THURSDAY, MARCH 18, 1875

SCIENTIFIC SURVEYS

THE almost universal idea in this country of what constitutes a Scientific Survey goes no further, we believe, than the departments of Topography and Geology, and, as we are a seafaring people, the Hydrography of our coasts. We daresay many of our readers will be surprised to hear that some whose opinions in matters of this kind ought to have great weight, deem any survey totally inadequate which does not, to a greater or less extent, include nearly every department of science. What are the prevalent notions on the subject on the other side of the water, may be learned from a Report just issued on a proposed New Survey of the small State of Massachusetts.

Last year the American Academy of Art and Sciences presented a memorial to the General Court of the State of Massachusetts, urging the necessity for a new Scientific Survey of the Commonwealth. It is forty years since there was a survey of the State; that was the first public survey in the United States, and included not only topography and geology, but zoology, botany, and agriculture as well. The biological surveys were so well done that some of the reports are even yet regarded as standard works, but the advances in all departments during the past forty years have been so great, that practically a new survey is required.

The suggestion of the new survey came appropriately from the principal scientific body of the State, and it is gratifying to see that the Legislature have such a respect for its opinion as at once to take action upon the suggestion. The memorial of the Academy was referred to the Board of Education, a committee of which took the wise course of calling to their council the most eminent men of science in the State, who could aid them with their advice. The names of most of those who were called in to give the results of their study and experience are known to science all the world over; they are Professors B. Peirce, N. S. Shaler, and E. N. Horsford; President Clark, Dr. T. Sterry Hunt, Dr. Asa Gray, Dr. A. S. Packard, Mr. G. B. Emerson (who reported on the trees and shrubs in the former survey), Mr. Alex. Agassiz, Hon. Moses Kimball, Mr. C. F. Adams, Mr. S. H. Scudder, Mr. A. G. Boyden, and Mr. H. F. Walling.

The Report which has come to hand gives an account of the meeting between these eminent representatives of science, pure and applied, and the committee of the Board of Education. Each one freely expressed his opinion of the desirableness of the proposed survey, showed how it should be conducted so far as his own department was concerned, and pointed out the advantages which would certainly follow from a thorough survey. As might be expected, they are unanimously in favour of the proposed undertaking; and the immense advantages which were shown would accrue from it if carried out thoroughly in all departments, leave the State no alternative but to organise it as early as convenient.

A special committee from among the men of science named above—Messrs. Peirce, Sterry Hunt, Shaler, and Scudder—in their Report to the Education Committee recommend a scale of 1 : 25000, or $2\frac{1}{2}$ inches to the mile, as the scale which ought to be adopted for the survey; but this they do solely on the score of expense, admitting the superiority of the 6-inch scale. Prof. N. S. Shaler, in an impressive article in the March number of the *Atlantic Monthly*, strongly advocates the latter scale; for although the immediate cost would be at least double that of the smaller scale, still in the end it would be more economical; as, although the smaller scale would serve many useful purposes in the meantime, he declares it would be found that the survey would have to be repeated on the larger scale. We think the State of Massachusetts would be wise to profit by Mr. Shaler's hint, and accomplish the survey once thoroughly and completely on the larger scale, so that it would never require to be repeated. Indeed, the United States have had several lessons on this point; a considerable number of the States have been surveyed, but the surveys have all been more or less failures; "there is not a single survey in this country," Prof. Shaler states, "which does not need at the moment to be done over again."

The practical advantages of topographical and geological surveys are so evident that it is unnecessary to point them out; no one, we presume, will deny that it is the interest and duty of every civilised country to obtain a complete and trustworthy knowledge of the extent, configuration, and composition of its surface. The important practical advantages which may result from a thorough geological survey have been well illustrated by a recent undertaking in America—the Hoosac Tunnel. It is Prof. Shaler's belief that "a due inspection of the surface of that ridge would have disclosed some of the difficulties encountered in the excavation of the tunnel, difficulties which would have been in a large measure avoided, had the engineers been forewarned. It does not seem too much to say that the cost of a complete survey, with a map on the scale of six inches to the mile, might have been saved by this easily gained knowledge."

But the State of Massachusetts has already had the wisdom to perceive that it is for the material advantage of a country that a knowledge of more than its topography and its geology should be easily accessible. To a thickly populated country, what can be of more moment than its hydrography, its water supply, which is also of so great importance in connection with manufactures? In the proposed survey of Massachusetts a thorough knowledge of its hydrography will probably be considered as an indispensable part of the work. It seems almost a truism to say that in a country devoted to agriculture, an exhaustive scientific examination of its soil would be a work of the greatest national advantage; such an examination has been to some extent made in Massachusetts, and the scientific men whose advice has been asked urge that it should be carried out over the whole of the State.

The practical advantages to be derived from a knowledge of the botany and zoology of a country, especially a country where agriculture is one of the staple industries, seem almost equally apparent. If our farmers were well acquainted with all the plants and insects and birds which annually destroy so large a quantity of the cultivated produce of the soil, and at the same time knew how to meet their ravages, the saving to the nation would be enormous. Dr. A. S. Packard estimates that in Massachusetts alone they lose every year, from insects and parasitic plants, 500,000,000 dollars; and that in one year alone they lost by the army-worm 250,000 dollars' worth of hay-crops. No wonder he says, "Certainly it will be a good thing to have a body of observers at work systematically, year after year, collecting information, which may be spread before the farmers of the State and others interested." In this connection the words of Mr. A. G. Boyden are worth quoting:—

"The relation of the animal to the vegetable kingdom is a most intimate one. In the cultivation of orchards, garden vegetables, and things of that sort, upon which we as a people depend a great deal, we have to contend continually with insects; if we could learn, therefore, the facts about the insects that are found in this State; if we knew how they were generated, how they grow, and what they feed on, we might do a great deal towards saving a large part of the crops that are now destroyed by them. For instance, the canker-worm comes periodically, and very few people know much about the habits of this insect. Very little is known about insects by people generally. They do not even know them by name. They do not recognise an insect in the three stages of its life. Every gardener, every orchardist, every person cultivating herbs, trees, or shrubs, needs this information. As has been said this morning, we have not the books to which we can go for help in gaining this information. . . . Mr. Emerson has given us an excellent book on the trees of the State, which is a very great aid, but in respect to the other matters of which I have spoken, we have very few such helps as are needed. It would seem, therefore, that a survey of this kind, in which scientific men were employed, who could, as they went over the different localities of the State, collect, incidentally, and without adding very much to the expense, the facts relating to these subjects, would be of great value."

The body of evidence contained in the Report before us seems to us to show clearly, what indeed is almost self-evident, that one of the first duties of a nation, from the lowest point of view of self-interest, is to obtain a complete scientific knowledge of its home and all that it contains; only thus can it be able to make the most of its natural resources.

While the great practical advantages of the survey were insisted upon, the gains to science and to education which would accrue from it were also brought prominently forward. Some important problems in science, it was shown, might be solved by a thorough geological and biological survey of Massachusetts; one of the most important of these is in connection with Cape Cod.

"Here, in Massachusetts," Prof. Shaler says, "you have certain peculiar questions connected with the distribution of animal life to the north and south of Cape Cod, which offers one of the most remarkable illustrations of the variations in the distribution of animal life that is afforded anywhere in the world. The constant changes as years go by, the influence of temperature on the distribution of animals, these are questions which can be investigated there. There is no question that Cape Cod is one of the great problems of Massachusetts, and it is a problem on which a large number of investigations should be hung. Prof. Peirce, who has carefully traced and grouped the facts connected with that part of the coast, will agree with me in saying that Cape Cod is the key-point; that geologically it is the most important point in Massachusetts, with regard to the agencies that have been at work in the creation of the soil, especially with reference to the glacial period, &c."

With regard to education, it was shown that in several ways this exhaustive survey would be of great value. It was proposed by some that the scientific students in the several colleges might with advantage to themselves be occasionally employed on the work, while they might be of some assistance to the survey-parties; this plan, if judiciously carried out, might indeed be of great service both to the students and to the work of the survey. Prof. Shaler pointed out that what he thinks the principal defect of the British Survey does not concern its work, but its effect upon British science. "It has not taken pains," he said—and we cannot take upon ourselves to judge of the justice of his statement—"to connect itself enough with the work of education in Great Britain; and the result is, as is admitted by some of the oldest geologists there, that there are few young geologists coming up in England at this time." This, if true, is certainly a great lesson for Massachusetts, as Prof. Shaler says; we hope, however, he has overstated the case, or at least that the supply of geologists in this country is not dependent on the Geological Survey. It was shown that in other ways a complete survey in all departments would be of the highest advantage in carrying on the practical education of the young in schools of all classes; and that from want of the results of such a survey, education was seriously hampered.

It will thus be seen that if in the course of years—for it is proposed to do the work leisurely and allow eminent scientific men to share in it as they can find opportunity—the people of Massachusetts do not have one of the most accurate and most complete surveys in the world, it will simply be because they are blind to their own real interests, which have so forcibly been brought before them by some of the most eminent of their scientific men, in whom the State is so rich. But as "the commonwealth of Massachusetts has not been wont long to weigh great advantages against small expenditures, so we may safely anticipate," with Prof. Shaler, "her speedy action."

Need we point any moral for ourselves from the liberal and comprehensive ideas which the comparatively small (its extent, 7,800 miles, is only about that of Wales) and young State of Massachusetts has of what a survey of her territory includes? We have our topographical and our geological surveys, both doing excellent work, and both already productive of large practical and scientific results. But if we want to make the most of our small and over-crowded country; if we want, as we certainly should if we have our own welfare at heart, to have a complete knowledge of our country's resources, why should we stop short at topography and geology? Forty years ago Massachusetts showed itself to be far wiser than Britain is even now. Even then the little Transatlantic State saw it to be to its best advantage to know all about its soil and its natural products; we do not know that the question has ever been mooted in this country. A knowledge of what is being done on the other side of the water may give us a perception of our true interests and our duty to ourselves and the world. To apply the words of Prof. Shaler: "Look at it as we may, measuring its immediate gains to our mines, our fields, our water-mills, to our cities in their water supply and sewage, to our railways and common roads, to the interests of each owner of an acre that is to be improved; or considering the remoter yet not less real economy which is found in increased knowledge of the Nature about us, and in the advancement of education, the reasons for Survey this are very strong."

THE COUNTESS OF CHINCHON

A Memoir of the Lady Ana de Osorio, Countess of Chinchon and Vice-Queen of Peru; with a plea for the correct spelling of the Chinchona *genus.* By C. R. Markham, C.B., F.R.S. (London: Trübner and Co.)

THIS work is an attractive addition to the early history of quinine and the other alkaloids derived from the same source. The general subject is full of interest to numerous classes of the community, and the importation of plants into our Indian possessions has been the subject of much attention on the part of our Government. Indeed, it was the result of the author's exertions that living specimens were obtained in this country, and by this means that India was supplied; it is therefore natural that he should take a parental interest in this matter.

The knowledge of the efficacy of these drugs was brought to Europe in the year 1640 by the Countess of Chinchon on her return to Spain with her husband at the expiration of his term of office as Viceroy of Peru. This lady during her residence there was attacked by tertian fever, and after being reduced to the point of death, was, under romantic circumstances related by the author, cured by the use of Peruvian bark. On the return of the count and countess to the castle of Chinchon, it is gratifying to read that the countess, who had brought with her a supply of the precious bark which had effected such a wonderful cure upon herself, "administered Peruvian bark to the sufferers from tertian agues on her lord's estates in the fertile but unhealthy *vegas* of the Tagus, the Jarama, and the Tajuña. She thus spread blessings around her, and her good deeds are even now remembered by the people of Chinchon and Colmenar in local traditions" (p. 45).

Though from time to time during the succeeding hundred years powders of the Peruvian bark were imported into Europe, it seems that no scientific account of the tree was published until 1740, in which year De la Condamine published a description and figure in the Memoirs of the Academy of Paris for 1738, under the generic name of *Quinquina*. This communication contained also an account of the history of the drug, wherein the name of the Countess of Chinchon was duly mentioned and properly spelt, and on the information obtained from it and quoted in acknowledgment, Linnæus, in the second edition of his "Genera Plantarum," published at Leyden in the year 1742, founded his genus *Cinchona* in honour of the Countess of Chinchon.

The author commences his book by tracing the pedigrees, accompanied by coloured illustrations of the armorial bearings, of the families of Ana, Countess of Chinchon, and of the Count of Chinchon; nor does he omit to describe and illustrate the town, neighbourhood, and castle of Chinchon. The town contains some 6,000 souls, and its distance south-east from Madrid is given as twenty-four miles.

But it is reserved to the end of the book to treat of a matter which evidently lies deeply seated in the author's affections; unless for its sake the book would probably never have been written. This is a vigorous argument, called in the title a plea, for what he considers to be the correct spelling of the generic name.

The author's object is to prove that the name *Cinchona* should be replaced by *Chinchona*, and he argues that the latter form is etymologically right, that Linnæus was misinformed as to the true spelling of the countess's title, that it is supported by the majority of authorities who have studied the genus in its native *habitat*, and is now the form in common use where the plant is cultivated, as well as in official correspondence, and that it is consequently the most convenient form. He further states that the former spelling has never been generally adopted.

In the matter of etymology the author is certainly right, but neither botanists nor the public are simply led by this rule when more important considerations require a different course; botanists have greater regard to priority and the public to general convenience, and both in respect of priority and convenience *Cinchona* is the more correct word.

It has been already explained that Linnæus was not misinformed as to the spelling of Chinchon; and it is therefore probable that he considered euphony in forming the name, in accordance with his aphorisms: *Terminatio* et *Sonus* nominum genericorum, quantum fieri possit, facilitanda sunt. Nomina generica *sesquipedalia*, enunciatu *difficilia* vel *nauseabunda* fugienda sunt. Thus, in honour of Barrelierus, Linnæus named Barleria, and in many other cases he sacrificed strict etymology to elegance and convenience.

Mr. Hanbury, in the *Athenæum* for January 30, has shown that, in the course of a long correspondence with Linnæus, Mutis, though in his earlier letters he spelt the name *Chinchona*, yet in his later letters he followed the spelling of Linnæus, and wrote *Cinchona*; also, that in 1758, J. Ch. Petersen read at Upsala an academical dissertation, "*De Cortice Peruviano*," Linnæus presiding, and in this paper he always spelt the word *Chinchona;* this is, however, not a botanical essay.

Linnæus, in all his other works and editions, always retains his original spelling. The author erroneously states that Linnæus altered the spelling in his different editions, and draws the inference that Linnæus was willing to modify his original spelling and desired to spell the word correctly. In the sixth edition of the "Genera Plantarum," published at Stockholm in 1764, on p. 91 the word is accidentally spelt *Cinhona*, but this was clearly a typographical error; for in the synopsis of the genera of Pentandria, on p. 69, it is spelt *Cinchona*, and so again in the index to the volume; and if further proof is wanted, the error on p. 91 was given in the errata and corrected. In the edition of 1767, printed at Vienna, which is without the authority of Linnæus, and is, in fact, only a reprint of the sixth edition, the same spellings occur in each place, except that we find in the errata, *Cinbona* (instead of *Cinhona*) corrected into *Cinchona*.

So universal was the authority of the Linnæan spelling, that no botanical treatise published and adopted a different one until the year 1862. The name *Chinchona* does not occur in Steudel's "Nomenclator Botanicus," second edition, published in 1840–41.

With regard to the botanical authorities that the author claims for his spelling, Mr. Hanbury has shown that Ruiz, Pavon, and Mutis rather incline the other way; Ruiz and Pavon, in their great work, the "Flora Peruviana," &c., adopted *Cinchona*, and Mutis finally came to the same conclusion. Mr. Spruce, another of the claimed authorities, in the Journal of the Linnæan Society, writes *Cinchona*, though in certain Blue Books he writes *Chinchona*. It must be remembered that such Blue Books appear to have been prepared under the direction of the author in his official capacity at the India Office, and to have had the word *Chinchona* forced into prominence. There remain only Tafalla, a pupil and successor of Ruiz and Pavon, Zea and Caldas, pupils of Mutis, all three of but little importance, as well as Dr. Seemann and the author, to weigh against such authorities as Humboldt and Bonpland, Poeppig, Weddell, Triana, Karsten, and others, as well as the universal concurrence of all the great systematic botanists from the time of Linnæus to the present day.

If then this question is to be settled by the weight of usage and authority, it is evident that an exceedingly rough balance suffices to give a ready result unfavourable to the author's case.

It is equally clear that much inconvenience would ensue from the change proposed and adopted by the author. To the systematic botanist great would be the inconvenience of altering the second letter of a generic name the first letter of which is C, an initial which is commoner than any other, and which stands for about one-seventh part of the whole number of genera. The suggestion that in an index a cross reference would meet the difficulty is good to a certain exent, but it would not altogether remove the nuisance; nor would the chemist, the apothecary, and the public generally accept without repugnance a change which would affect the spelling and damage the pronunciation not only of the original word, but also of derivatives in frequent use such as Cinchonine, Cinchonidine, Cinchonicine.

In short, the Linnæan name *Cinchona* is no longer under the control of the Countess of Chinchon, nor of the town of Chinchon, nor yet of those enamoured of either; it sufficiently recalls the memory of the benevolent countess; but it has long become scientific and general property, and stands by the right of usage and priority; it has a settlement due to a century and a third of time, and neither scientific men, nor the commercial world, nor the general public will be likely to alter it and the several words derived from it on the plea set up by the author.

W. P. H.

GERLAND'S "ANTHROPOLOGICAL CONTRIBUTIONS"

Anthropologische Beiträge. Von Georg Gerland. (Halle an der Saale: Lippert'sche Buchhandlung, 1875.)

THE present volume is, as the author informs us, only the first of a series of several volumes, in which it is his intention to group together as far as possible all the aspects under which the modern science of anthropology may be considered; to weigh the importance and estimate the nature of the problems which it has to solve; and to bring clearly and objectively before the reader the different steps that have been attained, or are demonstrable by facts, in the history of the origin and subsequent development of mankind.

The difficulty of the task which Dr. Gerland has thus set himself seems to us to be only equalled by the probable remoteness of its accomplishment. We all know that there is a tendency amongst German writers to project works on too colossal a scale, and to fill in their ground with such inexhaustible masses of detail, that every fresh accumulation of facts becomes a mountain across their readers' path, tending to obstruct rather than to clear the view; and valuable as are the materials which Dr. Gerland has brought together, his "Anthropological Contributions" cannot be pronounced free from these tantalising failings. Those who have time and patience to follow the author along all the collateral lines of inquiry into which his subject is incessantly divaricating will no doubt find themselves repaid for their labour; but the anthropologist, who has neither the need nor the leisure for going over old ground in search of new facts, will find it difficult to sift the wheat from the chaff.

In his introductory chapter Dr. Gerland considers all the branches of human inquiry with which anthropology is associated; the importance of missionary enterprise in relation to its bearing on the extension of our anthropological knowledge; and the influence that the estimate in which women have been held among any definite people, or at any fixed epoch, has had in modifying the *morale* and *physique* of the entire sex.

In the second, or main section of the work, the author treats of the primary and developmental history of man from the evolution point of view. Setting aside the hypothesis of special creation as utterly untenable, and as wholly discarded by every rational anthropologist, he proposes to consider man as derived by mechanical means from a natural animal source; beginning his line of argument by a discussion on the relative claims of the different portions of the habitable world to be regarded as the cradle of the human race. In this section of his work Dr. Gerland shows a vast amount of curious learning, and brings together a valuable mass of facts relating to the past as well as present fauna and flora of different regions, and their consequent greater or lesser adaptability for the coexistence of man. He considers the fac that the African races depend for their food-supplies on plants such as the sorghum and other cereals, which have come from Asia, although their own continent possesses many edible indigenous plants to which recourse is had in times of emergency, as a proof that man did not take his origin in Africa, for it is wholly irrational to suppose that after having once used native-grown cereals in their primary condition, men should have neglected these in favour of others imported from another continent like Asia.

In discussing the probable period in the earth's history when man appeared, the author insists upon the absolute necessity of geognostic repose as an indispensable element in the development of man from an animal origin. Cataclysms and violent disturbances of the earth's crust are obviously incompatible with the free enjoyment of all the essential requirements of animal existence, without which any advance in the developmental order of such an existence is inconceivable. In conclusion, he claims to have proved that we have solid grounds for maintaining that man, considered both in his psychical and his physical nature, has been developed gradually and normally, and must be regarded as a link in one and the same serial chain of development to which all other organic bodies belong. Furthermore, he asserts that we cannot regard the organic and the inorganic as of heterogeneous origin; such an assumption would militate against the unity of the universe; and therefore we must assume that the organic has been developed from the inorganic. As development depends upon attraction and motion, and assimilation regulates the combinations of atoms and molecules, the ultimate development of more highly organised bodies is dependent upon the assimilation of more perfect combinations of matter, or, in other words, on better food, and hence the striving of the animal nature to obtain definite forms of nourishment must of necessity have exercised a paramount influence on its higher development. Thus, he argues that the organs of the senses, as sight, taste, &c., resulting ultimately in the formation of brain and nerve centres, have been developed in the vicinity of the mouth as auxiliaries in the process of nutrition. The author believes that every group of organisms has a definite supreme beyond which it cannot ascend: and while he considers that, mentally and psychically, the best of the human race will probably in remote future ages be able to attain a higher degree of perfection than any allotted to us in the present age of the world, he does not anticipate that externally they will differ greatly from ourselves.

The difficulty of answering why animals no longer pass the bounds of their parental types, he meets by assuming that the cosmical, natural, and geognostic relations which rendered such an advance possible in the case of the human race, and of the forms from which it was directly developed, no longer exist, and that hence the lower animals must remain fixed within their several limits.

We do not know how far his German readers may approve of the phonetic mode of spelling adopted by the author, but we confess that, notwithstanding the high authorities which its advocates advance in its justification, we fail to recognise its expediency or desirableness, and greatly prefer the ordinary mode.

OUR BOOK SHELF

The Aërial World: a Popular Account of the Phenomena and Life of the Atmosphere. By G. Hartwig, M. and P. D. With eight Chromoxylographic Plates, a Map, and numerous Woodcuts. (London: Longmans and Co., 1874.)

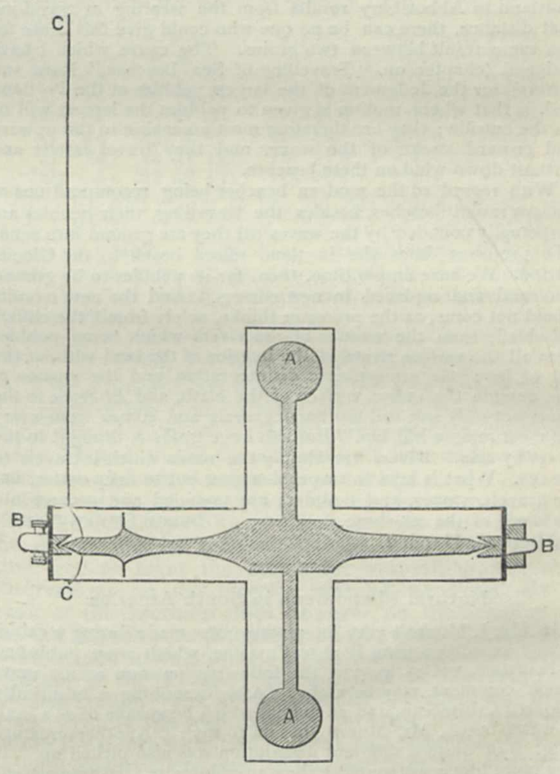
DR. HARTWIG is already well known as one of the most successful popularisers of the results of scientific research; and judged of from the point of view from which they are written, his books must, we think, be reckoned as of considerable value, and as likely to be of much use, both in spreading accurate scientific information and in giving their readers a taste for further independent study of science. Under present conditions we deem works of this class a perfectly fair means of scientific propagandism, hoping all the same that the time will come when the gospel of science will need no allurements to make it attractive to the people. In this volume Dr. Hartwig gives a vast amount of information on a great many subjects intimately or remotely connected with the air. It is not merely a popular treatise on Meteorology, which of course has a large share of space devoted to it, but it contains as well much information on Sound, Light, Aërolites, Geology, Ocean Currents, Flight of Birds and Insects, Aërostatics, and many other things in "the heavens above, the earth beneath, and the waters under the earth." All the information in the book is valuable and rendered attractive mainly by a profusion of anecdotes, on the whole happily introduced. Dr. Hartwig's style is fluent and generally agreeable, sometimes eloquent and occasionally florid. His information, collected from a vast variety of sources, so far as we have tested it, is accurate and well up to time. We sincerely wish the work a large circulation. The numerous illustrations add in the main to its attractions.

LETTERS TO THE EDITOR

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

A Gyrostat Problem

THE following question, taken from an examination paper set to the students of the Natural Philosophy Class in this University, Sir W. Thomson desires me to send to NATURE, as one likely to be interesting to its readers. The answer will be sent later, when the examination is over:—



"A gyrostat, hung by a cord C C at a distance of six centimetres from its centre of gravity, keeps its axis B B horizontal when turning in azimuth at the rate of one-fourth of a radian * per second. How many revolutions does the fly-wheel A A make per second? The weight of the wheel and case is 2,250 grammes, the mass of the wheel alone is 1,800 grammes, and its radius of gyration is four centimetres."

The University, Glasgow, March 13 D. M'FARLANE

* The term radian has been recently introduced by Prof. James Thomson to denote the unit angle, that is, the angle subtended by an arc equal in length to the radius.

Origin of the Chesil Bank

IN your report (vol. xi. p. 299) of the paper on this subject by Prof. Prestwich, read at the Institution of Civil Engineers, are these words:—"The large dimensions of the bank he attributed to the great accumulative and small lateral action of the waves." Why, then, does not so general a cause form hundreds of such banks? Why is "the great accumulative action of the waves" confined solely to the Chesil Bank, and particularly to the Portland end of it? Because the travelling of the pebbles is *towards* Portland, which checks the travelling, and so allows of "accumulation" exactly as a groin does. This is the simple "open sesame" of the secret; and if we could build groins as large as Portland, every one of them would "accumulate" a bank of precisely the same conditions as the Chesil Bank. If the pebbles travelled *from* Portland, as the professor thinks, that end of the bank should be the lowest; it would be perpetually robbed by the waves. But it is the highest—forty-three feet; and the Abbotsbury end, to which he supposes the pebbles to travel, should be the highest, but it is the lowest—scarcely more than half the height, twenty-three feet; while at Bridport there should be a still higher bank, for the professor makes the pebbles travel from east to west there and meet the pebbles which had "travelled from the opposite direction, viz., from west to east." But at Bridport there is not a single pebble, but only blown sand.

That the largest pebbles accumulate at the leeward end of beaches is not a matter of opinion, but a matter of fact, and the fact may be *seen* at every groin in the world. So that the large pebbles at Portland, instead of testifying against the travelling from west to east, testify conclusively for it. If there is anyone who can suppose that the diminishing of the pebbles in size from Portland to Abbotsbury results from the wearing in travelling that distance, there can be no one who could give this cause for the same result between two groins. The cause which I have assigned (chapter on "Travelling of Sea Beaches," Rain and Rivers) for the lodgment of the largest pebbles at the Portland end, is that where motion is given to pebbles the largest will be on the outside; they are therefore most amenable to the upward and onward stroke of the wave, and they travel fastest and furthest down wind on these beaches.

With regard to the modern beaches being recompositions of ancient raised beaches, besides the travelling, their pebbles are perpetually pounded by the waves till they are ground into sand. The professor dates the Portland raised beach to the Glacial Period. We have ample time, then, for its pebbles to be ground into sand and replaced by new comers. And the new recruits would not come, as the professor thinks, solely from "the cliffs," but chiefly from the mouths of the rivers which bring pebbles from all the various strata of the interior of the land without the aid of ice; for atmospheric disintegration and the erosion of rain denude the entire surface of the earth, and *let down* to the rivers not only soft soil but hard gravels and stones from every the most remote hill-top. But this huge traffic is brought to the rivers by rain. Rivers are simply the roads which it travels to the sea. What is held in suspension goes out to deep water, but the gravels, stones, and boulders are pounded and ground into the sands of the sea-shore. GEORGE GREENWOOD

Alresford, March 2.

Natural Phenomena in South America

IN Mr. J. Munro's very interesting notes made during a cable-laying expedition from Parà to Cayenne, which were published in NATURE, vol. xi. p. 329, the following passage occurs upon which comment may be useful. After describing a beautifully coloured Crustacean, and an animal which he speaks of as a crab or water-beetle, Mr. Munro goes on to say: "Another creature (Fig. 3) of quite a different description was also picked up. It was more like a water-spider than anything else. Its transparent hair-like limbs were dappled with dull green, and it seemed a mere skeleton framework made to carry a small white sac containing entrails, which was slung underneath." From the figure it is tolerably evident that this creature is one of the Pycnogonidæ, whose place in a classification of the animal kingdom is scarcely yet definitely settled, but which are ranged by Prof. Milne-Edwards among Crustaceans. It seems highly probable, then, that "the small white sac containing entrails" should rather have been described as a pair of very slender legs carrying egg-bags. This at least would be in accordance with what is known of other species of Pycnogons, none of which carry their entrails in sacs slung underneath.

The delicate spider-crab (Fig. 1), which charmed Mr. Munro with its hyaline limbs and varied colouring, seems from the figure to be nearly allied to the genus Stenorhynchus.

The affinities of Fig. 2 cannot be guessed at without additional details.

It is likely enough that all the creatures mentioned may be specifically new. THOMAS R. R. STEBBING

Torquay, March 10

Volcanic Action in the Sandwich Islands

IN your notice of my book, "The Hawaiian Archipelago," (vol. xi. p. 322), you allude to the statement that volcanic action on the Sandwich Islands "has died out from west to east." It has also died out in a *southerly* direction, through nearly four degrees of latitude. In the pit of Hale-mau-mau within the crater of Kilauea, on January 30, 1873, the violently agitated mass of lava continually took a *southward* direction, and broke in very elevated surges upon the cliffs on the *south* side of the lake. On June 4, 1873, when the aspect of the pit had undergone a very great change, there was a violent centripetal action, but the sort of rotating whirlpool continually formed, invariably rotated in a *southerly* direction. Some years ago, during a terrible eruption of Kilauea, when a river of lava from 200 to 800 feet wide, and an estimated depth of twenty feet, was running towards the sea with an estimated velocity of twenty-five miles an hour, four large "fire-fountains" boiled up when the stream issued from the earth. An intelligent observer, Mr. Whitney, noticed that the lava was ejected with a rotary motion, and that both the lava and stones thrown up rotated *towards* the *south*. I should be very glad to know any probable explanation of these phenomena, and if this apparently persistent southerly extinction and motion have any and what value as scientific facts?

Mr. Munro (vol. xi. p. 329) describes the locking together of trees of different species in the neighbourhood of Parà. The instances of this in the Hamakua forest on Hawaii are very numerous and striking. The Ohia (*Metrosideros polymorpha?*) is seen in the closest conjunction with the large tree-fern of the district, with a universality which leads some people of more than average intelligence to assert dogmatically that the fern is the invariable parent of the Ohia! The junction is so intimate as to be *apparent* interpenetration. The greatest height of any tree-fern that I have measured is eighteen feet of caudex; but I have seen Ohias with an estimated height of eighty or ninety feet carry the tree-fern with them to a height of fully thirty feet, the fresh pea-green fronds branching out from among the dark leaves and deep red blossoms of this very handsome evergreen.

6, Alva Street, Edinburgh, March 3 ISABELLA L. BIRD

The Height of Waves

THE height of waves has long been a vexed question amongst all classes of theoretical and practical observers. The late Admiral Fitzroy has left on record that on one occasion the measurement from crest to hollow was seventy feet. The figure seems high, but close and varied observations made during a storm on the passage from Liverpool to New York, in January, convinces me of the correctness of the Admiral's statement. In this storm, for the first time on record, large ocean steamers were rounded to with a fair wind, the universal opinion being that it was too dangerous to run with the sea far on the quarter. The captain of a German steamer, on arriving at New York, spoke in enthusiastic terms of the grand spectacle a White Star steamship presented as she "leaped from wave to wave like a gigantic fish," adding: "I am sure she must have hove to in the end."

This remarkable gale swept over a portion of the Atlantic which the French call "Le trou de diable," and it well merits the designation. Roughly, its focus may be considered to be in 45° N. and 40° W. When the wind sets in strongly from the north-west, the sea rises in an incredibly short space of time; and at the close of a long winter gale it is a grand sight to watch the great waves as they roll up astern at the rate of twenty-five miles per hour, sweep by the ship, and break far ahead. There is a feature in connection with the waves of the Atlantic which is worthy of notice, viz., with a south-west or southerly gale their height is insignificant. A practical proof of this is that large steamers run in the trough of the sea without inconvenience; but with less wind from the north-west they have occasionally to be kept off their course to avoid damage to boats. What occasions this remarkable phenomenon? It cannot be the "fetch," as seamen term it, for in some positions the southerly is the longer. Neither can it arise from the lack of force on their part, for they often blow for days at a time, and the total number of foot pounds acting on any particular spot must be enormous. Again, a north-wester during winter or summer tears the surface of the water as if a harrow had passed over it, while the southerly gale leaves no trace behind, save the ordinary break of the crest. These are facts known to everyone who crosses the Atlantic, but no satisfactory explanation of their origin has yet been given.

I give the data from which my observations were made, in order that anyone may draw his own conclusions. This ship is 450 feet long on the upper deck, and the fore yard is 62 feet above the level of the sea. From a position 239 feet abaft the foremast, where the height of the eye was 27 feet, the crests of the advancing waves at times appeared above the fore yard. Estimated distance between the crests of the waves, two-and-a-half times the ship's length.

Celtic, Feb. 13 — WM. W. KIDDLE

OUR ASTRONOMICAL COLUMN

VARIABLE STARS.—The following are the dates of maxima and minima of variable stars occurring in April, May, and June, according to the elements of Prof. Schönfeld (1875), stars with short periods being omitted; unless otherwise expressed the date is that of a maximum. The positions of these variables are doubtless in the hands of observers generally.

April 1	T Ursæ Maj., *min.*	May 23·6	R Virginis, *min.*
1·5	R Bootis, *min.*	23·7	R Scuti, *min.*
2	S Aquarii.	28	R Sagittarii.
3·6	T Cancri, *min.*	29·4	R Ceti.
4·5	R Sagittæ, *min.*	31	S Cephei, *min.*
8·9	R Vulpeculæ, *min.*	June 1	R Piscium.
13·8	η Gemin. *min.*	1·2	S Ophiuchi.
14	R Geminorum.	1·5	T Serpentis.
15·3	S Vulpeculæ, *min.*	11·9	R Vulpeculæ.
17·7	R Scuti.	13·9	R Sagittæ.
25·5	S Aquilæ, *min.*	15·3	R Leonis.
28·7	U Virginis, *min.*	20	T Cassiop. *min.*
May 3	R Canis Min. *min.*	21·8	S Vulpec. *min.*
3·3	R Corvi.	23·6	R Persei.
13·6	S Vulpeculæ.	24	S Coronæ.
16	S Arietis.	24	R Scorpii.
19·2	R Leonis Min.	25	S Herculis, *min.*
19·3	S Hydræ.	27·8	R Scuti.
19·7	U Herculis.	28·6	R Camelop.
20·1	S Leonis.		

"Linea" communicates the result of his examination of Σ 747 on March 9; the magnitudes appeared to be 7 and 8, as in the last Greenwich Catalogue, the smaller star *s.p.* If "Linea" refers to *Astron. Nach.* No. 2026, he will see from the position there given by Herr Falb for his new variable star, that there is no doubt of its identity with the preceding component of the above double star. It is also No. 10527 in the reduced catalogue of Lalande, and No. 274 in the volume of observations made at the Radcliffe Observatory, Oxford, in 1872, which has been circulated during the last week.

Mr. Birmingham, of Millbrook, Tuam, in *Astron. Nach.* No. 2028, draws attention to a star of 7th magnitude in Monoceros, which he appears to consider new. On Feb. 14, rough measures gave its position in R.A. 7h. 24m. 22s., Decl. 10° 4′ S.; the colour was reddish-yellow. On looking to the sky, it is evident that the R.A. as printed is nearly one minute too great, and the star is identical with Lalande 14599, estimated 1797, Feb. 27, of the 6th magnitude. Lalande's place brought up to the beginning of the present year is R.A. 7h. 23m. 27s·1.; N.P.D. 100° 4′ 12″. The star is entered 6 on Fellöcker's Berlin chart, but is not found in any recent catalogue. In all probability Mr. Birmingham has detected a new variable star. On March 14 it was very little below the 6th magnitude, and, in a hazy sky, had a deep yellow light.

MARS AND 3 SAGITTARII, 1875, JUNE 29.—A very close approach of this planet to the fifth magnitude star 3 Sagittarii will take place during the night of June 29; indeed, with Leverrier's place and adopted diameter of the planet, the star would be occulted for a few minutes by the northern part of the disc, at the Observatories of Cordoba and Santiago de Chile. The phenomenon will not be visible in this country. The much-desired observation of the occultation of ψ Aquarii on the 1st of October, 1672, during Richer's expedition to Cayenne, was lost, through a clouded sky, and from the same cause Rümker, at Paramatta, was prevented observing an occultation of 446 (Mayer) Leonis, on the 16th of February, 1822.

ENCKE'S COMET.—Inquiries arrive from the southern hemisphere with respect to the path of this comet after perihelion passage. The elements determined for the present year, after including the perturbations of Mercury, Venus, the Earth, Mars, Jupiter, and Saturn, are as follows according to Dr. von Asten:—

Perihelion Passage 1875, April 13·06815 G. M. T.

	°	′	″	
Longitude of perihelion	158	13	9	Equinox of 1870·0
Ascending node	334	32	19	
Inclination	13	7	17	
Angle of excentricity	58	8	56	
Mean daily motion	1079″·2209			

The editor of *Astronomische Nachrichten* having notified his intention of reprinting Dr. von Asten's ephemeris, which extends to the middle of August, in his next number, it may suffice to give here a few positions to indicate the general track of the comet. The places are for Berlin noon:—

	R.A.			N.P.D.		DISTANCE FROM	
	h.	m.	s.	°	′	Sun.	Earth.
May 15	0	36	23	105	43·5	0·822	0·564
,, 25	0	8	48	110	31·4	0·995	0·580
June 4	23	41	36	114	43·5	1·156	0·590
,, 14	23	9	54	118	48·6	1·306	0·600
,, 24	22	31	13	122	33·9	1·448	0·619
July 4	21	46	43	125	21·9	1·581	0·659

After Encke's comet is beyond our reach, nearly two years will elapse before any other known comet of short period is visible. Neglecting perturbations, D'Arrest's comet would arrive at perihelion again in the middle of April 1877, but the circumstances would not be favourable for observation.

THE TRANSIT OF VENUS

AS we intimated last week, news has now been received more or less from all the Kerguelen parties. Details of the observations of these and other parties appeared in last Thursday's *Times*, and we shall here endeavour to present the principal astronomical results.

The weather on the island during the transport and after the landing of the various parties was horrible; the day before the Transit was one of the most trying kind, and at night the barometer was falling, and any observations on the morrow seemed hopeless. By a freak of the southern skies, however, on the morning of the 9th the sun rose without a cloud; but a bank began to form soon after sunrise. From the despatch of Capt. Fairfax, of the *Volage*, we learn that at the principal English station "the sky was cloudy and there was little wind. Venus was seen to break into the sun's disc, but before the internal contact a cloud had obscured the sun. Several observations and photographs of the sun were taken during the forenoon, and the internal and external contacts at egress were observed. At the other English stations and at the American stations the contact at ingress, but not at egress, was obtained. The Germans got both contacts at ingress and egress. The astronomers are pleased with their success." From an account of the observations made by the Americans, communicated by one of themselves to the *Capetown Standard and Mail*, and quoted by the *Times*, we learn that, all things considered, their success was great.

"The perfection of the calculations was surprisingly wonderful.

Not only was the angle of calculation drawn exactly, but the computed time was drawn to the nearest minute. After first contact, the measurement of cusps proceeded at intervals of five seconds. Near the moment of second contact, a cloud interposed, but it cleared away almost instantly, and enabled the astronomers to obtain the moment of second contact a little late, and to proceed with the measurement of distances of the limb of Venus from the sun's limb. This ended the part of the astronomical observers for the time being. Meanwhile the photographers were hard at work. During this time, half an hour, no fewer than forty-five photographs were taken of the sun. From this time until the Transit was over, photographs were taken whenever breaks in the mist gave the opportunity, the mist growing into clouds as the day wore on, gradually shutting out the sun from sight. In all, sixty-five photographs were obtained, including several of the different stages of egress."

Our readers will no doubt remember what has been said about the high strategic value of Kerguelen. "For the Delislean method," to quote the article in the *Times*, "relied on by the English chiefly, it is the station at which (the Crozets being unoccupied) ingress was most retarded. Next in value to it from this point of view came St. Paul's Island (of which more presently), and then Bourbon, Mauritius, and Rodrigues.

"Further, the entire Transit was visible from Kerguelen, therefore observations of duration could be made, and therefore it was a Halleyan station, and, let us add, the Southern Halleyan station of the very highest value. Thus, combining observations made at Nertchinsk and Kerguelen, we get a difference of duration of thirty-two minutes; the more easterly group of stations lying round New Zealand combined with Nertchinsk, only giving a difference of some twenty-eight minutes at the outside; and Mauritius, combined with the same place, only giving twenty-four minutes. For the photographic or direct method also it was of the highest importance, combining the photographs taken with those secured in Siberia and India. We are now, then, in a position to analyse the telegram. Observations of ingress retarded to combine with the observation of ingress accelerated, made at the Sandwich Islands, have been secured by three parties. We may say, then, that the Delislean observations have been successful. Unfortunately, we gather that the photographic record of the interior contact is wanting. This, however, is of less value, as the Sandwich Island party, with an ingenious confusion of the subjective and objective, have already informed us that 'Janssen failed.'

"As in no case did the same observer secure both ingress and egress, the value of the observations for the application of the Halleyan method is doubtful; but the last reference—'Americans obtained some photographs'—may, when the work comes to be finally discussed, prove to be the most important of all, and astronomers all over the world wlll be very anxious to know the precise success attained, and it is very probable that it was great.

"Although we have thought well to wait for the news from Kerguelen before continuing our Notes, it must not be imagined that no intelligence of interest has been received since the last Notes appeared. On the contrary, the real interest is increasing as the details arrive; besides which, the French have received news from their parties at St. Paul's Island and Campbell Island, stations evidently outdoing even Kerguelen in the wretchedness entailed upon the observing parties, though that seems much to say after the report to the Admiralty which we published yesterday;" while details of the observations at New Caledonia were given in last week's NATURE by one who took part in them. "At St. Paul's Island the observations have been most satisfactory, as both internal contacts were observed and numerous photographs were obtained. This is good news for the partisans of all three methods, ingress being greatly retarded here, as before stated. Unfortunately, the still more heroic occupation of Campbell Island has been without result. 'Venus seen before ingress only; no contacts; all well,' is the news telegraphed from San Francisco, which must have cost M. Bouquet de la Grye a heavy pang to send home.

"We next come to the more detailed accounts, and among these, that forwarded by M. Janssen to the Secretary of the French Academy of Sciences demands the first place. After describing all the care he took in the choice of his station, he goes on :—

"Some days before the Transit, our fears were increased. Nevertheless, on the morning of the ninth the weather was pretty good, although the sky was a little overcast. The first contact was secured by M. Tisserand and myself. In the 8-inch equatorial, of which the object-glass is very good, the image of Venus appeared very round and well defined, and the relative motion of the disc of the planet with regard to the solar disc went on in a geometrical manner, without any appearance of ligament or black drop. But rather a long time elapsed between the moment at which the disc of Venus was tangent to the sun's limb internally and that of the appearance of the fine line of light between them. This anomaly I ascribe to the atmosphere of the planet. I caused a photograph to be taken at the instant the contact appeared to be geometric, and on the plate the contact had not yet taken place. M. d'Almeida obtained a plate containing forty-seven photographs of the solar limb which leads to the same conclusions. I intend to discuss these observations, which seem to me to lead to important consequences.

"After the first interior contact, M. Picard and M. Arens took as many photographs as possible, but the clouds greatly hindered us.

"Finally, near the second interior contact, the sun cleared as if providentially, and M. Tisserand was able to determine the time with precision. The sky was perfectly covered at the time of last exterior contact.

"During the Transit even we got news from Kobé that the first two contacts had been observed, and that fifteen photographs had been taken, and, finally, shortly after our own observations, M. de la Croix announced that he had obtained the last two contacts, the last one only uncertain.

"He then concludes :—

"I must not conclude without referring to an observation which relates to the corona and the coronal atmosphere of the sun. With glasses of a certain violet-blue colour, and very pure, I was enabled to see Venus before she had touched the sun's disc. She was visible as a small, very pale, round spot. When she commenced to bite into the sun's disc, this spot completed the black segment which was visible on the sun. It was a partial eclipse of the coronal atmosphere. . . . I saw Venus two or three minutes of arc from the sun's limb.

"There are two points in Dr. Janssen's report of the greatest importance and interest. It seems not improbable that his observation of a geometric contact with the eye at the moment the contact was not complete to the photographic plate may be connected with Prof. Tacchini's observation with the spectroscope, to which we have referred in previous Notes. If the observation may be depended upon—and Janssen, it is not too much to say, is one of the best astronomical observers living—it is clear that the sun built up by the blue rays was smaller than the sun built up by the particular rays which in the telescope employed produced white light.

"The second point is the observation of Venus on the coronal atmosphere by means of violet glass. This attempt shows Janssen's genius in a remarkable manner. It is based upon the idea, derived from the eclipse work in 1871, that the coronal atmosphere is very rich in violet light, the idea in its turn being based upon the fact that the photographic corona is vastly different from the corona seen through a train of prisms. Of course, if this be so, the atmospheric light, which is not rich in violet rays, may be cut off by a glass of a dark-blue colour, which nevertheless will transmit the violet light coming from the corona, and so show Venus as a black spot.

"We condense the following details of the work done at the Australian stations from the *Melbourne Argus* :—

"At the Melbourne Observatory, presided over by Mr. R.L.J. Ellery, Government astronomer, the weather, by a happy chance, cleared up in time for the observation of the important internal contact. The atmosphere was splendidly 'steady' in consequence of the previous fall of rain, and the effect of this was that the definition of the phenomenon was very distinct. There was no haziness or appearance of a 'black drop.' The contact was clear and tangential, and altogether free from the expected interferences with a good observation. During the contact and the following few moments, the photoheliograph was set to work, and numerous photographs of the ingress were obtained. They were taken rapidly at about two-second intervals, and about fifty were secured. The great telescope was used solely for photographing, in addition to the heliograph, but unfortunately it could not be brought into position quickly enough for photographs of the ingress to be taken by it, though it was used very effectively further on. The clouds then, as if they had just parted to allow of an observation at the critical moment, closed again over the sun, and its face remained obscured, with only occasional breaks, till between two and three o'clock. These breaks were availed of to obtain micrometric measures of the planet, which was now well on the sun's disc, and also to take photographs with the photoheliograph and the great telescope, which were very successfully obtained. Between two and three o'clock the weather began to clear up a little, and the observers were able to go more leisurely to work. The photographing went on well, though with several interruptions from passing clouds. The internal contact at egress, a very important point, was also observed very satisfactorily, although the atmosphere was a little more disturbed than during the internal contact at ingress, and there was observed a faint attempt at that appearance known as the 'black drop,' and a slight hazy ligament. For these reasons the internal contact at egress was not quite so satisfactorily observed as that at ingress, though a very good observation was made. During the egress a satisfactory series of micrometric measurements was made of the 'cusps,' and a rapid series of photographs was also obtained at two or three seconds' interval by means of the photoheliograph. The actual first internal contact was later than it was computed it would be by 3m. 13s. The first internal contact occurred at forty-five seconds after noon. The tabular time was 11h. 57m. 32s. The internal contact at egress occurred at 3h. 29m. 5s., or 1m. 31s. after the computed time, which was set down in the tables at 3h. 30m. 36s.

"Two hundred Janssen photographs were taken, and on development they were found to be as satisfactory as could have been expected, considering the frequent interruptions from clouds, and they will probably furnish some very important data. Besides these, thirty-seven photographs were taken with the great telescope and forty-seven with the photoheliograph. These were only taken when the sun was unobscured.

"Mr. Russell, the Government astronomer at Sydney, reports as follows:—'Very fine at Sydney, also Woodford and Goulburn, and, I believe, Eden (Twofold Bay.) I obtained a good many photographs. No black drop. Contacts not obtainable to a fraction of a second.' Mr. Russell also states that a beautiful halo was visible around Venus (indicating the atmosphere), before the planet was wholly on the sun. The Government parties have a total of 1,300 photos.

"The German party at the Auckland Islands have been heard of; from ten minutes after ingress the weather was very fine, and 150 photographs were taken.

"Mr. Ellery, in a paper read before the Royal Society of Melbourne, has given some information of great importance from a physical point of view, consisting of a compilation of all the observations of this nature which have been forwarded to him:—

"Mr. Anketell M. Henderson, observing with a Browning 8½-inch Newtonian, writes:—

"'It cleared about 11.40, and I got my first observation. Definition perfect; not the slightest tremor. At 11.53 or thereabout I was surprised by seeing the surface of Venus, outside the sun, distinctly visible on a faint phosphorescent-looking background; it remained visible for about forty-five seconds, when clouds interfered.' Mr. C. Todd, of Adelaide, observing with an 8-inch refractor by Cooke and Son, remarked: 'For some time after internal contact at egress the portion of the planet which had moved off the sun was distinctly visible, appearing as though seen through a nebulous and luminous haze of a purplish hue, extending beyond and around the edge of the planet, and inclining to violet towards the sun.' He had received no other notes of the visibility of the disc of Venus outside the sun's disc at egress, and he had been unable to get any trace of it himself, although the sky was clear and he looked for it. At Glenrowan the Transit was seen earlier than at Melbourne, and when the planet was about two-thirds on the sun Mr. Gilbert remarked, 'N.W. limb slightly luminous.' He then came to the appearance presented at internal contact, of which he noted as follows:—'This phase was remarkably well seen, and was almost tangential and free from any haze, ligament, or other disturbance. The sky remained clear in the neighbourhood of the sun till after internal contact was well over. About half-past two, before contact, limb of sun appeared to bulge out so as to embrace Venus, the outwardly bent cusps continuing around Venus like a thread of silver. Occasionally a slight flicker between the limb of Venus and sun visible, then a hazy junction like thin smoke appeared, and finally a very faint smoky thread appeared to join the thin edges. This suddenly disappeared at 0h. 1m. 9·4s., Melbourne time.' Mr. White's observations gave almost similar results. At Mornington the late Prof. Wilson noted a 'fluffy connection,' which is undoubtedly the same phase already noted, viz., 'smoky connection.' At the final junction the sun's edge was very tremulous, but the sky was quite clear. Prof. Wilson stated of this phase that 'the sun's edge was boiling. Venus did not look round, but as you might imagine a spherical balloon not quite blown up; the edge looked crumpled. A small dark object was seen flickering backwards and forwards between Venus and the edge of the sun. This increased, and there was no other phase to which I could attach a definite time.' At Sandhurst, Mr. Moerlin, observing with a 6½-inch refractor, remarked: 'As the planet moved gradually near the sun's limb at exit, the sun's limb and planet appeared sharp and well defined, and the streak of light between the two was distinct and unmistakable. As it came nearer and nearer the same appearance was witnessed without any change whatever. The streak of light became smaller, and all at once a sort of triangular-shaped connection between the two was observed, an appearance which I have seen with the artificial transit, but to a more limited extent, the base of the triangle on the sun's limb, the apex on the planet. The time when this phenomenon first appeared was 3h. 26m. 54·3s. The planet every once in a while jumped off the apex of the triangle, and the rim of the sun's disc could be distinctly seen between the two, the distance, however, between the triangle and the planet when jumping, growing less. The jumping or separating of the apex of the triangle and the planet ceased a few seconds before what I considered tangential contact.' Mr. Todd says, respecting this phase, that 'it was quite clear at egress, which was well observed; no black drop, but the continuity of the sun's disc was first broken by an exceedingly fine black line. The planet was seen to be slightly disturbed, the outline of the ball being apparently drawn out into a thin band.' With respect to an atmosphere surrounding Venus and the presence of a satellite, some of the observers had noticed towards the centre of Venus a light which condensed almost to a bright spot; and the Rev. Mr. Clarke, of Williamstown, observed a brownish orange halo surrounding Venus, and some others had observed a coloured light, though the difference of the tint was no doubt due to the eye-pieces used. He himself observed a blue light surrounding the planet, and made a careful scrutiny of it. He also called Mr. White and several others to observe, and they all saw it. He also noticed the granulated—or, as it was called, willow-leaved—appearance of the sun, which was very distinct, but approaching the planet presented a blurred appearance. With respect to the bright spot noticed in the centre of Venus, the same phenomenon was observed in the centre of Mercury during the transit of that planet.

"It has been suggested that all the observing parties at stations in or near Australia should meet about February in Melbourne, and compare their observations. Similar observations to those which have evidently attracted the attention of Mr. Ellery in a marked degree were perhaps made under the best possible conditions by Mr. Hennessey, at a height of between 7,000 and 8,000 feet in the Himalayas, and by other observers in India." His observations have been communicated to the Royal Society, and will be found in NATURE, vol. xi. p. 318.

"We must wait for some time for the final determination of the sun's distance as determined by the Transit observations, but no time need be lost in fully discussing the various physical questions raised, in order that we may be fully prepared for the Transit of 1882."

THE PROGRESS OF THE TELEGRAPH

I.

IN the present day scientific research makes such rapid progress, and produces such wonderful results, that the mind ceases to appreciate the advancement, which can only be realised by looking back, from time to time, to ascertain what was the condition of any special branch, any given number of years ago. It is only necessary to retrace time some twenty-five years, and in almost every department of practical science the step by step advancement may be traced, from sewing machines to steam hammers; from lucifer matches to lighthouses. But, perhaps, in no department of the applied sciences has scientific research been productive of more valuable and practical results than in the vast arena of electrical investigation; and great as has been the progress made in this department, still the knowledge obtained tends only to point out the vast field of research open to the student in discovering those fundamental laws and harmonies in nature's laboratory at present concealed from our view.

Sufficient, however, is already known in this special department of knowledge to inform us that electrical action and activity enters largely into the constitution of the solar system, regulating, in some degree at present not understood, the relation between the sun and our globe, as regards various terrestrial phenomena; as well as the disturbances upon the solar disc in relation to our earth's terrestrial and magnetic currents, as demonstrated in the daily deviations of the compass, and auroral displays in the regions adjacent to the polar latitudes of the earth Thus we see that whatever may be the vast field of research that remains to the student in this branch of scientific investigation, most important results have been developed. Time has been almost annihilated, and in the race between the earth's revolution on its axis, and electrical speech, man's inventive genius has been victorious—time and space being so far distanced that in electrical transmissions from one part of the globe's surface to another, time has no value as measured by the earth's rotation; messages sent from India and the East arriving hours before the time of their despatch. The introduction of the electric telegraph is quite within the memory of the present generation. Up to 1844 electrical knowledge was more or less confined to the lecture-table; crude experiments upon frictional electricity and the elements of magnetic and voltaic phenomena constituted the portfolio of knowledge as accepted by the public. The profound researches of Oersted in 1819 in relation to the influence of a current of electricity upon the magnetic needle is of great importance and may be summarised as follows:—A magnetic needle poised on a pivot so as to move freely in a horizontal plane adjusts itself in what is termed the magnetic meridian. If a metallic wire is placed parallel to the needle at a little distance above it, and a

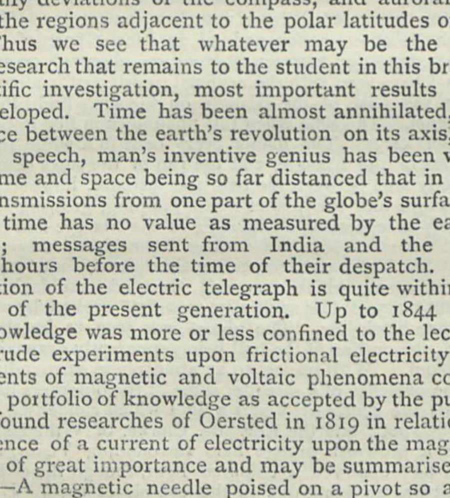


FIG. 1.—Action of an electrical current on the magnetic needle. (Oersted's experiment.)

current of electricity is passed through the wire, the magnetic needle will no longer remain parallel to the wire, but, leaving the magnetic meridian, will set itself across the current; and the same effect will be produced if the wire is placed below the needle, and it will be found that if the direction of the current in passing through the wire is from S. to N., the north pole of the needle will be deflected in an opposite direction to where the current is passed from N. to S.; in other words, when the current passes horizontally *over* the needle, that pole which is nearest to the negative end of the battery always moves to the *west*, and when the current is passed under the needle the same pole will deviate to the east. Ampère in 1820, who employed the magnetic needle, the coil of wire, and the galvanic battery, to indicate signals, developed the principles of the discovery of Oersted, and demonstrated the fact that currents themselves exert an influence on other currents. From the importance of Ampère's experiments in relation to all telegraph apparatus, a few words clearly illustrating the action of the current upon the magnetic needle are necessary.

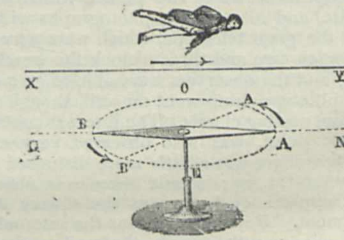


FIG 2.—Deviation of the southern pole towards the left, under the influence of the upper current.

If the observer regards himself as the conductor or connecting wire placed parallel to the needle, and whose face in every position is turned towards the centre of the

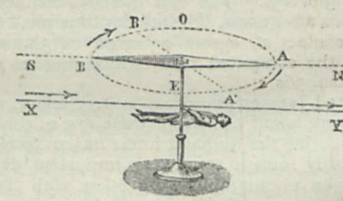


FIG. 3.—Deviation to the left of the current. Lower current.

needle, and the current from the positive pole of the battery to the negative pole is supposed to enter his feet and pass out at his head, the current will be found to develop a right and left influence on the magnetic needle, corresponding to the right and left of the person himself: so that *when an electric current acts on a magnetic needle, the south pole of the needle*—which is that which is directed towards the north—*is deviated towards the left.* Figs. 2 and 3 illustrate this: for when the parallel current is passed above the magnetic needle, the south pole A is deflected to A′ to the left of the current, or towards the *west;* and on the current being passed below the needle, the same pole is deflected to A′, being still to the left of the observer, but in this case the pole A has moved to the *east.* Ampère also demonstrated that when two metallic wires are traversed simultaneously by an electrical current, the wires are either attracted towards or repelled from each other according to the relative directions of the two currents. Thus, when they move in the same direction through the parallel wires, they attract each other, while they repel each other if they move in a contrary direction. Two non-parallel currents attract each other, if both are approaching or receding from the direction of the apex of the angle formed by the ends produced, while they will repel each other if one of the currents approach, and the other recedes from the apex of the angle. Fig. 4 illustrates the three cases of attraction and two cases of repulsion to which these laws of Ampère's refer. Ohm in 1827, who put forward his celebrated formulæ relating to the quantity of the galvanic current; Faraday in 1831, who discovered the electric current induced in a hollow coil of wire when a steel permanent magnet or an electro-magnet is introduced or

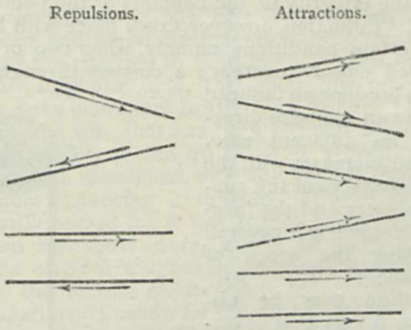


FIG. 4.—Law of the attraction and repulsion of a current by a current.

withdrawn from the coil; and Wheatstone, who in 1843 proposed to register observations of astronomical instruments with a view to determine longitude, and who shortly afterwards published, in the *Philosophical Transactions*, his investigations into the laws that regulate the transmission of electric currents through metallic conductors — were not then developed into any practical form; it was only about that time that public attention became directed to the probable future of the electric telegraph. The exhibition instruments open to the public at one shilling each, between Paddington and Slough, were the means of bringing to justice the perpetrator of a foul crime. These early double-needle instruments, long since obsolete

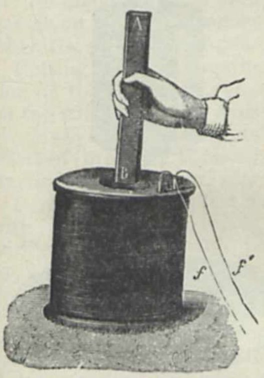


FIG. 5.—Induction by a magnet.

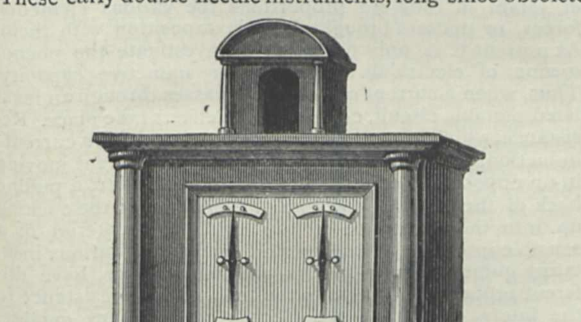


FIG. 6.—The Cook and Wheatstone double-needle Telegraph: 1845.

as regards construction, have been preserved as indicating he first era in telegraphic communication.

In those days electrical knowledge was in its infancy: the very wire between Paddington and Slough was insulated partly by silk and suspended through goose-quills attached to the posts along the Great Western Railway. In those days of electrical innocence the practical value of the return-circuit by means of the earth was undeveloped. As early as 1840 Wheatstone first conceived the idea and published his plans for transmitting messages under the sea by means of a submarine cable. That scientific men at that time considered that such a discovery would lead to most important results is testified to by the Abbé Moigno, who writes that it was announced by Wheatstone in 1840 that he had found the means of transmitting signals between England and France, notwithstanding the obstacles of the sea; and he emphatically adds: "I have touched with my hands the conducting wire which, buried in the depths of the ocean, will unite instantaneously the shores of England with the shores of France." In 1844, at Swansea Bay, off the Mumbles Lighthouse, the first practical experiment took place, and signals were transmitted from an open boat to the shore from a considerable distance. In the boat sat the inventor, Wheatstone, his eyes eagerly watching his galvanometer for the coveted signals —signals that would tell him his hopes were realised, and

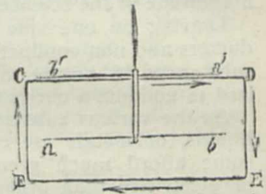


FIG. 7.—System of two magnetic needles, with their poles reversed, forming an astatic combination, neutralising the effects of terrestrial magnetism.

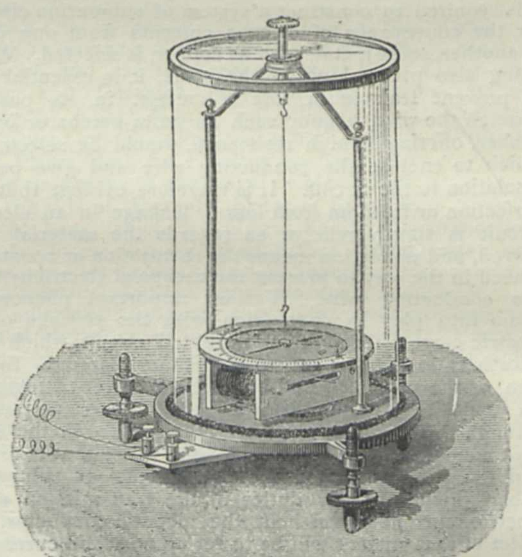


FIG. 8.—Astatic Galvanometer.

that he had triumphed over the elements. The last twenty-eight years have given birth to many wonderful and practical results. Between 1844 and 1848 railways were in their infancy; their limit of distance as compared with their present extent was very circumscribed. Equally so was electrical knowledge, as compared with the requirements of extended distance. In 1848 Holmes gave to telegraphy the practical result of his researches as regards the rapid transmission of signals over extended circuits. In those early days the five-inch astatic needles and coils of the Cook and Wheatstone system were absolutely useless for longer distances than one hundred miles, and as railways extended, so telegraphic difficulties were found to multiply. The introduction of gutta-percha in 1850 and a more perfect knowledge in the preparation of indiarubber as insulating mediums for electrical purposes have been the means of establishing upon a commercial basis electric communication between the chief empires of the earth, have united the eastern and western hemispheres by metallic highways of thought, threading the trackless ocean with its mysterious depths. It is thus that the primitive experiment of Wheatstone in 1844 has developed into the stupendous telegraphic undertakings that encircle the globe, uniting with a common interest all nations, creeds, and languages.

The principal laws that regulate the transmission of electric currents through metallic conductors are simple, and may be briefly described with sufficient distinctness to enable the general reader to grasp the intricacy and magnitude of the science of electric transmissions.

Leaving on one side the old accepted terms of conductors and non-conductors, for the present purpose all substances in nature must be regarded as able more or less to conduct a current of electricity.

As the various substances, gums, glass, wood, earths, liquids, or metals are examined, it will be found that some afford much greater facility for the transmission of electricity than others; consequently, if they are arranged according to the resistance offered to the current, a list somewhat similar to the annexed will be presented, commencing with those of least resistance: copper, iron, plumbago, sea-water, rain-water, snow, steam, moist earth, oils, ice, phosphorus, porcelain, baked wood, dry paper, hair, silk, mica, glass, wax, sulphur, shellac, gutta-percha, india-rubber. It therefore naturally follows that where it is required to construct a system of submarine circuits for the conveyance of electric currents from one place to another, some metal, such as copper, is selected. Water being also pretty high in the scale, it is essential that to prevent leakage or loss of current in its passage through the wire, a gum such as gutta-percha or indiarubber, offering a high resistance, should be selected in which to enclose the conducting wire and give proper insulation to the circuit. It is therefore evident that the perfection or freedom from loss or leakage in an electric circuit is simply relative as regards the material employed, and insulation means the obstruction or resistance placed in the way to prevent the escape of electricity from the conducting wire. Various important phenomena come into play in connection with the passage of an electric current through an insulated circuit, which it is necessary to explain in an elementary manner. Induction, or the production of an electric current moving in an opposite direction to that of the current passing through the insulated conductor, takes place in the adjacent medium to that of the insulated wire; that is to say, supposing an insulated metallic circuit—a submarine cable—is fulfilling its duties in the transmission of an electric current throughout the metallic conductor, the effect of that current will be to set up a second current in the water moving in an opposite direction. This opposite or induced current is well illustrated by the Leyden jar familiar to everyone. The inside metallic foil represents the copper wire, the glass separating the foils the insulation of the cable, the external metallic coating the water surrounding the cable. On electrifying the Leyden jar the internal and external metallic coats become charged with electricity in opposite states. The effect of this induced current on submarine cables is to retard or pull back the flow of the primary current, sensibly diminishing the speed of transmission as compared with that of a land line of telegraph. On a land line with a single wire the effect of induction does not take place, because the metallic conductor, generally iron, requires no insulating medium to enclose it, the air itself taking the place of the insulator; the wire requires to be insulated only at the points of support, the tendency of these being to produce a leakage or weakening of the current from water and other substances held in suspension in the air, impairing the integrity of the contacts at the points of suspension. Induction, however, takes place with land wires under certain conditions, namely, when two or more are suspended closely together; a current through one wire will then produce an induced current in an opposite direction in an adjacent wire. Induction increases with the extent of surfaces of the copper conductor and the insulator with which it is covered diminishing the speed of transmission.


Fig. 9.—Charging the Leyden jar.

Insulation may be obtained by a very thin covering of the insulating medium. Increase in the thickness of the material only mechanically renders the covering more secure. The effects of induction are decreased in proportion as the insulating substance is increased in thickness, the conducting wire remaining the same; with an infinite insulation like the atmosphere, induction would cease.

With insulated wires, absorption (inductive capacity) takes place. No substance in nature has yet been found that will not absorb some other element, force, or matter in a greater or less degree. Heat, light and electricity, liquids, gases, and metals under varied conditions are all alike susceptible, and will either be influenced or retain in different proportions the various elements, forces, or matters brought into juxtaposition with them. At present it is only necessary to investigate the phenomenon of electrical absorption or inductive capacity. Thus, when a current of electricity passes through an insulated metallic circuit, certain known effects take place. Resistance, which impedes the direct progress of the current; induction, or the setting up of a counter-current moving in an opposite direction, and exerting, as it were, a pulling back of the original current; absorption, or the sucking up into the substance of the insulating material of a sensible integrant of the original current. Various insulating gums, as gutta-percha and indiarubber, have different properties as regards the insulation or resistance to the lateral escape of the electric current they enclose, namely, the inductive effect in proportion to the insulation, and the absorption of the current as it flows through the conducting wire enclosed by them. As a sponge sucks up water, so to a certain extent does the insulator of the submarine wire absorb the electric current, the result being that, instead of the current passed into the wire at one end flowing through and emptying itself out at the other end of the wire, the current will flow out and leave a residue behind, an appreciable time being required for discharge to clear the line. This absorption of the current leaves the line clogged for the receipt of the next current, and greatly interferes with the rapid transmission of currents through insulated metallic circuits. It is therefore only in short cables that the transmission of the current may be considered instantaneous. In cables exceeding 150 miles in length, electric currents have a sensible duration.

(*To be continued.*)

ON SOME REMARKABLE CHANGES PRODUCED IN IRON AND STEEL BY THE ACTION OF HYDROGEN AND ACIDS

FOR a long time it has been well known to wire-drawers and other manufacturers, who free the iron or steel they are engaged in working from rust by cleaning it with sulphuric acid, that after this process the metal becomes much more brittle than before. Further, if a piece of iron wire that has been cleaned in sulphuric acid be bent rapidly to and fro till it is broken, and the fracture be then moistened with the tongue, bubbles of gas arise from it, causing it to froth. If this same wire be now gently heated for a few hours, or left in a dry warm room for some days, it will be found to have regained its original toughness, and not to froth when broken and the fracture moistened.

Some experiments made by the writer on this subject during the last three years, have shown that not only sulphuric, but hydrochloric, acetic, and other acids which give off hydrogen by their action on iron, produce the same effect, making it probable that hydrogen is the cause of the change. This view is confirmed by collecting the gas given off at the surface of the iron and burning it, when the characteristic flame of hydrogen is seen.

Putting the facts together, it seems probable that a portion of the hydrogen generated by the action of the acid on the surface of the iron is occluded and subsequently given off, either rapidly, as when the iron is heated by the effort of breaking it causing the water on the surface of fracture to bubble, or, more slowly, in the cold.

Perhaps the simplest way of charging a piece of iron with hydrogen is by laying it on a sheet of zinc in a basin of dilute sulphuric acid. An electric current is here set up, and the hydrogen generated by the action of the acid on the zinc is given off at the surface of the iron. In this way two minutes or even less will often suffice to charge a piece of iron with hydrogen and alter its properties as completely as one hour's immersion in dilute acid without the zinc.

The change in the properties of iron which has occluded hydrogen is not confined to a diminution of toughness, though this may be reduced to one-fourth, but is accompanied by a remarkable decrease in tensile strain, amounting in cast steel to upwards of twenty per cent. after twelve hours' immersion in sulphuric acid. With iron wire the decrease in tensile strain was found to be less than with steel; the reduction amounted however in some cases to six per cent. Some interesting differences are noticeable in the relative effect of occluded hydrogen on mild steel and highly carbonised steel, the diminution of tensile strain after occlusion of hydrogen being greater in the latter case than in the former.

As with the metal paladium, so with iron, the electrical resistance is increased somewhat by occlusion of hydrogen; in fact, it seems probable that every property of iron or steel undergoes a change after the occlusion of hydrogen, and the extent of this change becomes a matter of great interest to the engineer now that iron and steel are so largely used.

Cases of the deterioration in toughness of iron of excellent quality exposed to the action of gas containing acid, as in the upcast shaft of a coal-pit, have come before the writer's notice, in which the change appeared to have resulted more from hydrogen occluded by the iron than its corrosion by the acid vapours. It is also probable that rapidly rusting iron occludes hydrogen, and is thereby weakened in strength and toughness.

WILLIAM H. JOHNSON

THE SOUTHPORT AQUARIUM

THE grounds of the Southport Pavilion, Winter Gardens, and Aquarium Company occupy an area of about nine acres, extending from a portion of the sea-wall and parade, on which they have a frontage of 1,110 feet, to Lord Street, the chief thoroughfare of the town, which runs in a straight line, roughly parallel to the sea-coast, for nearly a mile.

Entering the pile of buildings, which occupy about the centre of the grounds, by the chief portico on the Lord Street side, and ascending a wide flight of steps, the Promenade Hall is reached, which is constructed of pitch pine, and is over the principal corridor of the aquarium, to which access is obtained by descending a flight of steps, or an incline, placed on either side of the staircase leading up to the hall, which, like the corridor beneath it, is 160 feet in length by 42. To the right of the hall, and separated from it by glass doors, is the Band Pavilion, which is said to be capable of holding 2,000 people; round it is a gallery used as a promenade, and in which pictures are exhibited, and beneath it is the refreshment department, which is on the basement level. Like the aquarium,* the Pavilion is oval in shape, the longest axis being 136 feet, the shortest 76. To the left of the great hall, glass doors give admittance to a glass conservatory, 174 feet in length by 74, stocked with tropical and subtropical plants and birds; beneath it are the remaining corridors of the aquarium.

The first corridor of the aquarium contains twenty-three tanks, the front of each consisting of three sheets of plate glass, as at Brighton; and the light, as there, is all transmitted either through the water in the tanks or through plates of opaque glass placed in the floor above. The roof consists of double groined arches, supported on moulded columns, made of concrete, which has been largely used in various parts of the building with good results.

Tanks 1 to 23 contain: Sea Anemones, Nos. 7 and 23; Octopi, 11 and 21; Crabs, Spiny and Common Lobsters, 10, 16, 19, and 22; four specimens of King Crabs, 20; Conger and Common Eels; Salmon Trout; Ballan Wrasse, 6; Rough Hound and other dog-fish; Cod and Rock Cod; Grey, Streaked, and other Gurnards; Whiting, Soles, Plaice, Bret, &c.; Father Lasher (*Cottus scorpeus*), 4; two specimens of the Angel or Monk Fish, 15.

By the side of the tanks, plates of fishes from Yarrel's work are hung, which, not always having any connection with the living fish exhibited, rather distract attention, and would be better collected together with various stuffed fish placed at the top of the tanks, and placed in a small museum. Amongst the plates are some original coloured drawings of Mr. Jonathan Couch, of seven species of sharks, signed "J. C., 1825"; also eight drawings of flying-fish, by the same.

Corridor No. 2 has a flat ceiling supported on iron columns, is lighted by windows looking on to the garden on the Lord Street side, and contains table tanks, rectangular and octagonal, the former being filled with fresh water, the latter with salt, containing, amongst other things, several species of *Serpula*, *Sabella*, *Terebella*, *Amphritite*, *Aphrodita aculeata*, and other annelides; Sea Anemones of various species; *Thyone papillosa*, and other *Holothuriadæ*; *Ascidiæ* and other tunicated molluscs; various species of Starfish, *Cidaris*; Norwegian Lobsters; Blennys, fifteen and three spined Sticklebacks, and large numbers of living zoophytes. Several of these tanks, both in the beauty of their varied contents and the care with which they have been selected and arranged, afford a good example of what can be done by art to reproduce a portion of the richness of effect of the actual sea-bottom.

On the right or seaward end of this corridor there is a Seal Tank, five seals living in it and in the Seal Pond in the garden between the entrance lodges and the portico of the Promenade Hall. On the opposite end of the corri-

* The ground slopes from the sea towards Lord Street, so that the aquarium is underground on the seaward side. In my "Notes on the Geology of Liverpool," NATURE, vol. ii. p. 390, I have described the sand dunes, &c., of this coast.

dor is a very large tank (24), containing a large number of freshwater fish given by Mr. T. R. Sachs, of the Thames Angling Preservation Society. In tank 25 are Sea Perch; and in tank 27, which occupies the entire side of corridor No. 3, being no less than 63 feet in length by 14 feet in width, with seven feet of water, are a large number of full-sized dog-fish, a perfect shoal of large cod, and a Monk Fish more than five feet in length.

The aquarium in this direction is capable of almost indefinite extension, should the present success of the Company be maintained.

The sea-water for the aquarium is obtained from the Baths Company, who draw their supply from a point in the channel near the end of the pier, which is more than 1,400 yards in length. The water is received in a large storage tank under the conservatory, from which it travels through the various tanks, returning to a lower storage reservoir, from which it can be pumped back into the upper one, not less than 150,000 gallons of water being in constant circulation. As at Berlin and Brighton, compressed air is forced into the tanks, through indiarubber pipes; and Mr. Lloyd's plan of putting oysters into the tanks, introduced at Brighton, is adopted. The tanks, as well as the rest of the building, including the conservatory, are lighted at night by gas.

In the existence of large aquariums at Southport and Brighton, the ideas so long advocated by Messrs. Carl Vogt, Milne-Edwards, and Dr. Anton Dohrn, for the establishment of zoological stations, have to a certain extent been realised in England; but before they can be made available for original observation and research, laboratories must be built, and depot stations established at a few points on the coasts of Ireland and Scotland. Moreover, other large expenditures of an eminently uncommercial character must be incurred, which will never be entertained by commercial companies; but these, on the other hand, would probably not object to afford facilities for study if the necessary funds were found by those colleges, universities, and learned societies that prosecute the study of biological science.

CHARLES E. DE RANCE

NOTES

THE Eclipse Expedition arrived safely at Point de Galle on March 15. The Indian observing party proceeds to Nicobar Island by the *Enterprise*, which left Calcutta on the 11th inst.

As we have already intimated, the Faraday Lecture of the Chemical Society will be given to-night in the Theatre of the Royal Institution by Dr. Hofmann, of Berlin, on "Liebig's Contributions to Experimental Chemistry."

THE service of meteorological telegrams to the ports of France was resumed on the 1st inst. The arrangements now in operation are as follows:—A large placard is sent down to be posted up in some public place, containing two specimen daily charts of the weather, and some simple rules for interpreting them. There are three blank spaces at the foot of the placard, which are intended for the chart of the preceding day from the *Bulletin International*, which arrives by post, and for two forecasts, morning and evening, which are to be transmitted by telegraph daily. It does not appear that there is to be any provision for exhibiting signals for the purpose of giving warning of storms. At present the only such signals which are apparently in use on the French coasts are those hoisted by the authorities of the Marine Ministry, from Dunkirk to Nantes, on the receipt of warning telegrams from London, and those hoisted south of Nantes, on the coast of the Bay of Biscay, on the receipt of orders from the Préfêt Maritime of Rochefort.

THE French Telegraphic Administration has appointed two delegates to examine, in common with the Board of the Observatory, what steps should be taken to collect by wire meteorological information, in order to send warnings to agricultural districts. The organisation of agricultural warnings will be one of the principal subjects of discussion at the forthcoming Paris Meteorological Congress.

M. MOUCHEZ, the chief of the St. Paul French Transit party, gave before the Academy of Sciences of Paris, at its sitting of the 15th inst., the first part of his report. M. Velin, the naturalist of the expedition, brought with him to Paris three living and a number of preserved specimens of all the species of the existing fauna, which is almost entirely marine. No landing could be effected on Amsterdam Island. Saint Paul and Amsterdam cannot be regarded as the remains of a shattered continent, but from their appearance and geological connection must have been elevated from the bottom of the ocean by individual volcanic eruptions.

WE learn from the *Saar und Mosel Zeitung* that we are liable to the importation not only of potato-beetles and Phylloxera, but even shells. About fifteen years ago some small shells were discovered in the Moselle near Treves, which were very different in form from the other native species. A few weeks back the discovery was made that the same locality now abounds in this new animal, as large numbers were found in a perfectly developed state. This seems to prove that the little ones, that were doubtless imported by some raft, have grown and propagated. It is stated that the real home of this species is the Sea of Azoff and the Black Sea, and it is remarkable that they inhabit both salt and fresh water.

THE *Kölnische Zeitung* reports that besides Phylloxera and the Colorado Beetle a third noxious insect has come over to Europe from America; it is the so-called Blood Louse, which causes much damage to apple-trees. As a practical remedy against this unwelcome guest, it is recommended to paint the young trees with naphtha and lime-water. With arger trees of course this is impossible; but it is said that if during winter a thin lime paste is placed in a circle round the tree where it comes out of the ground, the ova of the Blood Louse are then completely destroyed.

THE discovery is announced at the Pola Marine Observatory of Planet 143, by Director J. Palisa, with a telescope of 7⅜ ft. focal length. It appeared of the 12th magnitude, and the ephemerides given are: 1875, Feb. 23, 8h. 42m. 12s. Pola mean time; R.A., 9h. 57m. 57s. (daily motion − 60s.); and Decl. + 13° 46′ (daily motion + 1′). Of the 143 asteroids, 97 have been discovered in Europe, 41 in America, and 5 in Asia.

THE celebrated physicist Amberg lately delivered three lectures at the "Volksbildungsverein" at Cologne, principally on the phenomena of Electricity, Optics, and Acoustics.

THERE will be an election at Magdalen College, Oxford, in June next, to at least one Demyship and to one Exhibition in Natural Science. The stipend of the Demyship is 95*l*. per annum, and of the Exhibition 75*l*., inclusive of all allowances, and they are tenable for five years. Particulars may be obtained by applying to the senior tutor.

THE Council of the Senate of Cambridge University propose to offer a grace early next term for the appointment of a syndicate to consider the propriety of establishing a professorship of Mechanism and Engineering.

AMONG the papers appointed by the Council of the Institution of Naval Architects to be read at the meetings on the 18th, 19th, and 20th inst., are the following:—On the Telegraph ship *Faraday*, by W. C. Merrifield, F.R.S.; On a mode of obtaining the outlines of sea-waves in deep water, by W. W. Rundell; On the graphic integration of the equation of a ship's rolling, including the effect of resistance, by W. Froude, F.R.S., vice-president; On a method of obtaining motive power from wave motion, by B. Tower; Notes on polar diagrams of stability, &c., by John McFarlane Gray; On compound engines, by R. Sennett; On the *Bessemer* steamship, by E. J. Reed, C.B., M.P., vice-president.

M. WALLON, the new French Minister of Public Instruction, is an old University man; he was for years Professor of History in the Normal School. His appointment has given great satisfaction to the French *savants*, and the reception which he had on his installation on the 13th inst. was something more than a formal congratulation.

AN interesting study has lately been made by Prof. Holden, of the Washington Observatory, on the observations of Sir William Herschel upon the satellites of Uranus. It is well known that the latter astronomer sixty years ago announced that Uranus was accompanied by six satellites; but of the existence of four of these there has always been considerable doubt, since no one was ever able to confirm the observations of Herschel. In 1847 Lassell discovered two interior satellites, which were, however, different from those which Herschel suspected; and since that day the four problematical satellites of Herschel have been generally discarded by astronomers. Prof. Holden now brings testimony to the high excellence of Herschel's observations, as, by computing backward, he has shown that probably this distinguished astronomer actually observed the two interior satellites of Lassell (named by him Ariel and Umbriel); but that he was unfortunately prevented from identifying them as satellites because his telescope could not show them on two successive nights. The extreme difficulty of observing these objects makes us wonder at the marvellous skill and patience manifested by the elder Herschel in this laborious research, which was carried on by him from 1787 to 1810.

THE Imperial Astronomical Observatory of Brazil is a dependence of the Central College of Rio Janeiro, and is destined not only to teach practical astronomy to the students, but to make and publish astronomical and meteorological observations. The chronometers of the navy and army are there regulated, and the time is given daily by signal to the city. The building is situated on an eminence within the city, and the Government is now taking measures to improve its scientific character. The director is at present in Europe with a view of procuring such instruments and apparatus as may be adapted to the studies required of the institution. An entire reorganisation of the Observatory is under way, with the purpose of training more thoroughly the persons charged with geologic and geodetic works. There is also an observatory at the capital of the province of Pernambuco.

WE have received the Catalogue of the Library of the Manchester Geological Society, compiled by Mr. John Plant, F.G.S. We are glad to see that the members of this Society possess so good a collection of works connected with the various departments of geology, and we hope a large proportion of them take advantage of the privilege. Mr. Plant has arranged the books in eleven divisions, which will no doubt facilitate the work of reference, though it seems to us that divisions for works in German, works in French, &c., are unnecessary.

MR. HENRY CHICHESTER HART, B.A., one of the naturalists appointed to the Arctic Expedition of 1875, has published an enumeration of all the flowering plants and ferns known to occur in the Arran Islands, Galway Bay. The flora of the whole of the west of Ireland is extremely interesting on account of the south-west European types it includes, indicating the possible former existence of a connection between the British Islands and the Continent. The Arran Isles flora includes no endemic species, and, on account of their peculiar geological formation, the numbes of species is scarcely so large as might otherwise have been expected. The formation belongs to the Upper Carboniferous Limestone, and consists of deeply-fissured platforms or terraces, paved with large flags. Mr. Hart's list contains 372 species, including *Dabeocia polifolia* and some other West European forms. *Ajuga pyramidalis* and *Helianthemum canum* are at home here, and *Gentiana verna* is reported to be one of the commonest weeds. One of the principal features of the flora is the luxuriance of the ferns in the deep fissures of the rocks. The true maiden-hair (*Adiantum capillus-veneris*) is said to be common on all three islands, and often found with fronds two feet long. In the same situations the fronds of *Asplenium marinum* attain a length of three feet, and those of *Ceterach officinarum* a foot or more. Mr. Hart himself adds about twenty-five undoubtedly indigenous species to those previously known.

WITH regard to the conservancy and working of the East Indian rubber-trees (*Ficus elastica*), the yield of which forms one of the most important products of the Assam forests, we learn that there have been three proposals made to Government: the first is that Government should annually sell the right to collect the rubber; the second, that the rubber should all be purchased by Government; and the third, that Government officers should manage the forests. In opposition to this, however, it is said that much of the rubber is brought in from forests by wild and half-subjugated tribes, and still more by tribes that are under no subjection at all; so that conservancy is impossible, and a Government monopoly very difficult. Only two courses seem possible: either to allow speculators to make their own bargains with the hill men as they liked, or to enforce an effective Government control. Sir George Campbell considers the latter course to be the right one. The exports of caoutchouc, it appears, which amounted to 21,000 maunds in 1871-72, fell in 1872-73 to 11,000, this decrease being attributed to the closing of the Luckimpur forests with a view to preventing frontier complications.

THE quantity of sandal-wood sold in the provinces of Mysore and Curg during the year 1872-73 was 889 tons, valued at 27,896*l*.

THE growth of beet-root in Belgium for the manufacture of sugar appears to be falling off, owing to its prohibition by landowners and the unwillingness of the farmers to cultivate it in consequence of its exhaustive nature, a crop of beet impoverishing the soil considerably. It is said, however, that if the farmers could act independently, considerable quantities of beet would be grown, for not only would it then be advantageous to them in a pecuniary point of view, but it would furnish them with a new and valuable food for the use of their cattle and horses. In France, on the other hand, the cultivation of beet is being extended, the pulp, after the extraction of the sugar, proving very serviceable for fattening cattle.

DR. R. A. PRYOR intends publishing a new "Flora" of Hertfordshire, and to enable him to make it as complete as possible, he has issued a circular containing lists of plants respecting which further information is needed. Critical species will be thoroughly studied out. Webb and Coleman's "Flora Hertfordiensis" (1849), supplements to which appeared in 1851 and 1859, is a very good work, and the only "Flora" of the county hitherto published; but so much has been done in critical botany of late that it is, in this respect, out of date.

ON Friday the 12th inst. an icy cloud passing before the sun exhibited the laws of the formation of halos with an extraordinary precision. The cloud, driven by an upper wind, was travelling at a slow rate from south to north. A partial halo was first seen on the northern edge, developed itself, lasted as long as the cloud, occupied more than 16½° north and 16½° south of the sun, and diminished gradually until it disappeared on the southern edge of the cloud. It was, when complete, a perfect circle of white light, with the centre quite black, but not thick enough to prevent the sun being seen. The phenomenon lasted from 11·39 to 12·15, and was noticed at the Paris Observatory.

AMERICAN papers state that an earthquake at Guadalajara, Mexico, on the 11th of February, damaged houses and churches. The Seboruco volcano at the same time was in a violent state of eruption. The shocks extended to San Cristabal, where houses were destroyed, and several persons were killed.

FOR the protection of vineyards against frost in spring, the production of large artificial clouds of smoke is a common appliance in France and Germany. We now hear of a new method in this operation, recommended by M. G. Vinard. It is easily executed, and has proved successful; it consists in carefully mixing gas-tar with sawdust and old straw, and piling up this mixture into large heaps in the vineyards. The mixture remains easily inflammable, in spite of rain and weather, for more than a fortnight. When required for use, smaller heaps are made from the large ones, of about two feet in diameter, and are distributed in and round the vineyard. If there is little wind these heaps burn freely for about three-and-a-half hours, and produce a very dense smoke. The artificial cloud which thus enwraps the vines considerably decreases the radiation from the ground, and with it counteracts frost, which is greatest towards morning during calm spring nights, and which does so much harm to the plants.

IT is proposed—in fact steps have been taken—to acclimatise the Florida Cedar in Bavaria. The superiority of the wood of this tree (*Juniperis Virginiana*) over all other kinds of cedar, is well known, and the demand for the wood in Bavaria, where immense quantities of lead-pencils are made, has induced some manufacturers to take up the question of the acclimatisation of the tree in that country. Seeds have been sown in the Royal Forest, and about 5,000 young plants have been grown on one private estate: the cultivation of the tree is also being attempted in other parts of Germany.

IN a farm in the State of Nevada (U.S.), near the River Larson, there is a troop of twenty-six camels, all of which, with the exception of two, have been reared there. A few years ago nine or ten of these animals were imported into America, but only two survived; and these two, being fortunately a male and female, have produced twenty-four, all of which are now alive. The soil is sandy and sterile in the extreme, and the animals thrive well, although their only food consists of the prickly leaves of a small shrub, and bitter herbs which cattle will not touch. They are employed to carry merchandise, and perform considerable journeys across a very barren country.

A RECENT number of the *Courrier* of Jonzac reports that a meteorite was seen falling on a field in the Island of Oleron, and is believed to be a part of the meteor which was seen at so many places on the 10th of February last. The circumstances of the fall will be investigated carefully.

A METEOR was not only seen but actually caught at Orleans on the 9th inst. A small mass of pyritous substance was discovered in one of the streets, at the very place which had been struck by an immense flame a few seconds before. The pieces were divided among bystanders anxious to secure the possession of the smallest fragment of such a celestial object; but it is hoped some of the possessors will be intelligent enough to get a specimen sent to the Academy of Sciences.

ASTRONOMICAL and meteorological subjects are beginning to interest the French public. Two of the most influential Parisian papers, the *Temps* and the *Siècle*, publish daily, with comments, the weather forecasts of the Observatory.

WE may expect soon to see every large town in the kingdom in possession of an aquarium. A very fine one has quite recently been completed at Southport, a description of which we are able to give in to-day's NATURE; the foundation-stone of the Westminster establishment will be laid in a week or two; a scheme for the construction of an aquarium at Plymouth is maturing; an aquarium and winter garden is talked of at Edinburgh; a bill is before Parliament for the purchase of a site at Scarborough for an aquarium; and we have every reason to hope that Birmingham will soon be able to count one among its many other educational institutions. In a recent lecture at the last-mentioned town by Mr. W. R. Hughes, F.L.S., on Aquaria, the lecturer pointed out very forcibly how valuable such institutions might be made as a means of education. That gentleman deserves great credit for the trouble he has taken to obtain full information concerning the history and management of aquaria, and under his guidance we should think an aquarium at Birmingham ought to be second to none in the kingdom.

WE are glad to see from several numbers of the *Huddersfield Chronicle* which have been sent us, that the Huddersfield Naturalists' Society is in a healthy working condition. The members are evidently successfully investigating the natural history of their district, and from the reports of papers read and the discussions thereon, we judge that a considerable proportion of the members take a share in the business of the Society.

THE additions to the Zoological Society's Gardens during the past week include two Vervet Monkeys (*Cercopithecus lalandii*) from South Africa, presented by Mrs. A. Thornley; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mr. H. Edwards; a Chimpanzee (*Troglodytes niger*) from West Africa; two Indian Muntjacs (*Cervulus muntjac*) from India, deposited; a Yellow-bellied Liothrix (*Liothrix luteus*) from India, purchased; two Hairy Armadillos (*Dasypus villosus*), born in the Gardens.

SCIENTIFIC REPORT OF THE AUSTRO-HUNGARIAN NORTH POLAR EXPEDITION OF 1872–74 *

II.

MAGNETIC disturbances are closely connected with the Auroræ; while in temperate zones they are the exception, they form the rule in Arctic regions, at least the instruments are almost in constant action. This is the case for the inclination, declination, and intensity needles. As long as the vessel was drifting, *i.e.* until October 1873, the fixed variation instruments could not be used; absolute determinations with Lamont's magnetic theodolite were made, and several "magnetic journals" (only declination-readings) were kept, but already when near Nowaja Semlja, Lieut. Weyprecht found out that on account of the constant disturbances these readings were of very little value, as they could not be compared with simultaneous readings of the variation-instruments. In November, as soon as it was ascertained that the ice-field which enclosed the ship had come to a standstill, Lieut. Weyprecht had snow-huts constructed in which he fixed the variation-instruments, the magnetic theodolite, the inclinometer for the absolute determinations, and the astronomical instruments. The three variation-instruments for declination, horizontal intensity, and inclination had been furnished to the expedition by Prof. Lamont, director of the Munich Observatory.

After one day's work it was found already that the former methods of observation, *i.e.* simple readings at certain hours, are of no value whatever in Arctic regions, as they represent solely the accidental magnitude of the momentary disturbance. These neither give any true mean result, nor do they correctly represent the action of the needles. All intervals, which were observed for such readings at former expeditions, are absolutely useless, lying far too widely apart to permit of correct conclu-

* Die 2. Oesterr.-Ungarische Nord Polar Expedition, unter Weyprecht und Payer, 1872–74. (Petermann's Geogr. Mittheilungen, 1875; heft ii.) (Continued from p. 368.)

sions as to the general magnetic conditions. Under these circumstances Lieut. Weyprecht resolved to proceed very differently: upon every third day he let observations be made every four hours all the day long, and had the readings taken for every minute during one whole hour at a time; on each day different hours were chosen for the readings. Besides this, in order to get an idea as to the whole daily course, he made observations every five minutes during twenty-four hours, twice a month. With a view to make all observations as simultaneous as possible, the readings were taken immediately after one another (generally within eight to ten seconds), the telescopes of the three instruments being all fixed upon the same axis. These observations were continued from the beginning of January to the end of April 1874, comprising altogether thirty-two days of observation; Lieut. Weyprecht believes that when tabulated, their results will give a true representation of the unceasing changes with regard to direction and intensity of magnetic force in Arctic regions. In order to confirm the connection between the auroræ and the action of the needles, a second observer, independently of the others, observed the changes and motion of the auroræ. Absolute determinations of the three constants were made as often as circumstances permitted, to control the variation-instruments.

Apart from the Swedish Expedition, whose observations are not yet published, Lieut. Weyprecht points out that his are the first regular and simultaneous observations that were ever made in the Arctic districts. Moreover, he thinks that all former observations were made with the ordinary heavy needles, and that he was the first to use the light Lamont needles. For observations, however, under such conditions as the normal ones near the pole prove to be, heavy needles are perfectly useless; even the comparatively light intensity-needle of Lamont's theodolite oscillated so violently, on account of its unproportionally great moment of inertia, and even with moderate disturbances, that the readings became quite illusory. Almost on each magnetic day some disturbances were so great that the image of the scales could no longer be brought into the field of the telescopes on account of deflection; in order to ascertain even these maximal phenomena, Lieut. Weyprecht constructed an apparatus by which he could at least measure them approximately. He owns that as a matter of course his observations could not possibly be as perfect as those made at home, but thinks that it will be easy to modify Lamont's instruments on the basis of his experiences, so that with a future expedition, where there is a greater staff of observers, results could be obtained of any desired exactness. Altogether Lieut. Weyprecht's party of observers, consisting besides himself only of Lieut. Brosch and Ensign Orel, have taken about 30,000 readings from their different magnetic instruments, and the principal results are the following:—

The magnetic disturbances in the district visited are of extraordinary frequency and magnitude. They are closely connected with the Aurora Borealis, the disturbances being the greater, the quicker and the more convulsive the motion of the rays of the aurora, and the more intense the prismatic colours. Quiet and regular arcs, without motion of light or radiation, exercise almost no influence upon the needles. With all disturbances the declination needle moved towards the east, and the horizontal intensity decreased, while the inclination increased. Movements in an opposite sense, which were very rare, can only be looked upon as movements of reaction. The ways and manner of the magnetic disturbances are highly interesting. While all other natural phenomena became apparent to our senses, be it to the eye, ear, or touch, this colossal natural force only shows itself by these scientific observations, and has something mysterious and fascinating on account of its effects and phenomena being generally quite hidden from our direct perception.

The instrument upon which Lieut. Weyprecht placed the greatest expectations, namely, the earth-current galvanometer, gave no results at all, through the peculiar circumstances in which the explorers were placed. He had expected to be able to connect the auroræ with the galvanic earth-currents. But as the ship was lying two-and-a-half German miles from land, he could not put the collecting plates into the ground, but was obliged to bury them in the ice. Now, as ice is no conductor, the plates were isolated, and the galvanometer needle was but little affected. Prof. Lamont had supplied these excellent instruments also; the conducting wires were 400 feet long. Later on, Lieut. Weyprecht tried to obtain some results by connecting a collector for air-electricity with the multiplier of the galvanometer, but failed, doubtless for the same reason.

The astronomical observations while the ship was still drifting were confined to determinations of latitude and longitude, the latter by chronometers and correction of clocks, by lunar distances, as often as opportunity served. In this only a sextant and a prism circle with artificial horizon were used. When the ship was lying still, a little "universal" instrument was erected, and the determinations of time, latitude, and azimuth were made with this. The longitude was calculated from the mean of as many lunar distances as could be observed during the winter; they were 210 in number. The azimuth of a basis of 2,171 metres long, measured by Lieut. Weyprecht with a Stampfer levelling instrument, was determined with the universal instrument of the magnetic theodolite. All this work was done by Ensign Orel, Lieut. Weyprecht only taking a share in measuring lunar distances. The determinations of locality were made without regard to temperatures; if the mercury of the artificial horizon was frozen, blackened oil of turpentine was used instead.

Of the results of the meteorological observations, only some general ideas can be given, as here figures alone decide. They were begun on the day the explorers left Tromsö, and were only discontinued when they left the ship; thus they were made during twenty-two months. Readings were taken every two hours, and also at 9 A.M. and 3 P.M., therefore fourteen times daily. The observers were Lieut. Brosch, Ensign Orel, Capt. Lusina, Capt. Carlsen, Engineer Krisch (from autumn 1872 till spring 1873), and Dr. Kepes (during the last two months only). The direction as well as force of winds were noted down without instruments. Lieut. Weyprecht thinks this method by far the best in Arctic regions, as errors are more or less eliminated, while when using instruments the constant freezing, drifting snow, &c., produce errors that cannot be determined nor controlled; besides, anyone who has been to sea for a short time will soon acquire sufficient exactness in these observations.

Until the autumn of 1873 winds were highly variable. In the vicinity of Nowaja Semlja many S.E. and S.W. winds were observed; in the spring these veered more to N.E. A prevalent direction of winds was only recognised when in the second winter the expedition was near Franz-Joseph's Land. There all snowstorms came from E.N.E., and constituted more than 50 per cent. of all winds. They generally produced clouded skies, and the clouds only dispersed when the wind turned to the north. The explorers never met with those violent storms from the north, from which the *Germania* party had so much to suffer on the east coast of Greenland, and which seem to be the prevalent winds in the Arctic zone. Altogether, they never observed those extreme forces of wind which occur regularly in our seas several times in every winter (for instance, the "Bora" in the Adriatic). Every Arctic seaman knows that the ice itself has a calming effect upon the winds; very often white clouds are seen passing with great rapidity, not particulary high overhead, while there is an almost perfect calm below.

One peculiarity must here be mentioned. Lieut. Weyprecht made the remarkable discovery that the ice never drifted straight in the direction of the wind, but that it always deviated *to the right*, when looking from the centre of the compass; with N.E. wind it drifts due W. instead of S.W.; with S.W. wind it drifts due E. instead of N.E.; in the same manner it drifts to the north with S.E. wind, and to the south with N.W. wind. There was no exception to this rule, which cannot be explained by currents nor by the influence of the coasts, as with these causes there would be opposite results with opposite winds. Another interesting phenomenon in both years was the struggle between the cold northern winds and the warmer southern ones in January, just before the beginning of the lasting and severe cold; the warm S. and S.W. winds always brought great masses of snow and produced a rise in the temperature amounting to 30–35° R. within a few hours.

Little can at present be said on the result of the barometer readings, without a minute comparison of the long tables of figures, although very extreme readings occurred at times. The explorers had three mercury and four aneroid barometers; by way of control, Ensign Orel took the readings from five of these instruments every day at noon, while the intermediate observations were made with an aneroid.

The thermometers were suspended about four feet from the surface of the snow, in the open air, and perfectly free on all sides, about twenty-five yards from the vessel. Excepting the maximum thermometers, they were all spirit thermometers, made by Cappeller of Vienna. They were often compared with a very exact normal thermometer of the same make. Readings from a minimum thermometer were noted daily at noon; during the summer a black bulb thermometer was exposed to the rays of the sun; during the winter frequent observations were made with exposed and covered minimum thermometers to ascertain the nightly radiation at low temperatures. In both winters February was the coldest month, while January both times showed a rise in the temperature when compared either with December or February. In winter the temperature was highly variable, and sudden rises or falls were frequent; in the three summer months, however, the temperature was very constant, and changes very rare. July was the warmest month. The lowest reading was – 37¼° R. (nearly – 47° C.) The influence of extremely low temperatures upon the human body has often been exaggerated; there are tales of difficulty in breathing, pains in the breast, &c., that are caused by them. Lieut. Weyprecht and his party did not notice anything of the kind; and although many of them had been born in southern climes, they all bore the cold very easily indeed; there were sailors amongst them who never had fur coats on their bodies. Even in the greatest cold they all smoked their cigars in the open air. The cold only gets unbearable when wind is united to it, and this always raises the temperature. Altogether, the impression cold makes upon the body differs widely according to personal disposition and the quantity of moisture contained in the air; the same degree of frost produces a very uncomfortable effect at one time, while at another one does not feel it.

To determine the quantity of moisture in the atmosphere, an ordinary psychrometer, a dry and a wet thermometer, were used. But the observations with these instruments are not reliable at low temperatures, and had to be given up altogether during winter, as the smallest errors give great differences in the absolute quantity of moisture in the air. In order to determine approximately the evaporation of ice during winter, Lieut. Weyprecht exposed cubes of ice that had been carefully weighed to the open air, and determined the loss of their weight every fourteen days.

(*To be continued.*)

PRIZES OFFERED BY THE BELGIAN ACADEMY

THE following subjects for prizes to be awarded in 1866 have been proposed by the Royal Academy of Sciences, Belgium:—

1. To improve in some important point, either in its principles or applications, the theory of the functions of imaginary variables.

2. A complete discussion of the question of the temperature of space, based upon experiments, observations, and calculation, stating the grounds for the choice made between the different temperatures attributed to it.

Competitors should observe that the above question, stated in the most general terms, is connected with the knowledge of the absolute zero, definitely fixed at –272°·85 C., but that a historical and analytical inquiry into researches undertaken, previous to about 1820, to resolve this question, would offer a real scientific interest. Particular attention is called to the works of the end of the eighteenth century and the commencement of the nineteenth; among others, those of Black, Irvine, Crawford, Gadolin, Kirwan, Lavoisier, Lavoisier and Laplace, Dalton, Desormes and Clément, Gay-Lussac, &c. Note also the temperature, –160° C., which Person indicates; according to his formula, which connects the latent heat of fusion with specific heats, this number would represent the absolute zero. As it comes near to that given by Pouillet, it will be important to discover what is its signification, its import (*sens*), or its exact physical value.

3. A complete study, theoretical and, if necessary, experimental, of the specific absolute heat of simple and of compound bodies.

4. New experiments on uric acid and its derivatives, chiefly from the point of view of their chemical structure and their syntheses.

5. New researches into the formation, the constitution, and the composition of chlorophyll, and into the physiological *rôle* of that substance.

6. To expound the comparative anatomy of the urinary apparatus in the vertebrates, basing it on new organogenic and histological researches.

The prize for the first, the fourth, and the sixth questions will be a gold medal of the value of 800 francs, the prize for the fifth will be of the value of 600 francs, and the prize for the second and third questions will be of the value of 1,000 francs.

The memoirs must be legibly written, either in French, Flemish, or Latin. They should be addressed, carriage-paid, to M. J. Liagre, Perpetual Secretary of the Academy, at the Museum, before August 1876; any received after which will be out of the competition.

Authors must not put their names to their works. Only a motto must be attached, and the same written outside an envelope enclosing the author's name and address. This condition is indispensable.

SOCIETIES AND ACADEMIES

LONDON

Mathematical Society, March 11.—Prof. H. J. S. Smith, F.R.S., president, in the chair.—Mr. Roberts gave an account of his paper on a simplified method of obtaining the order of algebraical conditions.—Prof. Sylvester, F.R.S., then spoke on "an orthogonal web of jointed rods, a mechanical paradox." If two sets of points be taken respectively in two lines perpendicular to each other, either in a plane or in space, and a *linkage* be formed by connecting each point in one set with each point in the other by jointed rods, this constitutes what the author means by an orthogonal web. It is *not* a fixture, and its motion is subject to this curious condition, that either each set of points must always continue to lie in the same right line, which may be called a neutral position, or else one set will lie in a right line and the other in a plane at right angles to such line. Starting from the neutral position (or position of *double-lock*), the system may be said to be subject to an optional locking about one or the other of the two perpendicular lines, and an unlocking about the other, but when once put in motion the system must be again brought into the same or a new neutral position before the one axis of lock can be got rid of, and another at right angles thereto substituted in its stead. If the whole motion be confined to a plane, the paradox consists in the link-combination possessing one degree of liberty of deformation (αλλοιωσις as distinguished after Plato from κινησις), although a calculation of the amount of restraint by the general method applicable to such questions would seem to indicate that it *ought* to form an absolutely rigid system except in the case where there are only two joints in one at least of the two sets. Taken in space there is the further and more striking paradox that the number of degrees of liberty of deformation according to the choice made of one or the other of the two sets of points to be unlocked out of the rectilinear into the planar position will be the *alternative* of two numbers, viz. the number of joints in the one set or in the other set (which need not be the same), a kind of indeterminateness in the "index of freedom" without precedent in kinematical speculations. As lightning clears the air of impalpable noxious vapours, so an incisive paradox frees the human intelligence from the lethargic influence of latent and unsuspected erroneous assumptions. Paradox is the slayer of prejudice.—The Secretary, in the author's absence, then read a portion of Mr. G. H. Darwin's paper on some proposed forms of slide-rule. The object of the author was to devise a form of slide-rule which should be small enough for the pocket and yet be a powerful instrument. The first proposed form was to have a pair of watch-spring tapes graduated logarithmically, and coiled on spring bobbins side by side. There was to be an arrangement for clipping the tapes together, and unwinding them simultaneously. Two modifications of this kind were given. The second form was explained as the logarithmic graduation of several coils of a helix engraved on a brass cylinder. On the brass cylinder was to fit a glass one, similarly graduated. To avoid the parallax due to the elevation of the glass above the other scale, the author proposed that the glass cylinder might be replaced by a metal corkscrew sliding in a deep worm, by which means the two scales might be brought flush with one another.

Anthropological Institute, March 9.—Col. A. Lane Fox, president, in the chair.—Sir Duncan Gibb read a paper on Ultra Centenarian Longevity, in which he exhibited some tables giving eighty-four instances of the reputed age of 107 to 175 years, a certain proportion of which he considered he had grounds to believe to be correct. Of nine living centenarians whom he had previously examined for physiological purposes, he now added a tenth—the Tring centenarian—who died recently in her 112th year. The correctness of her age was considered in an exhaustive manner, and the reasons were given to justify this conclusion. Mainly they consisted of the discovery of the register of her baptism at Chinnor, Oxford, in 1763, from information furnished by herself; the birth of her first child Samuel, when she was between twenty-nine and thirty; the drowning of him and some thirty-four other persons by a catastrophe at Hadlow in 1853, when his age was stated to be fifty-nine on his monument; and the calculation of dates and other circumstances in the old dame's family history. The proofs were altogether on the side of certainty, whilst any objections that could be brought forward were of the feeblest character, especially such as the inability to find a register of the marriage with her husband, who was a soldier in the Bucks Militia. Her physical condition, from careful examination during life in October 1873, was next described, when all the organs and functions of the body were, for the most part, found to be healthy, and corresponded to those of a person a fifth of her age. All that was confirmed in every respect by inspection after her death in January last, and the results proved the absence of the usual well-known senile changes, which explained the fact, as the author stated, that not only she, but the nine other persons he had examined, were enabled to reach the age of 100 years, and even to overstep it. Yet, with the attainment of such a great age, there was always an amount of feebleness present which very slight causes influenced, and thus life soon came to an end. In the old dame the merest chill or slightest possible cold extinguished the spark of life. The occurrence of a well-authenticated case like hers readily explained the fact that now and then, under peculiarly favourable circumstances, especially in a more equable climate than our own, the century is exceeded by several decades. And the occurrence of such great ages as have been recorded from time to time by honest and conscientious inquirers of former years, need not be looked upon with doubt, much less with distrust, for the anxiety to prove the correctness of such ages was as great then as it is now.—Previous to the ordinary meeting, a special general meeting of the members was held to authorise an application to the Board of Trade for a license, and to adopt the draft memorandum and articles of association for the incorporation of the Institute. It was also resolved that ladies be admitted as members with all the usual privileges.

Royal Horticultural Society, Feb. 17.—Scientific Committee.—Mr. A. Murray, F.L.S., in the chair.—Dr. Masters showed fruit of *Fuchsia procumbens*. The Rev. M. J. Berkeley exhibited leaves of *Thea Bohea*, from the Natal Botanic Garden, affected with a lichen, *Strigula Feei*, Mont. Mr. Keit, the curator, states that it makes its appearance as a minute speck of brown colour which gradually enlarges in circumference till the end of the season, when the margin assumes a pale green colour, and ceases to grow. Mr. Berkeley found that the brown substance was composed of a species of *Cephaleuros*; it consisted of decumbent articulated threads, each of which has at its tip a globose sporangium. It is very near *Chroolepus*, and if some lichens are parasitic on *Chroolepus*, this may be on *Cephaleuros*.—Prof. Thiselton Dyer exhibited specimens of *Baridius aterrimus*, an insect most destructive to orchids at Singapore. He also called attention to the occasional formation of tubers within potatoes, which he believed to be due to ingrowing shoots derived from the eyes.—A portion of a letter from Santarem, addressed by Mr. Trail to Dr. Hooker, was read, describing the ant-inhabited bullæ on the leaves of some *Melastomaceæ*. After careful examinations Mr. Trail was quite at a loss to determine the exact connection between the bullæ and the ants, of which at least three species inhabit them.

General Meeting.—W. Burnley Hume in the chair.—The Rev. M. J. Berkeley remarked that he had placed some very old specimens of *Micrococcus prodigiosus* (blood rain) on rice paste, and they had recommenced growing, and had spread as far as could be expected from the state of the weather. According to Mr. Stephens, the plant retains its power of vegetation after it has been in an oven forty-eight hours.

March 3.—Scientific Committee.—Dr. Hooker, C.B., P.R.S., in the chair.—The Rev. M. J. Berkeley read a letter from Mr. Moseley, the naturalist on board the *Challenger*, relating to a fungus, *Sphæria sinensis*, growing out of a caterpillar and used as a delicacy by the Chinese.—Prof. Thiselton Dyer showed a ball formed by the action of the sea out of fragments of *Caulinia* from the shore at Mentone, collected by the late Mr. Moggridge.—A discussion arose as to the effect of lichens on trees in connection with the occurrence of species of *Strigula* on the leaves of the tea plant, and the injury which is found to arise in mossing the stems of *Cinchona* in India after removing the bark, if lichens are mixed with the moss. The Rev. M. J. Berkeley thought that all the evidence was against any penetration of the hyphæ of the lichen into the subjacent tissues of the plant upon which the lichen grew. The lichens were injurious by preventing the access of light and air. If they were scraped off the branches of apple-trees infested by them, and the surface were washed, the tree soon recovered, which would not be the case if the hyphæ had penetrated into its tissues.—Dr. Bastian said that he had examined some of the nematoid worms found in the swellings on the roots of cucumbers. They were, however, too immature to determine their genus.—Dr. Masters alluded to a Chinese primrose exhibited, in which there was a partition throughout the leaves, stem, and inflorescence of colour. He thought that this was an instance of dissociation of hybrid characters. A similar bilateral partition of colour sometimes took place in plants raised from cuttings, when of course the above explanation would not apply.

General Meeting.—Bonamy Dobree, treasurer, in the chair.—The Rev. M. J. Berkeley addressed the meeting. He called attention to the gigantic Sweet Potato (weighing over 15 lbs.), *Convolvulus Batatas*, from Madeira, shown by Dr. Hooker; a branch of the Kumquat, *Citrus japonica*, with fifty-six fruits; and a charming miniature Orchid, *Masdevallia melanopus*.

Physical Society, Feb. 27.—Prof. Gladstone in the chair.—Mr. Wills, F.C.S., submitted to the Society apparatus which he had devised for exhibiting the sodium spectrum to an audience. The experiment as usually shown consists in volatilising the metal or one of its salts between the carbon poles of a lamp and in projecting the spectrum on to a screen. The method is imperfect, as the characteristic lines of sodium are always associated with the continuous spectrum of the electric light. Mr. Wills prefers, therefore, to obtain a sodium flame by burning hydrogen which has been passed over the surface of the molten metal; by this means a pure sodium spectrum may be thrown on the screen. Prof. McLeod suggested that other metals might be introduced into the hydrogen flame in a finely-divided state, and that the continuous spectrum might be eliminated by employing a horizontal slit.—Prof. G. C. Foster then read a paper, by himself and Mr. J. O. Lodge, on the lines of flow and equipotential lines in a uniform conducting sheet. The first experimenter who worked on this subject was Kirchhoff, who used plates of copper, but owing to their small dimensions, his measurements were imperfect. Quincke employed rectangular plates, and afterwards discs of lead and copper conjointly, so that he obtained a difference of potential at the junction. The next experiments were made by Prof. Robertson Smith, who used conducting discs of tinfoil and deduced equipotential lines from the lines of flow. Prof. Foster stated that the general mathematical theory had been fully established by Kirchhoff, who had verified it experimentally in all its main features. The object the authors of this paper had in view was to show that Kirchhoff's results can be arrived at by very simple mathematical processes, if each electrode by which electricity is supplied to or taken from the sheet be regarded as producing everywhere the same effect as it would if it were the only electrode in the sheet. The electrical condition of every point in the sheet thus appears to result from the simple superposition of the effects due to the several electrodes. This mode of treating the question has been adopted by Prof. Robertson Smith, but his paper was in the main addressed to mathematical readers. It was the aim of the authors, however, to show that the chief results could be established by elementary methods which can be included in ordinary class teaching. The paper contained, in addition to the mathematical discussion of the subject, a description of an experimental method of laying down the equipotential lines on a conducting surface, so that the difference of potential between any two consecutive lines may be constant. Measurements were also given of the resistance of discs of tinfoil of various sizes, and with the electrodes in various positions. The results agreed closely with the calculated values, and thus supplied a verification of the theory which Kirchhoff had been unable to obtain in consequence of the small resistance of the discs used by him. Mr. Latimer Clark made some observations on the methods by which contact was made between the electrodes and the conducting sheet, and Prof. Adams then described some of the results which he had just communicated to the Royal Society, on lines of force.

Entomological Society, March 1.—Sir Sidney Smith Saunders, president, in the chair.—Mr. F. H. Ward exhibited living specimens of a *Lepisma*, allied to *L. saccharina*, which he had not previously observed in this country. They were found in a bakehouse near London, in the brickwork of the oven and other warm parts of the buildings. Mr. M'Lachlan suggested that they might have been introduced with American flour, as Mr. Packard had recently published an account of a species closely allied to *L. saccharina*, which he thought might probably be found identical with the present species.—Mr. Ward also exhibited microscopic slides showing the sexes of the Chigoe, and portions of the human skin with the insect attached.—Mr. Champion exhibited larvæ of *Empusa pauperata* from Corfu.—A note was received from Mr. W. C. Boyd with reference to some fleas exhibited at the last meeting. He stated that fleas were frequently found in the inside (not the outside) of the ears of wild rabbits, especially about this time of year; and that his brother had seen a rabbit which must have had three hundred fleas in the two ears. He believed the rabbits were not much troubled by the presence of the parasites, as he had never noticed any inflammation, however many fleas there might have been.—The Rev. Mr. Gorham communicated a paper containing descriptions of eighteen new species of *Endomycici*, from various tropical countries.—Mr. Dunning directed attention to an interesting paper by Dr. Leconte, on entomological nomenclature and generic types, which appeared in the December part of the *Canadian Entomologist*.

EDINBURGH

Royal Society, March 15.—David Milne Home, LL.D., vice-president, in the chair.—The Council having awarded the Makdougall Brisbane Prize for the Biennial Period 1872-74 to Prof. Lister, for his paper on the germ theory of putrefaction and other fermentative changes, the medal was presented to him by the chairman, after a discourse by Dr. Crum-Brown upon the nature and merits of Prof. Lister's investigation.—The Council have awarded the Neill Prize for the Triennial Period 1871-74 to Mr. Charles William Peach, for his contributions to Scottish zoology and geology, and for his recent contributions to fossil botany.—The following communications were read:—On the diurnal oscillations of the barometer, by Alex. Buchan, M.A.; on phenomena connected with the subject of single and double vision, as shown by the stereoscope, by Robert S. Wyld; on products of oxidation of methyl-thetine, by Prof. Crum-Brown and Dr. Letts.

CAMBRIDGE

Philosophical Society, Feb. 22.—A communication was made by the Rev. O. Fisher, upon the formation of mountains on the hypothesis of a liquid substratum. This paper was a sequel to one read in December 1873, in which it had been shown that, upon the supposition that the inequalities of the earth's surface have been formed by contraction of its volume through cooling, they are too great to be so accounted for if the earth has cooled as a *solid* body. In the present communication it was therefore assumed that there is a *liquid* layer beneath the cooled crust; and an approximate calculation was made of the form which the corrugations of a flexible crust would take if so supported. It was shown that their lower surface would consist of a series of equal circular arcs arranged in a festoon-like manner, and having a radius $2\frac{\rho}{\sigma}c$, where ρ, σ are the densities of the crust and liquid respectively, and c the thickness of the crust. It was argued that the consequences of this form of corrugation agree fairly well with some of the phenomena of mountain elevation, but that it does not suffice to explain the ocean-basins and the continental plateaux.

GLASGOW

Geological Society, Feb. 11.—Annual Meeting.—The president, Sir William Thomson, LL.D., F.R.S., delivered an address on Underground Temperature. Sir William explained at the outset that the mathematical theory of underground temperature involved phenomena which might be divided into two classes—periodic and non-periodic. The periodic phenomena occurred over and over again with perfect regularity in successively equal intervals of time; the non-periodic might be approximately periodic, or irregularly periodic, without strictly fulfilling that definition. But, on the other hand, the action which had no periodic character whatever might be irregular, or there might be a gradual secular variation. There might thus be three classes of phenomena—secular variation, irregular variation, and periodic variation. He then described the mathematical theory of Fourier, as applied to periodic variations, observing in passing that it was equally convenient for dealing with all the three classes. That theory was one of the most beautiful pieces of application of the mathematical instrument which they had in the whole history of science. It constituted a new branch of mathematics, and was invented by Fourier for the purpose of analysing the phenomena of the conduction of heat through solids. He exhibited a diagram showing the results obtained by Forbes from thermometers placed at depths of three, six, twelve, and twenty-four feet below the surface in Craigleith Quarry, the Experimental Gardens, and the Calton Hill, Edinburgh. The results of these observations which Forbes commenced, and Sir William continued for seventeen years, showed that the variations were greater nearer the surface, that a higher temperature was generally indicated at a later period at the greater depth, and seemed to show also that the sandstone of the Craigleith quarries had a greater conductivity than the trap-rock. Sir William concluded by referring to the temperature of the earth as indicating its former condition, and promised at some future time to treat this subject at greater length before the Society.

DUBLIN

Royal Geological Society, Feb. 11.—Prof. Hull, F.R.S., president, occupied the chair, and delivered the anniversary address, in the course of which he pointed out some subjects where investigation on the part of members of the society seemed desirable. One of these was cave explorations in Ireland, an investigation which had been pursued with very great success in England and France, and along the shores and islands of the Mediterranean. Prof. Hull mentioned a number of interesting discoveries of animal and other remains that had been made in the caves of Ireland, which he said furnished proofs of the wide field of research that was open to them. Another subject which he recommended to the consideration of the members was the microscopic examination of rocks, and he hoped that the many curious rock-formations to be found throughout Ireland would be studied and reported upon by those who felt an interest in the matter.—Sir Robert Kane, F.R.S., was elected president for the year.

BOOKS AND PAMPHLETS RECEIVED

BRITISH.—Consumption and Tuberculosis; their Proximate Cause and Specific Treatment by the Hypophosphites: John Francis Churchill, M.D., Paris (Longmans).—Problems of Life and Mind. Vol. ii.: George Henry Lewes (Trübner).—The Marine Invertebrates and Fishes of St. Andrews: W. C. M'Intosh, M.D., F.R.S.E., C.M.Z.S., &c. (A. and C. Black, and Taylor and Francis).—A Whaling Cruise to Baffin's Bay. 2nd edit.: Capt. A. H. Markham (Sampson Low and Co.)—Facts about Breadstuffs (Porteous).—Astronomy; by J. Rambosson. Translated by C. B. Pitman (Chapman and Hall).—Ornithology and Conchology of the County of Dorset: J. C. M.P.—Proceedings of the Royal Society of Edinburgh, 1873-74.—Instructions for the Observation of Phenological Phenomena. Prepared by request of the Council of the Meteorological Society (Williams and Strahan).—Catalogue of the Library of the Manchester Geological Society. Edited by John Plant, F.G.S.

AMERICAN.—Principles of Chemistry, and Dr. Hinrich's Molecular Mechanics (Davenport, Iowa, U.S.)—Annual Report upon the Survey of Northern and North-Western Lakes in charge of C. B. Comstock (Washington).—Bulletin of the United States Geological and Geographical Survey of the Territories: 2nd series, No. 1 (Washington).

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