THURSDAY, AUGUST 30, 1883

THE BRITISH ASSOCIATION

SOUTHPORT has been selected for the meeting of this body in 1883, and the fifty-third annual session will commence on the 19th and end on the 27th of September. It is not necessary to dilate upon the various reasons which led up to this arrangement. Suffice it to say, that there was strong opposition on the part of considerable University and manufacturing cities; and the success of Southport may, no doubt, be in great part attributed to the enterprise and business zeal which, within two generations, have raised it from a seaside village to a populous, well-built, easily accessible corporate borough.

To many people, perhaps the majority, in the southern counties, Southport is a name, and nothing more. It is doubtful whether the topographical knowledge of most educated Southerners would enable them to say, offhand, in what county it is situate. No one, however, has probably once visited the town without finding many things to admire and buildings to surprise. We may be pardoned for saying that Southport is less than eighteen miles from Liverpool, thirty-six from Manchester, sixteen from Preston; Wigan, Blackburn, Bolton, Burnley, Oldham, and other large centres of manufacture being within easy distances. It should be enough to say that a circle, having its centre at the Town Hall, with a radius of forty miles, would include 4,000,000 people. The public buildings are handsome and commodious, and every accommodation is at hand to render the forthcoming gathering, even if very large in number, a perfect success.

Liverpool being so near, a well-founded hope exists that the town will be honoured by a visit from numerous American, colonial, and foreign men of science. It must not be forgotten that Edinburgh and Dublin, Glasgow and Nottingham, Newcastle and Birmingham, are all within ready access of Southport.

Southport is about five hours from London, and has through communication by two railways with every important town in the United Kingdom.

On this occasion the Reception Room will be at the Cambridge Hall; the Council Room in the same building; the evening meetings and *conversazioni* will take place in the Winter Gardens, which have been specially retained wholly for this purpose; the General Committee Room will be at the Town Hall; Sections A and B at the Atkinson Art Gallery; Section C at the Temperance Hall; Sections D_1 and D_2 respectively at the West End and at the Congregational School Room; Section E at St. George's Hall; Section F at St. Andrew's Hall; and Section G at the Town Hall. After this list, no one can doubt that there is ample accommodation, both for the members as a body, and for the several Sections.

There are several first-class hotels, capable alone, it is estimated, of boarding and lodging 1000 people or more. Apart from this, there are houses where apartments are available to any reasonable extent. Probably the various "company"-houses, as they are styled locally, could accommodate between 10,000 and 12,000 persons. In addition to the regular places of this sort, many more householders are prepared to become amateur lodging-house keepers for the time in case of need. The Secretaries and Recorders of Sections will be boarded and lodged in houses on the Promenade, facing the sea, and within three minutes' walk of the Winter Gardens, or four to six minutes from the Reception Room, which is in the centre of the town.

Dealing in detail with the arrangements for the meeting, it may be mentioned that the Local Executive Committee has for chairman Dr. James Wood, Mayor of Southport. Among other members of the Committee in question, the names are found of the Earl of Derby, the Earl of Crawford and Balcarres, the Earl of Lathom, Prof. Greenwood, and Prof. Roscoe (all of whom are also vice-presidents of the Association for this year). Committees have been formed to deal with hospitality and lodging arrangements, excursions, *conversazioni* and evening meetings, audit and finance, and the lecture to the operative classes. The local secretaries are Mr. J. H. Ellis (the Town Clerk), Dr. H. H. Vernon, and Mr. T. W. Willis (B.A. Cantab.).

The retiring president, we may remind our readers, is Sir C. William Siemens, and the president-elect is Prof. Arthur Cayley, Sadlerian Professor of Mathematics in the University of Cambridge.

The first general meeting will be held on Wednesday, September 19, at 8 p.m., when Sir William Siemens will resign the chair, and Prof. Cayley will assume the presidency and deliver an address. On Thursday evening, September 20, at 8 p.m., there will be a *soirée* in the Winter Gardens; on Friday evening, September 21, at 8.30 p.m., a discourse on recent researches on the distance of the sun, by Prof. R. S. Ball, Astronomer-Royal for Ireland; on Monday evening, September 24, at 8.30 p.m., a discourse on galvanic and animal electricity, by Prof. J. G. McKendrick, Professor of Physiology in the University of Glasgow; on Tuesday evening, September 25, at 8 p.m., a *soirée* in the Winter Gardens; and on Wednesday, September 26, the concluding general meeting will be held at 2.30 p.m.

It must not be forgotten that on Saturday, September 22, at 7 p.m., a lecture to working people will be delivered by Sir F. J. Bramwell on "Talking by Electricity: Telephones"; it is expected that the usual flock of Saturday excursionists will furnish an overflowing audience.

In connection with the *soirées*, it may as well be stated here that there is to be an exhibition of objects of scientific and artistic interest in the covered skating rink, a very prominent feature of which will be an exceptionally complete installation of electric lighting on the Siemens system. We believe that this last is intended to be one of the most complete exhibitions ever yet seen of its kind. There will also be in the large Pavilion (where the presidential address and evening discourses will be given, and concluding general meeting held) an exhibition of Lewis's improved system of incandescent gas lighting. This will also be given on the nights of the two *conversazioni*. The entries for other classes of exhibits (microscopes, &c.) are very satisfactory.

A feature of these yearly gatherings is the arrangement for excursions to places of interest in the neighbourhood of the town selected from year to year. These are very numerous this time, and include Knowsley, Lathom House, Ince Blundell Hall, the Abram Colliery, Stonyhurst College and Whalley Abbey, the Lake District, Haigh Hall, St. Helen's and Widnes, the Wigan Coal and Iron Company's Works, Chester and Eaton Hall, Liverpool (including a visit to a White Star steamer and a run along the dock's front), Clitheroe District (Geological), and others which may be announced in these columns next week.

Rufford Park and Rufford Old Hall will also be visited, as well as the county town, Lancaster, which deserves more than passing mention. There is the old church there, the ancient castle (the residence, ages ago, of John of Gaunt), aqueducts of some importance, the Roman camp in the vicarage grounds, the assize courts, and many other objects of attraction and public buildings, including asylums and hospitals of ancient and of modern establishment, and of very various character.

There will be garden parties at Knowsley (by the kindness of the Earl and Countess of Derby), at Lathom House (on the invitation of the Countess of Lathom), and at Ince Blundell (the residence of Mr. T. Weld Blundell). In addition, the Mayor of Southport will give a garden party at Hesketh Park on Friday, September 21; and it is rumoured that he will also have two afternoon receptions, on days to be arranged hereafter, at his own residence, Woodbank. The Rev. C. Hesketh Knowlys, the rector of the mother parish of North Meols, will also give a garden party in his grounds.

The three railway companies running into the town, two of which have terminal stations at Southport, are all offering advantages and facilities in order to help making the meeting a success. For instance, the London and North Western Railway will run through carriages to Southport on September 17, 18, and 19, from London (Euston Station), Willesden Junction, Northampton, Stafford, and Crewe, by the 7.15 a.m., 11 a.m., 1.30 p.m., 3.0 p.m., and 4.0 p.m. trains, and similar arrangements will be carried out for the return journey.

Liberal arrangements have also been made by the local railway companies for the benefit of excursionists to the many attractive districts in the north and west of England.

The arrangements at the Reception Room in Cambridge Hall will be of the usual complete kind at these gatherings, including postal, telegraph, ticket, reserved seats, lodgings, inquiry, lost property, daily journal, members' lists, local programme, guide-book, and other departments. The hall has been newly decorated throughout for the occasion, and, when furnished and in full work, will doubtless bear favourable comparison with similar rooms at previous meetings of the Association. The telephone will also be brought into play, so as to connect all the Section Rooms both with the Reception Room and the Winter Gardens, as well as with the principal hotels and other large establishments in the town.

A local fund has been raised of over 2600*l*., and strenuous efforts are being made to increase that amount to 3000*l*. This will most probably be accomplished.

Looking to all these facts—bearing in mind that Southport has a promenade of over a mile facing the sea, on which are three of the chief hotels and a string of handsome private residences and lodging-houses; a pier, which, with its extension, is within a few hundred yards of a mile in length; the boulevards (in Lord Street and its continuations east and west), bordered by handsome edifices, public buildings of no mean architectural pretension, banks, &c.—enough has been said to justify the hope that Lancashire will once more distinguish herself as the hostess of the British Association, as she undoubtedly did in 1870 (the last time that it met within her borders), when, under the presidency of Prof. Huxley at Liverpool, one of the most characteristic, as well as one of the most numerously attended and in every way brilliant and successful meetings of the British Association was held.

PROFESSOR HAECKEL ON CEYLON

A Visit to Ceylon. By Ernst Haeckel; Translated by Clara Bell. (London: Kegan Paul, Trench, and Co., 1883.)

WHEN a man of scientific genius writes a popular book, it will generally be found to be either a great success or a great failure; mediocrity, as a rule, does not attend the work of such a man in either direction. Now Prof. Haeckel is already well known to all the world as one of the few leaders in science whose literary ability is on a level with his more professional attainments, and whose genius is therefore exhibited in exposition as conspicuously as it is in research. Thus it was that when we heard he intended to publish a popular account of his six months' travel in the tropics, we expected a great treat in the way of literary performance. We had, of course, read a good deal about Ceylon before, and thus knew that it was a part of the world which in point alike of natural scenery and natural history was well calculated to arouse the enthusiasm of such an artistic-minded naturalist as Prof. Haeckel; and knowing that his pen can paint almost as vividly as his brush, we were prepared for something of unusual interest in the story of his "Visit to Ceylon." Perhaps, therefore, it is not possible to say anything in higher praise of his book than that it has even surpassed our anticipations. The man of science has retired, as it were, into the background, and left the way clear for the man of letters, the shrewd observer of men and things, the poetic lover of Nature—the frank, open-hearted, wide-minded German character which finds so admirable an expression in this great German biologist. Whether he is diving down among the coral reefs, forgetting his wounds in the keen joy of exploring the beauty and the wonder of those biological treasure-houses, or whether he is scrambling to the "World's End" through almost untrodden and untreadable jungles 8000 feet above the sea; whether he is moving in English society and deeming it needlessly formal in the matter of dressing for dinner under a tropical climate, which has turned his carefully-provided swallow-tail coat as white as a sheet with mildew; or whether he is living for six weeks at a time zoologising in a remote native village without ever seeing a white man—wherever he is and whatever he is about, we are alike charmed by the character of the man which unconsciously looks out at us in every page, and throws around him, as it were, a halo of romance.

We have said that in all this the man of science has been allowed to retire into the background. But not on this account has the man of science been idle. Prof.

Haeckel went to the tropics to work and not to play, and work he did, with a vigour and pertinacity which, under the circumstances described, can only be called astonishing. To have gone out day after day and week after week surface-fishing in an open boat beneath the almost vertical rays of a tropical sun, is in itself to have performed a feat of physical endurance which, so far as we are aware, has never been performed by any other naturalist; and to have worked steadily for half a year from daydawn to night, exploring, collecting, and investigating as Haeckel investigates—feeling all the while, as he expresses it, that each day was costing him, as a mere matter of money, somewhat over 5*l.*—to have worked thus would have been to exhaust the strength of many a younger man even in a much higher latitude than that of Ceylon. The results attained by such a naturalist in such a region, and working at such a pressure, of course constitute an immense harvest—so much so, indeed, that he thinks he has more material in his collections than the term of his natural life will admit of his sufficiently investigating. But with all this, he has wisely avoided burdening his account of "A Visit to Ceylon" with any details of his scientific labours. The book is intended for general readers, and while a sufficient number of scientific observations on the flora and fauna of the island are thrown in here and there to complete the picture which he gives of the place, these are always judiciously subordinated to the main design of speeding an honest tale by telling it plainly.

After an entertaining account of his voyage and of a week spent in Bombay, the traveller proceeds to give his first impressions of Ceylon. He is most of all struck with the magnificent luxuriance of the tropical vegetation, some of his descriptions of which are admirable specimens of word-painting. Everywhere he meets with the greatest kindness and courtesy, of which he is lavish in his acknowledgments. Having been a guest at various houses, visited and studied botanical gardens, made sundry excursions, &c., he eventually sets up a zoological laboratory upon the coast. This having constituted the main object of his journey, he had taken with him sixteen large packing cases filled with all the equipments required for zoological and morphological research. The choice of site lay between one or other of two sheltered bays—Galle and Belligam. At the former he would have the advantage of living among civilised Europeans, and of being the guest of the hospitable and cultivated English consul, Mr. Scott, of whom he speaks in terms of high esteem; at the latter he would be the only European within a radius of many miles, and require to take up his quarters in a small government house. Such being the circumstances, he says:—

"After much hesitation, and long debating the *pros* and *cons*, I finally decided for Belligam, and I had no reason to regret the choice. The six weeks I spent there were full to overflowing of wonderful experiences, and never to be forgotten as forming the crowning 'bouquet' of my Indian journey, the sweetest and brightest flowers in a garland of delightful memories. Though I might perhaps have carried on my zoological studies better and more conveniently in Galle, I gained infinitely more on the side of general knowledge of nature and humanity in the charming seclusion of Belligam."

If the naturalist had no reason to regret this choice, assuredly his readers have not, for the account which follows of his residence among the natives is the most entertaining part of his narrative. On his first arrival he is met by a general assembly of the inhabitants, his advent having been expected in consequence of the governor of the island, Sir James Longden, having written to the native officials "to be in all respects civil and serviceable." The civility in the first instance takes the form of series of ceremonious addresses presented to him by one native magnate after another, emphasis being given to the close of each by "a grand rattle of drums performed by a row of tom-tom beaters squatting in the background." These high functionaries presented in their dress a sort of hybrid between the European and the Cinghalese. "Beginning at the top, a tall English chimney-pot charmed the eye—of all head coverings beyond a doubt the most hideous and inefficient. However, as the Cinghalese see Europeans wear this cylindrical headpiece on all solemn occasions as the indispensable symbol of birth and culture, never abandoning it even in the greatest heat, they would regard it as a serious breach of etiquette to appear without the singular decoration." Below the hat there came "an enormously high and pointed white shirt-collar, and a coloured silk scarf tied in a bewitching bow." Then a swallow-tailed dress coat, white waistcoat with jewelled buttons and gold chains. But instead of trousers wherewith to complete this grotesque imitation, each of the dignitaries ended off in a red or party-coloured petticoat and bare feet.

Having suitably acknowledged this unexpected ceremony, Prof. Haeckel sets to work unpacking and setting up his laboratory in one of the rooms of the government house. From that moment throughout his stay of six weeks he is pestered by the insatiable curiosity of the entire neighbourhood, and even by that of native visitors from a distance, which on one occasion presented themselves in the form of four old maiden ladies of distinction, "each more wrinkled and hideous than the last," who desired to be instructed in science and to have their photographs taken. The Professor is here ungallant enough to remark, "If they had been but three, I could have mistaken them for the three Phorcydes, the witches of the classical Sabbat, and might have made myself agreeable to them after the fashion of Mephistopheles." Hoping to satisfy the universal curiosity in a collective manner, he tried the experiment of giving lectures through an interpreter; but he found that there was no spark of real scientific interest underlying the childish desire to see something new. However, he managed to get on admirably with all around him, gave away multitudes of presents in the shape of coloured prints, &c., presided one day over the grand Buddhist festival for the 19th of December, and on the 20th filled the same office of president at the annual festival of the Wesleyan mission. "I had done honour to the sublime Buddha yesterday, and to-day I must pay tribute to worthy Mr. Wesley. . . . My friends in Galle and Colombo, who heard through the papers of my extraordinary proceedings, laughed at me 'consumedly.'"

But we have no space to give any sketch of the strange experience of these six weeks' sojourn among the primitive natives, so curiously composed of the instructive, the æsthetic, the ludicrous, and the pathetic. We have said enough to show that the book ought to be read by every one, and therefore we shall now conclude by drawing more prominent attention to sundry opinions and suggestions, which, as Englishmen, we should desire to see our Government consider and act upon.

First, as regards the promotion of science:—

"The extraordinarily favourable climate and position of Peradenia especially fit it for more extensive use from a scientific point of view as a botanical station. In the same way as our young zoologists find the recently established zoological stations on the sea coast (at Naples, Roscoff, Brighton, Trieste, &c.) of inestimable value for their deeper scientific studies and experiments, a year's residence in such a botanical station as Peradenia would give a young botanist more experience and work than he could obtain in ten years under the various unfavourable conditions at home. Hitherto, less has been done in the tropical zones than elsewhere for such establishments for study and experiment, though they would be exceptionally beneficial. If the English Government would establish and maintain such a station for botany at Peradenia, and one for zoology at Galle—in the charming bungalow, for instance, belonging to Capt. Bayley, which is admirably suited to such a purpose [and would be sold by the owner to effect it]—they would be doing signal service to science, as they have already done by the *Challenger* Expedition and other great undertakings—and once more put to shame the great Continental States of Europe, who spend their money chiefly on breechloaders and big guns."

In reading this passage all true Englishmen should feel regret that their Government is not deserving of the meed of praise which the courtesy of the writer bestows. Seeing that we are the great maritime and colonising power, it is nothing short of a public disgrace that we are without a zoological station upon any of our thousands of miles of coast, and that hitherto there is no prospect of our escaping from the sarcasm (whether conscious or unconscious) wherewith the national seat of "deeper scientific studies and experiments" in marine biology is here specified as *Brighton.* Is it too much to hope that the Fisheries Exhibition may at length help to open the eyes of a Liberal Ministry to the importance of doing something in this direction?

Only in one particular does the English rule in India fall under censure, and this has reference to the atrocious treatment of the stage-coach horses. The scenes described are certainly monstrous beyond imagination—flogging by the whole village, dragging by the nostrils, wringing by the ears, and burning with torches. Truly, as Haeckel observes: "It is difficult to conceive how the English Government, which is generally so strict in its arrangements and discipline, has not long ago put an end to this brutality to animals, and more particularly extended its protection to the wretched horses that serve the 'Royal Mail Coach.'" Here is surely something for the anti-vivisectionists to memorialise upon with benefit.

We cannot take leave of this delightful book without congratulating the translator on the beautiful English into which she has rendered it.

GEORGE J. ROMANES

OUR BOOK SHELF

Elements of Histology. By E. Klein, M.D., F.R.S., &c. (London: Cassell and Co., 1883.)

THIS, which is the first of Cassell's "Manuals for Students of Medicine," contains 342 closely-printed pages, with 168 well-executed woodcuts, mainly reproduced from Klein and Noble Smith's "Atlas of Histology," or the "Handbook for the Physiological Laboratory," intercalated in the text. It is not too much praise to say that the information in this little volume is generally very complete, quite up to date, and written in a concise, though, at the same time, thoroughly clear style.

Dr. Klein wisely omits all reference to the titles of works and papers, introducing where necessary simply the name of the discoverer of, or observer most intimately associated with, the structure referred to. Where different opinions exist, this is obviously convenient, and the right thing to do; but why on page 7 the names of fifteen histologists, followed by the words "*and many others*," should be given, it is difficult to understand, especially as they are quoted with reference to the indirect division of nuclei or Karyokinesis, of which every worker at histology must have seen many examples.

In a work like the present, where all usually received ideas are given, it is curious to find that no reference is made to Schäfer's with regard to striated muscle. Surely this cannot be an accidental omission, especially as Haycraft is twice quoted.

That the action of tannic acid on human red corpuscles is not described in the text, although figured (p. 9, fig. 9*a*), is clearly an oversight, as that of boracic acid on newt's red corpuscles is both figured and described. In future editions it will be convenient if the same numbers be used in the text as in the diagram when describing the different parts of the kidney tubules, constant reference to the description of fig. 133 being now necessary.

With the exception of the above minor details, unqualified praise must be given, and the "Elements of Histology," which is really a very complete manual, should be used and re-used by every student and practitioner of medicine who wishes to acquire a sound knowledge of the normal histology of man. J. W. G.

LETTERS TO THE EDITOR

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

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

"Elevation and Subsidence" again

A LETTER appears yesterday, again criticising Mr. Starkie Gardner's general views about pressure, in the same sense as was done by myself a fortnight ago. But, referring to that gentleman's opinion that pressure can render rocks molten or fluid, Mr. Young goes on to remark: "Is not the supposition the exact reverse of what is really the case, viz. that not only does pressure *not* liquefy rocks, but actually *prevents* their melting at a temperature at which they *would* melt were the pressure removed?" Your correspondent, offering this remark with a query, seems as if his mind was not quite made up on the subject; and with reason; for it must, I think, be considered at present an open question whether the temperature of rocky matter is, or is not, raised by pressure.

Sir W. Thomson stated, in an address to the Geological Society of Glasgow in 1878, that certain experiments by Dr. Henry Muirhead and Mr. Joseph Whitley seemed to show that iron, copper, brass, whinstone, and granite are less dense in the solid than in the liquid state at the melting temperature. If so, pressure would assist in liquefying these substances. On the other hand, some observations of Mr. Johnston-Lavis, made on lava at Vesuvius, point in the opposite direction. Granted that the earth is, as a whole, extremely rigid, we cannot gather from that fact any certain information about the effect of pressure on "rocky matter," when near the melting temperature. We do not know whether the nucleus of the earth consists of matter which could, under any conditions, be directly converted into surface rock; nor yet do we know anything certain about its temperature at depths bearing considerable ratios to the radius. Indeed the state of our knowledge is best expressed by the words of the old song, "Oh dear! what can the matter be?" It is even conceivable that, whatever it be, it may be above its own critical temperature; in which case the laws affecting incompressible liquids become inapplicable.

An interesting paper upon this latter hypothesis was published by Prof. Zöppritz in the *Transactions* of the first Geographical Congress of Berlin, 1881. It is entitled "Ueber die Mittel und Wege zu besserer Kenntniss vom inneren Zustand der Erde zu gelangen," and published by D. Reimer, Berlin.

Harlton, Cambridge, August 24 O. FISHER

I OBTAIN NATURE in monthly parts, and am indebted to a friend for calling attention to the article on "Elevation and Subsidence" by Mr. J. Starkie Gardner in vol. xxviii. p. 323, in which he considers that, "wherever considerable weight is added to any part of the earth's surface, a corresponding subsidence of its crust almost invariably follows." As it is evident from the last paragraph in Mr. Gardner's paper that he esteems this opinion to be novel to the readers of NATURE, and being the first time it can be considered as having been discussed in your pages, it might have been more satisfactory perhaps had he passed in review the conclusions arrived at by others who have preceded him.

Sir John Herschel (see "Physical Geography," § 132, 1862, and "Familiar Lectures," Lecture I.), assumed in a general manner that "if continents are lightened they will rise; if the bed of the sea receives additional weight it will sink." It is to be regretted that the facts advanced as evidence by so great an authority did not prove sufficiently conclusive to claim general acceptance. Mr. T. F. Jamieson, F.G.S., in 1865 (*Quarterly Journal of the Geological Society*, vol. xxi. page 178), considered that the enormous weight of snow accumulated during the glacial period "may have had something to do with the depression of the land which then occurred, and that the melting of the ice at its termination would account for the rising of the land."

Under the advocacy of Prof. James Hall ("Palæontology of New York," vol. iii., 1859), the subject has received much consideration in America; this has been so great that Capt. C. E. Dutton, of the United States Geological Survey, was enabled to say that "few geologists now question that great masses of sedimentary matter displace the earth beneath them and subside" (NATURE, vol. xix. p. 251).

The principle that accumulation of material causes subsidence and that denudation results in elevation of the crust of the earth has been advocated by myself on numerous occasions during the last eighteen years, being considered equally applicable to rocks of every age during the whole series; in England from the Cambrian rocks of Shropshire to those now in process of deposition in the seas which surround our coasts. The idea originated to me from observations in the Longmynd and of the Upper Silurians of Shropshire and North Wales during 1864. Its universal application and the physical effects dependent on the phenomena formed the special subjects of two addresses as president of the Liverpool Geological Society in 1871 and 1872. The conclusions were deemed by NATURE (vol. vi. p. 379) of such importance that you considered my "interpretation of the facts deserved further consideration." Abstracts of these essays also appeared in the *Geological Magazine*, vol. ix. p. 119, and vol. x. p. 202. The views entertained have been subsequently advocated by me in the *Proceedings of the Liverpool Geological Society*, the *Geological Magazine*, and the *Reports of the British Association*, the last time being during the meeting of the British Association at Southampton (*Report*, 1882, p. 540), which paper has appeared in full in the *Geological Magazine* for July and August, 1883.

The only author who has considered this subject and to whom Mr. Gardner refers, is the Rev. O. Fisher, F.G.S., whom he deservedly praises for his masterly work, "The Physics of the Earth's Crust," 1881.

In spite of much adverse criticism I have been content to wait all these years, feeling convinced that after commendation similar to that accorded by you (by no means a singular occurrence), the subject of oscillation, as the result of changes in the distribution of sediments, would eventually be taken into consideration; for a frequent remark has been that "there appears to be something in it"; and no geological fact is more persistently referred to than that the formation of sedimentary strata of every age "*has occurred during a period of subsidence.*"

Birkenhead, August 22 CHARLES RICKETTS

"Decentralisation in Science"

I FULLY agree with the remarks on this important subject made in your leading article of last week; and the necessity for local scientific societies being in some way placed in direct communication with each other and with the central metropolitan societies has long been present in my mind. It is perhaps as yet premature to broach any definite scheme for effecting this object, which, as the writer of the article points out, would be surrounded by very great practical difficulties. The whole subject might very well be discussed by the Conference of Delegates about to attend the meeting of the British Association at Southport.

There are numerous scientific societies and field-clubs throughout the country whose work is being frittered away in useless directions solely from the want of proper scientific guidance. As a preliminary step towards this most desirable economising of individual energy it appears to me that centralisation in the various counties is the first essential. This has been well enforced in the Preliminary Report of the "Local Scientific Societies" Committee of the British Association, published in NATURE a short time ago by Mr. Francis Galton, the Chairman of the Committee.

It is most satisfactory to know that the British Association has taken the matter in hand, as this body is of all others the most competent to deal with the subject, if for no other reason because the Association is the only scientific society that holds its meetings in various provincial centres. Among the difficulties that would have to be met in any scheme of county affiliation not the least formidable is the purely local feeling existing in many small societies, which leads their officers and members to reject all overtures from larger and more influential bodies in the mistaken belief that cooperation would entail a loss of individuality. A good illustration of this kind of difficulty has quite recently come under my notice in attempting to bring about some kind of amalgamation between the local societies of the county of Essex.

Till such narrow views of the functions of a local society are successfully combated no great advance towards centralisation can be made. R. MELDOLA

21, John Street, Bedford Row, W.C., August 27

The Earthquake in Ischia

IN 1878, when touring in the Himalayas, we spent the last two Sundays in August at Kyelang, in the Lahoul Valley. On each of these days I felt a sharp shock of earthquake about 4 p.m.

On both occasions I was sitting in a room on the upper floor of the German missionaries' house. A broad wooden verandah runs round the front and sides of the lower floor of this building.

I was about to rise and leave the room, when I heard a loud rumbling noise; my first idea was that the children of the house were amusing themselves with dragging each other in a small wooden waggon up and down this verandah as they were in the habit of doing, but the sound was much louder, as loud as that of a railway train when near the spectator. A second later I felt a violent oscillation, and a padlocked door, opposite the door of exit, shook violently backwards and forwards several times. A week later another earthquake occurred almost at the same hour, and under the same conditions.

Three years later, in 1881, we again passed through the same part of the Himalayas on our return from the Spiti Valley, which we had reached by way of Kunówar.

This time no earthquake took place during our stay in Lahoul; we crossed the Rotang Pass, and went to stay in the Kulu Valley with our friend Col. S——, Deputy Conservator of Forests at Mañali, about sixteen miles on the southern side of that mountain. Col. S——'s house is raised high above the river on the right bank of the Beas; it is placed in the midst of a Deodar forest, and built of wooden logs placed horizontally, and alternating with courses of large stones laid one upon the other, but not mortared together. A wooden verandah runs all round the building, and forms a balcony to the rooms on the upper floor. I imagine it is its mode of construction which enabled this house to resist the severe test to which it was subjected on this occasion.

On October 1, about 1 p.m., we were sitting, a party of three persons, in a temporary verandah resting on the bare earth, and floored with matting, which our host had erected to supplement the permanent one where our native tailor was seated at work.

I had just risen to speak to him, but before I could do so, a loud rumbling sound seemed to come on my right hand (or from the direction of the Kulu Valley).

One of the party called out *thun*—we had had a thunderstorm the day before—but changed the word to *earthquake*. For a second or two I held my breath—I felt rooted to the spot; then the permanent wooden balcony over my head began to creak and groan most violently, and I distinctly saw the front wall of the house advance towards me, and recede from me, three or four times.

After the motion had ceased, the rumbling sound, which at its greatest intensity seemed beneath our feet, died away in the opposite direction (or towards Simla). I made many inquiries afterwards, but was unable to ascertain whether any shocks of earthquake had been experienced on these dates either in Kulu in 1878 or in Lahoul or at Simla in 1881.

The recent catastrophe in the Island of Ischia has called the attention of those who make a study of such disturbances of the earth's surface to the simultaneous occurrence of earthquakes in various parts of the world, which induces me to send you these facts, in the hope that they may interest some of your readers and lead them to form some conjecture as to the possible centre of the earthquakes in the Himalayas.

I am not aware to what extent the geological formation of the Himalayas has been investigated, but (speaking as a non-professional) during three long tours in various parts of these mountains I have never observed any traces of extinct volcanoes. I ought, however, to mention, perhaps, that there are hot springs at Beshist on the left bank of the Beas River, about four miles from Mañali, and also at Manikern, in the Parbuti valley, which debouches from the Kulu valley, about thirty miles lower down, also on the left bank of the river. Manikern is a great place of resort for Hindu pilgrims, who consider these hot springs miraculous; it is also occasionally visited by Europeans who have found these waters efficacious in rheumatic affections. Earthquakes do not seem to be uncommon in these valleys, but it has been remarked that they generally, if not always, occur in the autumn, just when the rainy season is at an end.

COSMOPOLITAN

Lime and Bones

THE observation of your correspondent in NATURE, vol. xxviii. p. 329, regarding the effect of lime in strengthening the bones of children, induces me to communicate certain facts which I observed during a recent tour of two months in Norway.

We travelled by land from Christiania to Throndhjem, thence by sea to the North Cape and back, and made expeditions into the interior at different points on our downward journey.

I noticed everywhere an extraordinary number of weak-boned, crippled, and bandy legged children, also a great number of men and women with weak bones and distorted limbs.

Almost the whole of Norway is a network of mountains composed of various forms of primitive and metamorphic rock, and though marble exists in this country I saw none in the districts through which we passed.

COSMOPOLITAN

Christiania, August 11

Copper and Cholera

REFERRING to the paper read before the French Academy (as reported in your last issue) on copper as a preservative against cholera, it may be worth while to state that when visiting the great copper mines at Fahlun in Sweden (probably the oldest and largest in the world) I was informed that cholera had never appeared there, and that so well was the fact known that on the last visitation of cholera in Sweden some members of the Royal family took up their abode in Fahlun to escape the disease. The atmosphere was there loaded with copper fumes to such an extent that not a trace of vegetation was visible on the hills surrounding the town; so that this really seems to confirm by experience on a large scale the theory alluded to.

WALTER R. BROWNE

Sulphur in Bitumen

FROM the abstract of the meeting of the Paris Academy of Sciences in your last number (vol. xxviii. p. 408), M. B. Delachanal appears to consider that the presence of sulphur is peculiar to the bitumen of the Dead Sea, and from this he deduces a theory as to its inorganic origin.

In some experiments which I had occasion to make this summer on the bitumen of the Great Pitch Lake of Trinidad I found that this substance contained a very considerable quantity of sulphur. Several per cents. of the volume of the gas obtained by its destructive distillation consisted of hydrogen sulphide. The origin of this asphalt is generally considered to be organic, but I am not aware whether the entire absence of calcium salts from its ash, a fact which was proved nearly a century ago, and has since been confirmed, has been explained on this theory.

HUGH ROBERT MILL

Edinburgh, August 27

Thunderstorms and Auroræ

A CONNECTION between these phenomena has been repeatedly suggested. J. W. Ritter has articles on the subject in Gilbert's *Annalen* (1803 and 1804), and Kupffer has a long one in 1827. Other writers who have dealt with it or with the connection between auroræ and atmospheric electricity generally are Schübler (1817), R. Phillips (1854), F. Dellmann (1860), E. Loomis (1860, 1861, and 1862), A. Poey (1861), A. De la Rive, F. Abbott (1863), E. Edlund; and in NATURE, vol. xii. p. 127, there is a summary of the observations by Herr von Bezold. This may serve as a partial answer at the end of Mr. Chadbourn's letter.

A. RAMSAY

4, Cowper Road, Acton, W., August 27

The Meteor of August 19

THE details of this meteor in the letter of your correspondent Mr. Mott and my own are for the most part in such close accordance that one might suppose we had been comparing notes. There is, however, one particular in which our respective accounts differ so widely that one feels inclined to ask whether there were two meteors or whether one of your correspondents has made a mistake as to the direction of the course of the meteor.

First let me correct an error of my own. I find now I was wrong in giving the point of starting as a *few degrees* eastward of the north star. I am somewhat of a stranger at the place where I saw it, and I now find that the point from which it started was as nearly as possible north-east, and about 65° or 70° above the horizon.

I am quite clear as to the path being downwards in an almost perpendicular direction inclining a little to the left. Mr. Mott, on the other hand, describes it as "nearly horizontal, inclined a little downwards about 10° or 12° above the horizon, apparently much foreshortened." It appears to me—perhaps owing to a want of scientific knowledge—quite impossible that a meteor visible a few miles south-west of London, falling as I have described, could be identical with one seen two hundred miles north-west of London travelling in the direction described by Mr. Mott. I of course lay the stress on the direction of the meteor and not the distances of the observers from London.

A. TREVOR CRISPIN

Lansdowne Road, Wimbledon, S.W., August 27

IT may be of interest to some of your readers to know that the meteor mentioned in NATURE as seen on Sunday evening, August 19, was also seen here, timed by me at 10.1 p.m. The compass bearings were from south-east past east to east-east-north, about 35° from horizon; colour, yellow orange; first seen coming from behind a cloud; divided due east, one part falling considerably.

W. M. POOLEY

Bath Road, Cheltenham, August 26

Stachys palustris as Food

I SHOULD be much obliged if any of your readers could give me any information as to whether the rhizomes of *Stachys palustris*, L., are used by the country people either in Great Britain or elsewhere for food. I believe the English name of the plant is Base Horehound, and that in the last century it was so used.

A. WENTZ'L

Krásnicza Wola, Grodzisk, near Warsaw, August 18

OYSTERS, OYSTER FISHING, AND OYSTER CULTURE AT THE FISHERIES EXHIBITION

As long as the English "native" keeps its prominent place in the market all questions concerning oysters and oyster culture will have a special interest for the British public at large. For the man of science oysters are none the less interesting, although from a different point of view. For him it is a great puzzle that up to now we are in so profound a state of ignorance concerning certain of the most important phases of life of a mollusk so exceedingly numerous, which may indeed be called very common, if not always plentiful, all along a large extent of the European coast. Questions such as the following:—Are oysters functional hermaphrodites or not? At what age can oysters reproduce their species? How long do the oyster larvæ (the so-called "spat") swim about in the ocean as free and independent, although minute, living specks? What is the effect of currents and temperature, both upon the growth and upon the fertility of the oyster? are or were up to very lately wholly unsolved, and no really scientific inquiry had thrown any definite light upon them. Even the anatomy of the oyster was very imperfectly known, and it was only last year that the researches of Dr. Hoek, exhibited in the Netherlands department of the Exhibition, threw a flood of light upon this point. These are the first of a more extensive series of investigations which are still in preparation, and which will treat of the embryology and the food of the oyster, the fixation of the spat, and the physical conditions under which the apparently very fertile oyster beds of the Eastern Scheldt are placed. These investigations have been undertaken and pursued for three summers consecutively by the Netherlands Zoological Society.

The exhibit in the Netherlands department is the only one in which the scientific side of the oyster question comes into the foreground. Highly interesting from the point of view of practical oyster culture are, however, two exhibits—one in the Norwegian, one in the British department, which we propose to describe somewhat more at length.

The Norwegian one is a bottle containing oysters from the small lake of Ostrawigtjen, near Soggendahl, on the south coast of Sweden. This lake, which is only about 800 feet long and 500 feet wide, with a depth of about six fathoms, may be regarded as a real "hothouse" for oyster culture, the temperature of the water being at the end of last April no less than 22° C., whereas in winter the water at a depth of three fathoms never registers any lower temperature than 7° C., the average bottom temperature in summer being 27° C. Considering the latitude in which the lake is situated, these temperatures are indeed very remarkable, and have not yet been fully explained. Some would ascribe it to a most luxurious vegetation of Confervæ which is found in the lake, the partial decomposition and fermentation of which might increase the temperature. It is, however, open to question whether this confervoid vegetation must not perhaps be rather looked upon as an effect than as a cause of the high temperature.

This lake incloses a natural bed of oysters, and already *at the end of March some of these oysters contain ripe black spat.* In the summer months the productivity of course greatly increases, and up to November (*i.e.* nearly nine months consecutively) ripe oysters with larvæ in their gills are met with.

It need not be said that this is a splendid collecting ground. The spat is collected on birch twigs which are suspended in the water on wires stretched over it.

In 1882 one thousand collectors were brought out, each having a surface of about sixteen square feet, and on these 730,000 young oysters were obtained, which were than transferred to natural beds in the fjord close to Stavanger.

If the oysters were left where they are they would certainly grow very quickly; oysters of one year sometimes attaining a size of six to seven centimetres. For several reasons, however, the transfer is regarded as more suitable for them.

A most curious fact concerning this lake remains yet to be told, viz. that it is situated 2½ feet above high-water mark; that it is separated from the sea by a dry tract of land with large boulders; and that only between September and March, when the weather is very rough, fresh sea water can gain access to the lake by the sea being thrown across this tract of land. At the opposite side of the lake a small rivulet of fresh water enters the lake.

A second "hothouse" for oyster culture appears to have been discovered only very lately; it is in most respects similar to the first; the depth is about 3½ fathoms; the temperature in October was 18° C., in April 21° C. It is situated at Vesetvig near Stavanger, on the Hardanger fjord.

The British exhibit, to which we would wish to call attention more especially, bears the name of Wootton, Isle of Wight. It consists of models of ponds devoted to the "basin culture" of oysters, essentially different in principle from "foreshore culture," which is at present more successful and more generally recommended.

"Basin culture" is nevertheless perhaps a future stage, when once the acute practical intelligence of the oyster-culturist and the investigations of zoologists shall have succeeded in reproducing the natural circumstances under which the oyster spat lives and thrives. At the conference on oyster culture held by Prof. Hubrecht, we were told that investigations more especially relating to basin culture were at the present moment being carried on in Holland. The result obtained in the Isle of Wight was this, that in the first year (1880) the number of the spat obtained was about 25,000, in the second year (1881) 250,000, and in the third (1882) 1,500,000. Notwithstanding this successful commencement, the final results have as yet remained far below the expectation, since only a comparatively small number could be brought to be marketable oysters. A difference between these experiments and those carried on in the Netherlands, which may perhaps prove to be one of fundamental importance, is this, that no contrivances have been made use of in the Isle of Wight to sufficiently aërate the sea water in the basins. Lack of oxygen may have been the principal cause of the great mortality of the spat. Moreover, a certain amount of sea water was let in and let out at favourable tides, and this must to a certain extent have interfered with the reliability of the results.

These experiments were carried on with oysters that were imported from the Arcachon beds.

The exhibits in the ostreicultural department by Mr. Fell Woods, the well-known director of the South of England Oyster Company (Hayling Island), and by the Whitstable Oyster Company, likewise deserve attention. In both, specimens of shells of one-year-old oysters are shown, the occupants of which are said to have produced "black spat" at that early age. Even if these observations are well authenticated, it is nevertheless recognised that such facts are very rare exceptions, and that generally at three years, and more profusely still at from four to six years, the maximum quantity of ripe spat is produced by the oysters, whose generative organs are most active at that age (cf. Hoek).

France has only a comparatively small exhibit; the implements used in oyster culture at Arcachon are there shown. The Netherlands are represented by a more complete collection, showing both dredging and collecting apparatus, so-called "hospitals," tiles, knives, &c. Models of several oyster parks, partly constructed in old fortifications, and consequently having a very "defensive" aspect, are, moreover, exhibited, as well as maps and charts showing the way in which the foreshores, &c., are leased by Government to individuals and companies interested in oyster culture. For further details concerning oyster culture in the Netherlands, we may refer the reader to the conference paper on this subject. On the whole oyster culture appears to be very successful in this country.

In the American department there is a large collection of the most various oyster-shells, as well as the model of a vessel occupied in dredging an oyster bed. "Culture" of oysters appears to be very little practised in that country up to the present day, the natural beds being as yet of a nearly inexhaustible richness, especially in the Southern States, where they are principally situated in the lagoons along the coast-line, and the oysters very often used as manure. Nor has the trade in these regions been developed to any extent. More northward Chesapeke Bay is the richest ground, and from thence oysters are transplanted along the coasts of the different Northern States, and at the same time brought into the market in enormous numbers. Together with the scientific investigations in the Netherlands, those in the United States, conducted by Brooks and Ryder, and those of Bouchon Beaudely in France, stand foremost as commendable efforts to bring pure science to bear upon fishery problems of great practical importance.

UNITED STATES COAST AND GEODETIC SURVEY[1]

THE author of this very important treatise states, in his preface, that he has attempted to give a sufficiently comprehensive account of the theory of projections to answer the requirements of the ordinary student of this subject. The literature of projections being extensive—the work of the most eminent mathematicians—the author has contented himself with making such extracts from the great mass of papers, memoirs, &c., which he deemed requisite for his purpose, giving, for further information, references to such original sources as are comparatively easy of access.

As the different conditions which projections for particular purposes have to satisfy are so wholly unlike, no general theory underlying the whole subject of projections can be given; it is therefore conveniently divided into several sections: and here the author mentions his obligations to M. Germain's most important "Traité des Projections" (Paris, 1865), which contains an account of almost every projection that has been invented. At the request of the Superintendent, Carlile P. Patterson, the treatise has been divided into two parts. The first part contains the mathematical theory of projections, while the second part contains merely such a sufficient account of the various projections as will enable the draughtsman to construct them.

The surface of the sphere being non-developable, the exact representation of even a portion of it upon a plane is impossible. Certain conditions can, however, be fulfilled which will render it sufficiently exact for any particular purpose. The areas may be proportionately preserved, in which case we have an equivalent projection; or the angles of small portions may be preserved, in which case we have an orthomorphic projection. The exigencies of any particular use for which a projection is designed give rise to a great number of other conditions corresponding to which projections have from time to time been invented: so that the history of projection has been peculiarly that of the solution of more or less independent problems: for a complete account of which the reader is referred to M. D'Avezac's "Coup d'Œil historique sur la Projection des Cartes de Géographie" (Paris, 1863).

[1] "United States Coast and Geodetic Survey" (Carlile P. Patterson, Superintendent). A Treatise on Projections. By Thomas Craig. (Washington: Government Printing Office, 1882.)

The author has treated his subject under the following heads:—

I. Orthomorphic Projection.
II. Equivalent Projection.
III. Zenithal Projection.
IV. Projection by Development.

The first part of the volume treats of the mathematical theory, and is subdivided into nine sections. The first section contains a brief introductory account of the principal properties of conic sections and perspective projection—the most natural and simple method of representation. Sections II. and III. treat of methods of orthomorphic projection. Section IV. treats of projections by development; Section V. gives an account of zenithal, and Section VI. of equivalent projections. Students of these sections are presumed to have a fair acquaintance with the methods of ordinary analytic geometry and the elements of the differential and integral calculus. The next three sections are extremely general, and will require rather more extensive mathematical knowledge. These sections were designed to connect the particular problem of the plane representation of a sphere with the much more comprehensive methods of representation of one surface upon another, and to induce in the student, having a real interest in the general theory, a desire to consult the original memoirs for fuller information.

The second part of the volume, which treats of the construction of projections, does not appear to require any detailed description; but as much of it is merely reprinted from the first part, the propriety of thus separating the "construction" from "theory" seems rather doubtful. The book ends with thirty-one tables, nearly all extracted from the original memoirs of the writers on different parts of the subject of projections. In some cases, however, improved tables by other authors are given. Where the ellipticity of the earth has been taken into account the tables are given unchanged, as the effect of small changes of ellipticity would be almost inappreciable; and, moreover, we have in p. xiii. of the introduction the important statement that "The United States Coast and Geodetic Survey will undoubtedly soon be able to produce a much better value of the ellipticity than has yet been given."

Such are the contents of this valuable book we have endeavoured to describe. It presents, however, some signs of hasty arrangement and want of strict attention to the correction of the press, which will doubtless be removed from the next edition. Indeed the copy under notice would scarcely seem intended for publication in its present form. For instance, "The accompanying plates . . ." mentioned in p. 230 are wanting; and we notice the following typographical errors, &c.:—

Preface, p. x. *Philosophical Magazine*, 1865, should be 1862.

Preface, p. x., and Introduction, p. xiv. There are obvious errors in the title of Gauss's Memoirs.

Introduction, p. xiv. *Phil. Trans.* vol. I. should be vol. L.

P. 80, line 12 from bottom, for pl*a*tting read pl*o*tting.

Pp. 80 and 210. The descriptions of Cassini's projection do not seem to be correct.

Pp. 81, 82, and 210. The woodcuts defective.

P. 83. Curious error in the numerator of the general expression for ρ.

Pp. 67 and 197. Woodcuts of Fig. 13 not good.

Pp. 71 and 201. Fig. 15, woodcuts require correction.

Pp. 76 and 206. Fig. 18, woodcuts not very good.

P. 149. In the denominator of the value of m the power 2 of $(1 \mp \epsilon \cos \omega)$ should be ϵ. In the first term of the denominator of the value of k, $\sin^2 \frac{\omega_1}{2}$ should be $\sin^2 \frac{\omega_2}{2}$, and in the second term ω_2 should be ω_1.

P. 150, line 2. For $1 \epsilon^2 \cos^2 \omega$ in the denominator of the last term of the value of $\frac{dm}{n}$, read $1 - \epsilon^2 \cos^2 \omega$.

P. 214. Fig. 44, the letter P out of place; compare with Germain's Fig. 98; in the letterpress "angle $APC = \omega$" should be $= \pi$.

Also the numbering of the sections seems to require some revision. Section VII. referred to in p. xiii. of the introduction, as containing Mr. Schott's account of the polyconic projection, is not of course the Section VII. of the text, and though Part II. is not divided into sections, yet in p. 230 "The Tables" appear under § xii.

PROMISE AND PERFORMANCE IN CHINESE SCIENCE

UNDER the title of "Science à la Chinoise," a writer in a recent number of the excellent *North China Herald* dwells on what may be called the disparity between the promise and the performance of Chinese science. The ancient classics contain beautiful maxims on the necessity for research into nature. The "Great Learning" tells us that knowledge is perfected by the investigation of nature; Confucius urged his pupils to study the "Book of Poetry," because, among other things, they could become acquainted with the names of plants and animals; Mencius tells us that the careful study of phenomena is the road to knowledge, and in illustration says: "Though heaven is high and the stars distant, yet, having investigated their phenomena, we can sit down and calculate their revolutions for a thousand years." It has long been a proverb among the learned that to be ignorant of a single thing is a disgrace to the true scholar, and to be ignorant of nature is as if nature did not exist. When the revered ancient sages of China, whose words are in the mouths of all, thus encourage scientific research, we should be led to anticipate great results from the patience, intelligence, and ingenuity of the Chinese. But, as in so many other respects in that anomalous country, we have excellent maxims and little more. There is, says this writer, neither research nor knowledge; science has no existence. There is indeed a considerable natural literature. From ancient times the Chinese have taken note of natural phenomena. Their record of solar eclipses is perhaps the most ancient and accurate in the world. They have more or less elaborate works on astronomy, mathematics, botany, zoology, mineralogy, physiology, and many other sciences. Yet there is scarcely any true science in them. Classification, even in regard to plants and animals, there is none. Mineralogy is mainly a description of curious stones. Nor is there any progress, for the more ancient works are generally the best, and as a consequence the Chinese to-day are as their fathers were thousands of years ago. The superstitions respecting natural phenomena, which are as living active truths to-day for all classes in China, remind us rather of man in his state of barbarism than of the ancient culture and civilisation of the Middle Kingdom. The sun and moon are to the Chinese as they were to primitive man, living things, gods to be worshipped. The stars in their courses powerfully influence, if they do not absolutely determine all human events. In them the wise may read as in a book the destiny of man and the fate of empires. Their combinations make lucky and unlucky days, and we shall do well to note carefully their signs and silent warnings. Comets are the precursors of famine, pestilence, and war—prognosticators of the wreck of empires and the fall of kings. Eclipses are the periodic efforts of the dragon fiend to destroy the lights of heaven, and every notice of an approaching eclipse sent by the Imperial astronomer to the provinces is accompanied by a Government order to employ the usual methods of gong-beating and so forth in order to rescue the threatened luminary. Again, thunder is the roar of the anger of heaven, and to be smitten by a thunderbolt is to be marked as a thing accursed. Wind is born in the heart of great mountains, whence it issues at the command of the wind-god. Most districts have their wind-mountains. That at Lung-Shan in the northern province of Chihli is the most remarkable. It has a cave at each of its four sides. The spring wind issues from the cave on the eastern side, the summer wind from the southern, and so for the others. Wind eddies or whirlwinds are raised by the hedgehog in his rapid passage from one place to another, the dust serving to screen him from the vulgar gaze. Rain is produced by the dragon god, who carries up vast quantities of water from the lakes and rivers in his capacious jaws, and pours it down in showers over the earth. Every mountain has its spirit or genius, every valley its nymph, every spring its naiad. Hence mountains and rivers, old trees and curious rocks, become objects of worship.

These and the like superstitions which enter every domain of nature are not confined to the poor and illiterate; they are shared by the rich and learned, nay, they are repeated and acknowledged by the Imperial Government itself in its decrees in the *Peking Gazette*. The highest scholar in the empire knows no more of nature than the humblest peasant. The years have come and gone, repeating the same old story, but there has been no ear to hear it, no mind to understand it. Nature has found no interpreter among the Chinese; during their long national life they have contributed nothing to science. How are we to account for this? In other fields of national effort, and especially as inventors, they must be allowed a high place. It cannot be indifference, for they have written largely on the beauties, marvels, and mysteries of nature, and many have shown keen interest in the discoveries of science. It may partly, perhaps, be due to the fact that the intellect of the nation is employed in the struggle for place and power along grooves in which science has no part. The writer we quote thinks it is mainly owing to the narrow and perverted system of education; and while the present system continues the study of science will be impossible to the youth of China. The cleverest young men find it as much as they can do to take their first degree at twenty. The higher degrees, which are also the avenues to office, can scarcely be won for years later, and thus they cannot afford a thought for anything beyond the common curriculum.

ON THE PROPERTIES OF WATER AND ICE[1]

DR. PETTERSON'S memoir is a most valuable contribution to our knowledge of the natural history of the waters of the globe. Every reader of Arctic voyages must be familiar with the variety of names attached to the different kinds of ice met with in these regions, such as "pack-ice," "bay-ice," "brash-ice," and the like. To one who has never seen them, the names convey very little information either of their appearance or of their mode of formation. Dr. Petterson's paper explains in a satisfactory and very remarkable manner the nature of the difference between the different kinds of ice.

In the first part of the work the subject is treated physically, and in the second chemically. In both parts there is much that is new and valuable.

In the Arctic Ocean, and especially in that part of it visited by the *Vega*, the saltness of the water varies much from place to place. The large rivers of Siberia constantly pour forth fresh water which lies on the surface of the ocean and spreads round the coast like a fringe. This layer often extends a considerable distance out to sea, where it gradually thins out. Nearer the shore it is thicker, but wherever the depth exceeds 20 or 30 metres the dense ocean water is found below and the two layers

[1] "On the Properties of Water and Ice." By Otto Petterson. Publication of the *Vega* Expedition. (Stockholm, 1883.)

persist without sensible mixture. As an example may be cited some observations made on board the *Willem Barents* in the Kara Sea on August 3, 1881:—

Depth, fathoms.	Temp. °C.	Density.
0	+8·2	1·006
1	+6·2	1·009
2	+1·7	1·020
3	−1·0	1·0236
5	−1·5	1·0247

Here, while we have what is practically fresh warm water at the surface, and to a depth of a fathom from it, at two fathoms we have cold Arctic Ocean water. Looking therefore to the great variety in the composition of the waters exposed to the winter cold and therefore likely to produce the ice met with in Arctic regions, Dr. Petterson has studied separately the change of heat and volume by the freezing of (1) pure water, (2) brackish water of little saltness, and (3) ocean water of ordinary saltness. With regard to the freezing of brackish or salt water no previous investigations of a quantitative character exist, and the author's results are all new. With regard to the freezing of pure water the most important investigations were those of Plücker and Geissler. While verifying their result as to the *average* coefficient of dilatation of ice, the author made the important discovery that the volume of ice *decreases* as the temperature rises, in the vicinity of the melting point. In extending his researches to brackish and salt waters he found this anomaly more and more accentuated the more salt was contained in the ice formed. Rightly seizing the importance of this very remarkable observation the author makes the behaviour of pure ice in the vicinity of its melting point one of the main objects of the investigation. The "dilatometer" used was a glass vessel of peculiar construction and of a capacity of 41 cubic centimetres. The water to be experimented on was frozen in it, so that it formed a cylinder of ice surrounded by mercury, which extended also into a capillary tube and indicated changes of volume. As the accuracy of the results depends, amongst other things, on the correctness of the determinations of the absolute dilatability of mercury; and as this is somewhat uncertain, and indeed variable, at low temperatures, the author adopted the device of Plücker and Geissler for producing a practically undilatable envelope for his experimental substance. The principle of it is very simple. The envelope is of glass with a coefficient of expansion 0·000028; that of mercury is 0·000181. If the volume of the glass envelope is to that of the mercury contained in it in the inverse proportion of their coefficients of expansion the residual volume will be constant even though the temperature vary. If the volume at 0° C. of the glass be 18·1 cc. and that of the mercury 2·8 cc the residual volume is $18·1 - 2·8 = 15·3$ cc. If the temperature is $t°$ the volume of the glass is $18·1 (1+0·000028t)$ and that of the mercury $2·8 (1+0·000181t)$, and the residual volume is $v = 18·1 - 2·8$ as before. The effect of variation in the coefficient of expansion of the mercury is thus reduced to a minimum.

When a cylinder of ice had been frozen in the instrument, it was immersed in a mercury bath, and subjected to variations of temperature, either with freezing mixtures, or, in winter, by exposure to the atmosphere.

These series of experiments were made with distilled water. The first series was made with water taken from the store jar in the laboratory. It gave a slight opalescence with nitrate of silver, and cannot therefore claim to have been pure. The ice formed by its congelation expanded with rise of temperature from −20° C. to −0°·3 C. Here it began to contract until it melted at 0° C. Two other series of experiments were made with water repeatedly distilled. The ice from it did not begin to contract till the temperature had risen to −0·03° C.

There can be no doubt, especially in view of later experiments with brackish waters, that the not chemically pure distilled water did contract at a measurable distance from its melting point. With regard to the other two samples, the temperature at which the ice began to expand with heat is so close to its actual melting point, that it is impossible to have implicit reliance in the result claimed. The author's own view will be best judged from the following paragraph (p. 282):—

"It is impossible to decide if absolutely pure water would be entirely free from this weakness or not, since we cannot assume that water which has boiled for a quarter of an hour or more in a glass vessel is absolutely free from minimal quantities of foreign substances as, for example, sodium salts, silica, &c. For my own part I am rather inclined to think that absolutely pure water, if it could be tested, would show an absolutely fixed melting point, but I think that this problem very much resembles another question still undecided, viz. is absolutely pure water a conducting or non-conducting substance for electricity?"

It would be well to repeat the experiment with pure freshly distilled water, freeing it from air by boiling *in vacuo*, which Dr. Petterson's apparatus would easily admit of. There would then be very much less risk of the glass being attacked.

Experiments made with sea-water ice proved that the property of contracting with heat, as the melting point is reached, becomes more and more marked the greater the quantity of salt in the ice. Three series of experiments were made. In the first, the ice when melted had a specific gravity of 1·0003, and contained 0·014 per cent. chlorine. It began to contract at −4° C. The second had a specific gravity of 1·00534, and contained 0·273 per cent. chlorine. It began to contract at −14° C. The third had a specific gravity of 1·0094, and contained 0·649 per cent. chlorine. It was contracting at the lowest observed temperature, −19° C.

In connection with these remarkable results it must be mentioned that at the same temperature, as, for instance, −15° C., the volume of the ice which on being melted furnishes 1 cc. water at 0° C. is less the greater the amount of salt contained in it. Sea water being an exceedingly complex body, it is to be hoped that Dr. Petterson will extend his research so as to examine in the same direction the ice formed by simple solutions of each of the more important ingredients of sea water. How different ice produced by the freezing of sea water must be from what we are accustomed to see on our lakes and ponds in winter, will be evident when we read (p. 286):—". . . The new ice which arises by sudden freezing of the calm surface of the Arctic sea is a *tough* substance, which can be wrinkled and folded by external pressure without breaking. Although it may be thick enough to bear the weight of a man, it is so plastic that a footstep makes a deep impression as in mouldable clay."

The physical part of the work closes with the investigation of the latent heat of fusion of fresh and salt ice. The result is that "the latent heat developed by the freezing of sea water is *extraordinarily inferior to that of pure water.*"

Hardly less interesting than his physical experiments, are the investigations into the chemical composition of sea water ice.

It has been very generally believed that sea-water ice owes its salinity to mechanically entangled brine, and that all that is really solid in it is pure ice. Scoresby, probably the most acute observer amongst Arctic voyagers, referring to this subject, says:—[1]

"Although I have never been able to obtain from the water of the ocean, by experiment, an ice either compact, transparent, or fresh, yet it is very probable that the retention of salt in ice may arise from sea water contained in its pores; and, in confirmation of this opinion, it may be stated that if the newest and most porous ice be removed

[1] "An Account of the Arctic Regions," Edinburgh, 1820, vol. i. p. 230.

into the air, allowed to drain for some time in a temperature of 32° or upwards, and then be washed in fresh water, it will be found to be nearly quite free from salt, and the water produced from it may be drunk."

During the Antarctic cruise of the *Challenger* the writer of this notice made some experiments to decide the question whether or not sea-water ice is a mixture of pure ice and sea water or brine. The *melting point* of salt-water ice of various sources was carefully observed, with the following results. Ice formed in a bucket of sea water over night melted at − 1·3° C. The bulk of ice formed was insignificant compared to the volume of water in which it was formed, so that this was a specimen of *bonâ fide* sea-water ice, without admixture of snow or spray. In the same way the melting point of pack-ice was determined. The freshly collected ice began to melt at − 1° C.; after twenty minutes the thermometer had risen to − 0·9°, and two hours and a half afterwards it stood at − 0·3°, having remained constant for about an hour at − 0·4°. Another portion of the ice rose more rapidly in temperature, and when three-fourths of the ice was melted, the thermometer stood at 0° C. In the case of the ice frozen in the bucket, the melting point remained constant for twenty minutes at − 1·3°, after which no observations were made, so that we do not know if this ice, formed under the most favourable circumstances, showed the same irregularities as the pack-ice, picked up out of the sea; but as the bulk of ice experimented on did not much exceed 10 cubic centimetres, the greater part of it must have melted in the twenty minutes. Indeed as the amount of ice formed in the bucket did not sensibly alter the composition of the water left liquid, there seems to be no reason why the ice should not be a homogeneous substance.

Adhering brine can have no influence on the melting point of ice, consequently, if sea-water ice consists of pure ice with entangled brine, it must melt at 0° C. If its melting point is different from 0° C. then the solid matter of the ice is not pure ice. We have seen that frozen sea water has a melting point of − 1°·3, which is fairly constant, and that pack-ice, which must necessarily be formed by the freezing of salt water, the congealing of spray, and the accumulation of snow, begins to melt about − 1°, the temperature gradually rising as the constituents of lower melting point are liquefied. It is thus readily apparent how it is that Scoresby found that such ice "allowed to drain for some time in a temperature of 32° or upwards," produced in the end potable water. The salt-water ice of low melting point effectually prevents the intermingled snow from melting, which finally remains practically intact, and of course can be drunk on being melted.

Dr. Petterson on purely chemical grounds comes to the same conclusion. He says (p. 303): "Those who support the common theory that sea ice is in itself wholly destitute of salt, and only mechanically incloses a certain quantity of unfrozen and concentrated sea water, must confess that we in this case ought to find by chemical analysis exactly the same proportion between Cl, MgO, CaO, SO_3, &c, in the ice and in the brine as in the sea water itself." That this is not the case is shown by a number of analyses of sea-water ices in which the proportion of Cl : SO_3 varied from 100 : 12·8 to 100 : 76·6, the average proportion in sea water being 100 : 11·88. The results of his investigations may be summarised as follows:—

Ocean water is divided by freezing into two saliniferous parts, one liquid and one solid, which are of different chemical compositions. Taking the relation Cl : SO_3 as standard of comparison, the most striking feature of the freezing process is that the ice is richer in sulphates, and the brine in chlorides. The extraordinary variation, both in saltness and in chemical composition of every individual specimen of sea ice and sea brine, shown by the tables, depends on a secondary process, by which the ice seems to give up its chlorides more and more, but to retain its sulphates. Hence the percentage of chlorine is no indication of the saltness of the ice, though it may to a certain extent be taken as an index of its age.

In connection with this part of the subject, the author cites Prof. Guthrie's work on Cryohydrates, and gives the following table:—

Cryohydrate of		Contains		Solidifies at
NaCl	...	76·39 per cent. water	...	− 22° C.
KCl	...	80·00 ,, ,,	...	− 11°·4 C.
$CaCl_2$	...	72·00 ,, ,,	...	− 37° C.
$MgSO_4$	...	78·14 ,, ,,	...	− 5°·0 C.
Na_2SO_4	...	95·45 ,, ,,	...	− 0°·7 C.

Supposing that these cryohydrates are formed in the freezing of sea water, it is easy to see how, as the temperature rises, the chlorides melt out first and leave the ice richer and richer in sulphates.

Before concluding this notice, attention must be called to a statement in a note at the foot of p. 318: "As a thermometer immersed in a mixture of snow and sea water, *which is constantly stirred*, indicates − 1°·8 C., we may regard," &c. This can be true only if the temperature of the atmosphere is − 1°·8 C.; if it is 0° C. or higher, the temperature of the sea water will assuredly rise to the melting temperature of snow, or 0° C.

Even though it should turn out that chemically pure ice does, as the author suspects, melt suddenly without previous contraction *as ice*, the discovery of the existence of a *minimum density point* of ice, not chemically pure, which includes all the ice on the globe, is one of the very highest importance.

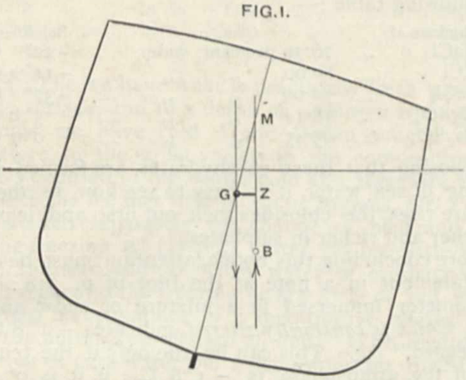
It is to be hoped that we shall soon have a further instalment of work on a subject so large and so important, and with which the author has shown himself so well qualified to deal. J. Y. BUCHANAN

THE STABILITY OF MERCHANT STEAMSHIPS

I PROPOSE to state, and in part to restate, the more important scientific considerations concerning the stability of merchant steamships which the investigation of the *Daphne* disaster has brought to light, following the main lines of the second part of my Report, which has been published *in extenso* in several newspapers. In this case, as in all cases touching the complicated question of ship stability, it is very necessary to be careful not to draw hasty inferences or any inferences at all which are not strictly deducible from the facts or principles established.

It is desirable to guard the reader in the first place against considering the cases of the ships *Daphne* and *Hammonia*—which I have had occasion to associate somewhat closely in my Report—as identical in more than a certain number of features, there being other features in respect of which there is little or no resemblance. I will presently point out both the resemblances and the differences, but first let me remind the reader unfamiliar with naval science what is meant by a curve of stability, quoting the Report as far as may be necessary for the purpose. Fig. 1 may be taken as the transverse section of a vessel inclined at an angle of 15 degrees to the upright. The total weight or gravity of the vessel will act downwards through the centre of gravity G, and the total buoyancy will act upwards through the centre of buoyancy B, as the arrows indicate. It will be obvious that the vessel cannot rest in the inclined position with these forces and no other operating upon her; she must revolve until gravity and buoyancy act in the same vertical line, but in opposite directions. The further she is inclined the more will the ship be immersed on one side and emersed on the other, and therefore the further out will the centre of buoyancy move. Now as neither the gravity nor the buoyancy need be altered in amount by mere inclination, and as they are equal and opposite in direction, it follows that, whatever the inclination, the force acting will always be the same, but the leverage, marked G Z, will vary as the centre of buoyancy moves. At 30 degrees inclination, for example, G Z is much greater than it is in Fig. 1 at 15 degrees. In Fig. 2 these lengths are set up as

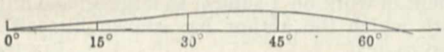
FIG. 1.



ordinates of a curve, and similar lengths for inclinations of 45 and of 60 degrees are similarly set up; the curve drawn through their upper extremities is this vessel's "curve of stability," observing that the base line is divided into equal lengths for equal angle intervals on any convenient scale.

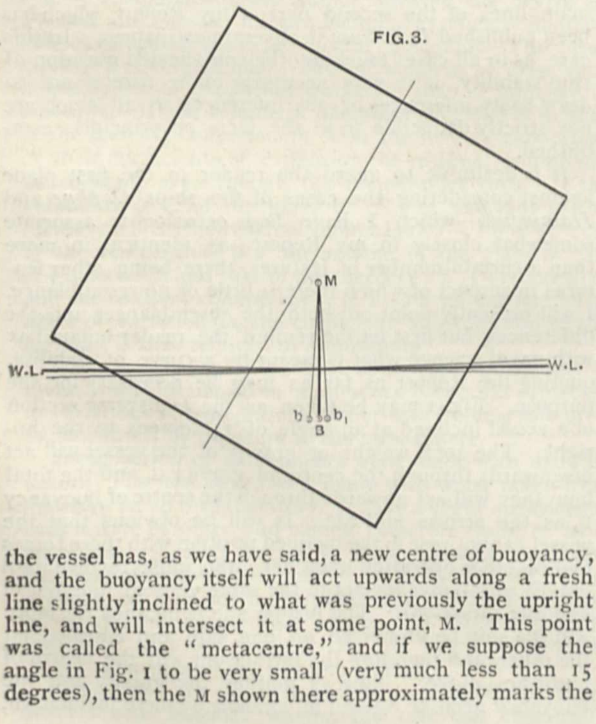
As regards the "metacentre," I must explain here, as

FIG. 2.



I did in my Report, that in former times, when "initial stability" alone was calculated, the word "metacentre" had a much more limited meaning than it possesses now. It formerly had relation to the upright position of the vessel, in which case the buoyancy acts upwards through the centre line of the ship's section—along G M, for example, in Fig. 1. After receiving a slight inclination,

FIG. 3.



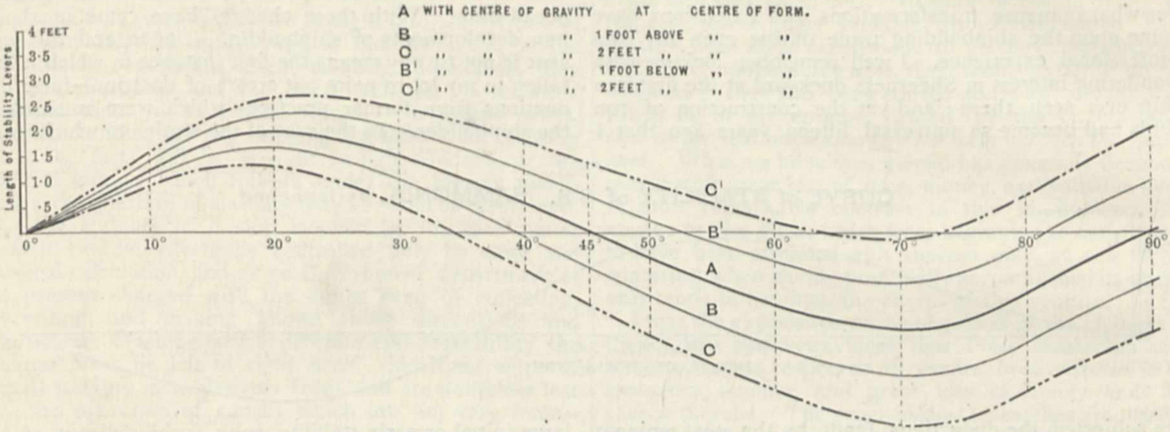
the vessel has, as we have said, a new centre of buoyancy, and the buoyancy itself will act upwards along a fresh line slightly inclined to what was previously the upright line, and will intersect it at some point, M. This point was called the "metacentre," and if we suppose the angle in Fig. 1 to be very small (very much less than 15 degrees), then the M shown there approximately marks the "metacentre." When a ship is much more inclined, the point at which two consecutive lines of the buoyancy's upward action will intersect may not be, and often will not be, in the middle line of the ship at all, but this point is nevertheless called the "metacentre," and the use of the word in this extended sense has recently become general. In Fig. 3 is shown a floating body of square section, inclined in the water at an angle of about 30 degrees. W L is the water line or line of flotation; B is its centre of buoyancy. By giving it a "slight" inclination from the position, it will of course have a new centre of buoyancy given to it. If we incline it one way *b* will show this, if we incline it the other way *b′* will show it, and for each of these positions there will be a new line of action or buoyancy. But these lines of action, together with that through B, will all meet or intersect in one point, and this point (M) will be the metacentre at 30 degrees of inclination. In Fig. 4 I have shown curves of stability for a prismatic body, with the centre of gravity in the centre of form, and also with that centre in some cases raised and in others placed below the centre of form. In this figure the draught of water is taken at 3/25ths of the total depth of the prism. In Fig. 5 I have given curves of stability for the prismatic body with the centre of gravity and the centre of form taken as coincident, but with different draughts of water. In Fig. 6 I have given the curve of stability of a similar prismatic body, immersed 2/5ths of its depth, and having its centre of gravity situated 6 inches below its metacentre. These figures serve to illustrate very clearly the error involved in the assumption that with stability at the upright position and stability at 90 degrees—or but little instability at the latter, which is what some authors have instructed the profession to be content with—there need be no apprehension of any deficiency of stability at intermediate angles of inclination. They show that with square sections and prismatic forms there may be various dispositions of centre of gravity and draughts of water, with which stability in the upright position and again at 90 degrees are not proofs of safety, but indications of the gravest danger.

With these figures before us, we now have both the *Hammonia* case and the *Daphne* case amply illustrated, and can carefully distinguish between the two. The *Hammonia* case—as put forward by Mr. Biles, who conducted her calculations—is that of a high-sided vessel with her stability reaching a maximum soon after she had inclined 30 degrees; and she therefore finds her analogy in one or other of the cases shown in Fig. 5. In the latter figure it will be seen that with the centre of gravity in the centre of form all positive stability vanishes at an inclination of 45 degrees in the two cases A and B; but the *growth and decline* of the stability are very different indeed at the different immersions. When the immersion is smallest the stability rises in a steep curve (A), attaining a comparatively large maximum something under 20 degrees, and then declines, more gradually than it rose, as the inclination goes on. By increasing the immersion from 3/25ths to 5/25ths the curve B is produced, and here we see a vast change of stability, the curve, which rises very slowly from the base line, never reaching one-fourth the maximum ordinate of curve A; only attaining its maximum beyond 30 degrees of inclination, and then declining less slowly than it rose, until it vanishes. Immerse the body to double the last immersion, and we find in curve C that now, instead of vanishing at 45 degrees, the stability only there begins, rising to a small maximum a little beyond 60 degrees and vanishing at 90 degrees. It is in curve B that we find a state of things very closely analogous to that disclosed by the *Hammonia* curve, which I now give in Fig. 7. In both cases the stability increases but slowly; in both it reaches early a maximum; and in both it disappears altogether before the vessel is more, or much more, than inclined through half a right angle. The case of the *Daphne* resembles this in the slowness with which the stability increases as the vessel is inclined, this slowness being due to the same causes in both cases doubtless; but an examination of the triple-branched curve of her stability given in Fig. 8 shows that the analogy between the two cases ends at quite a moderate angle of inclination, say 30 to 31 degrees. In this figure (8) the curve A

FIG. 4.

CURVES of STABILITY of PRISMATIC BODY of SQUARE SECTION

DRAUGHT of WATER $\frac{8}{25}$ ths of DEPTH.

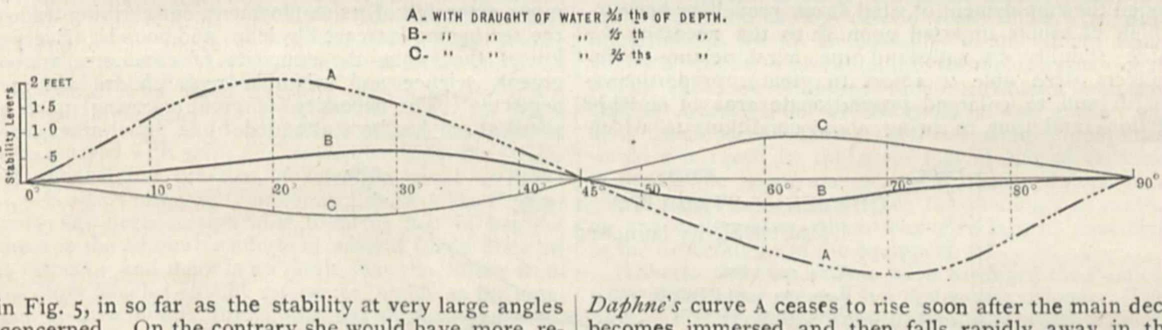


is constructed on the assumption that the ship was free to take water on board as the main deck became immersed; the branch B presumes the poop to have been watertight; and the branch C is calculated to show how the stability curve would have increased until the bulwarks came under water, provided these bulwarks had been watertight. It will at once be seen that the *Daphne* cannot be regarded as analogous to the *Hammonia* or to the curve

FIG. 5.

CURVES of STABILITY of PRISMATIC BODY of SQUARE SECTION

WITH CENTRE OF GRAVITY AT CENTRE OF FORM.



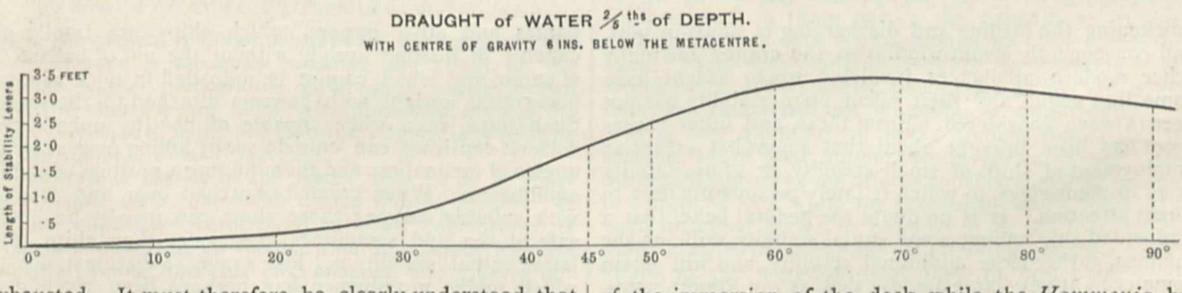
B in Fig. 5, in so far as the stability at very large angles is concerned. On the contrary she would have more resembled the case of Fig. 6, provided her sides had gone as high as her topsides and been there decked over. The *Daphne's* curve A ceases to rise soon after the main deck becomes immersed, and then falls rapidly away in the same manner and for the same reason as all ships lose stability when, or soon after, the freeboard has become

FIG. 6.

CURVE of STABILITY of PRISMATIC BODY of SQUARE SECTION

DRAUGHT of WATER $\frac{2}{5}$ ths of DEPTH.

WITH CENTRE OF GRAVITY 6 INS. BELOW THE METACENTRE.

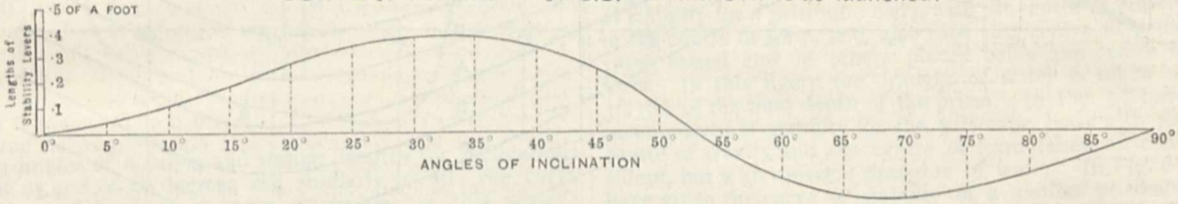


exhausted. It must therefore be clearly understood that it is in the early stages of the two curves that the cases which I have had to make public find their resemblance; at the later stages the *Daphne* illustrates the consequences of the immersion of the deck, while the *Hammonia*, by losing all stability before the deck became immersed, opened up a state of things which startled her builders, surprised the profession, and confounded the text-books, and must force extended calculations upon all those who hereafter undertake to launch ships upon the stability of which any doubt can by possibility exist.

It is pretty widely regarded as a remarkable fact that there should have been any deficiency in the knowledge of shipbuilders concerning the conditions or possible conditions of the stability of ships at their launching draughts. But to me this deficiency seems the most natural thing possible. It needs no explanation to those who remember what immense transformations and extensions have come upon the shipbuilding trade during even my own professional experience. I well remember looking with wondering interest in Sheerness dockyard at the first iron ship ever seen there; and yet the construction of iron ships had become so universal fifteen years ago that I wrote my work on "Shipbuilding in Iron and Steel" to meet a widespread necessity, the idea of writing descriptions of wood ships having already passed away. I equally well remember the building at Sheerness of the first screw steamship ever constructed there; but where now are any but screw steamships built for ordinary ocean work? Some sailing ships and some paddle steamers doubtless are built even now; but the screw steamer has almost undisputed possession of the world's ocean trade. With these changes have come in wholly new developments of shipbuilding science, and the present is not by any means the first instance in which it has fallen to my lot to point out errors of doctrine—false deductions from former practice—which were misleading the shipbuilder. In the case of the strains to which ships

FIG. 7.

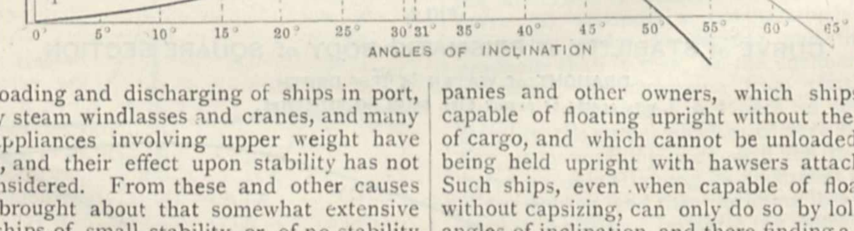
CURVE of STABILITY of S.S. "HAMMONIA" as launched.



are subjected, the deductions made by the most eminent men who discussed the subject scientifically at the end of the last and the beginning of the present century seemed to me to be irreconcilable with the conditions of modern ships, and after lengthened investigations I found that they were not only wrong, but in some cases the reverse of the truth, and I contributed to the Royal Society a paper on the subject which has brought modern theory and modern practice into better relationship. In the matter of stability it was most natural that as we abandoned the employment of wind as our propelling power—which of course imposed upon ships the necessity for large stability to withstand the wind-pressure—shipbuilders were able to resort to greater proportionate length and to enlarged proportionate area of midship section; and thus to bring about conditions in which large initial or early stability, so to speak, fell out of demand. Nor is it easy to say when deficient stability would have come under close investigation, had it not been for the accident of certain ships of very *low freeboard* coming under consideration at the Admiralty, as explained in my Report. These led to the calculation of stability at successive angles of inclination, and to the method of recording the results in the form of the "curve of stability" previously described. But besides the *change* of the seagoing ship, there has been the enormous extension of its employment, our carrying trade on the sea having increased by leaps and bounds. Every one knows that when the demands of commerce are very urgent, science and scientific research are apt to be neglected. The necessity for great carrying power and speed at sea has been attended by an equal necessity for

FIG. 8.

CURVES of STABILITY of S.S. "DAPHNE" as launched.



quickening the loading and discharging of ships in port, and consequently steam windlasses and cranes, and many other modern appliances involving upper weight have come into vogue, and their effect upon stability has not been always considered. From these and other causes there has been brought about that somewhat extensive employment of ships of small stability, or of no stability at all in themselves, to which it lately became my duty to direct attention. It is no doubt the general belief that a high-sided ship having some initial stability, will, as she inclines, gather large additional stability, and will retain some even at very large angles; that, as my Report states, has greatly encouraged people to be satisfied with very small initial stability, in some cases with none at all, and even less than none. Many steamships of large tonnage have been built of late years for influential steam companies and other owners, which ships are totally incapable of floating upright without the aid of ballast or of cargo, and which cannot be unloaded in dock without being held upright with hawsers attached to the shore. Such ships, even when capable of floating unballasted without capsizing, can only do so by lolling over at large angles of inclination, and there finding a position of stable equilibrium. When carefully watched over and stowed with suitable cargoes, these ships can usually be made safe at sea, and sometimes even safer than ships with larger initial stability but less range—a circumstance to which undue prominence has perhaps been given, and which has diverted many from the grave elements of danger which more often are associated with small initial stability. "There is not the least doubt, however, that a very small initial stability given to many modern mercantile steamships—given in the belief that much more is sure to be gained as the ship inclines (within large limits)—has resulted in the capsizing of many ships at sea, and in grave danger to many that are still afloat, not in the same manner, because not in the same condition as to lightness as the *Hammonia* and *Daphne*, but from other not less real deficiencies." Sad and serious as this statement is, I repeat it here with perfect confidence in its accuracy.

Sometimes such vessels are brought into a condition of apparent safety by the stowage of their own coal, but as the coal is consumed their stability diminishes, they capsize, disappear, and the word "missing" is recorded against them in an official return. No means exists, notwithstanding all our shipping legislation, for insuring that the facts will be brought to light—indeed, at the official inquiry which follows under the present conditions, the question of stability may not even be mentioned. As the stability of a ship is often an intricate matter which can be effectually controlled only by close and careful calculation, and as no Government department is at present charged with the duties even of collecting, recording, and making known those dimensions and particulars of ships which determine their stability, the matter must be left to right itself. Maritime ships of small stability incur dangers from, and are doubtless lost by, the operation of causes which are but very imperfectly appreciated.

It is under the urgent pressure of a very rapidly growing mercantile steam marine that the shipbuilding trade has somewhat, I fear much, outrun the companionship and regulation of science. It is only quite recently that the necessity for developing their scientific staff and appliances has been borne in upon the minds of shipbuilders. There never, even yet, has been so much as a training school or college established by them for the education of young naval architects and draughtsmen throughout the country. But the Admiralty have had their dockyard schools at work for nearly forty years; school after school of Government naval architecture has been established; the Institution of Naval Architects has been formed, and done invaluable work, for more than twenty years; and some private shipbuilders have at length entered with spirit and enterprise upon the labour of developing the practice of scientific naval architecture. No part of my duty in connection with the *Daphne* inquiry has been so agreeable to me as that of bearing witness to the admirable efforts of several Clyde firms in this respect; and there is no result that can follow from the inquiry which I should esteem so highly as the emulation of their efforts throughout our shipbuilding establishments generally—unless, indeed, it were that of a general awakening of *shipowners* to their great and enduring responsibilities in this matter.

EDWARD J. REED

INTERNATIONAL POLAR RESEARCHES

AT the present moment, when every student of modern science is anxiously awaiting the result of the labours of the international observation parties which have for nearly a year been self-imprisoned around the Pole, I venture to make the following suggestions relating to international Polar researches.

The state of the ice in the Arctic seas is, as is generally known, very changeable during various seasons. It is thus impossible beforehand to draw conclusions as to the probable state of the ice one summer by its state the year before, and this circumstance has greatly impeded active researches in the Arctic regions. From time to time valuable and expensive expeditions have been despatched, but these have in most instances been unfortunate enough to encounter the adverse seasons, and the purely geographical gain has in consequence not been in proportion to the cost. At other seasons, on the other hand, when the ice seems to have promised a far advance northwards there has not been any expedition ready to take advantage of the circumstance. Had there at certain times and seasons been expeditions prepared to use the opportunities which have presented themselves, and in the right locality, I have not the least doubt that a very far advance into unknown Polar regions might have been made at a very small cost. In spite of the, in many respects, exceedingly valuable discoveries which have resulted from these expeditions to geology, meteorology, and other modern sciences, they seem certainly on the whole as if they had been started under an unlucky star, which is, in my opinion, caused by the circumstance *that the period and season selected have not been the proper ones*. What we have thus gained has generally been obtained with great loss of time, money, and valuable lives. A most remarkable contrast to this is, however, the voyage of the *Vega*, which from beginning to end seemed to have been attended with success only, as the forced wintering, when having practically accomplished its object, only tends to heighten the charm of this venture.

From the experience we have gained of the changes in the ice, it is however evident that Polar researches have hitherto, in one respect at all events, been effected in an erroneous manner, and great loss of money and life caused thereby. The *geographical* researches around the Pole should in my opinion be conducted in a different manner. Instead of, as has hitherto been the case, that finely equipped expeditions are despatched at random and at unconsidered periods, an arrangement should be made between the various European nations to equip a certain number of expeditions, which should be despatched *every* summer to the *same* locality *during a period of ten to eleven years*. During a period of this length it is probable that the conditions of the ice, which we may assume undergo periodical changes, have run their cycle, and during certain years of such a period opportunities would undoubtedly occur which would enable a very far penetration into the Polar basin.

The expenses attending such expeditions would, if skilfully arranged, not exceed those of one of the costly ones which have hitherto been despatched, while they would not result in the great loss of life which seems to attend the larger one or two years expeditions under which ambition naturally leads the members to venture on any undertaking which may give returns equivalent to the expectations of the equippers.

Hitherto the Dutch alone have arranged their expeditions to the Polar regions in a systematic manner. They have, as is generally known, for some years regularly despatched an expedition every summer to the regions around Spitzbergen and Novaya Zemlya; but that they have not, geographically, obtained any great results may be ascribed to the circumstance that they have employed sailing vessels instead of steamers. Neither have they in all probability laid special stress on geographical achievements in these parts; the expeditions hitherto despatched may thus be considered as mere pioneering ones. From next year it is, however, the intention of the Dutch to employ a steamer instead of a sailing vessel, and then their researches will, no doubt, be more fruitful.

It is now admitted by every student that Polar researches are of great importance in several respects, and the establishment of the international circumpolar stations is a proof of this, while the manner in which these have been arranged seems to promise to be the first step towards a series of researches in the Arctic regions, which would, as the meteorological ones, be best carried out through an international cooperation. In order to advance in the unknown Polar basin, it appears to me to be essential to abandon the random expeditionary attempts hitherto persevered with, and organise instead systematic researches. And if these are carried out by international cooperation, the levy on the individual participators would be very small indeed.

There are in my opinion three points in the Arctic seas which offer, I believe, special advantages as bases for penetrating towards the Pole, and on which particular attention should be concentrated, viz. the north of Spitzbergen, the north-east of Novaya Zemlya, and the Behring Straits.

To the north of Spitzbergen, *i.e.* to the north of the Seven Islands, Norwegian hunters have, in the autumn of certain years, found the sea to the north and north-east so free from ice that they have deemed it a very easy matter to have penetrated with a steamer considerably northwards. Such was, for instance, the state of the ice in the autumn of 1881. And similarly the sea to the north-east of Novaya Zemlya has in certain years been easy of navigation, and finally, judging by researches, it may be assumed that the same is the case with the sea north of the Behring Straits.

Now, in order to carry out the programme which I have here suggested for a more systematic research of the Polar regions, I advocate that four small but excellent steamers should be provided, of which one should every year be despatched to a station on the north coast of Spitzbergen, another to one at the northern point of Novaya Zemlya, and the remaining two to respective stations north of the Behring Straits. This should be carried out during eleven consecutive years. Then when the state of the ice in certain seasons was very favourable, the vessels should take advantage of the opportunity and proceed northwards.

The advantage of this plan is that it would be attended with very little risk, while the object should be not to attempt to force an advance, but rather to wait patiently until the favourable opportunity presents itself, and then to act with boldness and decision. There is on the other hand every reason to assume that the time of the members of these expeditions would be employed throughout in a way beneficial to science. As a matter of safety it would also be advisable to establish fixed stations or depots in suitable places, to which the expeditions could resort in case of need.

From the experience we have gained of late it may be safely assumed that the Polar basin is not during any whole summer or autumn covered with continuous ice; it is in fact evident that the sea shows large tracts of open water during these seasons. The ocean ice north of Spitzbergen is thus always in a constant—at times even exceedingly violent—state of drifting in the most varied directions, according to the currents and winds prevailing. At times, too, the ice has been found to drift in a direction contrary to those of currents and winds. North of Spitzbergen there must, therefore, during certain periods of the season be large tracts of open water which are capable of receiving the enormous ice masses in drift.

As is generally known, Petermann advanced the hypothesis that Greenland extended in a more or less broad belt of land towards the Pole, from whence it diverged downwards to Behring Straits. If this is so, the great Polar basin should be divided into two parts with a common outlet into Behring Straits, although distinctly separated from each other by the land belt in question. They would at the other end discharge themselves into two different channels, viz. one in Baffin's Bay and the other in the Greenland and East-Spitzbergen ocean. This hypothesis has been supported by many eminent *savants*, as for instance Parpart, Jäger, and Chavanne.

Without, however, disputing the correctness of the reasons for this assumption, it would not be difficult to point out circumstances which would refute the hypothesis. And although several things seem to corroborate the assumption that the real Polar basin contains a belt of smaller and larger islands, it is perfectly obvious that the climatological and consequently the glacial conditions of these regions would have been quite different from those now prevailing had a large continent of the kind described by Petermann occupied the greater portion of the central Polar basin. I myself believe, judging by the strong motions of the ice north of Spitzbergen and Novaya Zemlya, and certain circumstances attending the same, that the climate of the Polar regions is a sea or insular climate rather than a continental one. In making this assertion, however, I do not say that a continent such as that referred to has not existed there in the Tertiary or early part of the Quaternary period.

However this may be, the question to be solved is one of preeminent importance to men of science, and I feel certain that a mode of research effected in the manner I have here advocated would certainly result in its solution. KARL PETTERSEN

Tromsö Museum, July

NOTES

A MEETING of the General Committee of the International Fisheries Exhibition was held at South Kensington on Tuesday. Mr. Birkbeck presided, and read the Report of the Executive Committee, which stated that the number of visitors to the Exhibition has, up to the present, been very large. The numbers up to Saturday, the 25th inst., were 1,444,515, showing a daily average of 16,050. The juries have, with few exceptions, now completed their labours, and their reports will be laid before the Special Commissioners, appointed by Her Majesty's Government, for consideration and approval. The Report closes as follows:—"With regard to the future, it is indispensable that the Executive Committee should obtain the necessary powers from the General Committee to announce the closing of the Exhibition on some day to be fixed hereafter, and that they should further be invested with authority to carry out any negotiations and make any agreements they may deem necessary for the subsequent utilisation of the buildings, which have been erected at so great a cost, in order that a fair proportion of the money that has been expended upon them may be recovered. In furtherance of the latter object, the Executive Committee have much pleasure in stating that they have received from Her Majesty's Commissioners of 1851 an intimation that, provided the grounds are used solely for the purposes of holding exhibitions, they would be willing to extend the existing agreement (which expires on December 31 next) for a further period of three years. The Executive Committee have every reason to believe that, with the approval of the Prince of Wales, exhibitions of great importance will be held in each of these years. Under these arrangements the authorities, which His Royal Highness may be pleased to constitute for carrying out each of these exhibitions, will become tenants of the Fisheries Exhibition, and would accordingly pay a proportion of the original cost as rent for the use of the buildings. The Chairman said it was a matter of congratulation that the numbers admitted had proved to exceed the most sanguine expectations of the general public, and the Committee had every reason to believe that for the future, especially during the month of September, large numbers of visitors would attend. The most important portion of the Report referred to the future use of the buildings. Next year it was proposed to hold a great international exhibition of horticulture, floriculture, and forestry, and they had every reason to believe it would be successful. There had been some question of the conferences being continued later on. The discussion on the paper by the Duke of Edinburgh was adjourned *sine die*, and probably, if His Royal Highness was in London at the end of September or the beginning of October, he might be disposed to attend. There was also another promise given that there should be a fishermen's congress, which it was proposed should be held at the end of September. The only other matter was with reference to the juries. The reports had nearly all come in, and they had only now to wait for the meeting of the Government and Special Commissioners to confirm the various awards.

ON the occasion of the unveiling of the statue of Daguerre at Cormeilles on Sunday, it was stated that the family is not extinct, The present representative being M. Behon-Daguerre, a contributor to French scientific journals. It was on August 19, 1839, that the Daguerreotype was publicly exhibited by Arago at a sitting of the Academy of Sciences. This communication was made in accordance with the provisions of a law granting to Daguerre and Niepce a joint annuity of 400*l*. for the purchase of their invention on behalf of the French nation. Of the members of the Academy sitting on August 19, 1839, only two are now alive—M. Dumas, the Perpetual Secretary, and M. Chevreul, who was then in the chair. It was M. Chevreul who congratulated M. Daguerre in the name of the Academy of Sciences.

AN excellent paper taken from an address delivered to secondary school teachers in Switzerland has been circulated by the U.S. Education Bureau to answer the question, How to teach natural science. It urges that knowing facts is not the object of such education; in that case a supply of works of reference would be a royal road. "One gets on faster with a child by carrying it, but it is for the child's interest to teach it to run and swim by itself." A teacher, therefore (who must be laboriously grounded himself), must patiently bring *all* his scholars, not the most promising only, to discover and observe facts for themselves—teach them to *see*. Cram is most dangerous in scientific teaching, because most easy to both of them. Books, therefore, should be little used, and nothing about an object should be taught without such object before them. After *seeing*, the next lesson is *describing*, with the help of drawing if possible, both leading to accuracy in the use of language. Plants first, which are plentiful for experiments, then animals of different classes; later on minerals should be chosen, mechanical effects on these latter first, later on chemical. The district museum of natural history and such classes would mutually assist each other greatly; in fact neither, to be successful, would long go on without the other. And, indeed, the lecturer wisely cautioned his hearers that making collections must not become a rage with the pupils.

M. PASTEUR has addressed a telegram to M. Dumas, Perpetual Secretary of the Academy of Sciences, to inform him that he has received telegraphic news from the French Mission which has gone to Egypt to study the cholera. M. Pasteur says that it contains very curious observations of a highly novel character.

THE Royal Commissioners on Technical Instruction are now engaged in preparing their Report, which promises to be a work of considerable magnitude. The completion of it will probably occupy more time than was originally contemplated.

PROF. W. M. HICKS, M.A., has been appointed Principal of Firth College, Sheffield, in the room of Prof. Jones, the newly-appointed Principal of the South Wales College. Mr. Hicks is a Fellow of St. John's College, Cambridge, and was seventh Wrangler in 1873. He worked in the Cavendish Library under the late Prof. Maxwell.

IN addition to the observations carried on around the Pole the physical institution at Upsala has also carried out others in that place during the winter, which were brought to a close on August 15 last.

WE have received from the President of the University of Tokio the Calendar of the Departments of Law, Science, and Literature for the session 1881–82. Like the Report of the Japanese Department of Education, this volume comes somewhat late. As is the case with all the Japanese educational establishments, we notice here the rapid reduction in the number of foreign teachers, and the increase in the number of qualified natives who take their places. Thus in the department of science we find thirty-six instructors of various grades, of whom only seven are foreigners, and there have recently been still further reductions. Many of the native professors appear to have excellent academical degrees from European and American universities, and one is a Cambridge Wrangler. Among the changes in the curriculum during the session we observe that the permission to students to choose between the study of French and German is taken away, and the latter language made compulsory. "This change has been made in order to enable students to pursue their studies or professions in future to the best advantage, since it is believed that Germany is the country where the sciences here pursued have reached the highest comparative development." Several graduates were despatched during the year to Europe to continue the study of zoology, mechanical engineering, medicine, and political science. The total number of students was 170, 91 of whom had entered for the scientific course; while the total number of graduates was 133.

THE new biological laboratory of the Johns Hopkins University, which will be opened next September, has, *Science* states, been especially constructed with reference to providing opportunity for advanced work in experimental physiology. It contains two large rooms for general advanced work in animal physiology, in addition to others specially designed for work with the spectroscope, with the myograph, for electro-physiological researches, and for physiological chemistry. It also contains a special room constructed for advanced histological work, and well supplied with apparatus and reagents, a room for micro-photography, and rooms for advanced work in animal morphology.

A TELEGRAM from Batavia, dated August 27, states that terrific detonations from the volcanic island of Krakatoa were heard on the previous night, and were audible as far as Soerakarta, showers of ashes falling as far as Cheribon. The flashes from the volcano were plainly visible from Batavia. Serang is now in total darkness. Stones have fallen at that place. Batavia was also nearly in darkness. All the gaslights were extinguished during the night. It was impossible to communicate with Anjer, and it is feared that some calamity has happened there. Several bridges between Anjer and Serang have been destroyed, and a village near the former place has been washed away, the rivers having overflowed through the rush of the sea inland. This rush is spoken of in the telegrams as a "tidal wave," but it is evidently more of the nature of an earthquake wave, a phenomenon so well known on the west coast of South America. Java is the centre of one of the most active volcanic regions on the globe; it has about sixteen active volcanoes, and many more which are mostly quiescent, not extinct.

A TERRIBLE tornado broke over the south-eastern part of Minnesota on August 22. At Rochester forty persons are reported to have been killed and fifty injured. A third of Rochester is stated to be wrecked, and it is feared that the whole country around that town is in ruins. The number of killed is estimated at some hundreds. A passenger train on the Rochester and Northern Railway was blown off the line, and it is reported that twenty-five passengers were killed and thirty-five injured. The storm also visited Utica, St. Charles, and neighbouring counties.

ON August 5 at about 9 p.m. a very fine meteor was observed from several places around Lake Vettern, in Sweden. It passed across the sky from west to east, and possessed a magnificent lustrous head and tail somewhat resembling a large rocket. Its speed was as slow as that of the latter, its passage occupying exactly two minutes, while it left a shining track for several seconds in the sky. On August 12 at about 9 p.m. a meteor was seen at Sarpsborg, in Norway. It represented a fireball with a long shining tail, passing in a straight line across the sky in an easterly direction. It was in view for about one minute.

A SHOCK of earthquake of a rather severe nature, but of short duration, was felt at Agram at 3.40 p.m. on the 28th inst. It was accompanied by subterranean rumblings.

M. JACQUELAIN has endeavoured to prepare a pure carbon for electric purposes that should be as hard and as conductive as gas carbon. He first takes gas carbon, which he submits to four processes: (1) treatment with dry chlorine at a red heat for thirty hours; (2) treatment with hot alkali for about three hours; (3) immersion in hydrofluoric acid (1 to 2 of water) at a temperature of 15° to 25°; (4) carbonised by heating strongly in the vapour of a high-boiling hydrocarbon, for commercial purposes gas tar will do well. All these operations may be performed after the carbon has been cut into sticks. By these processes the impurities have been reduced to a minimum and a good, pure carbon obtained.

THE director of the Jardin d'Acclimatation of Paris has just received an entire tribe of Kalmucks from the desert lands in the neighbourhood of the Caspian Sea. It consists of 9 men, 8 women, 4 girls and children, 18 camels, 15 mares and young horses, 10 Kirghiz sheep, with tents, instruments, arms, &c. They will probably visit London after having made in Paris a stay proportionate to their success.

ON Sunday week an extraordinary ascent was made at Nogent-sur-Marne. The aëronaut ascended at 4.30 p.m., and landed near St. Cloud on the following day at 7 a.m. He remained 14½ hours in the air, and travelled no more than 30 kilometres.

M. FRIEDEL has found that at certain temperatures blende, chloride of sodium, and boracite exhibit pyroelectric phenomena. Boracite he found to be so most markedly at the point when it lost its cubical form whilst cooling after being heated to 265°.

MESSRS. LONGMANS AND CO. have issued the eleventh edition of Prof. Atkinson's translation of Ganot's "Elementary Treatise on Physics." About thirty-two pages have been added to the new edition, while the chapter on the steam-engine has been entirely recast.

MR. FISHER UNWIN has added to his useful series of Half-Holiday Handbooks a Guide to Wimbledon, Putney, and Barnes. The same publisher also sends us a little Handbook to the Fernery and Aquarium.

M. DE FONVIELLE asks us to say that by mistake he stated in his note on the Montgolfier statue that it was cast in bronze; it is in plaster, and the cast is being executed.

THE additions to the Zoological Society's Gardens during the past week include a Maholi Galago (*Galago maholi*), purchased; a Vervet Monkey (*Cercopithecus lalandii*), presented by Mr. J. H. Sheppard; two Golden Eagles (*Aquila chrysaëtos*) from Scotland, presented by Mr. A. H. Browne; two Short-toed Eagles (*Circaëtus gallicus*), purchased; a Yellow-headed Conure (*Conurus jendaya*), presented by Her Grace the Duchess of Wellington; a Slender-billed Cockatoo (*Licmetis tenuirostris*), presented by Mr. R. Keele; a Land Rail (*Crex pratensis*), presented by Mr. M. Bryant; a Partridge Bronze-winged Pigeon (*Geophaps scripta*), and a Modest Grass Finch (*Amadina modesta*), presented by Mrs. J. Abrahams; a Martinique Waterhen (*Porphyrio martinicus*), a Mississippi Alligator (*Alligator mississippiensis*), presented by Mr. Cuthbert Johnson; six Chameleons (*Chamæleon vulgaris*), purchased; a Hog-nosed Snake (*Heterodon platyrhinos*), presented by Mr. F. J. Thompson.

OUR ASTRONOMICAL COLUMN

THE DIVISION OF BIELA'S COMET.—Those who have made themselves acquainted with Hubbard's masterly researches on the motion of Biela's comet will be aware that he arrived at the conclusion that the disruption of the comet, by whatever cause effected, took place in heliocentric longitude 318°·6, and latitude + 12°·0, distance 4·36, which position he states the comet occupied in November, 1844. In fact, if we adopt Hubbard's final elements for perihelion passage in February, 1846, we find for 1844, November 16·0 G.M.T., longitude 318° 36′, latitude + 12° 2′, radius-vector 4·3665, and the true anomaly 209° 57′. At the time when Hubbard's investigation was made, no one of the known minor planets attained this distance from the sun. We are now acquainted with several which recede further, towards aphelion passage, and an encounter between the comet and a small planet might explain the phenomenon which occasioned so much astonishment in 1845-46. The orbits of some 230 of these bodies have been calculated, but on submitting them to examination with a view to discover whether any one of the planets could pass through the point indicated by Hubbard as that of the separation of Biela's comet, we arrive at a negative result. *Andromache* recedes to a distance of 4·723 from the sun, *Ismene* to 4·590, and *Hilda* to 4·632, but at such distances all three are much nearer to the plane of the ecliptic than Hubbard's position. We may therefore say that if the Biela catastrophe was occasioned by collision with a small planet, it was not one of the large number already calculated.

VARIABLE STARS.—Mr. Knott has succeeded this year in following the variable S Virginis almost if not quite to a minimum, but unfortunately the long twilight, moonlight, and hazy and cloudy skies in July preventing him from fixing the exact date. On April 4 the star was 9·7m., and ruddy; April 25, 10·15; May 4, gauged 11·5; May 31, 12·1; June 25 and 28, 12·2 and 12·3; June 30, 12·7; and on July 4, by a doubtful observation, 12·75. The observations made by Mr. Hind, soon after the discovery of the star's variability in 1852, compared with those of Prof. Schönfeld to 1875, give the following elements;—

			Days.
Minimum	... ...	1875, April	27·4 + 373·77 E.
Maximum	... ...	1866, June	7·15 ,,

This formula assigns July 4, 1883, for minimum, a date closely borne out by Mr. Knott's observations, and for next maximum, 1883, October 30, not observable.

The star varies from about 5·7m. to 12·7. It is XIII. 420 of Weisse's Bessel, and its position for 1884·0 is in R.A. 13h. 26m. 56·9s., N.P.D. 96° 35′ 46″.

Mr. Knott has also found a maximum of R Scorpii on 1883, July 9, magnitude 10·1. S Scorpii had already passed maximum when the observations commenced in the middle of May.

THE GREAT COMET OF 1882.—It may be hoped that one or more of the larger instruments in our observatories will be employed in a further attempt to fix positions of this remarkable body during the absence of moonlight in September. Positions were given in NATURE, vol. xxviii. p. 334, and will also be found in the *Astronomische Nachrichten*.

Now that the period of revolution resulting from the most reliable calculations approximates to eight centuries, it would be interesting to bring together in their original form the numerous descriptions of the great comet of 1106, the substance of which is given by Pingré, more especially the references to the direction of the tail (between the east and north) in the latter part of the comet's appearance. Like the comet of 1882 it was seen close to the sun: one historian says it was so observed from the third to the ninth hour of the day on February 4.

GEOGRAPHICAL NOTES

WITH reference to the Austrian Meteorological Expedition which on Tuesday last arrived in Vienna from Jan Mayen, we are now able to give the following particulars of the wintering at the island. Leaving Iceland on August 1 the *Pola* sighted the southern point of Jan Mayen on the 3rd, but a thick fog prevented landing until the following day. Lieut. von Wolgemuth, with some officers, at once came on board, and great were the rejoicings on both sides at the meeting. The chief of the expedition states that at the end of August, 1882, the northern storms began with a heavy fall of snow. September was, however, fine and warm, but with October the storms from the north again came back with cold weather, accompanied by magnificent auroræ of yellow, blue, and sometimes even red colour. The aurora borealis was always seen, and in constant motion, at times covering the whole firmament. On November 12 the Polar night commenced, but the darkness was not appalling, as the ever-recurring auroræ lit up the night. Terrible snowstorms often compelled the members to keep indoors, and not until December came the ice began to form along the coast, but it was often after broken up under terrific storms. During these the spray from the surf on the coast was often thrown several hundred feet inland and covered every object with salt crystals, so that fresh water had to be fetched long distances. In January the greatest cold occurred, $-35°$ C., but even during that month southerly winds often brought the glass up to $+20°$ C. On January 30 the Polar night came to an end. March was on an average the coldest month, and during the same the station was for a short time snowed up. During April and May fresh weather reigned. Early in June a whaler passed the island, but did not observe the station, and by the end of the month no ice was found on the island. Throughout the winter but little stove firing was necessary, and both houses and the provisions fully answered their purpose. During an exploration of the island a grave was discovered which is believed to be that of one of the shipwrecked Dutch sailors who wintered here in 1633, and died through scurvy. The scientific observations of the expedition are, the members state, very valuable, and have been carried out in accordance with the international programme. There was no case of scurvy among the members or the crew, against which every precaution had been taken by the munificent patron of the expedition, Count Wilczek.

In September it will be exactly twelve months since the *Dijmphna* and the *Varna* were last seen in the Kara Sea, since when no news whatever as to the fate of the two vessels has been obtained. It was hoped that the *Willem Barents*, which has been cruising in the Kara Sea during the summer, would have brought some tidings of the missing vessels, but this expectation has failed, as recently stated in NATURE, the Dutch exploring vessel neither finding any trace of the same, nor learning anything from the Samoyedes on the coast of Siberia. If the rumour, which was current early in the year, that the Samoyedes had seen the wreck of a large vessel on the *east* coast of Waigatz Island, is remembered, and which was proved to be incorrect, we may assume that there is as little truth in the recent one to the effect that a vessel had wintered off the *east* coast of that island, a spot which it is hardly likely that either vessel could have reached. On the other hand there is little probability of the hope expressed by Hovgaard in his last despatch and by Nordenskjöld having been realised, viz. that the equinoctial gales of October would set the vessels free and enable them to winter at Port Dickson or adjoining port, as Hovgaard had instructions from Herr Gamél, in such an eventuality, to despatch a message thereof to Yakutsk, and if this was done it would have reached us ere now. There is now only the hope left, if no mishap has occurred to the vessels, that they got free early in the spring, as Norwegian smacks found open water in the Waigatz Strait as early as in May last, and have proceeded to Port Dickson, from whence news may now be looked for. This port may have been reached in safety, although it seems remarkable that the Dutch Meteorological Expedition should not have returned to Europe instead during the summer in accordance with the instructions of the Circumpolar Congress, by which all parties were to return in August of the present year. If to this are coupled the circumstances that the *Varna* is merely a third class Norwegian coasting steamer of inferior qualities and the *Dijmphna*, although strengthened for Polar exploration, an old vessel of no great strength, and that the vessels were last seen in a place which is notorious for the terrible pressure and drift of the pack-ice, with sudden hurricanes, there certainly seems ground for the anxiety for the ships which is now becoming manifest in Copenhagen and Amsterdam. The Dutch have, we learn, taken decided steps to ascertain the fate of their countrymen, it having been decided at a meeting in Amsterdam last week immediately to equip and despatch a steamer in search of the *Varna* from Hammerfest, in Norway.

The *Ellida* left Hammerfest last week to try to discover the missing Dutch Expedition. The Meteorological Institution has now contracted with the owners of a second ship, the *George*, which started on Saturday from Archangel with orders to land on the west coast of Waigatz, and to send help overland to the Kara Sea if the entrances by water are closed. A telegram from Utrecht announces that a Dutch gentleman offers a reward of 50,000 Norwegian krone to the ship which shall find the Dutch Polar Expedition, last seen in the autumn of last year on board the *Varna* in the Kara Sea. This expedition had assigned to it the carrying out of the magnetic and meteorological observations at the mouth of the Yenisei, under the command of M. Lamie, a lieutenant in the Royal Netherlands Navy.

In the *Bolletino* of the Italian Geographical Society for August, Sig. C. de Amezaga gives a detailed account of the Galapagos Islands, based on the recent reports of MM. Icaza and Wolf. The archipelago, which belongs politically to the Republic of Ecuador, is a sort of No Man's Land, at present almost uninhabited except by cattle, goats, swine, horses, asses, and dogs, placed there early in the present century, which have multiplied exceedingly, and partly reverted to the wild state. The dogs especially are very numerous and savage—like their wolfish ancestors preying on the goats and cattle. Similar propensities have been developed by the "bimana" from the mainland, who, at various dates between 1831 and 1878, have attempted to establish settlements on Floriana (Charles Island) and one or two other members of the group, but who generally ended by mutually exterminating each other. The archipelago comprises thirteen volcanic islands, and numerous rocks scattered over a space of about 6000 square miles, but collectively forming scarcely more than 720 square miles of dry land. Within this limited area are represented two remarkably distinct physical and climatic zones, one low, hot, barren, and rainless, extending from the sea-level to an elevation of about 650 feet, the other thence to an extreme altitude of 1435 feet (cone at north extremity of Albemarle Island), subject to tropical rains from February to May, followed by heavy dews for the rest of the year. Here the igneous rocks have been completely disintegrated, forming a thick layer of argillaceous clay and humus, on which flourishes a varied and vigorous vegetation. But this upland wooded region is of such limited extent compared with the arid lowlands, that probably not more than 60 square miles altogether are suitable for cultivation. The native flora, while in general of the American type, presents many peculiarities, especially in the phanerogamous plants, all of distinct species, which have not been satisfactorily explained by the special climatic and physical conditions. There is also a total absence of lianas, creepers, palms, musaceæ, aroideæ, and the other monocotyledonous families which form the glory of the Amazonian forests. The indigenous fauna is represented chiefly by reptiles, including four or five species of snakes, none of which are venomous. The huge turtles and land tortoises, the strange marine ignanas, and other survivals from remote geological epochs, impart a certain antediluvian aspect to the landscape, especially of the low-lying coastlands, which are little frequented by the animals recently imported from the mainland. The climate, everywhere healthy, with an average temperature not exceeding 73° or 74° F., even in the hot zone, is favourable both for stockbreeding and the cultivation of sugar, bananas, and all kinds of vegetables and fruits of tropical and temperate regions. There, are, however, no mineral resources, and a complete absence of guano, phosphates of lime and carbon, all of which were formerly supposed to abound in the archipelago. On the other hand, there are a few good and easily-accessible havens, such as those of Post Office Bay and Black Beach Roads on the east side of Floriana. Hence the Galapagos Group, lying at about 900 miles from Panama on the direct route to Australasia, cannot fail to acquire great economie importance as a provision and coaling station as soon as the projected interoceanic ship canal is constructed. The notice is accompanied by a good chart of the archipelago on a scale of 1 : 889,000, showing elevations, cones (of which two are still active), marine and prevailing atmospheric currents.

It may be remembered that Baron Nordenskjöld, at the moment of leaving Iceland on the present expedition, discovered in the possession of an Icelander an old map of North Europe, which he, judging from his announcement of the discovery through the medium of the Royal Geographical Society, believed to be very old, perhaps as old as the famous Zeno map, to which reference has previously been made in NATURE, and which he appeared to consider further supported his views concerning the Norse settlements in Greenland. We have, with reference to the map in question, received a communication from an eminent Swedish geographer, informing us that, having had an opportunity of examining the map now in Stockholm, he is convinced that it is simply a Dutch sea chart from the beginning of the seventeenth century, and of no value whatever, which he believes Baron Nordenskjöld did not, under a mere cursory examination, discover. In consequence of the opinion pronounced by our correspondent, the Swedish Geographical Society has decided not to have facsimiles of the map taken.

INDIAN METEOROLOGY[1]

II.

THE title of Paper IV.—"Storms in Bengal, accompanied by increased Atmospheric Pressure and the Apparent Reversal of the Normal Diurnal Oscillation of the Barometer," by Prof. J. Eliot,—must necessarily appear somewhat strange to those accustomed in our latitudes to the frequent masking, if not actual reversal, of the normal diurnal oscillation, by the large and rapid non-periodic oscillations to which the atmospheric pressure is subject.

There are two reasons why this reversal should be rare in the tropics, and of such frequent occurrence, as to be more often the rule than the exception, in higher latitudes. One is, that the range of the diurnal barometric oscillation is greatest near the equator, and diminishes as we approach the poles, and the other, that the range of the non-periodic oscillations varies in precisely the opposite way, increasing very nearly in the ratio (as Ferrel has shown) of the square of the sine of the latitude to unity.[2]

Instances of such inversion, are said by Prof. Eliot to be extremely rare in Bengal, but a perusal of the paper leads us to conclude that it is rather a case of *de non apparentibus* than *de non existentibus*, and that a tendency towards reversal takes place to some extent in all north-westers and analogous storms of a sudden and violent character.

Humboldt, Col. Sykes, and Allan Broun, have all graphically described the regular march of the diurnal barometric oscillation, but their observations were mostly made a good deal nearer the equator than Bengal, and thus in regions where reversal of the diurnal oscillation would be a still rarer phenomenon.

In the cases cited by Eliot, including one observed by Hill at Allahabad, the following characteristic changes were observed about the time of reversal:—

1. A marked rise of the barometer.
2. An equally marked and simultaneous fall of the thermometer.
3. A sudden decrease of the tension of aqueous vapour.
4. An instantaneous change of wind direction.

A consideration of all these features, leads the author to conclude that in these cases a downrush of cold air belonging to an upper current (which is known to travel seawards in Bengal, and is therefore dry) takes place in the centre of the area of low pressure belonging to the storm. On no other hypothesis, does it seem possible to explain all the facts, especially the rise in the barometer, and the fall in vapour tension.

A close study of these north-westers, whether accompanied by reversals or not, and their analogues in other parts of the world, is certain to unravel much of the complexity surrounding such and all aërial disturbances, and as all facts bearing on them are valuable, and the present writer was for some time resident in a locality (Dacca) where they occur with marked intensity, he may perhaps be allowed to remark that one of the most peculiar features he has noticed in connection with them, is the almost instantaneous return of the wind to its original direction after the rear of the storm-cloud has passed the zenith. Both before and after the storm, the wind in Bengal blows from the direction of the sea (south-east). The storm-cloud appears to form in the north-west by an aggregation of vapour that is carried thither in cloudlets from the sea. After a time, the threatening mass advances towards the sea, the sea-wind meanwhile blowing towards the advancing cloud with increased force, until the latter has arrived pretty close, when a lull takes place, after which the wind instantaneously changes to the opposite quarter (generally through the north), from which it blows with great violence. Then come the characteristics already noticed, together with continuous lightning and hail, the latter often very large.

When the storm-cloud, the rear of which presents a very definite outline, passes the zenith, the wind invariably returns to its former direction, and gradually dies down as night approaches. The whole phenomenon appears to favour the notion which has always been entertained by the writer, and is merely a slight extension of the explanation given by Prof. Eliot, that a sudden *oblique* uprise of moist hot air takes place, deflecting the upper current into a corresponding *oblique* downward course, which determines the direction of the storm and continues as long as the uprising air interferes with its regular motion parallel to the surface. This explains why the storm always follows the course of the upper current, as well as the immediate readjustment of the original conditions, as soon as the region of ascending air which causes the deflection has passed the spot.

Paper V. "On the Rainfall of Benares in Relation to the Prevailing Winds," by S. A. Hill.—The observations utilised in this paper, as far as the velocity of the wind is concerned, raise a question of general importance, and one which we think ought to engage the attention of all thoughtful, and certainly all practical meteorologists. Up to 1872, the anemometer was only 15 feet above the ground, but in that year it was raised to a height of nearly 80 feet. Now what are we to think of the effect of such a change of position on the observations?

According to Mr. Stevenson, 15 feet is the lowest elevation at which an anemometer should be placed, since below this height the velocity is found to be enormously affected by the nature of the surface. On the other hand, 80 feet is an elevation which would not only cause the instrument to register a considerably higher velocity,[1] but also secure for it nearly complete immunity from the disturbing influences which would be sure to affect it in the lower position.

It is indeed very much to be regretted that in setting up anemometers in India no sort of uniformity seems to have been attempted. Thus from a list of their elevations above the ground given in the "Meteorological Report for India" in 1876, every variety of height imaginable occurs, ranging from 5 feet 7 inches at Khandwa to 76 feet 11 inches at Benares! At no two stations are the anemometers at the same level, and though it is somewhat complacently admitted by Mr. Blanford "that it can hardly be affirmed that in the majority of cases the anemometric records are strictly comparable," one is naturally inclined to ask why the instruments could not have been placed, if not exactly, at least more nearly, at the same level. Such an arrangement would seem to be a cardinal requisite where such a sensitive element as air motion is involved, and indeed Mr. Stevenson's experiments have shown that while observations below 15 feet are almost useless, the velocity increases rapidly with the height through the first 100 feet; so that until a correction is made for the height, it would be vain to attempt a comparison of observations made at lower, with those at higher levels.

Fortunately in this case the discussion mainly relates to the direction of the wind, so that the conclusions are not seriously affected by the change in the position of the instrument.

The chief conclusion arrived at by the author is similar to that obtained by Mr. Blanford in the first paper of this series for Calcutta, except that Benares affords no corroboration of the conclusion drawn from the former register, that "rain is the more probable in proportion as the deflection of the monsoon current is greater."

It appears, nevertheless, that there is a well-marked connection between the amount of rain that falls *in a day* and the deflection of the rain-bearing current, the maximum amount being from the opposite quarter (north-west) to that from which the monsoon blows.

Paper VII. "Variations of Rainfall in Northern India," by S. A. Hill.—This is one of the most interesting and important papers of the whole series, its ostensible object being partly to test the soundness of the idea which was propounded by Dr. W. W. Hunter and others in 1877, that sunspots, rainfall, and the occurrence of droughts and famines were closely associated in India. Regarding this *vexata quæstio* it may be said at the outset that while the general results of an investigation embracing an area which covers eleven degrees of latitude and twenty of longitude (equal to that of the British Isles, France, Germany, Austria, Holland, and Belgium combined), like those of Mr. Blanford for Southern India, bear out Meldrum's theory of an eleven-year cycle of rainfall, they exhibit certain irregularities, or, more properly speaking, double oscillations, which, as Prof.

[1] Concluded from p. 407.

[2] "Relation between the Barometric Gradient and the Velocity of the Wind," by W. Ferrel. *American Journal of Science*, vol. viii., November, 1874.

[1] According to Mr. Stevenson's formula, which holds near the surface, the velocity would be increased by this change of position in the ratio 1·32 : 1. Thus for 1872 the observed mean value was 67·8. To make this comparable with the years that follow, it should be 89·4!

Hill shows, are probably due to local reacting circumstances, and which afford but little hope of our ever being able to forecast droughts and famines in North-West India solely from a knowledge of the state of solar maculation.

The fact that the terrestrial effects of solar changes are conspicuous in some localities and almost totally absent in others seems to many persons incompatible with the cosmical nature of the influences at work, but to those who study the subject it appears, on the contrary, the only result to be reasonably expected both from experience and analogy.

Thus ordinary weather is the integral of all the differentiations effected during the regular seasonal changes in solar declination, and it need scarcely be remarked what an endless variety of conditions we have in this case, due primarily to the operation of a gradual and periodic cause. Owing to diversities of superficial character, elevation, contour, latitude, &c., we have meteorological oscillations set up, differing from each other in phase and amplitude, which, like the tides of the ocean, in some places tend to exaggerate and in others to annihilate each other. So also must it be, where we have solar changes which gradually perform their cycle in a period of years. The forced oscillations they originate, though small, may in some localities, by a unison of oscillations of the same phase, or an absence of opposing oscillations, be exaggerated above the mean amplitude, just as in others they may, owing to an inequality of phase or the clashing together of opposite variations, be rendered inappreciable.

Prof. Eliot, in his "Report on the Meteorology of India for 1877" (p. 3), evidently recognises this fact, when he admits the probability that "at one part of the sunspot period one effect of the variation of solar radiation may be to exaggerate local irregularity." While therefore it is probable that we shall find only a few places, where the terrestrial effects of solar spot variation are of sufficient magnitude and regularity to render secular forecasting possible (assuming that our foreknowledge of solar changes is reliable), such a fact ought by no means to be used as an argument against the utility of studying the relations between solar physics and terrestrial meteorology.

Mr. Blanford, who from the first attacked the somewhat crude hypothesis propounded by Dr. Hunter regarding sunspots and famines in Southern India, has in his own person furnished a practical protest against any such idea, since his researches on the connection between barometric pressure and sunspot variation have tended, not only to confirm the belief in the bond existing between solar and terrestrial changes, but have also opened out new collateral facts, which, if followed up, are certain to yield results of the highest importance to the science of meteorology. His own views on this question, which have frequently been misunderstood in certain quarters, and referred to as adverse to the general question, are concisely expressed in the following sentence, which we quote from an official report recently made by him to the Indian Government:—

"While, however, I am unable to concede to the conclusions hitherto placed on record, that degree of importance which has sometimes been claimed for them, as affording rules of guidance for the prognostication of scarcity and famine, I am fully in accord with the Famine Commissioners as to the importance of following up such clues as they afford, and of pursuing with all the means at our command the investigation of the class of phenomena to which they belong. It has happened again and again in the past history of science, that hypotheses, which in their original form were more or less erroneous, have nevertheless been most fruitful in their results. In giving system and definite purpose to research they have served a most useful office; and although the course of their verification may have resulted in demonstrating their error, the same process has brought to light the germs of new and unsuspected truths which might have long remained hidden but for the stimulus to investigation afforded by rejected theories."

The nature of the entire question indeed, seems to have been a good deal misunderstood in this country, at least to judge from the extraordinary amount of obloquy and opposition which it has encountered in various quarters.

On the one hand, it must be obvious to any one who casts even a merely superficial glance at the vast changes in the physical condition of the sun, indicated by the spots, prominences, &c., and the dependence of all terrestrial meteorology on the quantity (and perhaps quality) of the heat radiated from our great luminary, that such changes in the former, must be reflected to some extent in the latter, as indeed they are universally allowed to be in the case of terrestrial magnetism. On the other hand, it is equally obvious to the merest tyro in meteorology, that such meteorological fluctuations, though in many cases distinctly recognisable, are not only of small average amplitude (especially in high latitudes) when compared with those which occur, as we say at present, non-periodically, but take a period of years to accomplish their cycle. To imagine therefore, that such changes, even if thoroughly determined, will *alone* enable us to forecast the general weather of a season or a year, is manifestly irrational as far as these latitudes are concerned, while even in India and the tropics generally, we have grounds for believing that there are only a few places, where the extreme range of the oscillation bears a ratio to the non-periodic changes large enough to constitute it the dominant factor of the weather.

That when the conditions which regulate the larger and more irregular changes are better understood, a knowledge of the underlying secular meteorological changes coincident (or nearly so) with the varying phases of solar activity, will be of great *assistance* in framing seasonal forecasts, it is impossible to doubt. At the same time it seems strangely to have been overlooked by the majority of those who have interested themselves in this fascinating question, that though the sunspot variation in meteorological elements may alone be insufficient to form the basis of a practical system of weather prophecy, it is very likely to prove *the key by which the entire weather problem may be solved*, since, when once we know the precise qualitative as well as quantitative meteorological effects of a gradual *secular* change in the solar radiation, coincident with the sunspot cycle, we shall gain an immense insight into the way in which the larger and more rapid oscillations are effected by the *ordinary* changes in solar radiation, brought about by season, latitude, geographical locality, &c., these latter oscillations only differing from the former, in being more frequent and of greater amplitude.

Prof. Hill in his investigation, adopts a plan which is obviously necessary to any one who knows the peculiarities of Indian meteorology, viz. the separate treatment of the summer and winter rainfalls.

The former season embraces the period from May to October, and the latter the remaining months. An eleven-year period, in favour of which there is a good deal of preliminary evidence, is assumed, in order to see if there is any correspondence with the analogous mean period of solar spot variation. The oscillation of the summer rainfall for the whole area about its mean, is then estimated for the cycle, and is found to accord generally with the results for Southern India, and with Meldrum's supposed universal law, in showing a direct variation with the sunspots, the range being twice as great as in Southern India. At the same time considerable irregularity is visible, some of the stations at the border of the monsoon region giving results contrary to the average variation. The winter rainfall on the other hand shows a much closer relation to the sunspots, the remarkable thing about it being, that instead of varying *directly*, as the summer fall, it varies *inversely* with the spotted area.

The variation of this winter fall shown in the text is very regular, and confirms a conjecture hazarded by the present writer in 1877, that the similar variation which he had previously shown to exist in the winter rainfall of Calcutta would be found to be more decidedly marked in the sub-Himalayan zone to the north of it (NATURE, vol. xvi. p. 267, Meteorological Notes).

In a postscript to the paper Prof. Hill has worked out the variation from a longer series of observations, which were discovered, apparently by accident, at the Board of Revenue in Allahabad, and which, by means of registers kept in the Himalayan province of Kumaon, "to which the civil disturbances following the mutiny of 1857 did not extend," allows the cycle to be worked out for the period 1844 to 1878. The final result given in the form of percentage variations from the mean, is as follows:—

Winter Rainfall of North India

Years of Cycle.	1	2	3	4	5	6	7	8	9	10	11
Mean percentage variation.	−6·8	−0·6	−3·6	−15·5	−17·3	+0·8	+27·3	+24 7	+2·1	−5·6	−5 4

For the summer rainfall the variation given in the text is as follows:—

Summer Rainfall of North India

Years of Cycle.	1	2	3	4	5	6	7	8	9	10	11
Mean percentage variation.	+3·6	+7·4	+9·8	+12·6	+7 8	−5 6	−10 8	−8·1	−10·0	−7·0	−0·6

In the cycle as arranged above, the first year is that which contains the year of maximum sunspot, and the eighth that of minimum sunspot.

With the figures in the text, the maximum winter rainfall occurs on an average rather more than a year before the minimum of sunspots, and the minimum of rainfall appears either to coincide with, or to follow the maximum of the sunspots, at about an equal interval.

While, therefore, the facts are so far favourable to a close connection between sunspots and rainfall in Upper India, they do not lead so much to the conclusion that the former directly affect the latter, as to their both being effects of some common and as yet undetermined cause.

It should be further noticed, both as a result of this investigation, and an example of one of the "new and unsuspected truths" which Mr. Blanford says are often incidentally brought to light, that the variations of the summer and winter falls are almost exactly contrary to each other, and as this has been found to occur not only in the years of the mean cycle, but also in individual years, it has been concluded by Prof. Hill that *in Northern India the winter rains are excessive when the summer rains are defective and vice versâ*.

This contrary variation, which is of itself a valuable discovery, is moreover shown to be due in some measure to a reaction of the winter on the summer rainfall. Thus, in years of heavy winter rainfall in Northern India, and therefore of heavy snowfall in the Himalayas, an excess of barometric pressure attended by diminished temperature, is found to occur during the earlier months of the year, which causes the air to move outwards from the centre of relatively highest pressure, and so bar the approach of the Arabian Sea current from the south-west, as well as the Bay of Bengal current from the south-east, and by thus compelling them to part with their moisture in other districts, such as the hills of Central India, or East Bengal and Burmah respectively, causes deficiency and drought over the Punjab and North-West Provinces, or Western Bengal.

On the other hand, in years of defective winter rainfall, the temperature is generally high, and the pressure low, in the early months of the year; while the currents from the south-east up the Ganges valley appear in full strength, and are accompanied by early and abundant summer rains.[1]

Mr. Blanford has partly attributed the high atmospheric pressure which occurs in the years of heavy snowfall, to the cooling thereby produced, but as this abnormally high pressure sometimes extends right down the Bombay coast, it is plain that the snowfall is not the only determining cause, and that we must look to some more general cause to explain the matter. Prof. Hill speculates very intelligently on this cause, but as the speculation requires confirmatory evidence, it will be as well perhaps not to dwell on it at present.

It may, however, be observed that this speculation accounts satisfactorily for the double oscillation of the Bengal summer rainfall with its *maxima* at both sunspot epochs, as well as the double oscillation of the annual rainfall of Southern India, noticed by the late Mr. J. A. Broun, F.R.S., in NATURE, vol. xvi. p. 334 (which, unlike that of Northern India, is solely due to the *summer monsoon current*) with its *minima* at both epochs, two remarkable facts, which might at first sight appear to be almost irreconcilable, if not unaccountable.

Before leaving this interesting and suggestive paper, it should be remarked that the variation in the winter rainfall of Northern India is shown to be closely connected with the curve of air-temperature in the tropics calculated up to 1862 by Dr. Köppen, and continued up to 1877 by Prof. Hill from Indian observations alone.

The following table gives the epochs of maxima and minima of both elements, and the conclusion can, we think, scarcely be resisted that there is a causal connection between them, since in every case but one, the rainfall epochs slightly *follow* those of the temperature:—

Maximum and Minimum Epochs of Tropical Temperature and Winter Rain

Minima. Temperature.	Rain.	Maxima. Temperature.	Rain.
1836·9	1837·8	1842·7	1842·7
1847·7	1848·1	1854·7	1855·0
1858·4	1860·6	1865·1	1865·5
1874·8	1874·7	(1876·3)	(1876·9)

[1] These opposite conditions are now so universally recognised, as almost to form a canon of Indian meteorology.

Similar variations are shown to exist in the winter rainfall of other parts of the world, as well as in the humidity of Russia and Siberia, which favour the hypothesis long entertained both by Prof. Hill and the writer, that "the winter rains in Northern India occur simultaneously with an increase in the quantity of aqueous vapour in the atmosphere over Eastern Europe and Western Asia, and that the cause of both may *possibly* be found in an unusually high temperature in the tropics, whereby the evaporation of the waters of the ocean is accelerated and the upper current of moist air known as the anti-trade has its velocity increased."

SCIENTIFIC SERIALS

American Journal of Science, August.—Principal characters of American Jurassic Dinosaurs, part vi.: Restoration of Brontosaurus, with plate, by Prof. O. C. Marsh. The restoration is effected by bones belonging almost exclusively to a single individual, which when alive was about fifty feet long; chief characteristics: long flexible neck, very short body, massive legs and feet, the latter plantigrade, and leaving footprints about a square yard in extent, very large tail with solid bones, remarkably small head, smaller in proportion to the body than that of any other known vertebrate, skull being less in diameter or weight than the fourth or fifth cervical vertebra. The living animal must have weighed over twenty tons, and appears to have been a stupid reptile of slow motion, without offensive weapons or dermal armature, amphibious in habits, feeding on aquatic and other succulent plants.—The evolution of the American trotting horse, by Francis E. Nipher. The minimum time of trotting a mile, in a previous paper determined at 93, is here reduced to 91 seconds, and it is suggested that the trotter will very probably finally surpass the race-horse in speed.—On concave gratings for optical purposes, by Henry A. Rowland, Professor of Physics, Johns Hopkins University, Baltimore.—Glacial markings of unusual forms in the Laurentian Hills, by Dr. Edmund Andrews. Several illustrations are given of the peculiar marks here described, which are chiefly curved striæ, serrated striæ, and curious scoop-marks, both striated and unstriated, very difficult to explain on any theory of glacial action.—Response to the remarks of Messrs. Wachsmuth and Springer on the genera Glyptocrinus and Reteocrinus, by S. A. Miller.—On the present status of the eccentricity theory of glacial climate, by W. J. McGee. In reply to recent critics the author urges several arguments in defence of Croll's theory of secular variations in terrestrial climate.—On the commingling of ancient faunal and modern floral types in the Laramie group, by Charles A. White.—Notes on some fossil plants from Northern China, by J. S. Newberry. From the general character of these plants, which were collected by Mr. Arnold Hague, the author considers that Pumpelly and Richthofen's estimates of the great area and value of the North China coal and iron deposits are by no means unwarranted. The plants, all of the Carboniferous age, seem to prove that the Chinese coal basins belong to two great geological systems, one answering to that of the European and American coal-measures, the other probably referable to the Rhœtic and Lias.—Review of De Candolle's "Origin of Cultivated Plants," with annotations on certain American species, by Asa Gray and J. Hammond Trumbull.—On the supposed human footprints recently found in Nevada, by O. C. Marsh.

THE *Journal of the Franklin Institute*, August.—Cranes; a study of types and details, by Henry R. Towne.—A remarkable error in the common theory of the turbine water-wheel, by J. P. Frizell.—Béton in combination with iron as a building material, by W. E. Ward.—The grindstone, by J. E. Mitchell.—The Glover tower and the working of sulphuric acid chambers, by Moses A. Walsh.—On radiant matter spectroscopy, a new method of spectrum analysis, by William Crookes, F.R.S.—The cause of evident magnetism in iron, steel, and other magnetic metals, by D. E. Hughes, F.R.S.—National Exhibition of Railway Appliances, Chicago, Ill.—Obituary, Benjamin Howard Rand, Franklin Institute.—Notes.—Induced currents in reciprocal movements.—Twinkling of stars during auroras.—Spanish copper tubes.—Photozincography.—Orange peel.—Constitution of the sun.—Colour of distilled water.—Deep-sea explorations.—Generation of inflammable gases in the diffusion of beets.—Amber.

Journal of the Russian Chemical and Physical Society, vol. xv. fasc. 5.—On the formation and properties of oxide of sodium, by N. Beketoff. The amount of heat disengaged during the complete hydration of sodium has been found equal to 55,000 calories, which figure, combined with that of Thomsen, gives 100,260 calories for the heat of oxidation of one molecule of sodium (50,130 for each atom).—On the naphtha lamp for burning heavy oils, examined at the Chemical Society's competition, by M. Andréeff.—On the naphtha of Caucasus, by MM. Markovnikoff and Ogloblin; second part.—The chief constituent parts of this naphtha, about 80 per cent. of it, would be hydrocarbons of the C_nH_{2n} series—C_8H_{16}, C_9H_{18}, and so on to $C_{15}H_{30}$. The authors propose to call them naphthenes, and describe their properties at length. The aromatic hydrocarbons constitute about 10 per cent. of the naphtha, partly known before, and partly seeming to belong to new series isomeric with the styrol series and its isologues. The oxygenated products, partly acid and partly neutral, play also an important part in the naphtha, which contains also a few phenols and lower hydrocarbons.—On naphtha; an answer to MM. Markovnikoff and Ogloblin, by Prof. Mendeléeff.—On the continuous graphic determination of the depth of shallow waters, by Prof. Petrushevsky. The author proposes to adjust to a boat a pole whose longer end would be dragged at the bottom of the river, whilst its shorter end would draw on a board the configuration of the bottom.—On the determination of the average coloration of a surface painted with different colours, by the same.—On the influence of light on the electrical conductibility of selenium, by N. Hesehus.

Archives des Sciences Physiques et Naturelles, July 15.—Verification of some atomic weights, by M. C. Marignac; first memoir, bismuth and manganese.—American ants, by Henry MacCook.—Ripple marks studied in Lake Leman, by Dr. F. A. Forel (one sheet of illustrations).—New researches on the Saturnian system, by W. Meyer.—Hypoxanthine in potatoes, by A. Weber.—Chloride of calcium, by V. Meyer.—Remarks on methods of determining vapour densities, by Alois Janny.—Acetoximes, by J. Petraczek.—On the aldoximes, by V. Meyer.

Rendiconti of the Royal Lombard Institute of Sciences and Letters, July 12, 1883.—Descriptive catalogue of a new series of rare or unpublished Greek coins and medals preserved in the Royal Numismatic Cabinet of Milan, by the curator, E. B. Biondelli. Amongst the 128 extremely rare and in some cases even unique specimens here described are medals of Julius Cæsar with Augustus from Achulla in Zeugitania, and of the two African Gordians from Cilicia, besides several coins from Sabrata, Thæna, Clypea, and other North African towns, including one of the Mauritanian king Ptolemy, son of Juba II., absolutely unique. The general catalogue of all the oriental and mediæval series, together with the historic and commemorative medals, is making rapid progress, and its publication is promised in a short time. The complete legends as far as legible are given in all cases, together with a brief description of the subjects.—The structure of the seeds in the family of the Oleaceæ fully described, by Prof. R. Pirotta.—On the functions of a single variant with more than two periods, $\pi, \pi', \pi'' \ldots$, by Prof. F. Casorati.—Meteorological observations at the Observatory of Milan, with tables of barometrical and thermometrical changes, and records of relative humidity, direction of the winds, and cloudiness during the month of June.

SOCIETIES AND ACADEMIES

PARIS

Academy of Sciences, August 20.—M. Blanchard, president, in the chair.—Observations on the smaller planets made at the great meridian of the Paris Observatory during the second quarter of the year 1883, by M. Mouchez.—On a letter of General Stebnitski concerning the figure of the earth, by M. Faye. The Russian *savant* holds that the actual form of the globe, as expressed by the ideal continuation of the sea-level beneath the continents, differs from the theoretic ellipsoid not only in the undulations produced by the attraction of mountain ranges, and of the denser parts occurring here and there in the crust of the earth, but also in the deformations due to the attraction of the continents. In reply M. Faye contends that the mathematical surface of the globe is not modified by these causes, and that the level of the oceans is not sensibly affected by the influence of the mainland.—A study of the deformations and development of heat produced by the use of round-faced hammers in forging, by M. Tresca.—Observations touching a passage in M. V. Burg's recent communication on the use of copper as a preservative against cholera, by M. Vulpian. The author explains that a statement attributed to him by M. Tresca, regarding the use of copper as a prophylactic by English and French officers in Egypt, India, and Cochin-China, is groundless. He adds that he regards the advantage of the use of copper as a preservative as extremely doubtful.—On the separation of gallium (continued). Separation from tungsten and phosphoric acid, by M. Lecoq.—Experimental researches on explosive gas motors, by M. A. Witz.—Researches on the iodide of nitrogen; on chemical radiometers or iodide of nitrogen photometers; on the preparation in a low temperature of nitrogen, iodide of ammonium, and iodate of ammonia under the influence of light, and on the double iodide of copper and nitrogen, by M. Antony Guyard.—A contribution to the history of the formation of coal, by M. B. Renault. The author concludes that in many cases fossil coal is produced by the transformation *in situ* of the constituent elements of the plants whose forms it has preserved; that both the wood and bark have entered into the formation of coal, and that in the process of transformation the organic elements have diminished in size in a determinable proportion depending on the primitiue density of the constituent organic matter.—Remarks on the *Phylloglossum Drummondii*, by M. C. Eg. Bertrand.

BERLIN

Physiological Society, July 27.—Prof. H. Munk spoke regarding the doctrine of the functional restoration of the cerebrum first deduced by Flourens from experiments he made on the cerebrum of doves. Flourens had observed that, on the excision of but a small part of the greater brain, the disorders which resulted in the sensuous perceptions and intelligence of the animal operated on ceased after some time, and the animal then acted as before in its normal state. On the excision, however, of a larger part from the cerebrum, the subsequent restoration was only incomplete. Were, again, a very large part cut off from the greater brain, the resulting disorders continued to the end of the animal's life. Flourens had further concluded that the functions of the whole of the cerebrum were strictly equivalent to one another, and that every part of it was capable of vicariously taking the place of every other part. This doctrine propounded by Flourens regarding cerebral functions having, however, been overthrown in consequence of investigations by Fritsch and Hitzig and replaced by that of the localisation of particular functions in particular parts of the cortex cerebri, the phenomenon which to all observers, on the removing of less than a quarter from the hemisphere of the cerebrum, had suggested the idea of functional restoration of the brain, now received a different interpretation. By some investigators it was maintained that the restoration was to be explained by the function of the excided part of the brain being taken over either by the corresponding part of the other side or by some other part of the brain situated on the same side, in the cortex, or in the interior, in either case in addition to its own special function. Others, again, deemed the restoration only an apparent one; in reality no function was suspended by the removing of a part of the cerebrum, it was only a check that was imposed through the irritation of the act of separation, and when that was relieved, the normal functions came again into play. Prof. Munk has for several years carried on investigations into the functions of the cortex cerebri, leading, as is known, to the conclusion that a limited part of the cortex situated on the flap of the occiput was the seat of the central visual perceptions (the sphere of vision) and that another exactly defined part of the cortex, situated on the flap of the temples, marked the site of the acoustic perceptions (the sphere of hearing), while a third region was appropriated to the sphere of feeling. He has further prosecuted his inquiries into the question of the restoration of cerebral functions, and by experiment has endeavoured to determine whether the assumed restoration of functions previously discharged by parts of the cerebral cortex now removed were a true statement of the fact, and if so how this was accomplished. He first affirms the universally recognised fact that the restoration of matter lost to the brain by the excision of a part or parts of it in no case ever happened, but in every case after the excision the remaining mass only cicatrised. As regards functional restoration, then, his experiments in the spheres of sight and hearing led him to the following conclusions:—Were the spheres of sight or the spheres of hearing removed from an animal, it remained blind or deaf for the rest of its life; no restoration of the faculty in question ever took place in either case, though only limited portions of the brain were removed and the whole of its remaining mass were left intact; this latter could nevertheless in no case ever take the place of the excided parts. Were, again, only one sphere of sight or one sphere of hearing removed, the animal became blind or deaf on the opposite side, and this one-sided blindness or deafness likewise continued throughout the whole of the rest of the animal's life. Even should only small parts of one sphere of sight or one sphere of hearing be removed, restoration of the functions of these parts never followed. Were, for example, the outer half on the left side of the sphere of sight taken away, the median half of the right retina would then continue blind so long as the animal survived this operation. Were the inner half of the sphere of sight taken away, the lateral half of the opposite retina would be rendered blind throughout the rest of the animal's life. Were the hinder part of the sphere of hearing destroyed, the animal would for the rest of its life continue deaf to deep tones. Were the anterior half of the sphere of hearing taken away, the animal would be rendered for ever insensible of high tones by the corresponding ear. Even though ever so small portions of the sections in question of the cerebral cortex were removed, the corresponding part of the retina would be rendered blind, and the animal become deaf to the tones appropriate to the part where the excision was made. It is true that in time the animal learns to make up for the defects caused by the operations and with the remaining unaffected parts of the retina (supposing the operation has reference to the sight) will contrive to see so well, and act in general in such a way as to superficial observations to convey the impression of an animal endowed with normal powers of sight. On close examination, however, of the particular parts of the retina it will in every case be found that the parts corresponding with the excided part in the central cortex is blind. Functional restoration of an excided part of the cerebral cortex never therefore occurs, however small be the part excided. Otherwise, notwithstanding, it would seem to be the case with another function of the sphere of sight which is concerned not with the first visual perceptions but with visual representations or conscious images consequent on perceptions. Has an animal, for example, taken from it the central sphere of sight, it then loses all conscious images; the mere seeing of objects with the intact peripheral parts of the retina is still possible for it, but not the recognition of them. After some time, however, the animal will regain the power of forming conscious images, and will then recognise the objects it sees. Here, then, we have the restoration of a lost function on the part of the cerebrum. In this case, however, the functional restoration is, according to Prof. Munk, only an apparent one. The actual state of the case is as follows:—Conscious images are formed in this way. Visual perceptions becoming an object of attention produce visual representations which give rise in one place of the central organ to a change which, existing as latent conscious image, is aroused by an equivalent or similar visual representation, which in its turn is begotten of perception and attention. These conscious images have their seat in the central part of the sphere of sight corresponding with the central part of the retina, the place of clearest vision. If this central part of the sphere of sight be removed, the animal loses its conscious images, it is soul-blind. According to Prof. Munk's conception, however, the seat of conscious images lies in the centre of the sphere of sight only for this reason, that usually the visual perceptions coming from the central part of the retina, and therefore the most distinct, alone become the subject of attention, and are transformed into visual representations. The images of perception, on the other hand, reaching from the peripheral part of the retina to the peripheral part of the sphere of sight, being less distinct, do not become the subject of attention, and are therefore not transformed into visual representations. If, however, with the central part of the sphere of sight conscious images are taken away—if the animal is soul-blind—attention can now fasten only on the images which are seen by the periphery of the retina, the central part being quite vacant in consequence of the operation. In this case, then, visual perceptions in the peripheral parts of the sphere of sight are by attention transformed into representations, whence now conscious images are drawn. If you render an animal soul-blind on one side, it will never of itself draw conscious images from that side, it will see only with the central parts of the sound eye. If now, however, you blindfold the animal on its visual side, and so compel it to look with the peripheral parts of the side operated on, the soul-blindness on this side will vanish. Restoration is consequently a word totally inapplicable here. On the contrary, all that we here find is that cerebral parts are utilised as a repository of conscious images, which by the normal animal are not turned to account simply because it has other parts with more distinct powers of perception to answer its purpose. The circumstance that former observers have always been impressed with the idea of restoration of sensuous activity is to be explained by the fact that the sphere of sight and the sphere of hearing lie only to a small extent on the surface which is more exposed to injury, and therefore, in the case of a simple excision from the cerebrum, they are always only partially affected.—Prof. Zuntz related briefly that last year he had inoculated guinea-pigs with bacillæ of septicæmic rabbits and mice, and that they had all escaped harm. When, however, he repeated these experiments this year, the inoculated guinea-pigs all fell sick, but not from septicæmia, but from peritonitis. When, again, rabbits and mice were inoculated with bacillæ of guinea-pigs who had died of peritonitis, they bred lepticæmia and *vice versâ*. Under the microscope both kinds of bacillæ were seen to behave quite alike.

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Academy of Sciences, June 14.—F. Steindachner and L. Doederlein, contributions to knowledge of Japanese fishes (second paper).—E. Hann, on the climate of Bosnia and Herzegovina.—C. Etti, on the history of the tannic acid of oak bark.—M. Neumayr, on the morphology of the valve of bivalves.—L. Teisseyra, contribution to a knowledge of the Cephalopoda fauna of the Jura in the Risan Government (Russia).—Zd. H. Skraup and G. Vortmann, on the derivatives of dipyridine.

June 21.—H. Hammerl, a study on the copper voltameter.—R. Benedikt and M. von Schmidt, notes on halogen derivatives.—K. Hazura, on nitro-sulphoresoreinic acid.—H. Bittner, on *Micropsis veronensis*, a new Echinus of the Upper Italian Eocene.—Contributions to a knowledge of Tertiary Brachiura fauna.—A. Lieben and S. Zeisel, on the constitution of butyrochloral.—K. Natterer, on dichlorocrotonaldehyde.—J. Kachler and F. V. Spitzer, on the action of the isomeric camphor bromides on nitric acid.—Zd. H. Skraup, a sealed paper on the constitution of quinine.—S. Exner, on the defective excitability of the retina by light of abnormal incidence.—J. Woldrich, on the diluvial fauna of Zuzlawitz in Bohemia.

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