any further increase in the rise of water at the head of the loch. This exceptional case was advanced by Sir W. Thomson as strongly confirming my general principle, not as invalidating it; and I would therefore recommend Mr. Croll to test his method of investigation by this ascertained fact, rather than spend his time in demonstrating the impossibility of what he may hereafter have to admit as no less certainly proved.

WILLIAM B. CARPENTER

H.M.S. *Shearwater*, Malta,
Sept. 29

*See his Address on "The Distribution of Temperature in the North Atlantic," NATURE, July 27.

SCIENCE IN ITALY

IN NATURE for June 8, I sketched a short notice of some of the Italian scientific serials, among them the *Annali di Chimica Applicata alla Medicina*, published at Milan. With the commencement of the present year the *Gazetta Chimica Italiana* has been launched at Palermo. The project of this publication originated in Florence with a society of Italian chemists, who met there in October last, and resolved to entrust the first year's "direction" of the magazine to Prof. Stanilaus Cannizzaro of the University of Palermo.

The Italian Chemical Gazette very nearly resembles the *Journal of the Chemical Society of London*. Like this it contains, first, original memoirs; second, translations or abstracts of the most important foreign chemical memoirs; third, a review of technological chemistry, agricultural chemistry, and crystallography; fourth, a summary of the principal chemical journals of Germany, England, and France; fifth, miscellaneous notes that may be interesting to those who cultivate chemical science. It is published monthly.

The most prominent, the longest, and most interesting of the original papers is by Prof. Cannizzaro: "Historical notes and reflections on the Application of the Atomic Theory to Chemistry, and on the Systems of Formulæ for expressing the Constitution of Compounds." This paper is continued in the number for January, April, and May,

and is not yet completed. The following extract from the introductory observations will indicate the spirit in which it is written :—"A few are still dissatisfied with the arguments against the dualistic system, and continue to employ the atomic weights of Berzelius, or the equivalents of Gmelin ; and among those who have adopted the new system of atomic weights and formulæ, there are many who have done so merely in a spirit of concession, and make a display of scepticism respecting its intrinsic value ; others, on the contrary, push their faith to the extent of fanaticism, and give equal value to the essential and accessory parts of the system, or even cling to hypotheses that merely lean against it or have been discarded. They often speak on molecular subjects with as much dogmatic assurance as though they had actually realised the ingenious fiction of Laplace—had constructed a microscope by which they could detect the molecules, and observe the number, form, and arrangement of their constituent atoms, and even determine the direction and intensity of their mutual actions. These things, which have been offered merely as hypotheses more or less probable, and to be taken for what they are worth as simple artifices of the intellect, are valuable, and have done good service in collocating facts and inciting to further careful investigations that one day or other may lead to a true chemical theory ; but when perverted by being stated as actual truths, they falsify the intellectual education of students of inductive science, and bring reproach upon the modern progress of chemical science."

We learned a great deal from Italy in the Middle Ages, and may yet learn more. I earnestly commend the above lesson to some of our laboratory aspirants, who are occupying themselves in ringing the changes upon organic compounds, and who afterwards describe their atomic achievements as glibly, mechanically, and confidently, as though they had been laying bricks or piling shot.

An interesting paper (a note it is modestly called) on "The Absorbent Power of Red Phosphorus" is contributed to the May number, by Fausto Sestini, from the Laboratory of the Royal Technical Institute of Udine. (Udine is a small town, smaller than Croydon, and situated about 70 miles N.E. of Venice. How many of such towns in England have Royal Technical Institutes with laboratories for original research ?) The author finds that red phosphorus absorbs many substances without combining with them, after the manner of porous charcoal. Thus it may be made to take up 3·369 per cent. of iodine, a considerable quantity of sulphur, rosaniline, &c. This power of "chemical adhesion" may be easily and strikingly shown by shaking powdered red phosphorus in a test tube containing a coloured solution of iodine in bisulphide of carbon. When a sufficient quantity of phosphorus is used, the whole of the iodine is taken up and the solvent rendered colourless. Rosaline is similarly removed from an etherial solution, and a portion of it may be again recovered unaltered from the phosphorus by washing with alcohol.

The July number contains some further contributions by Sestini from the same laboratory, on the proportions of bisulphide of carbon, its solubility in water, and the compounds formed by its contact with aqueous solutions of the oxides of the metals of the alkaline earths. Also some interesting communications from the laboratory of the University of Siena by Prof. G. Campani, among which is one showing that the absorption bands of an ammoniacal solution of carmine so closely coincide with those of blood, as to be undistinguishable in a spectroscope with a scale of twenty degrees. Mr. Sorby will probably be able to tell us whether any difference is distinguishable by more minute examination.

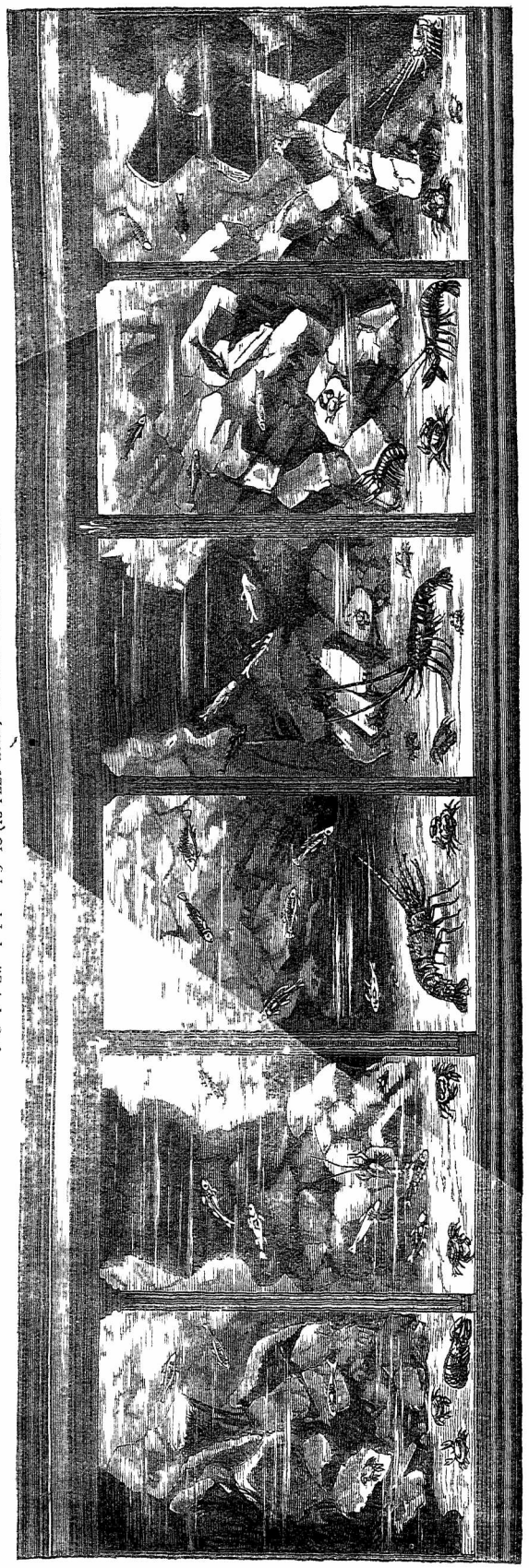
Lieben and Rossi contribute a series of rather important papers on some of the alcohols, and besides these there are some of the ordinary miscellaneous contributions to organic chemistry. W. MATTIEU WILLIAMS

THE CRYSTAL PALACE AQUARIUM

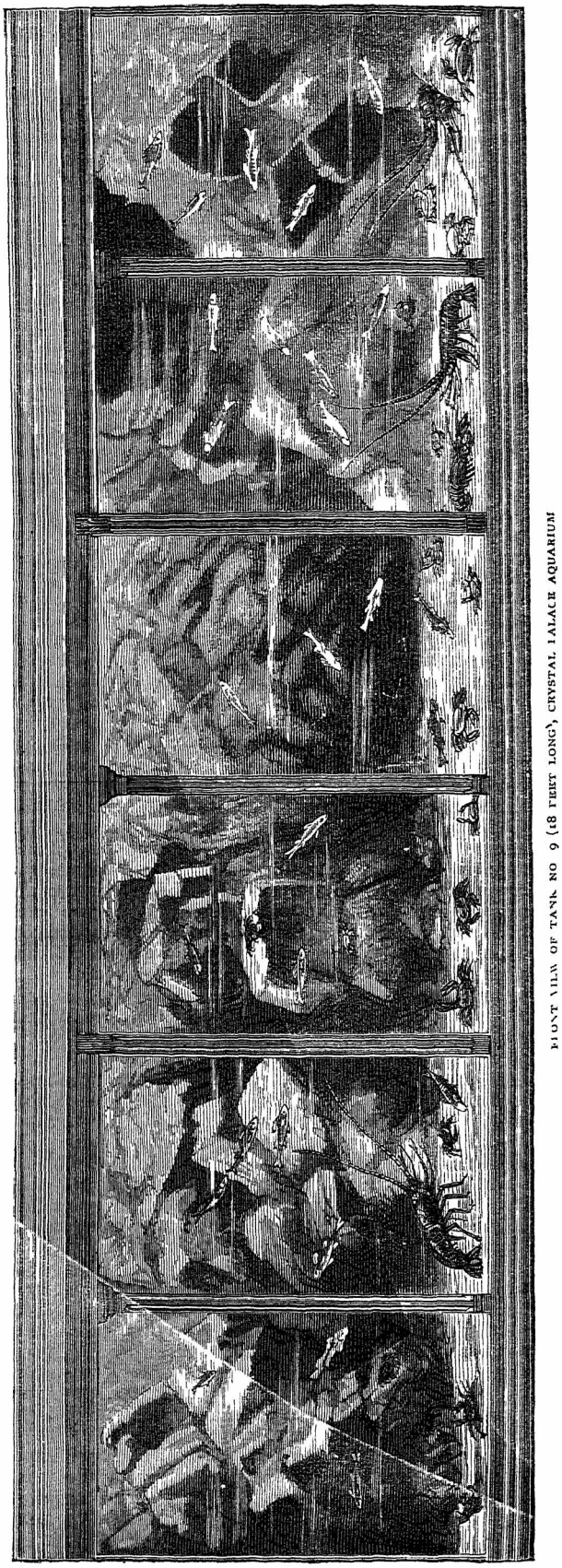
IN NATURE of April 20 last appeared a short paragraph, stating that this "enterprise, of which great scientific use can certainly be made," was taking form, and that when some of the marine animals were introduced, and the thing was in working order, a description of it would be given.

The building undertaken by the Crystal Palace Aquarium Company was commenced in July 1870, much too late therefore to be opened when at first contemplated, April 1, 1871, though at Easter last half a dozen of the marine tanks were temporarily converted into freshwater ones, and some pike, tench, carp, eels, &c., were shown therein for three daus ; when the place was closed, and the progress of the works continued, and then the establishment was finally opened on August 22, 1871. It would have been well if the sea-water had been in good condition in the early part of the summer, so that advantage might have been taken of the then exceptionally cool weather to transport some of the great abundance of animals at that time on the coasts of England ; but that was not possible, and then, when the water *was* fit, the weather became very hot, and the sending of many animals was thereby prevented. Such creatures as could be got, however, were obtained, and the opportunity is now being taken of the present increasingly colder season to add other animals constantly, so that in a short time most of the tanks will be populated.

The accompanying plan, on page 471, drawn to a scale of about 50 ft. to 1 in., shows the ground occupied by the Aquarium and its adjuncts to be nearly 400ft. long and 70ft. broad, and it is situated at the northern end of the Palace, on a portion of the site of it burnt in 1865. It is of one story high, and, therefore, this ground plan shows everything, except the sea-water reservoir beneath the Saloon G G, extending under its whole width, and running below Tanks 9 and 10, and going lengthwise from E to H2. This reservoir contains 80,000 gallons of sea-water, and the tanks above contain 20,000 gallons, in all 100,000, gallons weighing a million pounds ; and the fact of the aggregate contents of the tanks being only one-fourth of the contents of the reservoir, is extremely serviceable in keeping the water clear, as, supposing the water in, say tank 10 (holding 4,000 gallons), became turbid from any cause, it can be emptied by syphons in less than an hour into the reservoir, where so comparatively small a quantity of fluid would not appreciably disturb the purity of so great a mass, from which, in less than half an hour, No. 10 can again be filled, and thus all the tanks where animals exist, are, by being constantly pumped into, day and night, from the large, clear, and cool reservoir below, where there are no creatures, kept ever in good order. The main aëration which is thus depended on for the health of the creatures, is by these means produced by mechanical agitation, and the quantity of sea-weed necessary to decompose the poisonous carbonic acid gas evolved from the animals, which could not be effected by mechanical agitation, is grown upon the rocks of the aquarium by the action of light on the spores of algæ existing invisibly in the water. As the motion of the water needs to be incessant, all the machinery is in duplicate, there being two boilers, each of four horse power, two steam-engines, each of three horse power, and two of Forbes's patent pumps, and one of each is kept ever in action, the other being in reserve in case of accident. The sea-water issuing from the pumps at the rate (indicated by a counter, while a tell-tale clock furnishes evidence of the attention of three enginemen, each working for eight consecutive hours) of from 5,000 to 7,000 gallons an hour, passes in the first place into the two highest tanks, 9 and 10, half into each, and from thence it runs, diverging north and south, as far as tanks 18 and 1. From 18 it flows into 60, and from 1 into 39, in each case passing

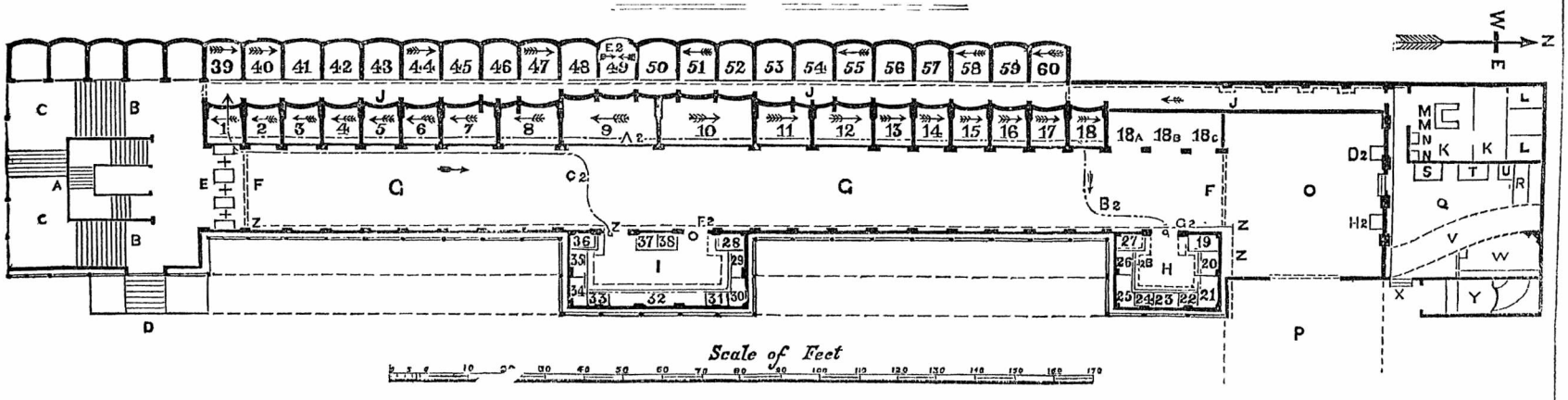


FOUR VIEWS OF TANK NO 10 (18 FEET LONG) CRYSTAL PALACE AQUARIUM



FRONT VIEW OF TANK NO 9 (18 FEET LONG), CRYSTAL PALACE AQUARIUM

PLAN OF CRYSTAL PALACE AQUARIUM.



KEY TO PLAN.

A Staircase from Palace.
BB Staircase to Palace.
CC Storerooms below Staircases.
D Communication with Palace Grounds (public).
E Turnstiles.
FF Screens at north and south ends of Saloon.
GG Saloon, containing Marine Tanks 1 to 18, and the three projected Fresh-water Tanks, 18A, 18B, 18C.
H North Room, containing Marine Tanks 19 to 27.
I South Room, containing Marine Tanks 28 to 38.
JJJ Attendants' Gallery, containing reserved Marine Tanks 39 to 60. (Private.)

KK Room, containing as follows :—
LL Two Steam Boilers, and
MM Two Steam Engines, and
NN Two Steam Pumps.

O Junction with Conservatory.
P Part of Conservatory (upper end).
Q Workroom.
R Slab for preparing Food for Animals.
S Store Cupboard.
T Slab.
U Sink.
V Flue.

W Office.
X Communication with Palace Grounds (private).
Y Heating Apparatus room.
ZZ Heating Pipes.
A2 Sea-water Pipes supplying Tanks 1 to 18.
B2 Sea-water Pipe supplying Tanks 19 to 27.
C2 Sea-water Pipe supplying Tanks 28 to 38.
D2 Point of issue of Sea-water from Reservoir to circulating system.
E2 F2 G2 Three points of entrance of Sea-water from circulating system to Reservoir.
H2 Float showing height of Sea-water in Reservoir.

The direction of flow of Sea-water in the Tanks is shown by arrows, which for want of space are omitted in Tanks 19 *to* 38, 41 *to* 43, 45, 46, 48, 50, 52 *to* 54, 56, 57, *and* 59.

below the floor of the gallery JJJ, and then the two currents converge centrally and fall together into the reservoir at tank 49. A portion of the water, however, is arrested above tank 9, and is by separate pipes conveyed into the rooms H and I, where, after circulating in the tanks 19 to 38, it finds its way to the reservoir below at F 2 and G 2. Independently, however, of the simple fall of water from one tank to another in steps of from 3 to 6 inches in height in the series 1 to 18 (tanks 9 and 10 being 6 feet high, while 1 and 18 are 3 feet high—all internally), other streams of water, mixed with great quantities of air in minute bubbles, are driven from the main pipe into all the tanks with force. through jets, so that myriads of such bubbles, controlled by stop-cocks, are forced in a state of fine division (resembling falling sand, or steam) nearly or quite down to the bottom of each tank, and thus the fluid is charged with as much atmospheric air as it will take up in open vessels. The amount of aëration (which also depends much on the amount of water entering) varies much, according to the dimensions of the tanks. Thus, tank 10 holds 4,000 gallons, and tank 1 holds 400 gallons, and, as tank 10 has a stream equal to its own bulk running through it once an hour, it necessarily follows that as the same current flows through tank 1 (of only one-tenth the capacity of tank 10) then tank 1 has a stream equal to its bulk, ten times as often as tank 10, that is to say, once every six minutes, and as these grades of aëration vary in all the tanks, they can be chosen according to the varying requirements of different kinds of animals. There is no intention to change the sea-water, but only to add from time to time a requisite quantity of distilled water to compensate for evaporation, and also to add whatever constituents the animals may deprive the sea-water of. For example, lobsters, crawfish, crabs, oysters, annelides with calcareous tubes, and many other animals, are constantly making new shells or adding to their old ones, and the matter is derived from the sea-water, and must be re-supplied.*

The material used for the pumps, stop-cocks, and jets, and for nearly all the pipes (the exceptions being the stoneware pipes connecting tanks 39 to 60) is vulcanite, or hard india-rubber. This was recommended by Prof. Faraday for the purpose in 1857.

In tanks 1 to 18 the creatures can be viewed only through the plate-glasses forming the fronts of the tanks; but in the twenty tanks of the rooms H and I (Nos. 19 to 38), which are made to contain small specimens, the view is through the surface of the water, as well as through the glasses of the fronts, as in the table-cases of a museum. The shallowness of these tanks, varying in water-capacity from 40 to 270 gallons each, much increases both their aëration and the accessibility of the objects they contain, and the much-shaded position of some of them, *e.g.*, Nos. 19, 21, 25, 27, 28, 30, 34, and 36, affords means of maintaining some organisms, both animal and vegetable, needing an unusual amount of darkness. For example, no green algæ (*Chlorosperms*) will grow in the gloom of these tanks, while they are admirably suited for the *Rhodosperms* (or red algæ) which always flourish best in much obscurity. So, too, no direct sunlight can enter tank 1, and as it contains only sea-anemones, it may be expected that this intentional arrangement will somewhat retard the usual fading of some of the colours of these animals when in aquaria. Tanks 1 to 18 are lighted from a source not seen by spectators in front of the glasses.

In tanks 39 to 60 the view is only through the surface of the water. These twenty-two receptacles, each holding about 300 gallons of sea-water, contain, or are intended to contain, creatures which are at intervals drafted into the show tanks (1 to 38) and, acting as reserves and not for public inspection, they enable large numbers of animals to be purchased when they are to be cheaply and easily got, and thus these store-places in part remove the uncertainty of supply, which hitherto has attended inland marine aquaria. They are also used to keep living food, as mussels and shrimps, for the other animals.

For the general supply of the aquarium, the company possesses a large marine pond, in communication with the sea at every tide, and serving as a store, with a resident agent (Mr. C. Rogers), at Plymouth. This pond is capacious enough to furnish many animals, otherwise hard to be got, to all the public aquaria in Europe. The company has another agent (Mr. John Thompson) and store-place, at Southend, Essex; and supplies are obtained also from Weymouth, from Mr. R. T. Smith; from Menai in North Wales, from Mr. E. Edwards; from Tenby, in South Wales, from Mr. W. Jenkins, together with other contributions from North and South Devonshire and the Channel Islands. Notwithstanding all these facilities, however, the difficulty of procuring animals in good health, and of sufficient variety, and of right size, is very great—so great, indeed, on account of periods of excessive heat or cold, or rough weather, that there are probably not more than a dozen or fifteen weeks of any average year (with seldom a couple of weeks consecutively) in which animals can be most advantageously got, and this applies especially to fishes.

The animals at present in the aquarium are the following* :—Sea-anemones, fourteen species; tube and other worms, six species; star-fishes, three species; sea-urchins, lobsters, crawfish, edible-crabs, spider-crabs, swimming crabs, and various other crabs; prawns, two species; barnacles, oysters, mussels, cockles, and scallops; whelks, periwinkles, dogwinkles, and tops; cuttles, two species; and many fishes, as skate, angel-fish, launce, pipe-fish, lump-fish, and sucking-fish; sole, plaice, cod, whiting-pout, whiting, and rockling; wrasse, four species; goby, three species; blenny, three species; dragonet, gunnel, grey-mullet, sea-bream, sea-scorpion, two species; pogge, gurnard, weever, and basse. All of these have to be fed constantly, many of them hourly, throughout the day, except on Sundays; and as for the sea-anemones, of which there are already in the aquarium over 3,000 individuals, everyone of them has a morsel of food proportioned to its size given it at frequent intervals with a pair of wooden forceps, by an attendant whose sole occupation this is, as these flower-like creatures being so very non-locomotive as to be almost absolutely fixed, cannot pursue their food, or in an aquarium obtain it in any other manner, they being deprived of the actual ocean, every wave of which, when the animals are in a state of nature, bringing them nutriment which is arrested by their outspread and waving tentacles.

* The sea-water was supplied in casks by Mr. W. Hudson, of Brighton.

* *Marine Animals in the Crystal Palace Aquarium, from August 20 to October* 10, 1871.—1. Actinoloba dianthus. 2. Sagartia bellis. 3. Sagartia miniata. 4. Sagartia rosea. 5. Sagartia venusta. 6. Sagartia nivea. 7. Sagartia troglodytes. 8. Sagartia viduata. 9. Sagartia parasitica. 10. Anthea cereus. 11. Actinia mesembryanthemum. 12. Bunodes Ballii. 13. Tealia crassicornis. 14. Cerianthus Lloydii. 15. Uraster rubens. 16. Cribella oculata. 17. Solaster papposa. 18. Sipunculus Bernhardus. 19. Nemertes Borlasii. 20. Terebella conchilega. 21. Sabella reniformis. 22. Sabella unispira. 23. Terebella penicillus. 24. Sabella tubularia. 25. Serpula contortuplicata. 26. Serpula triquetra. 27. Spirorbis communis. 28. Gammarus locusta. 29. Palæmon serratus. 30. Palæmon squilla. 31. Crangon vulgaris. 32. Homarus marinus. 33. Palinurus quadricornis. 34. Pagurus Bernhardus. 35. Galathea strigosa. 36. Galathea squamifera. 37. Porcellana platycheles. 38. Pinnotheres pisum. 39. Portunus puber. 40. Portunus depurator. 41. Carcinus Mænas. 42. Pilumnus hirtellus. 43. Xanthis florida. 44. Xanthis rivulosa. 45. Cancer pagurus. 46. Maia Squinado. 47. Hyas araneus. 48. Inachus Dorsettensis. 49. Stenorhynchus phalangium. 50. Balanus balanoides. 51. Lepas anatifera. 52. Ascidia mentula. 53. Cardium echinatum. 54. Mytilus edulis. 55. Anomia ephippium. 56. Eolis coronata. 57. Aplysia punctata. 58. Purpura lapillus. 59. Buccinum undatum. 60. Nassa reticulata. 61. Murex erinaceus. 62. Sepiola Rondeletii. 63. Octopus vulgaris. 64. Raia batis. 65. Squatina angelus. 66. Scyllium canicula. 67. Hippocampus brevirostris. 68. Syngnathus acus. 69. Ammodytes lancea. 70. Anguilla acutirostris. 71. Cyclopterus lumpus. 72. Liparis vulgaris. 73. Solea vulgaris. 74. Platessa vulgaris. 75. Motella vulgaris. 76. Merlangus vulgaris. 77. Morrhua vulgaris. 78. Labrus maculatus. 79. Labrus mixtus. 80. Crenilabrus melops. 81. Crenilabrus rupestris. 82. Callionymus lyra. 83. Gobius niger. 84. Gobius unipunctatus. 85. Gobius Ruthensparri. 86. Blennius pholis. 87. Blennius gattorugine. 88. Murænoides guttata. 89. Zoorces viviparus. 90. Mugil capito. 91. Pagellus centrodontus. 92. Tottus bubalis. 93. Cottus scorpius. 94. Asphidophorus cataphractus. 95. Criglia hirundo. 96. Labræ lupus.

The food consumed by a very few of the animals now present in the aquarium is vegetable, consisting of green seaweeds (*Ulva, Porphyra, Enteromorpha*, &c.), but by far the greater number have animal food given them. This consists of shrimps (alive or dead), crabs, mussels, oysters, and fish, but "butcher's meat" they never get. The large amount of organic matter thus continually (from 8 A.M. till 6 P.M. on six days a week) placed in the water, and the correspondingly great quantity of excrementitious matter resulting from it, is nearly all rendered harmless by being decomposed chemically by the oxygenation of the streams of water, and by the growing vegetation, without the use of any filter, and without the water being made turbid. In fact, the circulating system of the water in this aquarium is similar to, and avowedly made on the general model of, the circulating system of the blood of many of the animals which the aquarium itself maintains in life and health. Thus, the steam engine represents a heart, the coals consumed by the boilers are the food, the pipes are the veins and arteries, and the wide spreading air-charged streams of water discharged at the jets are the lungs.

Very few deaths occur, and the condition of the creatures will be further improved when the vegetation will have grown more. There are, however, reasons for supposing that not in any aquarium yet devised can any pelagic animals be permanently kept, and that therefore the bulk of specimens must be littoral creatures. But there are many marine animals and plants, both of the deep sea and the shore, which at present cannot be kept in captivity at all. The reason of this is in some cases known, but with others there is not the smallest clue as to the means to be adopted for their successful maintenance.

In front of tanks 1 to 18 are placed obliquely, and over tanks 19 to 38 are suspended vertically, glazed frames to contain drawings of the animals. These pictures will be numbered to correspond with the numbered descriptive paragraphs of a guide-book now being prepared for the aquarium, so that any animal can be readily found. Although tank No. 1 contains exclusively sea-anemones, and thus properly commences with the lower animals, yet the classification of the creatures throughout the building is not made with reference to any acknowledged system founded on organisation, but the creatures are, so far as the limits of the place permit, arranged with reference to *habits* rather than *structure*, and in such manner that, as much as possible, one animal shall not interfere injuriously with another.

The building is very cool in summer. Thus, during the hottest part of the season just passed through, when the true temperature of the general atmosphere in the shade was 88° F., that of the air in the aquarium was only 68° F., and the sea-water never rose higher than 63° F. For winter, hot-water pipes are arranged to maintain the temperature of the air from 60° F. to 65° F.

The ventilation everywhere is remarkably good, and there is no tank in any of the entire series of sixty, which cannot be brought into free contact, when needed, with the open air.

The amount of daylight can also be very exactly regulated; and as, for the exhibition of the aquarium on winter evenings, it will be necessary to use powerful artificial illumination, some experiments are now being made on the best mode of lighting it, but it is not precisely known what will be the behaviour, in artificial light, of animals a great number of which are more or less nocturnal. Indeed, in an aquarium the difficulty ever is to show animals which endeavour to avoid being seen.

The architect, Mr. C. H. Driver, of Victoria Street (the builders being Messrs. Jackson and Shaw),* has shown much ingenuity in turning to good account every part of the space placed at his disposal, and in his simplicity of design he has not disobeyed any law of service in construction, in any case. Everything is done with a meaning, and with a definite and obvious purpose. Thus, as animals cannot exist with comfort without rock-work in the tanks, it has been plentifully introduced; but whatever picturesqueness of form it possesses, is merely a consequence of its being in the first place useful, and so strictly and severely is this principle carried out, that such rock-work does not project anywhere even an inch above the water's level, instead of being employed, as in most Continental aquaria, that of Berlin in particular, in the spectator's part of the building, where it is not wanted, and where, being perfectly useless, it is therefore ugly, and is merely an expensive excrescence. Everything in the Crystal Palace Aquarium is made to look like what it is, and not like something else, and not to pretend to be some other and more expensive material. Thus, if deal wood for its preservation is necessary to be painted, it is not also grained to look like oak or walnut-wood. Nor is cement squared with imitation masonry joints, or otherwise treated so as to look like stone. Nor is there any use of sham marble. It was certainly deemed advisable to make the building externally to correspond in general appearance with the arched and other iron framings which compose the Crystal Palace adjoining, and in which the glass of that edifice is set, but even then, this framing on the outside of the aquarium walls is employed usefully to strengthen those walls, which are purposely made insufficiently strong if such framing were absent. And wherever, either outside or inside the place, a little enrichment has been indulged in, it properly consists only in *the decoration of construction, and not in the construction of decoration.* Systematic economy in this Aquarium is in fact throughout observed in such manner that the largest number and variety of animals may be preserved in the best condition in the smallest space.

The two woodcuts on page 470, each on a scale of half an inch to one foot, represent the pair of largest tanks, Nos. 9 and 10, inhabited by crawfish and other crustaceans, and by wrasse, grey mullet, and other fishes. The front of each tank is composed of three pieces of glass, divided and supported at equal distances from either end by two large vertical mullions of slate and iron, and subdivided by three other and smaller vertical mullions of iron only. These six glasses, each measuring six feet square and one inch thick, are among the heaviest polished plates made in this country, by Messrs. Goslett and Co., and the water pressure on their aggregate surfaces amounts to 46,656 lbs., or nearly twenty-one tons.

W. A. LLOYD

* "Buildings for scientific purposes should be plain and useful above all things, *in appearance as in fact.*"—PROF. RUSKIN.

*THE BIRDS OF THE LESSER ANTILLES**

THE Lesser West Indian Islands, although mostly belonging to Great Britain and inhabited by a large number of intelligent colonists, and moreover easily accessible from our shores by a regular fortnightly line of packets, have hitherto been strangely neglected as regards their zoology. Of their botany we have an excellent account by Dr. Grisebach, published under the energetic superintendence of the authorities of the Herbarium at Kew. I am anxious to call the attention of the students of NATURE to what an interesting field here lies available for investigation,—particularly as regards the ornithology of these islands.

The West Indian Islands seem to me to constitute a distinct subdivision of the neo-tropical region, which may be called the *Sub-regio Antillensis.* This sub-region is divisible into two portions, which correspond to the two usually recognised divisions of the islands into the Greater and Lesser Antilles. The former of these is characterised by the presence of the remarkable mammal-forms *Sole-*

* Principally extracted from a paper read before the Zoological Society, on March 21, 1871.

nodon, *Capromys*, and *Plagiodon*; and by several peculiar types of ornithic life, such as *Spindalis*, *Sporadinus*, *Todus*, and *Saurothera*, which run on as far as Porto Rico, but do not cross into the Lesser Antilles. The latter, if we put the Chiroptera aside, present but few traces of mammal-life, except one or two species of Agouti (*Dasyprocta*) and Mouse (*Hesperomys*), but are tenanted by certain characteristic forms of birds, such as *Ramphocinclus*, *Cinclocerthia*, *Orthorhynchus*, and *Eulampis*, which are not found in the Greater Antilles.

The ornithology of the Greater Antilles is now tolerably well known to us, although specimens from most of the islands are rare in collections and difficult to obtain. The Lesser Antilles, on the other hand, are still very imperfectly investigated as regards their birds, many of them being, so far as I know, still unvisited by any naturalist or collector. There can be no doubt, however, that every one of them is well worthy of being worked at, and that the results to be obtained from a thorough examination of the whole group would be of great importance towards a more complete knowledge of the laws of distribution. To show how slight our acquaintance is with this subject and how much remains to be done, I will mention the principal islands or island-groups in order, and specify what knowledge we have of their ornithology.

1. *The Virgin Islands.*—Out of these islands we may, I think, assume that we have a fair acquaintance with the birds of St. Thomas, the most frequently visited of the group, and the halting-place of the West Indian mail-steamers. Mr. Riise, who was long resident here, collected and forwarded to Europe many specimens, some of which were described by myself,* and others are spoken of by Prof. Newton, in a letter published in the *Ibis* for 1860, p. 307. Mr. Riise's series of skins is now, I believe, at Copenhagen. Frequent allusions to the birds of St. Thomas are also made by Messrs. Newton in their memoir of the birds of St. Croix, mentioned below. In the "Proceedings of the Academy of Natural Sciences of Philadelphia," for 1860, p. 374, Mr. Cassin has given an account of a collection of birds made in St. Thomas by Mr. Robert Swift, and presented to the Academy: twenty-seven species are enumerated.

Quite at the extreme end of the Virgin Islands, and lying between them and the St. Bartholomew group, is the little islet of Sombrero, "a naked rock about seven-eighths of a mile long, twenty to forty feet above the level of the sea, and from a few rods to about one-third of a mile in width." Although "there is no vegetation whatever in the island over two feet high," and it would seem to be a most unlikely place for birds, Mr. A. A. Julien, a correspondent of Mr. Lawrence, of New York, succeeded in collecting on it specimens of no less than thirty-five species, the names of which, together, with Mr. Julien's notes thereupon, are recorded by Mr. Lawrence in the eighth volume of the "Annals of the Lyceum of Natural History of New York" (p. 92). The remaining islands of the Virgin group are, I believe, most strictly entitled to their name, so far as ornithology is concerned, for no collector on record has ever polluted their virgin soil. Prof. Newton (*Ibis*, 1860, p. 307) just alludes to some birds from St. John, in the possession of Mr. Riise.

2. *St. Croix.*—On the birds of this island we have an excellent article by Messrs. A. and E. Newton, published in the first volume of the *Ibis*.† This memoir being founded on the collections and personal observations of the distinguished authors themselves, and having been worked up after a careful examination of their specimens in England, and with minute attention to preceding authorities, forms by far the most complete account we possess of the ornithology of any one of the Lesser Antilles. It, however, of course requires to be supplemented by additional observations, many points having been necessarily left undetermined, and it is much to be regretted that no one seems to have since paid the slightest attention to the subject.

3. *Anguilla, St. Martin, and St. Bartholomew.*—Of this group of Islands St. Bartholomew alone has, as far as I know, been explored ornithologically, and that within a very recent period. In the Royal Swedish Academy's "Proceedings" for 1869 will be found an excellent article by the veteran ornithologist, Prof. Sundevall, on the birds of this island, founded on a collection made by Dr. A. von Goës. The species enumerated are forty-seven in number, amongst which the most interesting perhaps is the *Euphonia flavifrons*, originally obtained, along with one or two other species, in the latter part of the last century, and figured by Sparrman in his "Museum Carlsonianum," along with several other species from the same island.

4. *Barbuda.*—Of this British island I believe I am correct in saying that nothing whatever is known of its ornithology, or of any other branch of its natural history.

5. *St. Christopher* and *Nevis*, to which may be added the adjacent smaller islands *St. Eustathius* and *Saba.*—Of these islands also our ornithological knowledge is of the most fragmentary description. Mr. T. J. Cottle was, I believe, formerly resident in Nevis, and sent a few birds thence to the British Museum in 1839. Amongst these were the specimens of the Humming-birds of that island, which are mentioned by Mr. Gould in his well-known work. Of the remainder of this group of islands we know absolutely nothing.

6. *Antigua.*—Of this fine British island I regret to say nothing whatever is known as regards its ornithology, Amongst the many thousands of American birds that have come under my notice during the past twenty years, I have never seen a single skin from Antigua.

7. *Montserrat.*—Exactly the same as the foregoing is the case with the British island of Montserrat.

8. *Guadaloupe*, *Deseadea*, and *Marie-galante.*—An excellent French naturalist, Dr. l'Herminier, was for many years resident as physician in the Island of Guadaloupe. Unfortunately, however, he never carried into execution the plan which I believe he contemplated of publishing an account of the birds of that island. He sent a certain number of specimens to Paris and to the late Baron de la Fresnaye, to whom we are indebted for the only article ever published on the birds of Guadaloupe,* or of the adjacent islands.

9. *Dominica.*—Dominica is one of the few of the Caribbean Islands that has had the advantage of a visit from an active English ornithologist. Although Mr. E. C. Taylor only passed a fortnight in this island in 1863, and had many other matters to attend to, he nevertheless contrived to preserve specimens of many birds of very great interest, of which he has given us an account in one of his articles on the birds of the West Indies, published in the *Ibis* for 1864 (p. 157). It cannot be supposed, however, that the birds of this wild and beautiful island can have been exhausted in so short a space of time, even by the energetic efforts of our well-known fellow-labourer.

10. *Martinique.*—This island is one of the few belonging to the Lesser Antilles in which bird-skins are occasionally collected by the residents, and find their way into the hands of the Parisian dealers. There are also a certain number of specimens from Martinique in the Musée d'Histoire Naturelle in the Jardin des Plantes, which I have had an opportunity of examining; but beyond the vague notices given by Vieillot in his "Oiseaux de l'Amérique du Nord," I am not aware of any publication relating specially to the ornithology of this island. Mr. E. C. Taylor passed a fortnight in it in 1863, and has recorded his notes upon the species of birds which he met with in the excellent article which I have mentioned

* Ann. N. H. ser. 3, vol. iv. p. 225; and P. Z. S. 1860, p. 314.
† Ibis, 1859, pp. 59, 138, 252, and 365.

* *Rev. Zool.* 1844, p. 167.

above, but these were only few in number. The International Exhibition in 1862 contained, in the department devoted to the products of the French colonies, a small series of the birds of Martinique, exhibited by M. Bélanger, Director of the Botanical Garden of St. Pierre, in that island.* This is all the published information I have been able to find concerning the birds of Martinique.†

12. *St. Lucia.*—Of this island I believe there is no published ornithological information whatever. The little knowledge of its avifauna which I possess is derived from two sources: first, a few specimens in the Paris Museum obtained by Bonnecourt, a French collector, who visited the island in 1850 and 1851 on his way to Central America; and, secondly, a small series of unpublished coloured drawings in the library of the Zoological Society by Lieut. Tyler, who formerly contributed to the "Proceedings" some notes on the reptiles of that island.‡ These drawings although rough and unfinished, are characteristic and mostly recognisable.

13. *St. Vincent.*—St. Vincent was formerly the residence of an energetic and most observant naturalist, the Rev. Lansdown Guilding, F.L.S, who, however, unfortunately died at an early age in this island without having carried out his plans for a fauna of the West Indies.§

Mr. Guilding paid most attention to the invertebrate animals, but his collection contained a certain number of birds, amongst which was a new parrot, described after his decease by Mr. Vigors as *Psittacus Guildingii*, and probably a native of St. Vincent.

14. *Grenada and the Grenadines.*—Of the special ornithology of this group nothing is known.

15. *Barbados.*—The sole authority upon the birds of Barbados is Sir R. Schomburgk's well-known work on that island.‖ This contains (p. 681) a list of the birds met with, accompanied by some few remarks. It does not, however, appear that birds attracted much of the author's attention, and more copious notes would be highly desirable.

Although Tobago and Trinidad are geographically reckoned in the Windward division of the Lesser Antilles, they have zoologically, I believe, nothing whatever to do with them. Both have been peopled with life from the adjacent mainland; or, if in the case of Tobago this was not originally the case, it has been overrun with continental species, and, as well as Trinidad, now presents few, if any, traces of Antillean forms. Of the ornithology of both of these islands we have excellent accounts; of that of Tobago by Sir William Jardine,** from the collections of Mr. Kirk; and of that of Trinidad more recently from the pens of Dr. Léotaud†† and Dr. Finsch.‡‡

P. L. SCLATER

REMARKS ON THE CLASSIFICATION OF FRUITS

TEACHERS and students alike must feel grateful to Dr. Dickson for his "Suggestions on Fruit Classification." The number of names applied to varieties of fruit renders the study most laborious; and as many of the varieties are closely related, the useless names ought at once to be got rid of. One thing strikes me as being a defect in Prof. Dickson's classification, and that is the employment of certain of the terms in two different ways. For example he uses the terms Achæne, Berry, and Drupe, in a broad and in a restricted sense. In a broad sense as the name of the *genus*, if one may so speak, and again uses the same word as a trivial name—a *species* as it were of the genus. The same is also true of his group of capsules, only he thinks a new name might be given to the fruits generally called capsules. It is unfortunate that four out of his five groups should be open to such an objection, and every teacher will at once be able to appreciate the difficulty which the student must have when the same word is used both in a broad and in a restricted sense. The term Schizocarp seems to be a very admirable one, and I do not think the terminology of fruits would be in any way burdened if a few more resembling it were used. It is not without a very great deal of hesitation that I venture to suggest that new terms should be applied to Dr. Dickson's four groups, Capsule, Achæne, Berry, and Drupe. I think that it is much less objectionable to introduce a few more terms, if distinctive and apposite, than resort to the difficult, and at all times confusing, expedient of using these words in a double sense. Taking the word Schizocarp as a type, I venture to suggest the term Achænocarp for the group of Achænes as used by Dr. Dickson, thus avoiding all confusion, and allowing the term Achæne to remain in its restricted sense. Regmacarp I would apply to the group of capsules, using the term capsule for one division of the group. Pyrenocarp seems applicable to the drupes, and Coccocarp to the berries. The derivation of these terms at once explains their application. Achænocarp, from *a*, privative; *chaino*, I open; and *karpos*, fruit. Regmacarp from *regma*, a rupture, in allusion to the dehiscence. Pyrenocarp from *pyren*, the stone of the fruit; and Coccocarp from *kokkos*, a berry. In using these terms I would employ them in the following manner:—

I. Dry Indehiscent Fruits.
  1. Achænocarps. Carpels one or few-seeded.
    A. Glans. Pericarp hard and thick.
    B. Achæne. Pericarp thin. Including the varieties Caryopsis and Cypsela.
  2. Schizocarps. Carpels breaking up into indehiscent portions.
    A. Carcerulus. Breaking longitudinally, no forked carpophore.
    B. Cremocarp. Breaking longitudinally, a forked carpophore.
    C. Lomentum. Breaking transversely.
    D. Dischisma. Breaking longitudinally, and then transversely. Fruit of Platystemon. The term, which is new, is derived from *dis* and *schisma*, a division.

II. Dry Dehiscent Fruits.
  3. Regmacarps.
    A. Follicle. Simple, dehisces by one suture.
    B. Legume. Simple, dehisces by both sutures.
    C. Capsule. Compound, dehisces longitudinally, transversely, or by pores.
    D. Regma. Compound, dehisces by rupture along inner angle of lobes.

III. Succulent Indehiscent Fruits.
  4. Pyrenocarps. Endocarp indurated.
    A. Drupe. One stone, simple or plurilocular.
    B. Pome. Two or more-stoned, ovary superior or inferior.
  5. Coccocarps. Seeds in a pulp.
    A. Uva. Ovary superior, thick or thin skinned.
    B. Bacca. Ovary inferior, thick or thin skinned.

IV. Succulent Dehiscent Fruits.
  A. Succulent Capsule. *e.g.*, Æsculus, Balsamina.
  B. Dehiscent Drupe. *e.g.*, Walnut.
  C. Dehiscent Berry. *e.g.*, Nutmeg, Squirting Cucumber, *Nuphar advena*.

W. R. MCNAB

* See article on Ornithology in the International Exhibition, *Ibis*, 1862, p. 288.
† On animals formerly living in Martinique, but now extinct, see Guyon, Compt. Rend. lxiii., p. 589 (1866)
‡ See P Z S. 1849 and 1850.
§ See his sketch of his plans, "Zool. Journ.," ii. p. 437. He died in 1832.
‖ "History of Barbados" London, 1847.
** Annals of Nat. Hist., vols. xviii., xix., xx. (1846-47).
†† Oiseaux de l'ile de la Trinidad, Port of Spain, 1866.
‡‡ See Proc. Zool. Soc., 1870, p. 552.

NOTES

WE greatly regret to have to announce that the state of the venerable Prof. Sedgwick's health is such that he will be unable to deliver his usual course of lectures during the ensuing academical year. His place will be filled *pro tem.* by Mr. John Morris, Professor of Geology at University College, London. Though we cannot but regret the cause which has taken Prof. Morris to Cambridge, his nomination by Prof. Sedgwick to serve as his deputy is a cause of congratulation to the University.

IN Sir John F. Burgoyne, F.R.S., who died on Saturday last, in the 90th year of his age, the English army has lost the most eminent man of science among her officers. In both civil and military capacities, as chairman of the Board of Public Works in Ireland from 1830 to 1845, and at the Siege of Sebastopol, he evinced engineering talents of no ordinary kind. Sir John Burgoyne's only son perished in the *Captain*, being in command of that ill-fated vessel.

DR. HENRY S. WILSON has been appointed Demonstrator of Anatomy at the University of Cambridge. Dr. Wilson formerly held a similar office in the University of Edinburgh.

THE Professor of Chemistry at Cambridge, Mr. Liveing, will give instruction in practical chemistry on Tuesdays, Thursdays, and Saturdays at 1 P.M. The instruction will be given at the University Laboratory. The Laboratory will be open for students daily from ten A.M. until six P.M. The Demonstrator (Mr. Hicks, B.A.) will attend to give instruction on mornings and afternoons alternately. The Professor of Chemistry will deliver a course of lectures in Spectrum Analysis and some other special branches of chemistry on Tuesdays, Thursdays, and Saturdays at noon, commencing on October 26, in the Chemical Lecture-room, next Downing Street. No fee will be required of those who do not wish for a certificate.

THE Oxford School of Science and Art, in connection with the Science and Art Department of the Council on Education, South Kensington, has been granted the use of the New University Museum at Oxford, where lectures will be given this month on Mathematics (Elementary), Magnetism and Electricity, Animal Physiology, and Inorganic Chemistry. We regard this act of the University as one of very good omen.

THE combined examination held by Magdalen and Merton Colleges for scholarships in mathematics and natural science terminated on Saturday, when the following elections were declared:—Magdalen College: Demyship in Mathematics—Mr. R. R. Corkling, Manchester Grammar School. Demyships in Natural Science—Mr. E. Steel, Manchester Grammar School; Mr. G. R. Christie, Magdalen College School. *Proxime accesserunt* for natural science demyship—Mr. Hamsworth, Mr. Hopwood, Manchester Grammar School. Merton College: Mathematical postmastership—Mr. F. G. Stokes, Cowbridge. Natural Science postmastership—Mr. Lane, Cheltenham Grammar School. There were fourteen candidates for the mathematical and sixteen candidates for the natural science foundations.

AT the Oldham School of Science and Art, three Queen's medals have been awarded by the Department to the artisan students of this school, the silver medal for mathematics to John Armitage; a bronze medal for machine construction and drawing to John Robertson; a bronze medal for applied mechanics to Thomas Marsden. Mr. Armitage has also gained a Whitworth Scholarship this year.

WE have received the examination papers for the Scholarship and Exhibition in Natural Science recently award by St. Mary's Hospital Medical School. The questions appear to have been very carefully framed to show the attainments of the candidates in chemistry, physics, zoology, and botany, and we congratulate this young school on setting so admirable an example to its older sisters in encouraging a real knowledge of science among its students.

EARL GRANVILLE has shown his interest in scientific instruction by offering prizes in chemistry, mechanics, and mathematics to the examinees at the Margate centre of the Oxford Local Examinations.

To Sir John Lubbock, who has recently been twitted on his predilections for prehistoric man, we commend a letter which has recently appeared in the *Times* to the effect that a large section of the old Temple of Avebury has just been parcelled off into building allotments, and that the remainder is likely to be similarly dealt with before long. It may be that from a utilitarian point of view this can no longer matter, inasmuch as this celebrated remnant of the "Stone Age" has been so thoroughly wrecked that scarce anything now remains of it. According to Dr. Stukely, the Temple was nearly perfect in the time of Charles II., who visited it, and had plans and drawings made, copies of which are reproduced in Dr. Stukely's works. There were then standing between 200 and 300 stones, and it was, in his opinion, as superior to Stonehenge as a cathedral would be to a parish church. All that now remains of this wonderful monument, and of the two avenues, each of nearly a mile in length, by which it was approached, is about two-thirds of the great circular earthen mound by which it was enclosed and about twenty of the stones. The rest have been utilised by the inhabitants of the village to build their cottages, erect their parish church, make bridges, stone fences, and mend the road. It is said that a beershop was built out of a single stone. This is encouraging!

THE death is announced of Mr. Thomas Pilgrim, engineer, who died on the 6th inst., at the age of seventy-one years, at his son's residence at Plumstead. For the last thirty-five years Mr. Pilgrim was intimately associated with Mr. Francis Pettit Smith, and with the introduction of the screw-propeller. He acted as chief engineer of the *Archimedes*, the first ship ever sent to sea propelled by the screw.

THE annual Exhibition of Fungi was held at the Royal Horticultural Gardens, on Wednesday the 4th inst., and was decidedly better than any of its predecessors. Nearly all the British edible and poisonous fungi were shown in a living state, including several rare species. The visitors showed the greatest possible interest in the plants exhibited, and the Fungus exhibition was one of the best attended of the year. The prizes for the best collections of edible and poisonous species, offered by Mr. W. W. Saunders, were in the first place awarded to Mr. English and Mr. W. G. Smith; but, through some informality on the part of these exhibitors, the first prize was ultimately conferred on Messrs. Hoyle and Austin, of Reading.

MARLBOROUGH COLLEGE has taken an honourable lead among our public schools in the cultivation of science, and we therefore turned over with more than ordinary interest the leaves of the Report of its Natural History Society for the half-year ending Midsummer 1871, just received. We do not look to these reports for papers of original research that materially advance our scientific knowledge; rather, for such as will in the first place show an accurate and careful observation of the phenomena of nature on the part of the writer; and, secondly, that will promote the study of natural history among his hearers. We are disposed, therefore, to agree with the secretaries that the production at the meetings of these societies of papers which show a very limited amount of knowledge, if only such knowledge as is shown be the result of honest work, is better than having no papers at all, and to endorse their remark in the preface, that "failure is the indispensable ingredient of success;

and that if the Society is worth anything at all, it is strong enough to outlive many unsuccessful papers." Judged by this standard, the Report before us is decidedly satisfactory. A few only of the papers read during the half are printed at length; but they contain evidence of much careful work in the various departments of natural science. Only one field day was held during the half; and the further publication of the new edition of the "Marlborough Flora" is postponed till the next number. The committee reports that the Botanical Garden, which was started last half in the corner of the Wilderness, has fully realised the hopes of its originators. We confidently expect from the Marlborough College Natural History Society a long career of usefulness, and no small share in moulding the scientific tastes of the rising generation.

IN our last week's number we referred to the Burmese hairy woman. A correspondent of the *Times* has supplied some additional information. He writes: "When I was at Mandalay in 1859, I saw the same woman and three of her children. The eldest and youngest were hairy like their mother, while the second, like his father, presented no such peculiarity. The husband was a man who report said had been induced to wed this woman to become possessed of the marriage portion which the King of Burmah had promised to bestow upon her on her bridal day. The bridegroom was a plucky individual at any rate, though his motives may have been somewhat mercenary. The hairy woman, whose name I now forget, had a pleasant and intelligent face—there was nothing whatever repulsive in it. The hair on the face and breast was several inches long; on the forehead it was parted in the middle, and blended with that of her head. Of a light brown colour on her cheeks, it paled gradually towards the bridge of her nose, and the centre of her lips, chin, and neck. Those of your readers who have a copy of Colonel Yule's narrative of the embassy to Ava will see a good likeness of the woman and a description of herself and family."

THE *Pall Mall* promises a novelty in literary publications. An English periodical is to be printed in Berlin, bearing the title of *The German Quarterly Magazine*. Its object is to make the treasures of German learning accessible to the English speaking public. Two of the most eminent literary men of Germany, Profs. Virchow and Von Holtzendorff, have undertaken its joint management, conducting the editing alternately, so as to offer in one number articles chiefly on Natural Science under the great physician's direction, and in the following essays on historical and political subjects published under M. Von Holtzendorff's supervision.

MESSRS. ASHER AND CO. announce for November, "Man in the Past, Present, and Future: a Popular Account of the Results of Recent Scientific Research, as regards the Origin, Position, and Prospects of the Human Race;" translated from the German of Dr. L. Büchner, by Mr. W. S. Dallas, F.L.S.

THE first two parts are published of a new edition of Griffith and Henfrey's "Micrographic Dictionary." The names of the editors, Dr. J. W. Griffith, the Rev. M. J. Berkeley, and Prof. T. Rupert Jones, are a guarantee that the treatment of the various subjects will be carried down to the present state of scientific knowledge; and that the book will be indispensable to every biologist and student of the microscope.

MR. ROBERT GRAY, late Secretary to the Natural History Society of Glasgow, has issued a prospectus of his work shortly to be published, "The Birds of the West of Scotland, including the Outer Hebrides, with Occasional Records of the Rarer Species throughout Scotland generally." Since the publication of the works of Sir William Jardine, Prof. Macgillivray, and Mr. Selby, nothing in a collected form on the Birds of Scotland has been brought under the notice of ornithologists, and the book seems likely to fill a useful place in ornithological literature.

A NEW description of lamp for street lighting has recently been experimented on in London, the principle of which is the application of reflectors, in order to bend down and utilise the amount of light which is at present wasted by upward radiation. It is manifest that the rays of light from a street lamp which now strike the eye of a spectator placed on the ground are only a small portion of those actually emitted by the flames. The rays which pass through the upper portions of the sides of the lantern, or through its sloping roof, are entirely dissipated, or at best, if partially and imperfectly reflected by clouds or atmospheric particles, become visible only in the form of the red glow which overhangs a distant town. Mr. Skelton, the inventor, calculates that about two-thirds of the light given by the gas flame are in this way lost, and he has arranged strips of looking-glass in such a way that the loss will be effectually prevented. The upper half of each side of the lamp, and the whole of each side of the sloping roof, are occupied by a frame, in which the strips are placed with their reflecting surfaces downwards, in a manner somewhat analagous to the laths of a Venetian blind. The precise character of the effect produced will depend upon the distance of the strips apart, upon their width, and upon their angle of inclination; but the general result is, subject to small variations, that the street receives three times as much light as would fall upon it through lanterns of the ordinary kind. The frames holding the strips are glazed on both sides, and made dust-proof, so that the mirrors will not themselves become soiled or tarnished, and the reflector as a whole can be cleaned in the ordinary way, by simply wiping the glass. The plan is equally applicable to every form of lamp, and the patent includes the application of prismatic reflectors, which would present advantages in certain cases

WE learn from the *Photographic News* that a correspondent, writing from Florence, says:—"The Ruballino Society have lent their steamer *Sardinia* to Mr. Josellis for his marine explorations. Mr. Josellis has invented a marine photographic apparatus connected with a diving bell, by which photographs of the 'world below the sea' can be taken. This diving-bell can be made use of in many ways, but one can understand how useful to natural science a series of negatives (to be afterwards enlarged) of the myriads of zoophytes found in the subaqueous world would be." Good news this for the managers of the approaching four years' dredging expedition. We should like, however, to hear something more of the principles of the apparatus.

THE editor of the *Scottish Naturalist* proposes to do for the Lepidoptera of Scotland what has been so well done for British plants in the *Cybele Britannica*. He solicits the assistance of all persons acquainted with the subject in ascertaining the distribution of the species throughout the country, which for that purpose is divided into thirteen natural districts. In addition to the district distribution, information is solicited on the following points:—The vertical range of each species; the relation between the range of a species and that of its food-plant; the relation between the range of a species and the geological formation of the district; the influence of the proximity of the sea, for some insects (as is the case with certain plants) appear to occur at a higher north latitude on the sea coast than inland; and local races or varieties. The list will be illustrated by a map of Scotland. It will appear primarily in the *Naturalist*, but a limited number of copies will be printed in a separate form.

THE ratio of suicides has been established by M. Decaisne recently before the French Academy of Sciences. It is in London only one in 175 deaths; in New York, one in 172; in Vienna, one in 160; but in Paris, it has reached one in 72. The number of suicides from drunkenness, which in 1848 was 141 for all France, reached 401 in 1866. We doubt the accuracy of all these figures.

η ARGUS AND ITS SURROUNDING NEBULA, &c.*

IN the last paper I had the honour of bringing before the Society, I referred to a correspondence which was then pending on the star η, and the attached nebula, in the constellation Argo-Navis. It will be fresh in the minds of many of the members of this Society that authorities, previously quoted, have confirmed the alterations that have been recorded in this object. Mr. E. B. Powell, of Madras, writing to the Royal Astronomical Society some observations on the binary star α Centauri, has a concluding note thus :—"I have to observe that to Mr. Abbott must be ascribed the first publication of the fact that η is no longer in the dense portion of the nebula, where it was seen by Sir John Herschel."—(*Vide* Monthly Notices R.A.S. vol. 24, p. 172.)

It was in March 1865, that I first pointed out the fluctuations in this object, through the Melbourne equatorial, to Mr. Ellery at the Observatory, when the star η was out of the nebula, and the altered figure of the dark space was filled with 12th magnitude stars, richly coloured as described in Monthly Notices R.A.S., vol. 25, p. 192.

Nothwithstanding this in connection with all other evidence, strong opposing influences have been brought to bear against the movements which have been observed, although it is well known to every astronomer that there is nothing stationary in the universe. The distance of such objects as the nebula about η Argus is in all cases so immensely great, their position in the sky often unfavourable, and convenient times for observing so far apart, that any alteration or physical changes may for centuries remain unknown.

The late Sir William Herschel writes, and is followed by Sir John, thus :—"Gravitation still further condensing and so absorbing the nebulous matter, each in its immediate neighbourhood might ultimately become stars, and the whole nebula finally take on the state of a cluster of stars," &c.—(*Vide* "Outlines of Astronomy," 5th edition, p. 640.) Mr. Proctor considers that an increased or decreased distance in space may account for the fluctuations.

The present object was observed and faithfully recorded by Sir John Herschel, when stationed at the Cape of Good Hope in the year 1837. It is quite impossible to say what, if any, alterations may have taken place in the nebula before that time; but it is cer ain that changes have taken place both in the star and in the nebula since 1854, and these fluctuations have been so great and unusual as to raise a doubt in the mind of Sir John Herschel as to their reality. This opinion, coming from such an authority, has influenced many others, who, notwithstanding all evidence, and without a single observation of their own, have refused to credit these recorded facts. Some also, who have but lately commenced observing, contrary to all scientific rule, ignore all previous observations made by others, in order to make an opening for their own.

To decide certain points of difference which are said to exist between the drawings made by Sir John Herschel, Lieut. Her-chel, and myself respectively, referees have been appointed by the Council of the R.A.S. The present paper has relation to the observations made for, and the reply sent to, the referees, in answer to their queries on the points alluded to.

In carefully looking over the drawings taken at Bangalore by Lieut. Herschel, with the object η Argus, 15° above the horizon, and also the reversed copy of Sir J. Herschel's, and on consideration of the discussion given with the drawings, I do not think that Lieut. Herschel's observations tend to disprove any one of the alterations which I have previously communicated to the Society. The present drawing, and the answers given to the referees, will, I think, render this clear.

The present observations have been made with the same instrument as the former ones, the object in the same position—approximately 80° above the horizon. The measures were taken with a bar micrometer by Cook and Sons, the bars being carefully traced in pencil on the drawing paper, in such a manner as exactly to fill the field of the telescope. All the stars visible were dotted down, the distances from η of the 6th, 7th, and 8th magnitude stars were lettered, measured, and catalogued from a scale of equal parts, after which the micrometer pencil lines were rubbed out, and the nebula inserted.

The first question put by the referees relates to a comparison of the positions of the principal stars and smaller groups as shown in my two drawings, which are said to have a sufficient general agreement with each other, considered as eye drafts, while they are irreconcilable with both Sir John's and Lieut. Herschel's configurations. A simple inspection of my drawing of 1870 with the reversed drawing of Sir John Herschel (A.A., plate 4 in the Monthly Notices R.A.S.) will show that the following principal stars hold a relative position considered as eye drafts, but not with the Cape Monograph as expressed in the letter D.D., C.C., (β), (κ), B.C., (E.), 522, 558, 640, 337, 383, 415, (γ), (λ), &c., &c. There are many other stars in my copy of 1870 that are not laid down in plate 4, pricked off from Lieutenant Herschel's drawing.

The other question of note refers to my "having placed within 11½′ (on the scale of my drawing of η) five stars of magnitude at least equal to η, that is, the 7th magnitude, while in Sir J. Herschel's monograph only one star of that magnitude (marked C.) occurs within that distance;" and continues, "can you give any elucidation of the cause of the discrepancy? also if you would furnish some instrumental determination of the difference of R.A., and P.D., between η and other stars of equal magnitudes."

In my acknowledgment of this letter to Mr. William Huggins, F.R.S., &c., I mentioned that it was not my intention or desire to dispute either Sir John's or Lieutenant Herschel's configurations, but to call the attention of the astronomical world to the altered features of both the star and the nebula, with a view of obtaining a solution of the changes seen in this most remarkable object. I further stated that the above question was of a physical nature, and could only be answered as such.

On reference to my former papers, it will be seen that mention is made, more than once, of the fact that the increase of stars of the same magnitude as η renders it difficult to know that star from others, but by its position, and a marked difference in the *light*.

It is to this cause I have so frequently referred the increase of light, which I think is now clearly confirmed by a comparison of Lieutenant Herschel's description with that of Sir John's. At one of the monthly meetings of the Society, Sir John Herschel considered the increase of light in the object, as recorded, very strange, and remarked, "when I was at the Cape the nebula could not be seen at all with the naked eye." Lieutenant Herschel, when at Bangalore, compared the increased light, when the object was only 15° above the horizon, to that of Pleiades in Taurus.

Mr. Le Sueur, in his report on the Melbourne reflector, says "the nebula around η Argus has changed largely in shape since Sir J. Herschel was at the Cape. The star shines with the light of burning hydrogen," and in his opinion "has consumed the nebula."

At the monthly meeting of the Royal Society of Victoria, held on the 13th of March, 1871, Mr. Fairlie McGeorge, who has now charge of the reflecting telescope at the Melbourne Observatory, read a paper in which he referred to some observations made with that instrument on the star η Argus, and the nebula; and stated "that the object had evidently undergone great changes since Mr. Le Sueur made his sketches of it. It was now beyond a doubt that enormous physical changes were still taking place."

The catalogue accompanying my present drawing, made for the referees, and laid on the table, will show that there are now in the same field two stars of the 6th, two 6½, three 7th, four 7½, four 8th, and nine of the 8½ magnitude, and it is literally crowded with others of from the 8½ to the 12th magnitude. Those lying outside the field and occupying an area of about 1½°, have their magnitudes attached. The small cluster I take to be Sir J. Herschel's 3276, described as "a fine, bright, rich, not very large cluster," if so it is now a beautiful cluster of richly-coloured stars, quite equal to κ Crucis.

It is almost impossible to define the boundary of the nebula, as it appears to be gradually fading away, and is not so distinct in outline as formerly.

The finest nights have always been selected for observing, and no delineation of the object has ever been given, but what was an accurate representation of its appearance through the telescope.

The following is an extract from a letter addressed by Mr. Severn, of Melbourne, to the Astronomer Royal, and printed in the Monthly Notices, Royal Astronomical Society, for April, 1870 :—"I may say that I cannot confirm the new position given to η Argus in respect to the nebula. I have watched it for fourteen years, and it is just where it was; of course much less brilliant."

A letter dated 21st June in the same year which I received

* Read at a meeting of the Royal Society of Tasmania, 9th May, 1871.

from Mr. Severn contains the following passage :—"My present motive is to draw your attention to the injustice done you in the η Argus business ; I have of course read all your letters in the Monthly Notices of the R.A.S. on the subject. You must not allow the *Spectator*, or Mr. Le Sueur, or any other man to deprive you of your discovery ; you have at least done, and that years ago, what the 4ft. Cassegranians and Mr. Le Sueur are claiming as their discovery. I can't stand this, and therefore if you don't defend yourself, by writing to our papers, I must. I send you a *Leader* with my paper in it, also another *re* η."

On reading these two extracts, which are dated about the same time, it will appear that the writer must have very suddenly changed his mind.

In June 1869 I visited Melbourne for the purpose of seeing the new large reflecting telescope, and must confess to being much surprised on seeing the object η Argus in such a small field with so large an instrument. Mr. Le Sueur thought at the time that he saw a faint shadow of a lemniscate ; and what I saw was a dark path across the nebula, not unlike that portion of Eridanus, occupied by 188 and 198 l. C. and not far from the star Achernar. The object was only seen between passing clouds, and although the best speculum was in the instrument at the time, the definition was not good.

In June 1862 I brought before this Society a copy of the drawing made from observations on that beautiful cluster of coloured stars known as κ Crucis, the original drawing, &c., of which was at the time remitted to the Royal Astronomical Society, with notes on the variation of both colour and position when compared as eye drafts, with Sir John Herschel's observations made at the Cape of Good Hope. (Vide Monthly Notices, R.A.S., Vol. 23, p. 32.)

As the instrument used at the Cape was in every respect different from the one used in Hobart Town, and the effect of colour varying, as it does, so much in different persons, I discontinued observing to allow time for other changes to become known, and have now waited nearly nine years, in order to compare the object with the previous drawing by the same optical means. Sir John Herschel estimated this cluster to be formed of from 50 to 100 stars ; in the drawing of 1862, a copy of which now lies on the table, there were laid down 75 stars to which the colour of each was given. It is now known that certain alterations have taken place since 1862, but a series of cloudy nights has prevented the possibility of preparing a sequent to the former drawing in time for the present meeting. F. ABBOTT

SCIENTIFIC SERIALS

Transactions of the Manchester Geological Society. Vol. ix., Parts 1, 2, and 3 ; Vol. x., Part 1. We have in these first three parts the President's Address and the papers read before the society during the session 1869-70. The papers are twelve in number, and embrace a variety of topics. Mr. Boyd Dawkins gives an account of some explorations in the Denbighshire caves. In one of these a large quantity of human bones was found intermingled with remains of horse, goat, hare, rabbit, badger, large birds, wolves, wild cats, foxes, and Celtic shorthorns, roe and red deer. He is of opinion that this cave has been used as a burial place at different times in the pre-Roman era. The skulls found belong to that type which Professor Huxley terms the "river bed skull," and the tibiæ indicated the platycnemic character or the bandy-leggedness of the people to whom they belonged. There are other three papers on palæontological subjects—"On a Specimen of Homalonotus Delphino-cephalus," by Mr. Edward Holber ; "On some Starfishes from the Rhenish Devonian Strata," by Mr. J. Eccles, and "On two Species of Productus," by the same author. To these may be added another by the president, Mr. J. Aitken, "On the Pholasboring Controversy," in which the author concludes, against the notion upheld by Mr. Macintosh, that the holes found in the faces of certain limestone rocks at many different levels, even as high as 1,435 feet above the sea, have been bored by pholades during a period of submergence. He inclines to the belief that the holes have been formed by land molluscs, as originally suggested by Dr. Buckland. There are several papers on physical geology, which will repay perusal. The longest of these is one by Mr. Spencer, "On the Millstone-Grit Rocks" of Halifax, which will be of use as a guide to that locality. The author distinguishes four beds of grit separated by intervening thick shales. Lists of fossils are given, and these are not so meagre as one might have expected. Mr. J. Curry has a paper "On the Throw of the Pennine Fault," which he thinks is not so great as is commonly believed. Some interesting "Observations on the Temperatures at the Pendleton Colliery," by Mr. J. Knowles, are sure to be frequently referred to. "On some of the Causes of the Different Modes of Working and Ventilating Coal Mines," by Mr. Warburton, contain some wholesome criticism. He maintains "that the systems of working coal, as at present practised, do not depend upon the nature or condition of either the coal or the roof, but upon the mining education of those who have the management." Difficulties in the way of ventilation arise from ignorance and from the modes of working often interfering with well-known natural laws. Other papers in Vol. ix. are "On the Use of Gunpowder in Mines," by Mr. Greenwell ; "On two Dykes in North Lancashire," by Mr. Eccles ; and "Observations on some Specimens of Silver Ore from United States," by Mr. Fletcher. Part 1. of Vol. x. is occupied for the most part with the President's address, inaugurating the session 1870-71. Mr. Aitken treats of our coal supply in its various aspects, and a number of other, chiefly palæontological, topics. The other communications in this part do not call for any special remark. They are three in number, viz., "The Spirorbis Limestone in the Forest of Wyre Coal Field," by D. Jones ; "On Faults in Drift," by J. Aitken ; and "On the Underground Conveyance of Coals," by G. C. Greenwell. We are glad to see from the report of the Council that the Society is flourishing, and that the number of contributors to the Transactions is increasing.

Verhandlungen der k. k. geologischen Reichsanstalt zu Wien. Nos. 8 and 9 (1871). No. 8 contains the usual short summaries of papers and reports, among which may be mentioned one on the last earthquake and the hotsprings and solfataras at Milo ; and another on the Tertiary Land-fauna of Central Italy, by E. Suess. The other papers are more of local interest, but a number of useful analyses of minerals is given. Among the notices of contemporary publications is one of a work by Dr. Prestel, on the Climatal and other Changes which the Coasts of the North Sea have undergone since Glacial Times. In No. 9 will be found a short account of a Coast Survey of the Adriatic Sea. The survey when completed will, it is expected, make the bed of this sea as well known as that of any other which has been explored. The bottom of the south basin of the Adriatic is covered throughout, it would seem, with a yellow sludge or slime, which is brought down by the large rivers of Albania. In this same area a remarkable rocky plateau rises up from the slimy sea-bed, at a depth of from 325 to 370 fathoms to within 100 fathoms of the surface. Some details of other parts of the sea bottom are given. The number contains several other reports, among which we find some account of the Library of the Institute, which would appear to be in a flourishing condition. The usual literary notices and lists of books received conclude the number.

SOCIETIES AND ACADEMIES

LONDON

Royal Microscopical Society, October 4.—Mr. W. Kitchen Parker, F.R.S., President in the chair. The first meeting of the session was held on Wednesday evening. Mr. Parker contributed a valuable paper "On the Development of the Facial Arches of the Embryo Salmon," at the conclusion of which he expressed his opinion that the development of the brain case of the osseous fishes demonstrates that group to be much closer allied to the Sauropsida, or Birds and Reptiles, than it is to that of the Batrachia, or Frog tribe. Mr. Parker highly eulogised the use of chromic acid as a medium for hardening without distorting the substance of the brain when required for sections.—Dr. Spencer Cobbold handed in a report on some preparations of Entozoa with accompanying notes, forwarded to the Society by Mr. Morris, of Sydney, and made observations on some of the most interesting forms. Of the five species collected by Mr. Morris, Dr. Cobbold stated that by far the greatest amount of importance was to be attached to the discovery in Australia of *Stephanurus dentatus*. This Entozoan was introduced to the scientific world as early as the year 1834 by Natterer, who found it in large quantities infesting the adipose tissues of a breed of Chinese pigs, on the Rio Negro in Brazil. Up to the year 1870 nothing further was heard of this parasite, when Dr. Cobbold received a communication from Prof. Fletcher, of New

York, stating that it was committing great destruction among the pork-raising districts of the United States, thousands of pigs in some localities falling victims to its ravages. In aspect and structure *Stephanurus* bears a close resemblance to *Trichina*, but is of much larger size, the cysts of the former frequently measuring an inch or an inch and a half in length; its greater magnitude is the principal safeguard against its introduction into the human subject. Dr. Cobbold supplemented his remarks with some observations on the question of sewage irrigation connected with the propagation of entozoic diseases. In his opinion it played a very important part, and he did not feel his position in the slightest degree destroyed from the fact of Mr. Hope's ox brought up for nearly two years on the produce of the "Breton" irrigated farm being entirely free from internal parasites of any kind. This animal had never been allowed to graze, but had had all its food cut and carried to it; its water was all brought to it, and altogether the animal had been so carefully guarded and nurtured that the Entozoa were shut out from any chance of obtaining a foothold. The soil, again, on Mr. Hope's estate was of such a porous nature that the matter containing the undeveloped germs was at once absorbed, while on swampy ground, as instanced about Croydon and other low-lying districts, where this mode of irrigation was practised, the roots of the grasses were constantly immersed in it. The prevalence of tape-worm and other entozoic diseases in those parts of India where sewage irrigation is carried out, is enormous, and thousands of cattle are destroyed as being unfit for human food. This wanton destruction of all carcases containing traces of *Cysticercus*, or other Entozoa, Dr. Cobbold severely censured, as the meat, on being thoroughly cooked, even though infested with parasites, is wholesome, free from any abnormal taste, and its consumption is unattended by deleterious results.

PARIS

Academie des Sciences, September 25.—M. Faye in the chair. M. Dumas, the perpetual secretary, gave many interesting details of a report written by a committee of which he is a member, describing the *Phylloxera vastatrix*, the pest of the vine. A prize of 400*l.* was offered for its destruction by the French Government, and will be awarded in 1873. But two candidates have invented means which appear to be good. M. Faucon has suggested putting the whole vine garden under water for two days, which is sufficient to suffocate the insects with injuring the plant itself. When it is impossible to inundate, M. Blanthou suggested to water with a liquid composed of 1,000 parts water and one of impure phenic acid.—M. Fonssagrives has discovered that the mouldiness of Roquefort cheese, which is eaten by French *gourmets* only in a state of putrefaction, when placed on a piece of bread, developes the *Oidium aurantiacum*, which may account for the abundant appearance of this pest last summer.—M. Dumas reported upon the results obtained by microscopical selection, as suggested by M. Pasteur and practised by many French silkworm breeders for curing the silkworm plague known as *pébrine*. The results are magnificent, and the plague may now be considered as almost entirely suppressed. Last year one-tenth of the French silkworm breeders used the method invented by M. Pasteur, and the use of it will be almost universal in the course of a few years.—M. Grimaud of Caux, one of the veteran members of the Parisian scientific press, read a memoir "On the Smoke of Locomotives in the Mont Cenis Tunnel." M. Grimaud finds it to be a great objection, and to require much caution. But such is not the advice of people who are fresh from the tunnel.—M. Philips read a long paper, by a gentleman who does not belong to the Institute, "On the Integration of some Special Differential Linear Equations." He commented largely upon the paper, which he finds worthy of much consideration. New communications "On the Spectrum Analogies of Simple Bodies" were also read.

PHILADELPHIA

Academy of Natural Sciences, January 3.—Mr. W. M. O. Vaux, vice-president, in the chair. Professor O. C. Marsh, of Yale College, exhibited a tooth of a new species of *Lophiodon*, from the Miocene of New Jersey, which was the first indication yet discovered of remains of the Tapiridæ on the Atlantic coast, or of the genus *Lophiodon* in this country, east of the Rocky Mountain region. The tooth, which was in a perfect state of preservation, was the first true molar of the left upper jaw. It measured across the crown seven lines in antero-posterior diameter, and eight and one-quarter lines in transverse diameter. This would indicate an animal intermediate in size between *L. occidentalis* and *L. modestus* of Dr. Leidy. From the latter species it may readily be distinguished by the enamel of the crown, which is smooth and not wrinkled. As this species is evidently distinct from any described, Prof. Marsh proposed for it the name *Lophiodon validus*. The specimen was found in the miocene marl of Cumberland County, New Jersey, and apparently at about the same horizon as the *Elotherium Leidyanum*, and *Rhinoceros matutinus* Marsh, from Monmouth County.

January 24.—Mr. Vaux, Vice-President, in the chair.—Mr. Thomas Meehan presented a fruit of a pear, which presented the external appearance of an apple, gathered from a Tyson pear tree growing in the garden of Dr. Lawrence, of Paris, Canada. Dr. Lawrence had a Rhode Island greening apple near the pear tree, and some of the latter interlaced with it. The pear tree was full of blossoms last spring, but only those interlacing bore fruit. They had all the appearance of apples, so much so, that many who had seen them supposed there must have been some mistake as to Dr. Lawrence gathering them. Dr. L., had, however, when he first saw them, obtained Mrs. Lawrence's aid in separating the branches, so that there should be no mistake. The specimens had been sent to Mr. Meehan, who regarded them as apples; but on cutting them open, found the seed to be of the pear. The granular matter characteristic of the pulp of the pear also existed in the carpels, but none in the pulp, which was wholly fibrous, as in the apple; the insertion of the stalk, also, was that of the pear. Instead of the cavity being funnel-shaped, as in the apple, it was campanulate, as if the stem had been pushed in, carrying the epidermis and pulp with it. He had no doubt that the fruit had the pedicel, carpellary walls, and seeds of the pear, with the granular pear-pulp wanting; but with the fibrous pulp and epiderm of the apple. As to the law of its production, he disliked speculation, but it would seem that there were two ways in which it might be produced—either by a natural evolution of form, independent of sexual influence, which plants at times exhibited, or by cross-fertilisation with the apple. In the latter case, if found true, it would have an important bearing on the question often mooted, whether cross-fertilisation effected change immediately in the fruit impregnated, or whether change only appeared after the germination of the impregnated seeds. In the case of varieties of Indian corn, we know the change is immediate; and it was generally believed some cucurbitaceous plants furnished similar facts; but he thought it had not been known in other plants, especially in the case of species as distinct as the apple and pear.

BOOKS RECEIVED

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