THURSDAY, APRIL 15, 1880

DOES CHLOROPHYLL DECOMPOSE CARBONIC ACID?

THE recent memoirs of Pringsheim, noticed in NATURE, vol. xxi. p. 85, by Mr. Vines ("Untersuchungen über das Chlorophyll," July and November, 1879) suggest very serious doubts as to the correctness of an inference which has crept, without the explicit consent of botanical physiologists, into the position of a fundamental doctrine of biological science. The recent excellent article in NATURE on "Vegetation under Electric Light," together with the discussion which took place at the Royal Society when Mr. Siemens's paper describing his experiments on plants under the influence of the electric light was read, tend still further to make it desirable to examine critically the claims which the inference alluded to has on our adhesion.

The inference in question is this, that the substance known as chlorophyll has the property of decomposing carbonic acid so as to fix the carbon and liberate a portion of the oxygen of that acid when in the presence of sun light. Accordingly it has been said that "Chlorophyll is the hand wherewith the organic world lays hold of the carbon of the inorganic world."

Vegetable physiologists are, however, careful not to commit themselves to such an assertion with regard to chlorophyll itself. The chlorophyll-grains or corpuscles are particles of protoplasm impregnated with chlorophyll much in the same way as the blood corpuscles and other tissues of animals are impregnated with hæmoglobin. It is one thing to attribute the decomposition of carbonic acid to "cells containing chlorophyll," or even to "chlorophyll corpuscles," and another thing to pass from such a wide statement to the definite ascription of the CO_2-decomposing property to the green-coloured substance chlorophyll.

It is perfectly true that by the method of concomitant variation we are led to a conclusion favourable to the *importance* of chlorophyll in this function. It is only by plants (or animals) containing chlorophyll and only in those parts of plants containing it that CO_2 is decomposed and oxygen liberated. Further, it appears that wherever chlorophyll is present *in a living organism* (even an animal) exposed to sunlight, the decomposition of CO_2 takes place. But whilst we are thus justified in *connecting* chlorophyll with the decomposition in question, any conclusion as to its sole efficiency, and accordingly any notion of a specific chemical activity on its part, is forbidden by two important facts: firstly, that living protoplasm is always present in intimate association with the chlorophyll when the decomposition of CO_2 is effected (forming the bulk of the chlorophyll-corpuscle); and secondly, that chlorophyll extracted from the chlorophyll-corpuscle and put to the test *in the absence of protoplasm* has hitherto not been shown to possess the power of effecting the specific decomposition sometimes attributed to it.

Very usually blood-red and leaf-green are placed side by side as complementary, not only in colour, but in function, the one active in oxidation and the special property of the animal, the other active in deoxidation and the special property of the plant. The pleasing agreement in difference which these two bodies apparently present has, no doubt, a real basis in fact, but the actual analogies between them have very possibly tempted the speculative biologist a little too far.[1] Both present remarkable and characteristic absorption spectra, both contain iron, both are diffused in the living albuminoid substance of organisms, the one of plants, the other of animals. Nevertheless a most important fact is true of hæmoglobin, which we have not ground for asserting with regard to chlorophyll, namely, that it can be extracted from the albuminoid substance with which it is associated, and then, when in a pure crystalline state, can be made to exhibit its peculiar property of combining with oxygen and again liberating that oxygen, just as it does in the living tissues.

On the other hand, the peculiar property which has been inferred for chlorophyll, namely, that of seizing the group CO from CO_2 and liberating O under the influence of sunlight, ceases altogether (as far as we know) when the chlorophyll is detached from the living protoplasm of an organism, and no effect of any kind upon CO_2 can be produced by its agency when thus isolated.

In reference to this objection to the assumed function of chlorophyll, it may be urged that the chlorophyll, when extracted from the chlorophyll-grain, is chemically altered by the solvent (alcohol or ether) used. To this it appears there is a complete answer. By chlorophyll we mean clearly enough the *green* substance present in the chlorophyll corpuscles. This substance is green in virtue of a specific absorption of light, which happens to be of such a nature as to cause definite well-marked bands of absorption in the spectrum of light which has passed through it. The solution obtained by appropriate treatment of green leaves gives precisely the same absorption-bands as does the green substance in the plant (the whole series being moved a very little to the blue end according to the known law that absorption-bands travel in that direction when a less dense solvent is substituted for a more dense one). Hence the *green* substance, to which we have to limit the term chlorophyll, may be inferred to exist unchanged in the solution.

The persistence of a complex banded absorption spectrum is, according to a large range of observations on the phenomena of absorption, a distinct proof of the persistence of chemical and molecular constitution. Those who are not prepared to admit this must, whilst thus disposing of a part of the evidence against the specific activity of chlorophyll, abandon the only evidence we have in favour of the specific activity of hæmoglobin, for it is upon the identity of the absorption-spectra of hæmoglobin, both in the organism and in the crystalline form, that we have to depend for the inference that the substance which we extract is the same substance as that which circulates in the blood and colours the muscles.

It cannot, however, be stated that a negative has been directly proved with regard to the supposed CO_2-decomposing property of chlorophyll. It is possible that chlorophyll, when extracted by solvents from the chlorophyll-corpuscles, may yet be shown to possess that property. The solvents themselves may, so long as they are present, exert an inhibitory effect. Whilst ether and alcohol may do so it

[1] As an example see Letourneau, "Biology:" Library of Contemporary Science, 1878, p. 97.

is possible that vegetable fats may be more propitious, or that some other solvents may be found more closely resembling the natural solvent of the chlorophyll-corpuscle than those at present known.

Apart, however, from the absence of sufficient evidence to warrant the assumption that chlorophyll has a specific chemical action on carbonic acid in the presence of sunlight, there have to be considered (1) facts connected with the part played by the sunlight which render it improbable that chlorophyll is thus concerned, and (2) facts which point to another use for chlorophyll, and one which involves that concomitance of chlorophyll with CO_2-decomposition which has been most strongly urged in favour of its supposed special property; (3) facts which suggest that such chemical activity as that sometimes attributed to chlorophyll is the special property of protoplasm, or rather of the higher members of that ever-ascending and descending series of albuminoid bodies occurring in organisms, of which series the theoretical apex is entitled to the name "protoplasm" (so far as the term can receive a chemical limitation).

1. If chlorophyll were the active agent in CO_2 decomposition under the influence of sunlight, we should expect the rays absorbed by chlorophyll to be those most efficient in promoting such decomposition. Such, it has been shown by Sachs and others, is *not* the case. Light which has traversed a solution of chlorophyll is still efficient in exciting the plant-cell (whatever part of the cell may be called into play) to the decomposition of CO_2 and liberation of O. It is true that the activity of light thus treated is diminished, but that is explained by the fact that the rays of the whole visible spectrum are some more, some less, capable of exciting the decomposition, and that the total amount of light transmitted is much diminished. The maximum evolution of oxygen by green plants is *not* in the red rays where chlorophyll most absorbs, nor in the indigo and violet which it also largely absorbs, but in the yellow, the orange, and the green, which it allows to pass entirely except for three very narrow and feeble absorption bands.

2. The action of light on the chemical motion of protoplasm (and we know of no changes in protoplasm which can be considered as other than chemical) is known to be a very important one. *Supposing* that chlorophyll is not directly related to the action of light in exciting the decomposition of carbonic acid by the true living substance of green plants, there are yet other activities of the protoplasm of the plant-cell to which it may be related. Engelmann has recently shown that luminous rays (independently of the obscure heat-rays) cause sudden contraction of protoplasmic organisms devoid of chlorophyll or other pigment, whilst the expansion of Æthalium on the surface of tan in the dark, and its contraction beneath the tan during sunlight, is a well-known phenomenon capable of experimental demonstration. The action of solar rays other than those highly endowed with the property of exciting thermal vibrations upon the living tissues of both animals and plants appears to be more general than has been usually admitted,[1] and due to a direct influence upon the protoplasm of living cells. This being the case, it is not surprising that, supposing the active agent in the decomposition of carbonic acid in green plants to be the protoplasm itself, that activity should be excited by the same part of the spectrum which excites the human retina. At the same time it would not be surprising that other specific chemical activities should be promoted in protoplasm by the incidence of luminous rays, and it may well be that chlorophyll has a relation to these activities rather than to the decomposition of carbonic acid.

It is here that the important suggestion of Prof. Pringsheim (*see* NATURE, vol. xx. p. 86), based on very simple but careful observations, comes in. The *respiration* of the plant-cell is promoted according to these observations by the action of light. Intense sunlight in the presence of oxygen gas causes the chlorophyll of a plant-cell (as watched with the microscope), to oxidise and disappear. Similarly it causes decomposition and disruption of the protoplasmic portion of the cell. Ultra-red rays have not this effect, and extreme red rays have it but feebly, whilst the more refrangible rays, even to an extreme distance in the blue, exhibit it powerfully. Here then is a chemical action taking place in the plant-cell under the influence of light, and in this case the rays which are active appear to be more nearly coincident with those absorbed by chlorophyll than in the case of CO_2 decomposition. It does not appear that the oxidising process is non-existent in the absence of light, but merely that it is far more active in the presence of light. Accordingly Prof. Pringsheim suggests that the true function of chlorophyll is, by its general absorbent action on light, to protect the protoplasm of the cell from this excessive oxidation, and especially to protect the protoplasm of the chlorophyll corpuscles. Oxidation being thus entirely or nearly entirely arrested in the chlorophyll corpuscles, whilst proceeding in a lessened degree in the general protoplasm of the cell, the protoplasm of the chlorophyll corpuscles is at liberty *under the influence of those rays of light which are allowed to pass by the chlorophyll* (the very reverse of former suppositions on the subject) to decompose carbonic acid and synthesise the elements of starch (or of hypochlorin). And we know, as stated above, that the rays of light allowed to pass by chlorophyll are those which are the most efficient in the excitation of this activity.

Prof. Pringsheim's hypothesis thus reconciles in a most ingenious manner the concomitance of chlorophyll and CO_2-decomposition with the inactivity of that body as isolated and the apparent irrationality of its absorption-phenomena.

3. That so special an activity as the decomposition of carbonic acid and synthesis of the elements of starch is due to protoplasm itself and not to a body which, like chlorophyll, appears to be of a *comparatively* simple chemical nature, is probable on *à priori* grounds.

Throughout the organic world—so far as our knowledge goes, and it may be admitted that it does not go very far—the more complex chemical processes connected with nutrition on the one hand and secretion on the other appear to be carried on directly under the influence of the living substance of cells. We know of no formed-products similar to chlorophyll which stand between the gland-

[1] The cases of "sun-burn" produced by the glare of the electric light without any accompanying sensation of heat, related both by Prof. Tyndal and Mr. Norman Lockyer, are in point. Further also the remarkable influence of exposure to sunlight on the phosphorescence of Beroë, as recorded by Prof. Allman, *Proc. Roy. Soc.* Edinburgh, 1862.

protoplasm of animals and the material which they break down into secretions, such as the components of bile, or such as the hydrochloric and sulphuric acid of other glands. But still more important are the examples of elaboration and synthesis presented by some of the lowest organisms. Without chlorophyll, or, as far as we have any ground for conclusion, any such intermediary, the protoplasm of the Bacteria acts upon ammonium acetate so as to build up carbon, nitrogen, hydrogen, and oxygen into an albuminoid compound like itself. Such action appears to be the specialty of protoplasm, for even when a share of the work is attributed in the green plant to the green pigment chlorophyll, yet we have to come back to protoplasm to finish the job and do the really difficult feat of combining carbo-hydrates and ammonia. By dismissing chlorophyll from the operation altogether we do not add materially to the capricious many-sidedness of protoplasm. Here it can take carbon from carbonic acid and nitrogen from ammonia, there it can do with nothing less than an acetate, there again it must have a tartrate at least, and in a fourth example it perishes without albumens.

If the green pigment has been misrepresented in the foregoing indictment, and if it really is something more than a screen for protoplasm, its character must be re-established by direct demonstration of its capabilities. The facts, as at present in evidence, look very much indeed as though chlorophyll had been assigned a position of unmerited dignity.[1] E. RAY LANKESTER

HANDBOOK OF BOTANY

Handbuch der Botanik. Bearbeitet und herausgegeben von Dr. N. J. C. Müller, Professor in Münden. Erster Band, Erster Theil. Anatomie und Physiologie der Gewächse. (Heidelberg, 1880: Carl Winter's Universitätsbuchhandlung.)

THE volume before us is the first of a work which is to treat of all the departments of the science of botany. In his preface Prof. Müller explains that he has been led to undertake this very serious task by the conviction that unity of design is the first essential in an educational work such as this is to be, and that this unity cannot be attained unless all the parts of it come from the same hand. Possibly his estimate of the value of this unity may be correct, but it must not be forgotten that the division of a labour such as this secures one very important advantage, namely, the complete treatment of each of the separate parts, and this may after all be quite as important as the unity of design.

These considerations naturally recall to memory the handbook which was planned on so magnificent a scale by Hofmeister. That work is still unfinished, and long periods of time intervened between the publication of volumes of it by the different authors, so that, as it is, the work necessarily exhibits but little unity of design, and must therefore, from Prof. Müller's point of view, possess comparatively little educational merit. As a matter of fact, however, the deficient unity is hardly noticed, for the parts are so complete in themselves that they can stand alone, and are of permanent value as books of reference.

We will now proceed to form an estimate of the success which has attended Prof. Müller in the execution of the first part of his plan. In this volume he treats more especially of the physiology of plants, giving also some account of their coarser anatomy, and he does so with so much detail that he fills more than six hundred pages. It will perhaps be well to defer any remarks upon the latter subject until it has been treated, as Prof. Müller promises, in a more complete manner in subsequent volumes.

With regard to physiology, then, it must be admitted that Prof. Müller's work is an elaborate one, and that it gives evidence of much labour and thought; but yet the result cannot be regarded as other than unsatisfactory. It contains a great deal of information, some of it of a very recondite description, but it is not arranged in a clear and logical manner so that the student can readily grasp the facts and appreciate their mutual relations. There is a want of proportion or perspective about it, and the result is that the fundamental facts do not stand out clearly from those of secondary importance. The mode of stating the facts is not always all that could be desired. On p. 1, for instance, protoplasm is spoken of as being *fluid* (*flüssig*), a mode of describing its consistence which is generally considered to be inaccurate. But the most serious defect in the book is the want of definite statements of the conditions under which the more important vital phenomena take place. There is a sort of vagueness about Prof. Müller's account of these which will prove distressing to any student who reads his book. For example, let us take the discussion of the mode of growth in surface of the cell-wall. On p. 100 there is a very brief statement of the theory of growth by intussusception; on p. 146 there is an account of Nægeli's theory of the structure of the cell-wall; but when we turn to p. 170, where the account of the actual growth of the cell-wall is given, no reference is made to either of these theories, which are generally regarded as being of the first importance in explaining the process of growth. Then as to the turgid condition of the growing cell: this is certainly mentioned on p. 170 and on p. 193, but no hint is given of the means by which this condition is produced and maintained, or of its significance in the process of growth. It is evident that a student would have considerable difficulty in obtaining anything like a clear idea of the mode of growth in surface of a cell-wall from Prof. Müller's account of it.

Again, there is no clear distinction made, in Prof. Müller's account of the circulation of liquids in the plant, between the slow movement of solutions of nutritious substances and the rapid movement of water in connection with the process of transpiration; and the paths along which the liquids travel in these two movements are by no means clearly traced. The recent important researches of Sachs and of von Höhnel on this subject appear to have been overlooked.

Further, in discussing the decomposition of carbonic acid by chlorophyll under the influence of sunlight, Prof. Müller makes no clear statement as to which of the

[1] Mr. Vines suggests that if Pringsheim's view be correct, then it might be possible by aid of an artificial chlorophyll screen to excite the protoplasm of fungi or even of animals to the decomposition of carbonic acid. This seems to me unlikely on account of the definitely characteristic chemical activities acquired by protoplasm in different organisms. *But it certainly would be worth while trying the experiment with an etiolated green plant and an artificial chlorophyll screen.* The experiment would be decisive.

rays of the solar spectrum are the more active in the process.

It would be easy to multiply criticisms of this kind, but enough has been already said to show that the book is unsuitable for the use of students, at least of those who are not already tolerably advanced. The first essential of a good handbook for students is that it should give a clear and, as far as possible, complete account of the actual attainments of the science of which it treats. This Prof. Müller's book certainly does not do. Many points of importance are either omitted or treated far too superficially, whereas others of less importance are discussed at great length in a highly theoretical manner, which, be it said, is often ingenious and interesting. The book cannot, therefore, be regarded as a successful handbook; its merits are rather those of a treatise upon those parts of the physiology of plants which are susceptible of a physical and mathematical treatment.

It only remains to add that the general appearance of the book, the paper, type, and figures are good, and to express the regret that there is not an alphabetical index at the end which might serve as a guide through the somewhat intricate mazes of the contents.

OUR BOOK SHELF

On the Urari, the Deadly Arrow-poison of the Macusis. By Richard Schomburgk, Ph.D. 4to. Pp. 18. (Adelaide: E. Spiller.)

IN this pamphlet the author describes the researches made by himself and by his brother, Sir Robert Schomburgk, into the modes of preparation of urari. Although an arrow-poison is prepared by a number of Indian tribes in Guiana, and between the Amazon River and the Orinoco, yet that prepared by the Macusi Indians is much stronger, and other tribes come very long distances in order to obtain it. This greater strength is thought by the author to depend upon the use by the Macusi Indians of the *Strychnos toxifera.* The bark of this plant contains all the properties of the urari, and the Macusi Indians add to it a number of other substances. With great difficulty the author prevailed upon an old urari-maker to show him the process of preparing the poison. The ingredients were—bark of *Strychnos toxifera*, 2 lbs.; from Yakki (*Strychnos schomburgkii*), ¼ lb.; Arimaru (*Strychnos cogens*), ¼ lb.; Wakarimo, ¼ lb.; the root of Tarireng, ⅛ oz.; the root of Tararemu, ⅛ oz.; the fleshy root of Muramu (*Cissus spec.*); four small pieces of wood of a tree of the species of Xanthoxyleæ, called Manuca. (Manuca is the strong bitter wood of a tree of the Xanthoxyleæ. The bark and the root are used as an effective remedy against syphilitic sickness on the Rio Negro, Amazon, and Rio Branco.)

These ingredients were crushed singly in a mortar, and the bark of *Strychnos tox.* was thrown first into a pot containing about seven quarts of water. As soon as the water began to boil he added at intervals a handful of the other ingredients except the muramu. The whole was then kept boiling very slowly, the foam being carefully skimmed away, for twenty-four hours, the mixture being kept at an equal heat. At the expiration of that time the extract had been reduced by boiling to about a quart, became thick, and assumed the colour of strong coffee. It was then strained through a large funnel made of palm-leaves and filled with fresh silk-grass. The filtrate was exposed in a flat vessel to the sun for about three hours, and he then added the slimy juice expressed from the muramu root, which had been previously soaked for a short time in the boiling poison. The urari immediately underwent a remarkable alteration, curdling to a jelly-like substance. The poison was then poured into very flat earthen vessels, in order to still further concentrate it by exposure to the sun. When it reached the consistency of thick treacle it was poured into small calabashes, where it ultimately changed into a hard substance. During the preparation a number of superstitious precautions are taken, in order, as they imagine, to prevent the poison losing its efficacy. No certain remedy is known for the effects of the poison; those employed by the Indians are the juice of sugar-cane either alone or mixed with an infusion of the leaves of the tree *Eperua falcata.* Salt and urine are sometimes also employed as remedies.

The author mentions the researches on the physiological action of urari by Waterton and Virchow, but seems unaware of, or at least does not allude to, the observations of Bernard, or the more recent works of German observers. This pamphlet is, however, interesting as containing the author's own original observations upon the mode of preparation of the urari, made, as they were, under great difficulties.

Notes of Observations on Injurious Insects. Report, 1879. (London: W. Swan Sonnenschein and Allen, 1880.)

THIS report, for the production of which we are mainly indebted to the exertions of Miss E. A. Ormerod, the Rev. T. A. Preston, and Mr. E. A. Fitch, is, this year, one of unusual interest, inasmuch as it reviews the destructive work of the insect world to our garden and field crops during a summer unequalled for its want of sunshine and continued heavy rains. Moreover, owing to the energy displayed by the editor in inducing gardeners, foresters, &c., to record what observations they may have made, we have, as the result, a very full and very varied report. Notwithstanding that the temperature was below and the rainfall above the average, "the returns show insect attack fully up to the usual amount, and insect presence often exceeding it. The unusual cold of the winter and the depth to which the frost penetrated the ground do not appear to have acted prejudicially on larvæ subjected to them, either at the time or in subsequent development, and the only cases in which the weather appears notably to have had effect in ridding us of insect attack is where the persistent rainfall or the tremendous downpour of summer storms have fairly swept the insects from the plants, or in some cases of leaf-feeders, where the plant-growth has (conjecturally) been driven on past the power of the larvæ."

Referring to the power of the frost "during the past winter" (the report is dated December 19 last), it is stated that at Dalkeith it penetrated the earth to a depth of fifteen inches, while in Perthshire it went down to from twenty to twenty-four inches. Miss Ormerod alludes to the prevalent idea that "cold kills the grubs," and gives her experience of an examination of all larvæ and pupæ found fully exposed to its influence, whether unsheltered, under bark, or in frozen ground. In every case, even where the ground was frozen so hard that it required a hammer to break it, and the larvæ and pupæ were perfectly rigid, on thawing they showed no sign of injury, "and in the case of the larvæ of the cabbage weevil (which was the only instance in which any immediate action was to be expected) they continued the operation of making their earth cases for pupation (as is usual with this grub on disturbance from the gall) as if nothing had happened."

The extreme severity of the winter was also favourable, in other respects, to insect-preservation, large numbers being secured from the attacks of birds by being buried under the snow or in the frost-bound ground.

The report, which embodies notes from observers all over the United Kingdom, is one of very great value not only to the entomologist, but also to the practical cultivator, whether of field or garden crops. The persistent energy with which Miss Ormerod and her coadjutors have advanced these inquiries, the result of which is the full and elaborate report before us, is worthy of all praise. It is satisfactory to learn that for the coming year a large number of fresh observers have promised their help, and with the hope that this notice may induce some of our readers to communicate their own experiences to Miss Ormerod at Dunster Lodge, Spring Grove, Isleworth, we may perhaps mention the following as a guide to the kind of information required :—

1. Any notes as to the extent of insect injury, and estimated pecuniary loss from such.

2. Remedies found of practical use in checking such ravages.

3. Any notes of coincident circumstances such as of weather influences, or surroundings, or state of the soil which may increase or diminish insect attack.

It is pointed out that even the shortest notes are valuable when collated with others, and the importance of noting down the observations as they occur is also impressed upon observers.

JOHN R. JACKSON

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 ensure the appearance even of communications containing interesting and novel facts.*]

The Density of Chlorine

IN NATURE, vol. xxi. p. 350, my friend, Mr. F. D. Brown, argues that the low density of chlorine at high temperatures may be explained on the assumption that it undergoes decomposition in the sense of the equation $Cl_2 = 2Cl$, thereby renewing a suggestion made by Lieben in a communication to the French Academy shortly after the publication of V. and C. Meyer's first paper.

A few days ago it might have been said that, however probable such an explanation might appear to be on general grounds, there was nothing in the Meyers' observations to justify it rather than the alternative hypothesis that the chlorine underwent decomposition into other as yet unknown substances. On the contrary, taking into account Meyer's observations on iodine, which by reason of their greater number may be regarded as furnishing more conclusive testimony than the more limited series with chlorine, there was apparently distinct evidence in favour of the latter view. The dissociation of iodine, according to Meyer, takes place within a range of about 400° C., between 600° and 1,000°, and a further increase of nearly 600° is practically without effect; whereas had the change been of the character indicated by Mr. Brown, a further diminution in density ought to have been observed.

A recent communication to the French Academy by Crafts and Meier, however, materially advances the discussion. These observers maintain that Meyer's estimates of temperature (made by the calorimetric method with a platinum block) are excessive, and that, in fact, the highest temperature realisable with the Perrot gas-furnace (determined by an air thermometric method), is 1,390° instead of about 1,570°. They have also obtained a considerably lower value for the density of iodine at the highest temperature of the furnace, the quotient of the theoretical density ($I_2 = 8{\cdot}786$) by the observed density being ·60 for their highest observation, and ·65 for Meyer's. Their results are as follows:—

Temperature. °		Density.	
445	8·70	8·78	8·75
830–880	8·04	8·11	
1,020–1,050	7·02	7·18	6·83
1,275	6·07	5·57	
1,390	5·23	5·33	

Should it ultimately be proved that the molecules of the halogens are thus dissociable, our present views regarding phenomena such as the nascent state and the influence of light in inducing hydrogen and chlorine to enter into reaction will meet with much support; the appeal as to their elementary nature will then be entirely thrown on the spectroscope for decision.

London Institution, April 10 HENRY G. ARMSTRONG

The Omori Shell Mounds

I HAVE received the enclosed letter from Prof. Morse, with a request that I should forward it to you. I hope that it may be published, for the article in NATURE to which it refers seemed to me to do very scant justice to Prof. Morse's work. I refer more especially to the evidence adduced by him on cannibalism by the ancient inhabitants of Japan—on their platycnemic tibiæ—on their degree of skill in ceramic art—and beyond all other points, on the changes in the molluscan fauna of the islands since the period in question.

It is a remarkable fact, which incidentally appears in Prof. Morse's memoir, that several Japanese gentlemen have already formed large collections of the shells of the Archipelago, and have zealously aided him in the investigation of the prehistoric mounds. This is a most encouraging omen of the future progress of science in Japan. CHARLES DARWIN

Down, Beckenham, Kent, April 9

IN NATURE, vol. xxi. p. 350, is a review of my memoir on "The Omori Shell Mounds" by Fredk. V. Dickins. I do not now heed the spirit in which it is written, nor would I deem it worthy of notice did it not occur in the pages of your widely-read magazine. One expects in a reviewer some knowledge of the subject he reviews. Mr. Dickins, by a series of mistakes, betrays his ignorance of the whole matter. The extraordinary blunder he makes regarding the Ainos has already been promptly corrected by a Japanese gentleman residing in London. It is charitable to assume that Mr. Dickins has not lived in Japan, otherwise he would not, in common with so many of his countrymen, commit the wilful blunder of calling the principal city of the empire by its wrong name. On the other hand, it is impossible he could have seen the Omori deposits, otherwise he would not make another blunder by expressing his belief that they have been completely swept away, when in truth but a small portion of them have been removed. He says: "These mounds consist for the most part of shells, little, if at all, distinguishable from what are still found in abundance along the shores of the Gulf of Yedo." Had he taken the trouble to read the memoir he attempted to review he would have seen that all the species occurring in the mounds vary in size, proportion of parts, and relative abundance of individuals from similar species living along the shores to-day. That some species extremely abundant in the mounds are scarcely met within the vicinity, while one species has never been found within 400 miles of Omori; indeed, it belongs to a different zoological province!

His complaint at the large number of plates given to the illustration of pottery, tablets, &c., shows how incapable he is of appreciating that part of the work which has received the highest commendation from archæologists, namely, the presenting as far as possible an exhaustive illustration of every form of vessel and variety of ornamentation. He laments the absence of a plate giving figures of the bones and shells, especially of the latter, which are stated to belong to extinct species. Had he looked at the last plate (a copper plate, by the way, and not a lithographic one, as he calls it) he would have seen every species, with one exception, figured, when similar forms from the neighbouring shores could be got for comparison.

I did not feel justified in comparing shell-mound forms with similar forms from Niigata, Kobe, or Nagasaki, and the reason will be obvious to any one having the slightest familiarity with the variations that species show in widely separated localities.

As to figuring fragments of bones, I did all that my limited knowledge of mammalian osteology would permit in identifying the common mammals, and in giving a list of them as other writers have done in similar investigations. Possibly Mr. Dickins may here find a fruitful field for investigation, in which he may establish the recent nature of the deposits. I cheerfully proffer to him a large accumulation of fragments of bones in Tokio waiting to be put together!

His comparison of the Omori pottery with Banko will greatly amuse any one at all familiar with Banko, or its associate forms, Hansuki, Otagukuan, Miki, Bashodo, Tokonabe, or their imitators either ancient or modern.

His review being thus occupied with a series of misstatements, he naturally finds no room to discuss my evidences of cannibalism or platycnemic tibiæ.

Finally, his ungenerous complaint of my well-merited compliment to the Japanese printers and binders who made the pamphlet, illustrates a lamentable but too common trait of the ordinary Briton in Japan, namely, that which manifests itself in a childish delight at the failures of the Japanese and in sneers at their successes. EDWARD S. MORSE

Salem, Mass., U.S., March 25

Wallace's "Australasia"

MR. EVERETT appears surprised that he should have to make any corrections in my brief account, in the above-named work, of Borneo and the Philippines, countries in which he has resided and travelled for many years. My surprise is that he has not been able to make far larger and more important corrections. Residents abroad soon acquire a mass of local information, and naturally think that what has been long familiar to themselves must be well known in England, forgetting that books on such subjects are written at long intervals, and when written rarely contain all the information up to date. I am exceedingly thankful for any additional facts or corrections for a new edition of the book, but I do not acknowledge to "errors" in the omission of facts which were not to be found in any books in English libraries at the time I wrote. I will make a few observations on the chief points in Mr. Everett's letter.

1. As to the accuracy of the maps I am not responsible, as Mr. Everett might well have supposed in a series of works issued in Mr. Stanford's name. The fact that Palawan and Mindanao are now as completely Spanish possessions as Luzon, is, I think, quite new to British readers.

2. I certainly omitted the mention of *Tupaia* among the Philippine mammals by an oversight. In giving a general sketch of the peculiarities of Philippine zoology I should, however, again omit Palawan from consideration, as that island is zoologically more nearly connected with Borneo. In the absence of all other information about Palawan, I took my account chiefly from Crawfurd's "Descriptive Dictionary." He mentions the frizzled hair of the natives, and deer among the wild animals; and as deer abound both in Borneo and the Philippines, their *absence* in Palawan requires proof rather than their presence.

3. The detailed range of the rhinoceros and wild cattle in Borneo has not yet, that I am aware, been given by any writer. My general statements, though imperfect, do not seem very far from the truth.

4. As to what Mr. Everett styles my "extraordinary statement" about the "Idaan" and "Milanow" tribes, I founded it on Mr. Spencer St. John's book. He says (vol. i. p. 396) of the Idaan—"They were a dark, sharp-featured race, intelligent-looking, and appeared in features very much like the Land Dyaks of Sarawak." While of the Milanows he says (i. p. 46) "some are clothed like Mahomedans, others like Dyaks, *to which race they undoubtedly belong*." As the Milanows live at the mouths of rivers, while the Idaan live inland, I cannot see the "extraordinary" character of the statement that they "correspond" to the division of Land and Sea Dyaks usually made in the Sarawak territory. This does not imply that there are no differences of language, customs, &c., but rather that there are such differences; but if there are radical *physical* differences they were evidently not known to Mr. St. John, whose long residence in Borneo and great opportunities for acquiring information entitle him to be considered an authority.

It will be seen that Mr. Everett's new matter is very scanty, and I should not have thought it worth while to do anything more than make use of it, were not his letter written in a somewhat critical spirit, which I think he would not have adopted had he known the great difficulty of obtaining accurate information on the innumerable subjects that have to be treated in a book of so wide a scope as "Australasia," and dealing with countries which have been as yet imperfectly described. Like some other critics, too, he forgets that general statements for popular information, which must be comprised within a few lines, cannot always be made strictly accurate without becoming vague, and thus ceasing to convey any definite ideas.

ALFRED R. WALLACE

The Comet 1861 I.

IN the course of some work on comets lately communicated to the Royal Society of Edinburgh, in which I show reasons for believing that a planet more distant from the sun than Neptune is at present in the position R.A. 11h. 40m., N.P.D. 85°, or thereabouts, I was led to the conclusion that the comet 1861 I., visible to the naked eye, should have been in perihelion three times before the last appearance. The period of the comet has been calculated to be 415·4 years. It ought therefore to have been visible in the years 1445, 1031, 615. Comets were observed in 1444, 1032, 617. It will be interesting to many readers of NATURE to know that these are identical. They were all observed in July or August, and were all seen to pass close to β Leonis. The following accounts of them have been given:—

A.D. 617 (?).—"In July a comet with a tail 3° or 4° long was seen near β Leonis."—(Ma-tuoan-lin.)

A.D. 1032.—"On July 15 an extraordinary star appeared in the north east. It approached β Leonis."—("Compendium Historiarum," 730.)

A.D. 1444.—"On August 6 a comet 10° long was seen to the east of β Leonis; it became longer day by day till August 15, when it entered the sidereal division of α Virginis."—(Biot.)

The longitude of β Leonis is 169°, its latitude 13° N. If the earth were to remain fixed in its position for July 15 it would see the comet 1861 I. pass through the point whose longitude is 169° 30′, latitude 13° N. If the earth were in the position of August 6 the comet would pass through a point whose longitude is 177° and latitude 13°, or to the east of β Leonis, and moving towards α Virginis. Thus these four apparitions are the same comet; and the meteor-shower of April 20, hitherto considered to depend on the comet 1861 I., cannot be considered to agree in period. GEORGE FORBES

Anderson's College, Glasgow, April 2

A Feat of Memory

THE following feat of memory seems to be worthy of record in your pages. It is new to the writer, though by no means uncommon over here.

Like the country itself, many institutions in the United States run to size in a way apt to astonish the dwellers in our "tight little island." So it is with hotels. Thus at some of them many hundreds of persons are simultaneously dining in one room. At the entrance, the hats, &c., of the guests are deposited with a person in attendance to receive them. He does not check or arrange them in any particular order, and he invariably restores them, each to the right owner, as they emerge from the dining-room. The difficulty of the feat naturally depends on the number of hats in charge at the same time. The most remarkable case which has come under the notice of the writer is at the Fifth Avenue Hotel, New York. There the attendant, who is on duty several hours a day, has sometimes as many as five hundred hats in his possession at one time. A majority of them belong to people whom he has never seen before, and there is a constant flux of persons in and out. Yet even a momentary hesitation in selecting the right hat rarely occurs. The performer at the above hotel says that he forms a mental picture of the owner's face inside his hat, and that on looking at any hat the wearer's face is instantly brought before his mind's eye. It would be interesting to test how far this power is possessed by an average unpractised person when put in the right way of doing it. While many of our ordinary recollections are not visual, at least not consciously so, it appears probable that most cases of extraordinary memory consist in an unusual power of making and retaining visualised impressions. Mr. Galton's interesting paper in NATURE (vol. xxi. p. 252) on "Visualised Numerals" goes a long way to show this to be so in mental arithmetic. Systems of artificial memory tend towards the same point; for they may be roughly described as mainly resting on the systematic manufacture of artificial visualisations; and the hat feat just narrated falls within the same category.

In working the rich mine which Mr. Galton's genius has discovered, I hope he will explore the vein of chess without the chess-board. As efforts of memory, such performances are as surprising as the numerical feats of Colburn and Bidder. And they notably differ from them in that the highest development is reached, not by young boys, but by men of mature years, who, as players over the board, have reached the front rank. The writer (in last year's *Chess Player's Chronicle*) attempted to give a rough estimate of the number of moves and positions possible at chess. They are of course practically illimitable; and with this fact in mind it is easy to form an idea of the difficulty of playing *twelve* games blindfold against very strong antagonists. This task, however, is often performed by Messrs. Zukertort and Blackburne, beyond question in England, and probably in the world, the greatest adepts in this branch of chess-play. It would be highly instructive to learn by what process, in so far as it is a conscious and describable one, these feats are achieved. If Mr. Galton takes the matter up, no doubt he will, with his usual skill, throw a flood of light upon the subject.

EDWYN ANTHONY

Riggs's Hotel, Washington, March 29

Meteor

A LARGE and brilliant meteor was seen here at 8.25 p.m. on the 7th inst. It appeared a little below Zeta Tauri, and travelled very slowly southwards in a line nearly parallel to the horizon, traversing a space of about 50°.

The meteor rapidly increased in brilliancy, and is described as many times brighter than Venus, until near the end of its course, when it diminished in size. No trail was seen, although the meteor appeared to smoke.

SYD. EVERSHED

Wonersh, Guildford, April 12

Carnivorous Wasps

A SUMMER or two ago I observed a number of dead flies, blue-bottles, humble-bees, and hive-bees on a certain part of one path in my garden; though the dead insects were removed every day, yet a fresh collection was seen every morning, the cause of death remaining unknown for several days. One morning I was earlier than usual in the garden, and I saw a number of wasps attacking flies and bees in their flight, biting and twisting their wings, and ultimately killing their victims on the ground.

The garden was at the time full of flowers, and the wasps appeared to be waiting in ambush for the flies and bees as they came over a low wall into the garden. Sometimes the wasps would bite the wings entirely off their victims, and they soon after appeared to be sucking the juices of the flies from the joint between the head and thorax.

WORTHINGTON G. SMITH

"Who are the Irish?"

WILL you permit a few words of reply to your notice of "Who are the Irish?"

Grateful to your critic for pointing out some hastily-written sentences, I am surprised he failed to see the real object of the little book. This was to show in a popular rather than a scientific way the folly of that *race hatred*, arising from the assumption that Irish are Celts and English are Saxons.

It was not necessary to cite French authorities on the Celtic question there, though they appear in the forthcoming pamphlet on "Who are the Scotch?" As for my supposed absurd remarks about Basques and Dark Irish, I only quoted the opinions of the learned Prof. Huxley. My simple and honest desire was to promote peace and goodwill between two peoples, more closely related than the factious and contentious care to believe.

JAMES BONWICK, AUTHOR OF "WHO ARE THE IRISH"

Acton, E., March 24

A LEAF FROM THE HISTORY OF SWEDISH NATURAL SCIENCE[1]

III.

IN a yet higher degree than fluor spar, phosphorus attracted attention through its property of being self-luminous in darkness in consequence of a slow combustion. This substance was accidentally discovered, as I have already mentioned, at the close of the sixteenth century, at Hamburg in the course of experiments made by the ruined alchemist, Brand, with a view to produce the philosopher's stone by the dry distillation of urine which had been evaporated to dryness. The raw material was not abundant, the process of manufacture uncertain, and phosphorus, which is now sold at about 7*s*. 6*d*. per kilogram, was worth many times its weight in gold. Soon after the physician Bernard Albinus discovered that the same substance could also be produced from the ashes of certain plants, but its general occurrence in nature (in the bones of animals and in the mineral kingdom) was first pointed out by Scheele and Gahn, who, during Scheele's stay in Stockholm (1768-70), are believed to have simultaneously made this important discovery.[1] It forms the proper starting point of our knowledge of this substance, of such extraordinary importance in the economy of nature, so indispensable in scientific agriculture, in medicine, and in numberless branches of modern industry.

In attempting to discover the cause of cold-shortness in iron, Bergman and the German Meyer believed that they had discovered almost simultaneously that it was caused by the iron being alloyed with a brittle and easily fusible metal, for which Meyer proposed the name *hydrosiderum*. Soon after, however, Meyer himself and Klaproth showed that a metal completely similar was produced by fusing together iron and phosphoric acid—the latter distinguished chemist expressly declaring that the *analytical* proof of this was difficult to carry out. The year after, however, Scheele succeeded in producing phosphorus in a very ingenious way from cold-short iron. We are thus under a great obligation to him for a very important contribution to scientific metallurgy.

As I have already stated, Brandt proved, about 1730, that the regulus of arsenic ought to be considered as a peculiar semi-metal, whose proper "kalk" was arsenious acid. If we except Macquer's discovery of arseniate of potash, our knowledge of this important and dangerous substance made little progress during the following decades, until Scheele in 1775 published in the *Transactions* of the Swedish Academy of Sciences his remarkable, and in this field epoch-making work "On Arsenic and its Acid." Scheele introduced to our knowledge arsenic acid and a number of its salts, and besides discovered that it gave with zinc a gas previously unknown, which contained "combustible air" and arsenic. This gas (arseniuretted hydrogen) is exceedingly poisonous, and experiments with it forty years after its discovery cost the German chemist Gehlen his life. It appears to be this gas which is given off in rooms where the paper-hangings contain arsenic. This work of Scheele's came to be of great theoretic importance by his sharp glance immediately noting that the white arsenic and the new arsenic acid were different degrees of oxidation, or as it was then expressed, different "stadia of dephlogistication" of the same metal. Long before Davy's discovery of potassium and sodium, Berzelius' of calcium and silicium, and Wöhler's of aluminium, Scheele appear to have had a clear insight into the relationship of the earths to metallic oxides.[2]

[1] Translated from a paper by Prof. A. E. Nordenskjöld of Stockholm. Continued from p. 541.

[1] The first account of this discovery is found in a note of two lines in Scheele's paper on fluor spar to this effect: "That the earth in bone and horn is lime saturated with *acidum phosphori* is newly discovered." (*Trans. Acad. Sc.* 1771). The discovery was ascribed by Bergman in his edition of Scheffer's Chemistry, at one place to Scheele, and at another to Gahn. The facts of the case are cleared up in Wilcke's biography of Scheele He had in the spring of 1770 mentioned to Gahn that he had found in burned hartshorn lime combined with a substance unknown to him, on which Gahn examined the "animal earth by means of the blow-pipe, and found it be composed of lime combined with phosphoric acid." Scheele at first doubted Gahn's statement, until in the summer of the same year at Upsala he for the first time made phosphorus from burned bones.

[2] All metallic "kalks," indeed all earths are distinct acids, whose difference depends on different proportions of phlogiston. In a letter to Hjelm Scheele says:—"The discovery of ferric acid is reserved for chemists, not earlier than the coming century, when we labour in the Elysian fields" Ferric acid was discovered in 1840 by Fremy.

Of still greater importance than the discovery of arseniuretted hydrogen was Scheele's discovery of sulphuretted hydrogen. Long before, indeed, it had been observed that when sulphides were decomposed an ill-smelling gas was given off which blackened silver (Boyle, 1663), was combustible, poisonous, and capable of being absorbed by water, to which it communicated its taste and smell (Rouelle and Meyer, 1754-1774), but no further examination of the nature of the gas had been carried out, and it was generally considered to be impure hydrogen. In 1777 Scheele isolated this gas, also a previously quite unknown fluid compound of sulphur and hydrogen, and gave a correct statement of their composition. The formerly neglected ill-smelling gas now became the subject of comprehensive researches by Bergman, Kirwan, Berthollet, &c. Its chemistry was completely cleared up, and it became an *indispensable* assistant in every laboratory and nearly every chemical manufactory.

At various Saxon and Bohemian mines there are found along with tin ore two kinds of minerals, whose weight early attracted the attention of the miners, and which, seeing no metal could be smelted from them, were considered as "wild" ores of tin. We find them described in detail for the first time in the Mineralogies of Wallerius and Cronstedt, and Cronstedt expressly states that they do contain tin as a proper constituent. One of these minerals, which was afterwards called *scheelite*, but at first by Swedish mineralogists *tungsten*, was found about 1770 in small nodules in the Bispberg mines in Dalecarlia, and was in consequence examined by Scheele. He immediately discovered that this mineral, which had been previously examined without success by so many chemists, was a compound of lime with a new metallic acid.

Bergman supposed that the chemist had here not only to do with a new acid, but also with the acid of a new metal, a supposition which was immediately confirmed by the Spanish chemists, the brothers Don Fausto [1] and Don Juan José d'Elhuyar. This metal is now called by different names—wolfram by Swedes and Germans, scheele and tungstène by the English and French. The last name is derived from tungsten, that given by the miners at Bispberg to the mineral from which the acid was first produced—a derivation perhaps difficult enough for a philologist to clear up in case it comes in question to determine the root of the Frenchman's *acid tungstique*.

The paper "On the Constituents of Tungsten" was published in 1781. In 1778 and 1779 Scheele inserted in the *Transactions* of the Academy "Researches on the Blacklead Molybdæna" and "Researches on the Blacklead Plumbago," of which one paper enriched science with a new simple substance, *molybdenum*, and the other taught us the true chemical nature of a mineral long used and unsuccessfully examined by many chemists. Both these researches have been of immense importance for the metallurgy of iron, the former through the splendid reaction (discovered by L. Svanberg and H. Struve in 1848) which phosphoric acid gives with molybdic acid, and which forms an indispensable means for every metallurgist for discovering the least trace of phosphorus in iron, the latter by the discovery that graphite enters as a constituent into various sorts of iron. Some lines on this point in Scheele's paper suggested the investigations of Bergman, Rinman, Monge, Berthollet, Guyton de Morveau, and others on the chemical difference between pig iron, bar iron, and steel, which alone rendered possible the development of the iron industry to the advanced position which it occupies in this era of steam-engines and railways.

Scheele further enriched our knowledge of the mineral acids by his discovery of nitrous acid and his examination of the products of the decomposition of nitric acid. It is said that an observation connected with this subject first led to his intimate acquaintance with Bergman, and his last scientific communication relates to this subject, inasmuch as shortly before his death he informed Wilcke by letter that nitric acid under the action of sunlight gives off combustible gas.

Want of space compels me to pass over many less considerable, but nevertheless often very important communications by Scheele. I have yet, however, to give account of his two greatest and most important labours.

The first of them was published in the *Transactions* of the Swedish Academy of Sciences for 1774, under the modest title, "On Brunsten, or Magnesia, and its Properties." Brunsten (black oxide of manganese) and various allied species of minerals are first mentioned in the fourteenth century by Albertus Magnus under the name of "magnesia," but they had long before that time been employed in the arts. Afterwards we find those minerals often referred to by mineralogists and chemists, and many unsuccessful attempts were made to ascertain their composition.

Soon after his coming to Upsala Scheele undertook, at the suggestion of Bergman, to try his strength on this difficult substance. Scheele showed at first that brunsten contained a peculiar base combined with a substance which had a strong affinity for combustible bodies. The properties of the new base were carefully investigated, also its relations to a large number of reagents. From these researches Scheele drew the conclusion that we had here to do with a metallic oxide—a view which was soon after confirmed by Gahn through direct reduction with charcoal. Chemistry was thus enriched with a new metal, *manganese*, which has long been very extensively used in the arts, among other applications in the manufacture of Bessemer iron. Scheele observed further that a solution of black oxide of manganese in muriatic or nitric acid when sulphuric acid was added gave a scanty white precipitate. It is distinctive of Scheele's chemical researches that he never neglected to investigate the cause of even the most inconsiderable occurrences in the course of the work, and many of his most important discoveries originated just from the attention he bestowed upon circumstances which would probably have escaped the notice of other chemists. The inconsiderable white precipitate led to the knowledge of a new earth, *baryta*, which soon after was found by Gahn in a mineral of very common occurrence, heavy spar. The salts of baryta are now indispensable in every laboratory as the means of discovering and separating sulphuric acid, and extensive branches of industry are grounded on the multitudinous applications which have long ago been found for this earth.

When black oxide of manganese was treated with muriatic acid Scheele observed that the dark brown solution, obtained by cold dissolving, when heated gives off a strongly-smelling gas, which from its colour was afterwards named *chlorine*. This was the third simple substance to whose discovery the examination of black oxide of manganese gave occasion. It is scarcely possible completely to sketch the enormous influence which the discovery of chlorine exerted on the development of inorganic, but perhaps still more of organic chemistry; and on all the branches of human knowledge and human industry which in any way are related to chemical science. As a single instance it may be observed that at that time there was no other method known of bleaching cotton cloth than by exposing it for a length of time to the action of sunlight. Every cotton-spinning or weaving manufactory therefore required extensive meadows for bleaching its wares. But land is dear in England, and on this account the branch of industry in question was about to migrate from that country, where in the middle

[1] Don Fausto afterwards became Minister of State in Spain. The two brothers studied chemistry for a time under Bergman at Upsala, and visited Scheele at Köping. These two distinguished Spaniards' account of this visit is the only information we now possess regarding Scheele's laboratory and home life at Köping.

of the eighteenth century it had begun to develop itself on an enormously great scale, to lands where ground could be obtained at a cheaper rate. In his first research on chlorine Scheele observed its bleaching property, which was carefully investigated by him, only however for theoretical, not for practical purposes. But ten years afterwards the discovery was practically applied by the French chemist Berthollet, who showed that manufacturers possessed in chlorine an invaluable means of giving cloth the desired whiteness by a simple chemical treatment within the manufactory itself. Now for the first time was it possible for the cotton industry to attain the enormous development, the immense social and political importance which the nineteenth century has witnessed. Chloroform and chloral, &c., are obtained by the action of chlorine on organic substances; by the action of chlorine on lime and potash are obtained chlorides and chlorates—all substances of incalculable importance for theoretical and practical chemistry, for medicine and the arts. Thus in the history of the natural sciences one discovery is linked with another, and the new truth which to-day seems devoid of importance to-morrow becomes a lever for advancing the happiness and well-being of the million.

The second of the works in question is separately printed, first in German, with the title, "Carl Wilhelm Scheele's, d. königl. Schwed. Acad. d. wissenschaft. Mitgliedes, chemische Abhandlung von der Luft und dem Feuer. Nebst einem Vorbericht von Torbern Bergman, Chem. und Pharm. Prof. und Ritter, verschied. Societ. Mitglied, Upsala und Leipzig," 1777.[1] In the introduction, dated 13th July, 1777, Bergman says that the work in question had been ready nearly two years, though various circumstances had delayed its printing, and in a letter to Bergman, preserved in the Library at Upsala, Scheele complains bitterly of the publisher Svederus' procrastination. Various of the most important observations recorded in this work had been already made during the examination of the black oxide of manganese (1771-1774). From all this it follows that Scheele's discovery of oxygen, of nitrogen,[2] and of the composition of atmospheric air took place simultaneously with Priestley's, and that both these investigators reached the same goal by widely separated paths. Lavoisier too is often, but incorrectly, named as the discoverer of oxygen. On the other hand, it was *his* genius that laid Priestley's and Scheele's discovery as the foundation for the new and still existing fabric of knowledge. While Scheele and Priestley,[3] who made the fundamental discovery on which the new theory was founded, remained at the old stand-point, this discovery was estimated by Lavoisier at its true value, and it thus became a veritable turning-point in the history of science. But the numerous ingenious experiments by which Scheele proved the propositions advanced by him at the very beginning of his treatise on "Fire and Air," *that the air is composed of two different gases*, still to this day are the corner-stones in the new fabric of science, and most of them are still repeated in every series of lectures on the subjects in question.

Death broke off Scheele's scientific path the same year that the work was printed in which Lavoisier distinctly rejected the phlogiston theory, and three years before the first edition of his "Traité Élémentaire de Chimie, présenté dans un Ordre Nouveau, et d'après les Découvertes Modernes" appeared. If a prolonged activity had been granted him, if he had made acquaintance not only with isolated propositions from the new theory, but with the fully-developed and completed system, would he have adopted the new theory, and with it as a starting-point gone forward to new and splendid victories in the field of research, or would he, like Priestley, have obstinately stood by the old views? To this question no positive answer can of course be given. But the whole direction of Scheele's activity as a man of science tells in favour of the former alternative, and even much in his peculiar theories which, if we except his attempt to include heat among chemical substances, have many points of contact with current ideas. One thing in any case is certain. He has done enough to earn a place in the first rank of the men of science of all times and of all lands, and his name shall always form one of the grandest memories of his native country.

[1] Most of Scheele's works were first printed in the *Transactions* of the Swedish Academy of Sciences, but were immediately after translated into foreign languages. After his death his collected works were published in Latin under the title "Opuscula Physica et Chemica," Lipsiæ, 1788-89. His short papers, in which important discoveries are often stated and *proved* in a few lines, are complete masterpieces, not only in respect of their contents, but also of their form and mode of exposition. "Ses mémoires sont sans modèle comme sans imitateurs!" (Dumas' "Philosophie Chémique," p. 96.)

[2] The Scotch physician Daniel Rutherford has also great credit in connection with the discovery of nitrogen. He showed in 1772 that a species of gas, which could not maintain combustion, remained after the carbonic acid was withdrawn by means of a solution of caustic potash from the air expired by animals. Rutherford however did not carry out any further investigation of the nature of this gas.

[3] Priestley says in his last work, "Mr. Scheele's discovery was certainly independent of mine, though I believe not made quite so early."

THE UNITED STATES WEATHER MAPS, APRIL TO JULY, 1878

THIS week we have the pleasure of presenting our readers, by the courtesy of General Myer, with the International Weather Map for July 1878, showing for that month the mean pressure, temperature, force, and prevailing direction of the wind. This is the fourth consecutive number of the series, which began with April of that year, and may be regarded as completing the record of the great outstanding features of those changes which characterised the weather of the northern hemisphere in its transition from the spring to the summer of 1878.[1] We shall here chiefly consider the departures from the averages deduced from the curves and figures of the Weather Maps, seeing that these well represent the great seasonal movements of the atmosphere, together with those meteorological conditions which rule the changes of weather occurring in the different regions of the globe on which the welfare and prosperity of nations so intimately depend.

The map for April showed very large deviations from the average atmospheric pressure in all quarters of the globe. Pressure was under the average over North America, Greenland, the Atlantic to south of Iceland, the north of Africa, over Europe south of a line drawn from the north of Scotland to the Sea of Azov; over the valley of the Obi and southwards to lat. 40°; over New Zealand and Australia, and northward to the Philippines; and probably also over a large part of the Indian Ocean, including Mauritius and the eastern part of South Africa. Elsewhere pressure was in excess of the average, but most markedly over the north and east of Europe, and the whole of Asia had a pressure above the normal, except the narrow patch already referred to in the extreme west of Siberia and Turkistan.

Of these disturbances in the distribution of the earth's atmosphere, by far the most remarkable was the depression in the heart of the Atlantic, midway between Spain and New York, which amounted nearly to half an inch. Round and in upon this area of low pressure the wind blew in the usual way, bringing warmth to the region lying to eastward and cold weather to regions lying to westward. On proceeding westward pressure rose, till on the coast of the United States it was only about the sixth of an inch below the normal; but proceeding further in a north-westerly direction through the region of the Lakes, the depression gradually again deepened, till near Lake Winnipeg it fell to full a quarter of an inch below the average. The result to the States was an unusual prevalence of southerly winds, a large rainfall for this spring month, and a temperature everywhere high for the season, rising in the N.W. States to 10°·6 above the average.

[1] These Weather Maps have appeared in NATURE as follows:—April, No. 535, May, No. 538, and June, No. 543.

Reverting to the great depression in the Atlantic, we see that it became gradually less and less on proceeding eastward, till at Gibraltar it had risen nearly to the average pressure of April; but from this point through the Mediterranean a secondary depression was formed, which was deepest over the region lying between, and inclusive of, the Adriatic and Black Seas. Over this region temperature was only the average, whereas to northward temperature rose above the average, the highest excess, $5^{\circ}\cdot6$, occurring in the south of Norway, which was just within the anti-cyclone area of high pressure. To the eastward of the area of low pressure in Western Siberia the temperature rose to $4^{\circ}\cdot4$ above the average, but along the slopes of the Ural Mountains to westward it was only the average, or even slightly below it.

In May pressure in the United States rose to about the normal in the north-western prairies, but eastward it was lower. The lowest depression, 0·070 inch, was about Lake Superior, to west of which, winds being in consequence north-westerly, temperature fell to from $3^{\circ}\cdot0$ to $5^{\circ}\cdot2$ below the normal, whilst in the Gulf States, winds being southerly, temperatures ranged from $0^{\circ}\cdot5$ to $2^{\circ}\cdot5$ above the average.

The great barometric depression in mid-Atlantic, which was so pronounced a characteristic of the meteorology of April, moved northwards in May to a position immediately to west of Ireland, and was still fully a third of an inch below the average. Between these barometric depressions in the United States and the Atlantic an area of high pressure wedged its way southwards from Greenland, and another high pressure area forced its way northwards from mid-Atlantic about lat. 30°, these two areas being each about a tenth of an inch above the normal. The influence of this distribution of the pressure was a temperature from $1^{\circ}\cdot0$ to $3^{\circ}\cdot0$ above the normal over the British Isles and Western Europe, a lowering of the temperature $2^{\circ}\cdot5$ below the normal in Iceland, and as regards the New England States, a lowering of the high temperature which had prevailed in April to the average in May.

The low pressure overspread the whole of Europe and the northern slopes of Asia, as far to eastward at least as the Yenisei, except the northern shores of the Mediterranean and a long narrow patch extending from the Black Sea to Riga. A secondary depression was formed in the basin of the Obi and its tributaries, its centre being 0·125 inch below the normal. On the east side of this depression, along the Irtish and Yenisei, temperature rose from $4^{\circ}\cdot5$ to $6^{\circ}\cdot6$ above the average of May, whereas to westward, as at Moscow, it fell to $3^{\circ}\cdot0$ below the mean. Thus these barometric depressions in Western Siberia during April and May were fraught with important consequences to the agricultural interests of a large portion of the Russian Empire, extending from the Vistula to the Yenisei.

The three barometric depressions, viz., those in the United States, in the Atlantic west of Ireland, and in Siberia, were merely centres of increased depression within a wide general depression encircling more than half the globe. From the shores of California eastward through the United States, the North Atlantic, the north of Europe and Asia to the basin of the Yenisei, there stretched a continuous broad region of low pressure; and it may be added that so far as observations show, another line might be drawn marking out also a continuous low pressure area extending from the Yenisei, through Turkistan, Syria, Egypt, Zanzibar, and Natal, to the Cape. At the same time pressure was above the average over India and Eastern Siberia; but the greatest rise of pressure had taken place in Australasia, so that whilst in April pressure was 0·298 inch below the normal in the south-east of New Zealand, in May it was 0·122 inch above it at Wellington, the increase from the one month to the other being thus 0·420 inch.

Some important changes in the great movements of the atmosphere were brought about in June. Pressure increased over the North-Western States and Western prairies, but the greatest depression below the average was now found over the Gulf and Atlantic States, with the inevitable result of a weakening of the southerly winds of June, an increase of north-westerly, and a lowering of the temperature everywhere, except in the Gulf States, the greatest depression of the temperature being $5^{\circ}\cdot6$ at Washington. The area of high pressure in the Atlantic increased a tenth of an inch and moved westward about 15° of longitude, and at the same time extended in area; the high pressure noted in Greenland in May now covered a wider extent and moved eastward, the greatest excess above the mean being 0·170 inch in the east of Iceland. The high pressure that lay between the Black Sea and Riga now extended westward to Switzerland and eastward to the upper reaches of the Yenisei. The temperature changes accompanying these great atmospheric movements were a slight lowering of the temperature below the average over the whole of Central Europe, the south-west of Norway, and the east of Scotland, and the raising of the temperature of the whole of the Russian Empire above the average, the excess in the valley of the Kama being $6^{\circ}\cdot5$, and from the Sea of Azov to the head of the Caspian $6^{\circ}\cdot8$. Pressure at the same time fell to some extent under the average along the Mediterranean and north of Africa round to Cape Verd Islands, a change intimately connected with the lowering of the temperature which set in to the northward over Central Europe.

Pressure continued low over Southern and South-Eastern Africa and in Mauritius, though relatively not so low as in the previous months; and it had again fallen greatly in Victoria, Tasmania, and New Zealand. The deficiency in the latter islands amounted to 0·429 inch, being a relative fall in the mean pressure as compared with May of 0·561 inch.

In India pressure in the west still continued above the average, the excess at Kurrachee being 0·050 inch; but in the east it had gone below the normal at Visagapatam, stood near the average at Port Blair, and at little below it at Manila. As regards this part of the globe, the meteorological position in June was this; except a narrow patch of higher pressure extending from the mouth of the Indus southward over the west of India, and thence south-eastward through Singapore and Batavia to Adelaide, South Australia, pressure would appear to have been under the average from Cape Verd Islands, round by the Mediterranean, Black, Caspian, and Aral Seas, Tashkent, Shanghai, New Zealand, Australia and the Cape.

In July pressure was under the normal in the United States and Greenland, with two centres of greater depression, one in the north of Greenland and the other about the Rocky Mountains south of lat. 40°. The influence of this arrangement of pressure, as regards the United States, was an increased prevalence and strength of southerly winds to east of the Rocky Mountains, accompanied with a temperature from one to three degrees above the average of July, and a rainfall considerably above the average; whereas on the Pacific coast N.W. winds were in excess, and the temperature in Oregon was $2^{\circ}\cdot7$, and at San Diego $1^{\circ}\cdot0$ below the mean.

From the north coast of South America, and thence stretching to north-east as far as the north of Iceland and Christiansund in Norway, lay a broad extensive region of very high pressure, embracing within its northern limits the whole of the British Isles, the north of France, Belgium, Holland, and a thin strip of the south-west of Norway, the centre being in mid-Atlantic about lat. 35° and long. 35°. In the British Islands temperature was above the average, the greatest excess being $2^{\circ}\cdot8$ in the north of England.

Another extensive area of pressure, above the July average, overspread India and extended towards the north-east, round by Barnaul, Irkutsk, Nerchinsk, Pekin, Shanghai, and Port Blair, whereas over the East India Islands, New Zealand, Tasmania, Australia, Mauritius, and the east of Africa, so far as observations supply information, pressure was under the average, and very largely so over the whole of the southern portions of this wide-spread region.

Between the high pressure of the North Atlantic and the relatively high pressure of Southern Asia, there was interposed an extensive tract of low pressure, stretching from Portugal to the Yenisei, and from Egypt to the North Cape, having its centre 0·244 inch below the average near Moscow. To the east of the Ural Mountains temperature rose to 4°·3 above the average; but on the west side of this depression temperature was 5°·0 at Warsaw and 8°·5 at Kem, west of the White Sea, below the average of July.

A striking feature of the distribution of the earth's atmosphere in July 1878, is the enormous breadths over which pressure was below the average, and the comparatively restricted regions over which it stood above the average. An explanation of this seeming anomaly is furnished however by the figures on the map for July, which presents for the first time a monthly mean for the centre of the Pacific Ocean. This mean is from the Sandwich Islands, and shows an excess there above the normal for July, amounting to the large figure of 0·300 inch.

Thus then the meteorology of the globe for July 1878, stands out as a singular phenomenon, characterised by these broad features, viz.:—(1) a greatly reduced pressure over a large portion of the Southern Hemisphere as compared with what usually obtains there in the winter month of July; (2) a much greater diminution of the pressure than usually takes place in the summer month of July over the land of the Northern Hemisphere, over North America, over Central and Eastern Europe, Western and Central Siberia; and (3) a much larger increase of pressure than usually occurs in the Northern Hemisphere over the great oceans in July, the area of unusually high pressure being extended, as regards the Atlantic to the north-east as far as Christiansund, and as regards the Pacific to westward over Central and Southern Asia, as far as the Arabian Sea. It may be worth remarking that this increased pressure over the oceans and diminished pressure over the land of the Northern Hemisphere is in accordance with what might be expected to result from an increased solar radiation; whilst on the other hand the increased pressure over Southern and Central Asia, and diminished pressure in the Southern Hemisphere, is not in direct accordance with this supposition. The point here referred to will however receive an illustration from subsequent numbers of the Weather Maps, by which it is probable that different results as regards the states of the atmosphere will appear, with the varying states of the sun from year to year.

The future maps of this international series will be eagerly scanned in connection with many of the larger questions of atmospheric physics, as well as those directly practical questions of climate with which we have been almost exclusively concerned in this article. It is plain that we need not hope to succeed in dealing with most of the larger problems proposed by meteorology without the help of the data laid before us in so full and convenient a form by the International Weather Maps of General Myer. It is only thus that we can trace to their proximate causes such climatal phenomena as the recurring droughts of India and the cold, sunless summer of the British Islands in 1879, and show their true relations to the great movements of the atmosphere. For this great work the highest praise must be conceded to General Myer, whose genius struck out this cosmopolitan scheme of observation, and whose powers of organisation and determination of will bore down all obstacles which stood in the way of its realisation; and he has the heartiest wishes of all for its more complete extension over British North America, South America, Africa, and among the islands of the Pacific.

WILLIAM SHARPEY M.D., F.R.S.

DR. SHARPEY, whose death we regret to announce took place on Sunday, was born April 1, 1802. He entered on the study of medicine at the University of Edinburgh in 1818. In the autumn of 1822 he came to London, where he spent three months in dissecting, and then proceeded to Paris, and occupied the following winter in the study of clinical medicine and surgery in the hospitals. In 1823 he graduated in Edinburgh, and subsequently was for a short time engaged in the practice of his profession in his native town, Arbroath. Soon afterwards he appears to have changed the plan of his life, and for the purpose of educating himself for the scientific career which he had resolved to adopt, he proceeded to the Continent. After spending several months, which were devoted to general culture, at Rome, Naples, and Florence, he resumed the study of anatomy at Pavia, under Panizza. The following years were spent partly in Edinburgh, partly in Paris, Vienna, Heidelberg, and Berlin. At Berlin he became the pupil and friend of Rudolphi, and by laborious anatomical studies laid the foundation of his future success and eminence. In 1831 he began to lecture in Edinburgh on anatomy, having his friend Prof. Allen Thomson as his associate; and in 1836 was invited by the Council of the University of London, now University College, to accept the Chair of Anatomy and Physiology, which he occupied until 1874.

It was about this time that he was most actively engaged in physiological investigation. His scientific writings, which were not numerous, have the characteristic excellences of accuracy of observation and soundness of judgment. One of his earliest contributions was on ciliary motion, and appeared in 1830. Others formed the subjects of articles in the "Cyclopædia of Anatomy and Physiology," while a still greater number were embodied in the successive editions of the "Elements of Anatomy." Notwithstanding the rapid progress of anatomical and physiological science during the past thirty years, none of Dr. Sharpey's observations have lost their value.

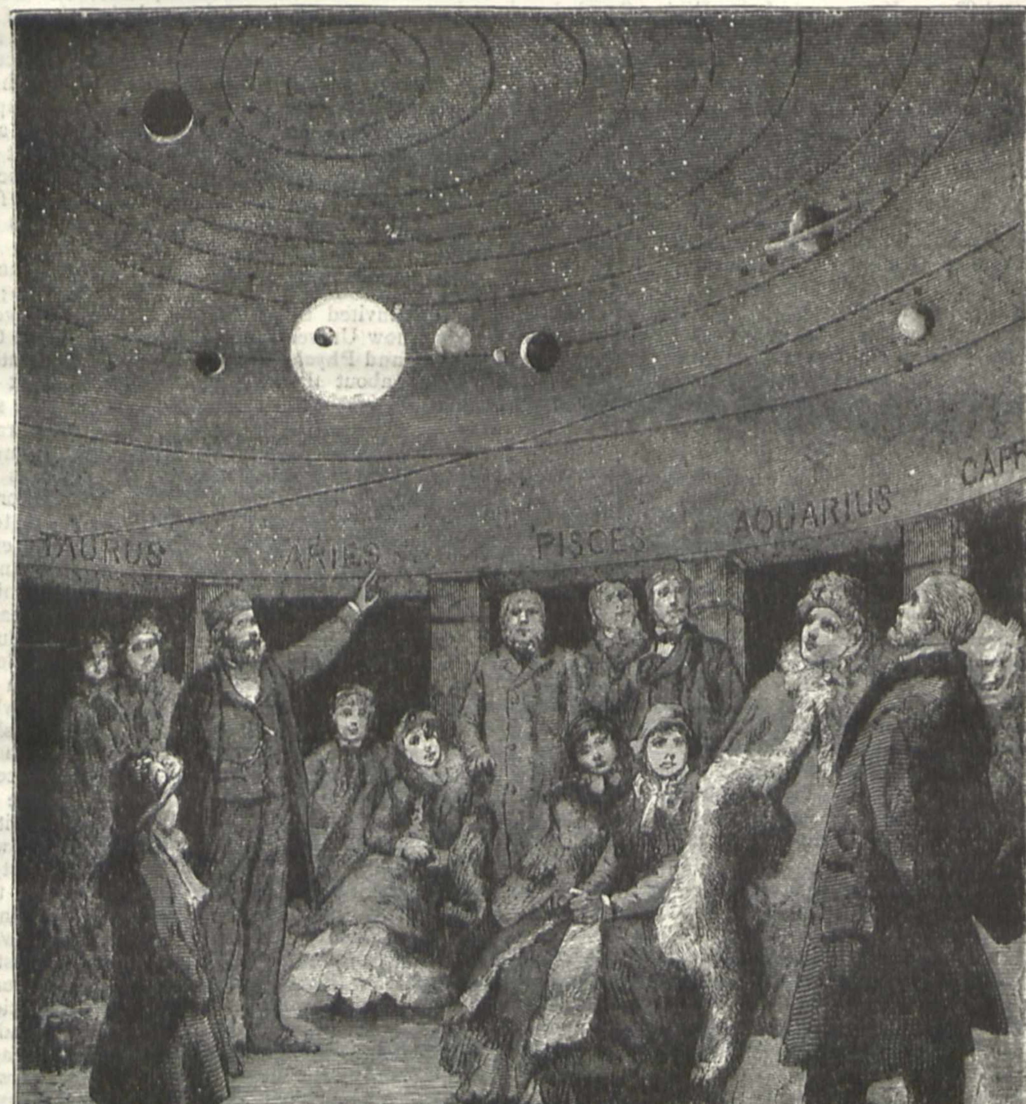
He was appointed Secretary of the Royal Society in 1854, shortly after important changes had taken place in its administration, in the bringing about of which he, with others whose names are not less distinguished, had taken part. The beneficial effect of these changes in extending the Society's influence for the advancement of natural science was due in great measure to the sagacity and energy with which he administered such of its affairs as fell within the scope of his duties—duties for which he was singularly fitted by the extent and variety of his learning, by the wisdom of his counsels, by the wide range of his scientific interests, by the candour and justice which guided him in appreciating other men's work, and by his ready sympathy with every true and honest worker.

Great as Dr. Sharpey's services to science were in his public capacities as Secretary of the Royal Society, as a Member of the Senate of the University, and of the Royal Commission on Science, and in other ways, these were perhaps not the most important. For years he was the greatest teacher of anatomy and physiology in this country, occupying a position side by side with Johannes Müller in Germany. Just as the influence of Johannes Müller's life and teaching is still powerful in that of his pupils, so we may confidently anticipate that Sharpey's work will follow him. Of the fellow-workers in his own field who are at this moment mourning his loss there is perhaps not one who does not directly or indirectly owe him that which has made him what he is; nor should we be far wrong if we were to add that those who are best endowed owe him most.

While the very sounds of our friend's voice are freshly impressed on our ears, it is too soon to do more than attempt to trace the more marked features of his character. The qualities which chiefly distinguished him intellectually were the variety of his knowledge, the accuracy of his memory, which he retained to the last without appreciable impairment, and his sound discrimination in all matters of doubt or controversy. To his friends he was endeared by his habitual consideration for the welfare and interests of others, his unwillingness to think ill even of those of whose conduct he disapproved, and his transparent truthfulness. When it is remembered how large was the circle of his acquaintance and the number of those who, during the thirty-eight years of his professorial life, came under his personal influence, we may well moderate our grief at parting with him by reflecting on the good that must have accrued from the life and labours of one in whom so vigorous an understanding was united with so genial and sympathetic a nature.

SIGNOR PERINI'S PLANETARIUM

IN NATURE, vol. xxi. p. 111, we described the ingenious planetarium recently invented by Signor Perini, and which has cost him seven years' constant labour. To-day we are able to present an illustration of this invention, which may give those of our readers who have not seen the original, some idea of its construction. The visitors are supposed to be standing underneath the dome, from which



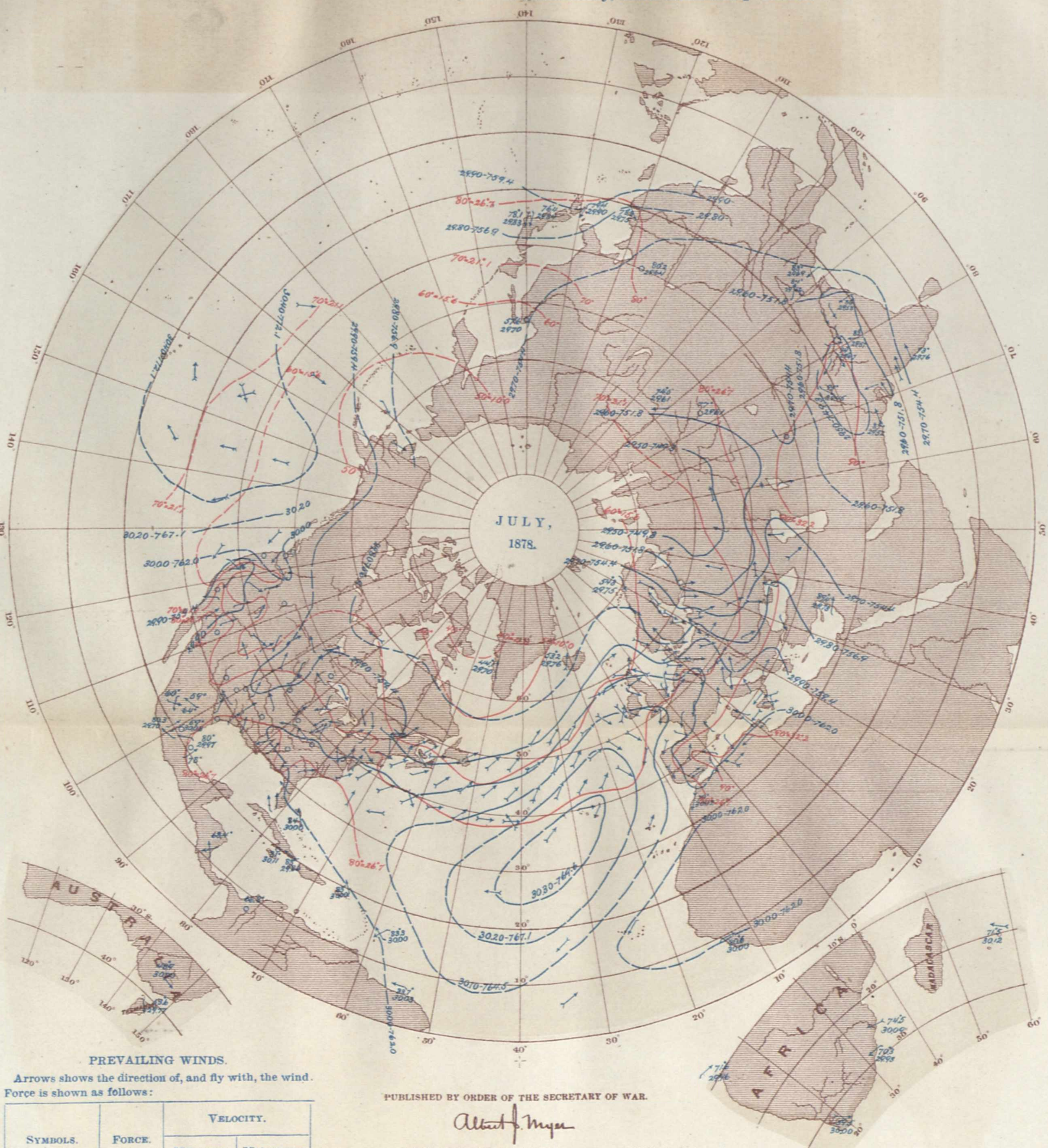
are suspended the sun and planets. Of course it has been necessary for purposes of illustration to greatly exaggerate the proportionate sizes of the planets, but our readers will see that for purposes of instruction Signor Perini's invention must be of the greatest possible utility. For details we must refer the readers to our previous article on the planetarium, which we believe is still standing and may be seen at 77, Newman Street, Oxford Street.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing October, 1877.

No. V.



PREVAILING WINDS.

Arrows shows the direction of, and fly with, the wind.
Force is shown as follows:

SYMBOLS.	FORCE.	VELOCITY. Miles per hour.	VELOCITY. Metres per second.
→	1, 2	0 to 9	0 to 4.0
⟩→	3, 4	9.1 to 22.5	4.1 to 10.1
⟩⟩→	5, 6	22.6 to 40.5	10.1 to 18.1
⟩⟩→	7, 8	40.6 to 67.5	18.1 to 30.2
⟩⟩⟩→	9, 10	67.6 up.	30.2 & over.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

ISOBARS AND ISOTHERMS.

Isobars in *blue*; detached barometer means in English inches.

Isotherms in *red*; detached temperature means in degrees Fahrenheit.

INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of July, 1878, based on the daily charts of the International Bulletin.

DEEP-SEA DREDGING AND LIFE IN THE DEEP SEA[1]

II.

THE surface-water of the ocean is inhabited by an abundant animal fauna peculiar to itself, and termed pelagic. In ubiquity of geographical distribution the animal forms composing this fauna approach very nearly the fauna of the deep-sea bottom. There appears to be a marked relation between the pelagic fauna and the deep-sea fauna. Almost all the deep-sea forms have closely-allied representatives floating or swimming near the ocean surface. The deep-sea sea-anemonies are represented on the surface by floating sea-anemonies. There are surface-worms, hydroids, bryozoa, barnacles, and fish represented by close allies on the deep-sea bottom. Lastly, there are abundance of surface Rhizopoda corresponding with the vast quantities of them below (Fig. 10).

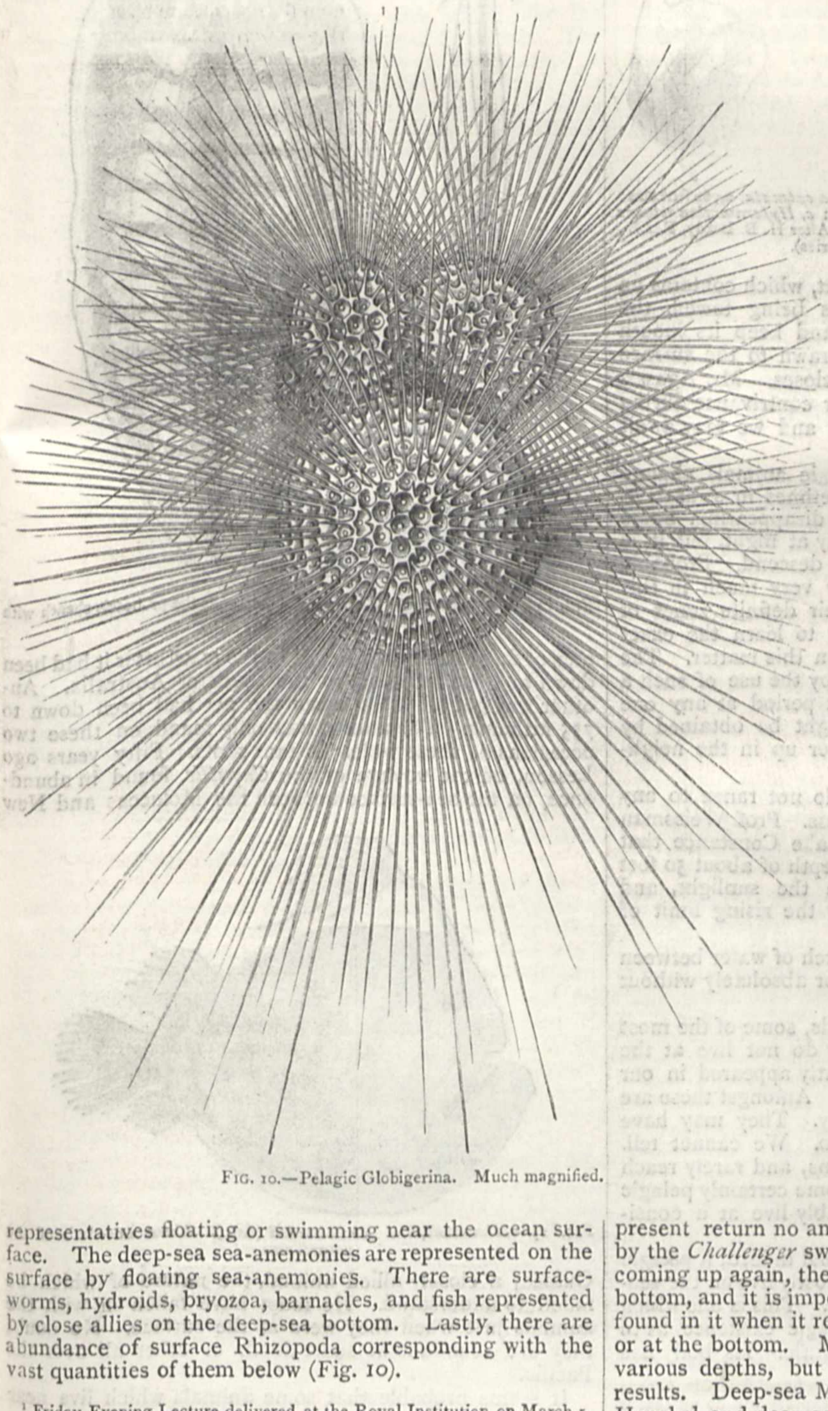


Fig. 10.—Pelagic Globigerina. Much magnified.

[1] Friday Evening Lecture delivered at the Royal Institution on March 5, by H. N. Moseley, F.R.S., Assistant Registrar of the University of London. Continued from p. 547.

Here is one of these surface Rhizopods, a Globigerina which, like most, but not all, of the Globigerinæ occurring at the surface, is covered with delicate calcareous spines projecting from its shell. That the deep-sea bottom is over vast areas covered by a mud composed mainly of Globigerina shells like this one, but without the spines, is well known to all my hearers.

An important question which has been much disputed is, whether the Globigerina mud is entirely derived from the surface, being made up of dead shells fallen from above, or whether the shells composing it live on the bottom. Mr. Henry Brady, after examining all the *Challenger* collections, concludes that the main components of the mud do live on the bottom. Certain species found there do not occur on the surface at all, and Globigerinæ occur on the bottom near our own shores, where none have ever been found on the surface. Further, the shells of the specimens found on the deep-sea bottom are much larger and thicker than any yet found on the surface. Here are some deep-sea Rhizopoda, concerning which there has never been any doubt as to their living on the deep-sea bottom. Dr. Carpenter described many such long ago. The accompanying illustrations (Fig. 11, *a*, *b*, *c*) are from Mr. Brady's figures. These Rhizopods are called arenaceous, because their shells are mostly made up of sand particles and foreign bodies of all kinds glued together. These arenaceous Rhizopods are abundant all over the world, and reach down to the greatest depths. One, shown in the figure (*a*), from 2,760 fathoms, has included sponge spicules in its test. Another one (*b*) is from 2,900 fathoms. It is chambered somewhat like a Globigerina. This other one (*c*) is attached to a heavy body, a sufficient evidence, were any required, that they lived on the bottom.

Supposing that Globigerinæ do live at the bottom as well as at the surface, do they also live at intermediate depths? This opens the most important question which at present remains to be solved with regard to deep-sea life. It applies not only to Globigerinæ, but to all the vast pelagic fauna to which I have referred. Do the jelly-fish, the crustacea, the mollusca, and other animals so abundant in surface waters inhabit also the depths of the mid-ocean, or is there a vast azoic area between the surface and the bottom untenanted by life in any form? To this question we can at present return no answer of any value. The trawls used by the *Challenger* swept, in going down to the bottom and coming up again, the whole stretch of the sea from top to bottom, and it is impossible to tell whether pelagic animals found in it when it reached the surface were caught there or at the bottom. Mr. Murray used the towing-net at various depths, but the same objection applies to the results. Deep-sea Medusæ have been described by Prof. Haeckel and deep-see Siphonophora by Prof. Studer, but both may have come from very small depths.

What is wanted to determine the problem is a net which can be let down to any required depth, securely closed, then be opened and towed for some time, then closed again and brought to the surface. Its contents would then be certainly derived from the depth at which it was towed. I devised, some months ago, a net which will, I believe, answer these requirements. Its mouth, which is fastened on a hinged frame, is kept shut by means of springs, but can be opened by the action of a pair of electromagnets excited by a battery on board

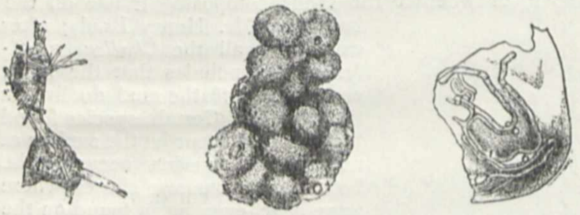


FIG. 11.—Arenaceous Rhizopoda. *a*, *Astrorhiza catenata*, 2,760 fathoms; *b*, *Sorosphæra confusa*, 900 to 2,900 fathoms; *c*, *Hyperammina vagans* attached to a piece of shell, 2,000 fathoms. (After H. B. Brady, F.R.S., *Quart. Journ, Micro. Sci.*, vol. xix., new series).

ship. A rope is used to tow the net, which contains an insulated wire. Whilst the net is being towed, the magnets are maintained in action and keep its mouth open. As soon as the net is to be drawn to the surface the current is stopped, and the net closes. Mr. Agassiz intends to use this net or some better contrivance during this summer on the American coast, and we may await the results with great interest.[1]

It has long been known that pelagic animals change their level constantly, appearing sometimes in swarms at the very surface of the sea, and again disappearing. Some come up in calm weather, others only at night, but it is quite uncertain to what depths they descend. Probably the different pelagic animals vary very much in this respect, and they may each have their definite zones of range. It would be most interesting to learn the exact habits of such animals as Pteropods in this matter. The question could easily be determined by the use of such a net as I have described for a short period at any one locality, and most valuable results might be obtained by any one who cared to take the matter up in the neighbourhood of our own coasts.

Very possibly the pelagic animals do not range to any great depth, 100 or 150 fathoms, or less. Prof. Weissman concludes from his researches at Lake Constance that the surface animals there sink to a depth of about 50 feet in the day-time in order to escape the sunlight, and rise slowly in the evening, following the rising limit of darkness in the water.

It is quite possible that a vast stretch of water between the surface and the bottom is nearly or absolutely without life.

There are a large number of animals, some of the most curious forms, which most probably do not live at the bottom of the sea, but which constantly appeared in our trawl-net when used in great depths. Amongst these are a large number of fish of great rarity. They may have come from 20 fathoms or from 2,000. We cannot tell. Possibly they live at 60 or 100 fathoms, and rarely reach the surface; hence their scarcity. Some certainly pelagic animals, which are very scarce, probably live at a considerable depth from the surface.

Here (Fig. 12) is a very scarce animal indeed, a pelagic Nemertine worm. The Nemertines mostly live on the sea-bottom, and are long and worm-like. This is one which has become so modified to live a pelagic existence as to resemble them in appearance very little. Its body has become transparent like glass, that the animal may become almost invisible to its enemies, whilst the branching intestine, the only part which could not be rendered translucent, has become brown-coloured, as in several other pelagic animals, to imitate floating sea-weed. The proboscis projected from the head shows the animal at once to be a Nemertine. I have called it Pelagonemertes. One specimen of this animal was found in the trawl after it had been down to 1,800 fathoms, to the south of Australia. Another was got off Japan when the net had been down to 755 fathoms. The animal was only found on these two occasions at these widely distant spots. Fifty years ago Lesson, on the voyage of the *Coquille*, found in abundance, on the sea-surface between the Moluccas and New Guinea, a closely allied animal, the nature of which he failed to understand. He must have fallen in with the animals just when they were at the surface. No doubt they are abundant at some depth or other all over the Pacific.

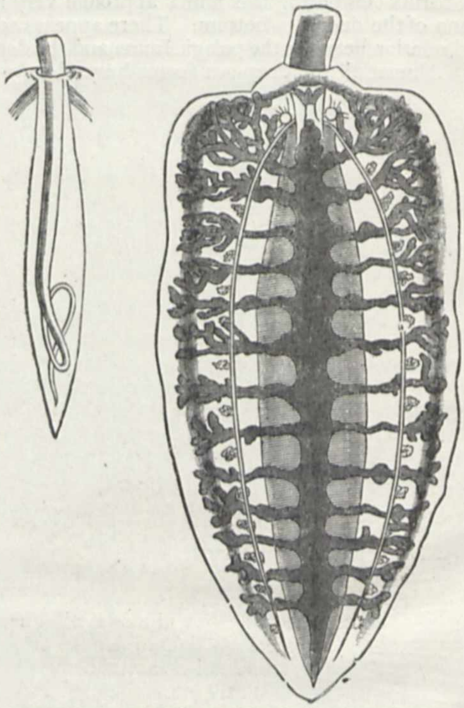


FIG. 12.[1]—*Pelagonemertes Rollestoni.* On the left the proboscis sheath with the proboscis coiled up inside.

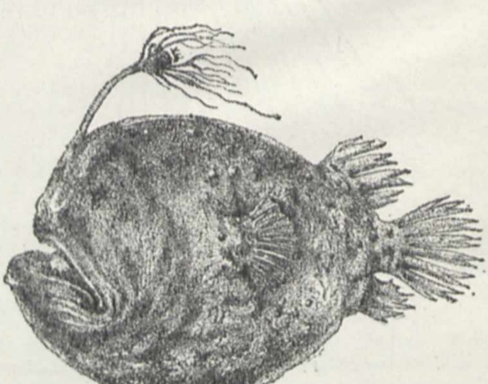


FIG. 13.—*Himantolophus Rheinhardtii* (Ltk.). About one-sixth of the natural size.

It seems probable that some animals which live near

[1] Since this lecture was sent to the printers I have heard from Mr. Agassiz that Capt. Sigsbee has invented a net which he expects will do all that is wanted with complete efficiency.

[1] From "Notes by a Naturalist," p. 573.

the sea surface when young in all the pleasures of warmth and sunlight, sink when fully grown to lead a sluggish life on the cold and dismal bottom. Here (Fig. 13) is a remarkable deep-sea fish. It is nearly allied to the Angler of our aquariums. It was found dead off the Greenland coast, but closely similar fish were obtained by the *Challenger* in great depths down to 2,400 fathoms all over the world. Mr. Agassiz also got plenty of them. The fish has a very near ally which lives on the surface amongst the gulf-weed, from which it builds curious ball-like nests. You see the fish has no ventral fins, and must be, like its surface relative, a very feeble swimmer. It has very small eyes and a huge mouth, and on the top of its head is a lure set on a movable stalk, with which, like the Angler, it attracts its prey within reach of its mouth. The fish is black all over, as are most deep-sea fish, except on the lure. This is composed of numerous tentacle-like branches, which are covered with white spots, probably phosphorescent, when the animal is living. At the bases of the branches are two horn-like appendages which are white, probably also phosphorescent. The fish most likely thus manufactures its own light, whilst its tentacles, spangled with bright spots, swayed to and fro, no doubt lure many a victim to destruction. This fish is sixteen inches in actual length.

Here (Fig. 14) is what Prof. Lütken, from whom these figures are taken,[1] believes to be the young of this curious

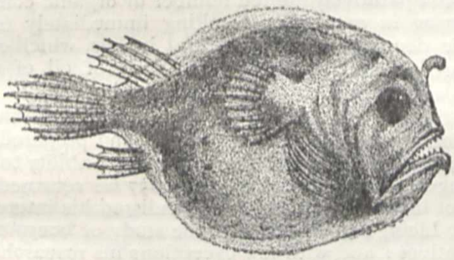


Fig. 14.—Young Himantolophus (Rheinhardtii?) from the stomach of an Albacore.

fish. It was found in the stomach of an Albacore Thynnus, a surface-living predatory fish which was caught in the tropical Atlantic. You see the little fish has, like the adult, no ventral fins. The eye is very much bigger in proportion than in the adult, but that is merely an instance of retention in the young of what has been nearly lost in the adult by disuse. Certain deep-sea blind crustacea similarly have young with fully-developed eyes. The lure on the head is just growing.

If the animal is not the young of the species just shown, which probably extends from Greenland to the tropics in the deep sea, it is certainly that of some closely-allied form. The young of other deep-sea fish have been found in the stomachs of Albacores. The young of most shallow-water bottom-living fish, such as the Angler and the flounder, pass their early existence at the sea-surface. If this deep-sea fish really develops in the early stage at the surface, how do the eggs reach the top of the water? Possibly they rise slowly from the bottom. Perhaps some other deep-sea animals go through their early stages at the surface.

According to Prof. Geikie[2] the deep ocean basins date from the remotest geological antiquity, and Dr. Carpenter in his late lecture here maintained the same conclusion. Whether such be the case or not, any changes which may have taken place converting deep seas into shallow must have occurred very slowly, so that ample time for migration of deep-sea forms to fresh deep seas must have been afforded. Why is it therefore that very many ancient forms do not occur in the deep sea? If the ancient deep sea had been colonised say in the Silurian or Devonian epochs, we should expect to find in its vast area many remnants of the fauna of that age and of subsequent geological epochs; and such was the conclusion of the late Prof. Agassiz, and of many other naturalists. It was expected that all kinds of ancient forms would be brought up by the deep-sea net. Contrary to anticipation, the deep-sea fauna is mainly composed of more or less modern shallow-water genera and their allies. The fish of the deep sea comprise amongst them no Dipnoi, no Ganoids, and no lampreys; they are allies of the cod, the salmon, and the Angler. There are no Trilobites in the deep sea, and no Graptolites, no Bellemnites. All the most ancient forms which now survive occur in shallow water. Lingula, most ancient of all, is abundant in two or three feet of water, and has, I believe, never been found below ten fathoms. Trigonia and Limulus survive in shallow water, and so do Amphioxus and Cestracion. Heliopora, the only living representative of a vast number of palæozoic corals, is a shore form.

It is true that corals which come within Milne-Edwards's definition of the Rugosa occur in deep water, but that group needs great modification, and the structural difference between the deep-sea forms and ordinary Caryophyllias is probably of comparatively little zoological importance.

Though stalked Crinoids occur in deep water, they are

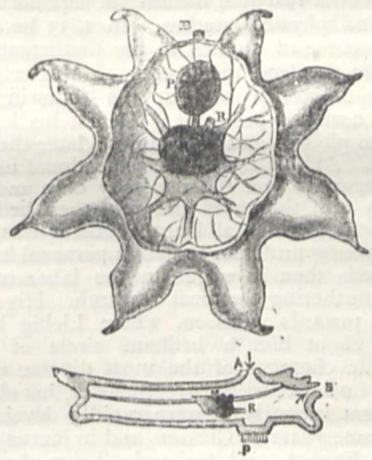


Fig. 15.[1]—Deep-sea Ascidian (*Octacnemus Bythius*). Above.—The animal viewed from below; of one half the natural size. The nucleus is seen in the centre through the transparent base of the animal. P, pedicle of attachment; B, exhalant orifice; R, rectum. Below.—Diagrammatic section through the middle line of the animal's body. A, inhalant orifice; M, muscle attached to nucleus; other letters as in figure above.

also found in a depth of only forty fathoms. There are a certain number of forms in the deep sea which do not occur now in shallow water, and do occur as fossils in the chalk or elsewhere, but they do not form a very high percentage of the total number.

We might have expected to find surviving in the deep-sea missing parts of the branches of the zoological family tree, animals of ancient pedigree which might for example have explained the affinities of the Bryozoa or the Brachiopoda, but scarcely a single animal thus of first-rate zoological importance was obtained in great depths. This is a most extraordinary fact, for in our deep-sea dredgings we have explored for the first time nearly three-quarters of the earth's surface.

The most important new animal, zoologically speaking, obtained from deep water by the *Challenger* Expedition is, as far as I know, this Ascidian (Fig. 15), which I have named Octacnemus. Most of its body is transparent. It has eight radiate arms. Its viscera are gathered together into a small nuclear mass as in Salpa, but the nerve ganglion lies on the mass. The animal is attached to

[1] "Vidensk. Selsk.-Skr." 5te Række, 11te Bd. v, p. 319.
[2] *Loc. cit.* p. 428.

[1] From H. N. Moseley, "Notes by a Naturalist on the *Challenger*," p. 588. (Macmillan and Co., 1879.)

the bottom by a small pedicle here. It is extremely aberrant in structure. It is from 1,070 fathoms.

Most of the interesting forms obtained by us are from comparatively shallow water. As an example may be cited *Syllis ramosa* of Dr. McIntosh, which is from 90 fathoms. It is a worm which branches in a most extraordinary manner, quite unlike any other annelid known. The entire body divides up into a series of complex ramifications. Nevertheless, as shown by Dr. McIntosh,[1] the worm belongs to a well-known shallow-water genus, Syllis. The head or heads of the animal were all broken off the single specimen obtained, and it is uncertain how many it may have had. The animal lives embedded in a sponge, in the canals of which its ramifications are received.

(*To be continued.*)

NICHOLAS ZININ

WE have already briefly alluded to the death of the veteran Russian chemist Prof. Zinin, which occurred at St. Petersburg, February 19. Nicholas Zinin was born August 13, 1812, at Choucha, in the Caucasus district. After completing the course of studies in the Government Gymnasium at Ssaratow, on the Volga, he entered the University of Kasan, where he is recorded as the recipient of two gold medals for superiority in mathematical and physical studies. In 1833 he finished the ordinary course of studies in the mathematical faculty. In 1836 he received the degree of Master of Sciences from the university, and in the following year was appointed assistant professor. At first his lectures were confined to physics and mechanics; later they embraced chemistry. At this epoch the educational authorities of Russia began to feel the necessity of a more intimate familiarity with the rapid progress then being made in chemistry in Occidental Europe, and it was decided to send the young professor to gain a personal knowledge of the methods then in vogue in the laboratories of the West for furthering chemical research. His face turned naturally towards Giessen, where Liebig had already gathered about him a brilliant circle of young and enthusiastic chemists of the most diverse nationalities. A special favourite of the great master, his abilities as an independent investigator were rapidly developed. After passing some years at Giessen, and in journeying through England, France, and Switzerland for the purpose of scientific observation, Zinin returned to Russia to receive the degree of Doctor of Sciences from the University of St. Petersburg. Until 1848 he continued in his professorship. At that date, however, attention had been so strongly drawn to his talents as a lecturer and as an investigator, that he was elected to the chair of chemistry in the Imperial Academy of Medicine at St. Petersburg. This position he continued to occupy until 1874, when he retired from active professiorial duties.

Zinin's first researches, made under Liebig's direction, were devoted to the products of decomposition of the oil of bitter almonds, to a new method of preparing benzilic acid, and to the formation of various compounds in the benzoylic series. They indicated painstaking labour and an unusually thorough insight into the nature of the reactions taking place. In 1842 he published a short research which attracted universal attention in the chemical world. It was entitled "Organic Bases Resulting from the Action of Sulphuretted Hydrogen on Nitro-naphthalene and Nitro-benzene," and described for the first time the formation of bases from nitro-compounds by means of reducing agents. It is chiefly in connection with this discovery that Zinin's name will remain closely associated. The interest excited at the time of its announcement was purely of a scientific character, but after a lapse of fifteen years it assumed a commercial importance of the highest kind, and to-day manufacturing interests involving many millions are based on that simple reaction of reducing nitro-compounds, to which we owe all the wealth of colour derived from aniline and its homologues. In 1844 he followed up the same line of discovery by producing the bases derived from the dinitro derivatives of benzene and naphthalene. By means of the same reaction he obtained also in 1854 the amido acid from nitro-anisic acid. In this connection should be mentioned likewise the interesting production of oxanaphthalide and formonaphthalide from oxalate of naphthylamine under the influence of heat (1858). In 1852 he discovered the formation of diamidodiphenyl by the action of sulphurous acid on azobenzene, a reaction which he found some twelve years afterwards to be induced also by hydrochloric acid. The nitro-derivatives of azobenzene and azoxybenzene were also submitted to a thorough investigation by him (1860). In 1852 he discovered likewise the aromatic thiosinnamines due to the action of mustard oil on aniline, naphthylamine, &c. 1854 witnessed the discovery of the ureides, the important class of compound ureas obtained by exposing urea to the action of acid chlorides or anhydrides. In this manner he prepared the first types of this group: acetureid $CO\begin{matrix}NH_2\\NH . C_2H_3O\end{matrix}$, benzureide, butylureid, and valerureide. In the following year Zinin increased the then comparatively limited number of organic compounds occurring in nature, or resulting immediately from the simple decomposition of natural bodies, which could be prepared artificially, by the synthesis of oil of mustard from allyliodide and potassium sulphocyanide. At the same time he claimed for the allyl group its now accepted position among the alcohol radicals, and prepared a number of allylic ethers in order to prove its ability to replace hydrogen atoms in acids. In 1857 he returned to the field of investigation which had enlisted his interest while under Liebig's guidance, viz., the study of benzoïn and its derivatives; and with few exceptions his researches up to the close of his life were confined to this subject. At this date he succeeded in introducing acid radicals into benzoïn by exposing it to the action of acid chlorides, and prepared in this way acetyl- and benzoyl-benzoïn. In 1860 he was successful in regenerating benzoïn from benzile—the product of its oxidation—by making use of reducing agents. At the same time he prepared a number of derivatives of benzile. Hydrobenzoïn was also obtained by him in 1862, as the result of reducing the oil of bitter almonds. In this connection may be mentioned his elaborate study, in 1868, of Laurent's *benzimide*—the complicated amide resulting from the action of acids on the oil of bitter almonds—in which he showed it to be a combination of the latter with the imide of formobenzylic acid. In 1867 Zinin submitted benzoïn to the action of hydrochloric acid, and obtained a compound, $C_{28}H_{20}O$, named by him *lepidene*. This body was studied exhaustively by him throughout a series of years. While unable to fathom the mysteries of its constitution, he prepared an extensive array of derivatives, oxylepidene, dioxylepidene, oxylepidenic acid, many products of substitution, &c., of nearly all of which two or more isomerides were obtained. So thorough was the study of the relations existing between the members of this series, that they will all fall into naturally-assigned places when once the bond between the lepidene group and bodies of known constitution is fairly established. In 1861, by the reduction of benzoïn, he obtained desoxybenzoïn, $C_{14}H_{12}O_2$, a compound which the reduction of chlorobenzile likewise yielded him a few years later. This body he changed by the action of nitric acid into nitrobenzile; and in 1868, by successive treatment with phosphorus pentachloride and reducing agents or potash, he changed it into stilbene and tolane, thus throwing an interesting light upon the constitution of benzoïn and its derivatives. In 1870 he

[1] Linn. Soc. *Journ. Zoology*, vol. xiv. p. 720, 1879.

obtained from desoxybenzoïn, by united oxidation and treatment with alcoholic potash, a peculiar body, $C_{70}H_{56}O_4$, to which he gave the name of *benzamarone*, and which he decomposed into desoxybenzoïn and *amaric acid*, $C_{46}H_{42}O_6$. This latter he decomposed, in 1877, into benzoic acid and so-called *pyroamaric acid*. Various homologues were obtained by varying the alcohol used as a solvent for the potash, and pyroamaric acid was shown to be a benzyl-ethyl-benzoic acid. One of his later investigations showed the peculiar property possessed by zinc of regenerating hydrocarbons from the solutions of their addition compounds by extracting the halogens from the latter.

The researches published by Zinin during the latter portion of his career, while marked by careful study and minute elaboration, lack much of that originality and generality of application characteristic of his earlier discoveries. As contributions to the development of the use of reducing agents in organic chemistry, they occupy, however, an important place in the annals of the science, while the *ensemble* of reactions and derivatives of the benzoïn group forms one of the important sections of the chemistry of the aromatic series.

Prof. Zinin's merits were warmly appreciated in his own country, and he was the recipient of numerous decorations, some of which were due to the important services rendered by him in the solution of questions connected with the Russian military department. In 1855 he was elected to the Imperial Academy of Sciences at St. Petersburg. He was the only Russian among the corresponding members of the Chemical Section of the French Academy of Sciences, and was likewise one of the few honorary members of the London Chemical Society and of the German Chemical Society. T. H. N.

WILHELM PHILIPP SCHIMPER

PROF. SCHIMPER, to whose death at Strassburg on March 20 we have already alluded, was one of the most prominent scientific men in Alsace. He was born, January 8, 1808, at Dosenheim, near Elsass-Zabern. After taking a course of theological studies at the University of Strassburg, he devoted his attention to natural history. A period of travel was succeeded by his appointment in 1835 as assistant in the Natural History Museum at Strassburg. In 1839 he became director of the establishment, and was elected Professor of Geology and Mineralogy in the University. Before this date he had already attracted attention in the botanical world by his studies on mosses, and he soon became one of the leading authorities on this branch. A monument of his work as a specialist is left in his famous "Bryologia Europæa," which appeared in six volumes with 640 plates, from 1836 to 1855; and was provided with an extensive supplement in 1866. Other well-known important works in this connection are his "Recherches anatomiques et morphologiques sur les Mousses" (1850), "Mémoire pour servir à l'histoire Naturelle des Sphagnum" (1854), and "Synopsis muscorum europæorum" (1860; 2nd edit. 1876). As a palæontologist Schimper has produced—1869-1874—a "Traité de Paléontologie végétale," in three volumes, which ranks among the best text-books on the subject. Much of his attention and time was directed to the rich fossil remains of Alsace itself, and it is to these studies that we owe the valuable monographs, "Plantes fossiles des Vosges," written in 1844 in connection with A. Mougeot; "Palæontologica Alsatica" (1854); and "Le Terrain de transition des Vosges" (1862). The marked talent for botany in the Schimper family is something unusual; Prof. Schimper's two cousins having gained, like himself, honoured places in the annals of the science. Karl Schimper, who taught at Munich and Heidelberg, and died in 1867, was distinguished as the founder of the modern theory on the position of leaves, so ably expanded by the late Prof. Braun; while Wilhelm Schimper has widely increased our knowledge of African flora by his researches in Abyssinia, where he was released from imprisonment by the English expedition in 1868.

NOTES

MM. W. DE FONVIELLE and D. Lontin described to the Paris Academy last week a magnetic gyroscope, the object of which is to give a movement of rotation to movable pieces of soft iron of various forms. M. de Fonvielle is at present in London with the apparatus, from which some very curious results have been obtained. We hope to give a full account of the invention, with illustrations, in our next number.

M. B. BRUNET has presented the sum of 20,000 francs to the French Association for the Advancement of Science, the interest to be distributed annually for the promotion of scientific research.

AMONG recent deaths announced are those of Dr. Joh. Eman. Zellerstedt, the Swedish bryologist; Dr. M. A. F. Prestel, of Emden, the meteorologist; and Dr. Mulder Bosgoed, of Rotterdam, author of a "Bibliotheca ichthyologica et piscatoria."

THE French Academy of Sciences numbers seventy-eight. At present two seats are vacant: one in the section of mechanics and one in that of geography and navigation. The number of foreign associates and corresponding members allowed by the statutes is 108. There are now four vacancies: two in the chemical section, one in the botanical, and one in that of geography and navigation. The classification of this portion of the Academy by nationalities affords an interesting view of the judgment of Parisian scientific men on their *confrères* according to "geographical distribution." France, outside of Paris, heads the list with 30 members; then follow Great Britain, 21; Germany, 17; United States, 8; Russia, 6; Switzerland, 6; Scandinavian countries, 5; Italy, 4; Belgium and Holland, 4; Austria, 2, and Brazil, 1.

IN a letter in yesterday's *Times*, deserving the serious attention of those in authority, Mr. Merrifield strongly advocates the appointment of an independent commission for inquiry into the whole question of the construction of our heavy guns. Mr. Merrifield seeks to show that the system at present in use is accompanied with the most serious disadvantages.

A PROSPECTUS has been issued by the Wilts and Hants Agricultural College, of which we spoke last week. Every arrangement has apparently been made for the improvement and comfort of students.

IN a paper in the *Journal* of the Royal Society of New South Wales, on the Forests of Tasmania, by the Rev. J. E. Tenison-Woods, the author gives some interesting data as to the probable age of the stately trees which people these forests. Judging from their size one would be inclined to attribute to them great antiquity. Mr. Woods was very anxious to collect data on the subject; but to nearly all his inquiries he only received mere guesses: from 200 to 300 years was the general reply. Mr. R. Hill, the proprietor of an extensive saw-mill at Honeywood, on the Huon, gave him, however, some more trustworthy data. Mr. Hill assured Mr. Wood that some of the gum-trees, and perhaps all of them, shed their bark twice in the year. The stringy bark (*E. obliqua*) is one of the most striking instances of this. He further informed Mr. Woods that, hearing a lecture from Mr. Bicheno on the growth of trees, and the statement that a ring of wood was added to the diameter each year of growth, he was induced to test the truth of this. There was a blue gum-tree in his garden in Hobart Town, the age of which he was sure of, as his brother had planted it eighteen years previously. He felled it and counted the rings, and found them to be thirty-six in number, or two for every year. From this, and from shedding the bark as described, and a long series of observations, he concludes that the sap rises twice in the year. He has for many years watched the growth of the trees, and he believes that for the first twenty years the average growth is about one inch in diameter for each year. Out of thousands of trees felled or cut in his mill, he has not found one over seventy-five years old, and a very large proportion of the serviceable timber is composed of trees about fifty years of age. Quite recently he has had a very interesting opportunity of verifying these observations. At Ladies' Bay (between Port Esperance and Southport), a paddock on the farm of Mr. D. Rafton was cleared for the purposes of cultivation. It was exactly sixteen years in 1877-78, since a crop was taken off it, and was quite overgrown with saplings, which were all cut down. Mr. Hill, at Mr. Wood's request, wrote to Mr. Rafton, requesting him to examine the stumps. In his reply he gives the number of rings in the longest saplings as thirty-three; size across the heart-wood where the rings cease one inch. The rings he observed were not an equal distance from each other, some of them being three times the size of the others. From these facts Mr. Woods thinks we may safely adopt Mr. Hill's conclusion that there are two rings of growth for each year, and that the tallest trees of the forest, the giant timber of Tasmania, range from fifty to seventy-five years old.

We take the following item of Yankee ingenuity from *Industry*, commending it to the attention of the Guilds' Technical Institute:—The Bridgeport *News* very cleverly describes an invention, credited to a Bridgeport Yankee, to prevent marketmen from palming off old eggs for fresh ones. The inventor proposes to arrange a rubber stamp in the nest of every hen, with a movable date. This stamp is arranged with a pad that is saturated in indelible ink. When the hen lays an egg, as is well known, she kicks slightly with her hind leg. An electric disk is arranged so that her foot touches it, and the stamp turns over on the ink pad, and then revolves, stamping the date on the egg. The hen then goes off about her business, the farmer's hired girl removes the egg and replaces the stamp, which is then ready for another. On each evening, after the hens have retired to their downy roost with the roosters, the date of the stamp is altered for the next day, and the work goes on. In this way there can be no cheating. You may go to the grocery and ask for fresh eggs, and the grocery man tells you he has some eggs of the vintage of January 29, 1880, for instance. You look at them, and there are the figures, which cannot lie.

The *Illustrated Scientific News* of New York describes and pictures a remarkable meteorite in the collection of Prof. W. E. Hidden, of the New York Academy of Sciences. It was found, July 19, 1879, on a plantation at Lick Creek, Davison Co., N. Carolina. When found it was covered with a thick scaly crust of oxide. It weighs 1·24 kilos., or 43¾ ounces avoirdupois. It is one of the rare class that does not show the Widmanstätten figures or lines indicating the characteristic crystalline structure of meteoric irons. A thorough analysis in duplicate of the specimen is now being made. Mr. Hidden has in his cabinet three other undescribed meteorites from the Southern States, which will be noticed in due time. One of these weighs 14·5 kilos, or 32½ ounces avoirdupois.

Prof. Silvestria, of the Catania Observatory, the *Times* Paris correspondent states, reports the fall on the night of March 29 of a shower of meteoric dust, mingled with rain. Besides the usual characteristics of colour, chemical composition, and the mixture of mineral and organic particles and minute infusoria, there was a considerable proportion of iron, either in a purely metallic state or in metallic particles, coated with oxide. The size varied from a tenth to a hundredth part of a millimetre, and the form was either irregular or spherical, as if it had undergone fusion. This phenomenon, according to the correspondent, was first observed in the Indian Ocean, south of Java, in 1859, and has been corroborated by Prof. Nordenskjöld's Arctic observations.

Mr. Hugh O'Donoghue McCann, of Bedford School, has been elected to an Open Scholarship for Natural Science at Queen's College, Oxford. The scholarship is tenable for five years, and is of the annual value of 90*l*. There were only two candidates.

On Tuesday next, April 20, Mr. Robt. H. Scott will give the first of a course of four lectures at the Royal Institution on Wind and Weather.

The 60th Ergänzungsheft of *Petermann's Mittheilungen* consists of an elaborate monograph on the Sea-Fisheries of the World, by Moritz Lindemann.

The Medical men of New South Wales have decided to form there a branch of the British Medical Association.

We have received a very favourable report of the progress and present condition of the City Industrial Museum of Glasgow.

A terrible cyclone occurred, the *Sydney Morning Herald* states, in New Caledonia and the Society Islands on January 24, resulting, so far as is known, in the loss of fourteen vessels in the vicinity of Noumea and the death of sixteen persons. In Noumea and its suburbs the amount of damage done was incalculable. It was certified by old colonists that there was never so severe a hurricane in those regions, or one which caused so much loss. The plantations up the country were destroyed and trees were uprooted or bereft of their branches. In many parts of the town, especially near the wharf, the eye was arrested in all directions by heaps of ruin. During the storm the harbour was completely invisible, owing to the thick fog caused by the rain and the spray of the waves being dashed about by the force of the wind. All the small boats were wrenched from their anchors and swept on to the piers. At sea the disasters were numerous; no fewer than fourteen vessels either sank or were thrown on some distant coast.

With the aid of an improved lantern for the oxyhydrogen light, invented by Mr. Holman, of the Franklin Institute, Mr. Outerbridge, Jun., lecturing lately to the Institute on "Coins and Coinage," made some interesting experiments, projecting enlarged images of ancient and modern coins on the screen with great sharpness and brilliancy, and showing the cupellation of gold and silver. In this latter a little "cupel" or crucible of calcined bone-ash was held in the focus of the condensing lens by means of a ring of thick copper wire, and its image appeared on the screen much enlarged. The cupel was then heated white-hot with an oxyhydrogen blowpipe. A weighed sample of gold alloy containing base metal was inclosed in an envelope of sheet lead pressed into the form of a bullet; this was dropped into the cupel, and was immediately melted. As the lead became oxidised it was gradually absorbed in the cupel, forming a dark ring at the bottom. A little sheet of light was noticed moving over the surface of the molten metal as the precious metal became exposed; then, at the moment when the lead was completely absorbed, carrying with it all the base metal of the alloy, the purified precious metal became visible as a brilliant globule, reflecting the light like a mirror.

The Leadville *Herald* reports, on the authority of "a gentleman who has, during the past two years, traversed the mountains in the vicinity of Leadville, and penetrated almost every one of their recesses," the fact of the existence of a veritable glacier, presenting all the characteristics of the Swiss glaciers, both in magnitude and motion, within twenty-five miles of that city. When first discovered several years ago, the report affirms, it was nearly a mile in length, and at the bottom of the "gulch" presented a sheer precipice of ice about 150 feet in height. Later in the season it had been considerably reduced both in length and bulk; but earlier in the following year it had regained first dimensions. The rocks on the sides of this immense mass of moving ice are said to show all the characteristic signs of glacier action. The location of this interesting natural curiosity is said to be in the Mosquito Range, about fifteen miles north of the Pass; and, being very inaccessible and out of the ordinary line of travel, the fact of its being discovered at this late day is accounted for.

THE experiment of sending up three connected balloons will be tried in Lille at the end of next May. The balloons are now fitting in the vestibule of the Palais de l'Industrie of the Champ de Mars, Paris; there will at the same time be a descent in a parachute by M. Tavis.

M. YON, one of the administrators of the Paris Captive Balloon, is publishing a pamphlet on the construction of a new directing balloon, devised on the plan worked out by M. Giffard in his great experiment executed at Paris in 1852. The only difference is that the motive screws are two, and placed laterally and attached to the ring. A captive balloon fitted up according to the principles practised so successfully by M. Giffard in Paris and in London is being constructed now at Brussels, in the vicinity of the next national exhibition, which will be opened on June 19 to celebrate the fiftieth anniversary of Belgian independence. The number of exhibitors amounts to 6,000, so that an exceedingly fair specimen will be offered to the world of Belgian resources and industry.

THE additions to the Zoological Society's Gardens during the past week include a Vervet Monkey (*Cercopithecus lalandii*) from West Africa, presented by Mr. L. Samuel; a Garnett's Galago (*Galago garnetti*) from East Africa, a Marsh Ichneumon (*Herpestes paludosus*) from South Africa, presented by Mr. A. Chirnside; an African Civet Cat (*Viverra civetta*) from Africa, presented by Mr. P. Lembery; a Banded Ichneumon (*Herpestes fasciatus*) from West Africa, presented by Mr. A. Ferris; a Common Jay (*Garrulus glandarius*), British, presented by Mrs. A. Dutton; two Graceful Ground Doves (*Geopelia cuneata*) from Australia, deposited; a Black Saki (*Pithecia satanas*) from the Lower Amazons, a Cape Hyrax (*Hyrax capensis*), a Robben Island Snake (*Coronella phocarum*) from South Africa, a Great-billed Rhea (*Rhea macrorhyncha*) from South America, purchased; an Amherst Pheasant (*Thaumalea amherstiæ*) from Szechuen, China, received in exchange.

OUR ASTRONOMICAL COLUMN

THE SOUTHERN COMET.—Dr. Gould, Director of the Observatory at Cordoba, has addressed to Prof. Peters of Kiel an interesting letter with observations of the great southern comet. The tail was seen at Cordoba on January 31. Two evenings later, when Dr. Gould first perceived it, the length was certainly 35°. Careful drawings of its position amongst the stars were made independently by two observers until February 14, after which it had not been distinguishable; it was then not less than 37° in length, but was seen with difficulty, and was scarcely brighter near the head than at its extremity. Even at greatest brilliancy about February 7, its light was nowhere superior to that of the Milky Way in Taurus. Dr. Gould states that from the first no nucleus had been discernible in the telescope, the head always appearing "cloud-like and filmy, and elongated in the direction of the tail, which it did not very much surpass in brilliancy;" indeed "the inordinate length of the tail and the great faintness of both tail and head" were very remarkable features in the appearance of the comet. Observations for position were obtained on six evenings between February 6 and 15, which have enabled Dr. Gould to claim priority in pointing out the probable identity of this comet with the great comet of 1843. Calculating from the observations on February 6, 9, and 12, he deduced the following first approximation to the elements:—

Perihelion passage, January 27·4185 M.T. at Washington.

Longitude of perihelion	280° 26′ 59″
,, ascending node	7 50 28
Inclination	35 5 30
Logarithm of perihelion distance	7·719160

Motion—retrograde.

So that, he remarks, the perihelion distance given by this first rough approximation is such that the comet's centre of gravity would have passed at a distance from the solar surface equal to only one-eighth of the sun's own radius.

Dr. Gould also refers to the discussion which took place in 1843 as to the possible identity of the comet of that year with the one observed in southern latitudes in 1668, and concludes:—"Although Hubbard's discussion shows that the observations of 1843 can be best represented by an ellipse of more than 500 years, and although the intervals of 175 years between 1668 and and 1843, and 37 years from the perihelion of 1843 to the present time, are not commensurable, still this argument against identity does not seem very forcible."

The "*Argus* Summary for Europe," published at Melbourne on February 19, contains three positions of the comet, communicated from the Observatory, which are as follow:—

	Right Ascension. h. m. s.		Declination. ° ′ ″
Feb. 9 at 9 p.m. ...	23 41 14·5	...	− 33 43 52
10 at 9 p.m. ...	23 58 23·0	...	− 33 44 58
14 at 9 p.m. ...	1 2 15·6	...	− 33 21 7

These places are termed approximate, and on comparing with the positions received from Dr. Gould and Mr. Gill's rough ones, it is evident that the declination of February 14 has been misprinted, and should be − 32° 21′ 7″. It is stated that on this date the nucleus had become very faint, and "even with the great telescope the tail could only be seen as a thin wisp extending eastwards from the head for a couple of degrees. The head itself appeared simply as a faint nebulous mass with a slight central condensation." Beyond the fact that the comet had passed the perihelion and was rapidly receding from us, nothing definite appears to have been known of the orbit at Melbourne up to February 19, and it is clear that at the Cape up to February 24 its similarity to that of the comet of 1843 had not been remarked, the elements which we have published from Mr. Finlay being entirely different. So that, as we have remarked, it is probable that Dr. Gould has priority in drawing attention to one of the most striking facts connected with the periodicity of comets.

From the first approximate position determined at Cordoba, and the Melbourne observations of February 9 and 14, Mr. Hind has calculated the following orbit, which still further adds to the probability of the identity of the great comets of 1843 and 1880:—

Perihelion passage, January 27·5272, M.T. at Greenwich.

Longitude of perihelion	278° 3′·7
,, ascending node...	0 5·7
Inclination	36 9·3
Logarithm of perihelion distance	7·81749

Motion—retrograde.

Prof. Winnecke also has found that the elements of 1843 represent, with very trifling differences, Dr. Gould's place of February 4 and Mr. Gill's rough positions of February 10–15, and thinks there can hardly be a doubt that the bodies are identical.

PHYSICAL NOTES

M. PAUL BERT lately described a telè microphone to the Académie des Sciences of Paris. The instrument thus denominated differs only in detail of construction from a form of microphone publicly described eighteen months ago in England. The transmitter of the telemicrophone consists of a tolerably thick disk of ebonised rubber, suitably mounted, to the centre of which one of the carbons is attached; the other carbon is kept lightly in contact with it with a pressure which can be adjusted by magnetic means, a small armature of iron being affixed to it, to which a steel magnet can be approached at will. The receiver is an ordinary Bell telephone. It is claimed that the voice is transmitted with less alteration of timbre than is usual with other telephones, and that there is a remarkable absence of the scraping noises that are almost inseparable from the employment of carbon transmitters.

IF rumour speaks truly, we are to hear shortly of another scientific invention worthy to stand beside the telephone or the phonograph in point of interest. Announcements of a mysterious *telephote* or *diaphote*, the discovery of two rival American inventors, have lately appeared in the paragraph columns of the non-scientific press, the instrument or instruments in question being declared capable of transmitting light as the telephone transmits sound. The rumour to which we allude, however, and of the truth of which we have authoritative information, is based upon the fact that Prof. Graham Bell has deposited in the Smithsonian Institution a sealed package containing the first results obtained with a new and very remarkable instrument first conceived by him during his sojourn in England in 1878.

M. MARCEL DEPREZ has recently described two important instruments to the Physical Society of Paris. The first is a galvanometer adapted for measuring very strong currents of electricity, and consists of a series of soft iron needles placed between the limbs of a steel horseshoe magnet of great directive force. Parallel to the plane of these needles and of the poles of the magnet are wound a few coils of stout wire to carry the current. The needle sets itself almost instantly in the position of equilibrium; hence it is suitable to measure currents which exhibit rapid variations in strength. The second invention of M. Deprez is an apparatus adapted for continuously registering the total amount of energy developed by a current; an industrial problem of great importance. The current is passed through an electrodynameter, being, however, bifurcated; the larger portion traversing the outer coils, the smaller portion traversing a wire of high resistance and then passing through the movable inner coils. The product of these two partial currents is proportional to the energy of the current; and as the mutual action of the two coils is also proportional to the product of the two partial currents, nothing more is needed than an appropriate registering apparatus to integrate the various portions of the total amount of energy. In this manner the amount of energy expended in the production of an electric light under any particular circumstances may be determined.

AT a recent lecture before the Society of Arts Dr. Heaton exhibited a large number of applications of Balmain's luminous paint, a substance based upon the famous "phosphorus" of Canton, and upon the phosphorescent powders investigated by Becquerel. Amongst other interesting matters it was shown that a can of hot water placed upon a shining surface of the paint dims its brilliance, though it recovers on cooling. The application of a lump of ice produces a contrary effect. A tube of "Canton's phosphorus," prepared more than a century ago by Canton himself, was shown still to possess phosphorescent properties.

WITH regard especially to the spectra and composition of nebulæ, M. Fiévez, of the Brussels Royal Observatory, has recently, following the example of Huggins, experimented as to whether an alteration in the luminous intensity of a gas, *without modification in the temperature or the pressure of this gas*, may involve disappearance of one or several lines in the spectrum. The method he adopted was that of projecting, by means of a lens, on the slit of a spectroscope, a real image of the luminous body (part of a Plücker tube), and then altering the intensity of this image, either by reducing the aperture of the projection-lens or by displacing a diaphragm pierced with a circular opening between the lens and the image projected. Hydrogen and nitrogen were the gases. With the former, as the brightness diminished the line H disappeared first, then the line C, the line F remaining last. The lines which disappeared did so by gradually diminishing in length. Nitrogen gave like results, and the following additional experiment was of a confirmatory nature:—If, at a moment when most of the lines are extinguished, the aperture of the slit be increased without changing the position of the screen, the lines that had disappeared return. It seems, then, well established that a gas, though possessing several spectral lines, may be manifested in the spectroscope by presence of a single line, the others remaining invisible by reason of the little brightness of the luminous body. On this ground certain nebulæ showing the lines of nitrogen and hydrogen which longest resist extinction are considered by M. Fiévez (with Dr. Huggins) to contain those gases, and the *relative* invisibility of the other lines (*relative* because they might probably be perceived with more powerful telescopes) is attributed to an absorption in space acting equally on rays of any refrangibility.

SOME experiments by M. Ziloff on the magnetisation of liquids are described in the *Journal de Physique* for March. It appears, *inter alia*, that the magnetic coefficient of the aqueous solution of perchloride of iron is not constant, but that it is a function of the magnetising force. As the latter is increased the magnetic coefficient increases, reaches a maximum for a determinate value of this force, and then diminishes, at first rapidly, and then slowly.

THE action of salts on water-absorption by roots, as studied by Sennebier, Sachs, and Burgerstein, having been left in some doubt, M. Vesque has recently made fresh experiments, and on the following plan:—First, the influence of salt and salt mixtures was tried on the absorption of water by the roots of uninjured plants whose aërial parts were subject to unchanged atmospheric conditions. Then their influence on water absorption by a severed branch, then on that of severed roots. M. Vesque's conclusions from the first series of experiments are as follows:—1. Under ordinary conditions, *i.e.* the plants suffering no lack of mineral nutriment, distilled water is better absorbed than solutions of salts and nutritive liquids. 2. When plants have been exposed a longer or shorter time to the influence of distilled water they absorb better the solutions of salts and nutritive liquids than pure water. 3. Even a short contact of the roots with distilled water acts favourably on the absorption of salts, and conversely a temporary contact of the roots with a salt solution on that of distilled water. 4. The influences are greater the more concentrated the solutions of the salts and the nutritive liquids. 5. There is no qualitative difference between absorption of the solution of an isolated salt and a nutritive liquid. The experiments with severed roots and branches yielded similar results. These also absorbed more distilled water when they had previously been in salt solution, and took up more salt solution when they had stood for more or less time] in distilled water.

AT a recent lecture at the Conservatoire des Arts et Métiers, on the Industrial Applications of Artificial Refrigeration, M. Raoul Pictet produced a veritable sensation by coining a medallion in frozen quicksilver of the weight of fifteen kilogrammes.

GEOLOGICAL NOTES

DEVONIAN ROCKS OF BELGIUM.—We have just received the first descriptive memoir issued by the Geological Survey of Belgium. It is a quarto pamphlet of some seventy pages by Prof. Malaise, containing an account of fossiliferous Devonian and Cretaceous localities. The author has been at work collecting his materials for more than twenty years, and he now publishes a list of 173 places in Belgium from which Devonian fossils have been obtained. These places are arranged stratigraphically, and the names of the fossils found at each are given. As a contribution to the local geology of Belgium the pamphlet will doubtless prove of service. It is evidently a piece of laborious and painstaking work, of the kind that ought to precede the broad generalised summaries which the Survey will eventually be able to present for the information of the world. There is attached to it an index map, on which each of the fossiliferous localities is marked with a coloured spot, to which is attached a symbol indicating its geological horizon. Though the map is not, in the ordinary sense, a geological one, it tells its story clearly, and will be a convenient guide to those who purpose to visit the fossiliferous sites among the Belgian Devonian rocks. Prof. Malaise prefixes to his statistics a short introduction, in which he traces the history of Devonian classification in his own country and gives the subdivisions of the Devonian system which his own labours have led him to adopt. He modifies Prof. Gosselet's arrangement, taking the Couvin shales and limestone with *Calceola* out of the Inferior and placing it in the Middle Devonian group, together with the Givet limestone, but leaving the shales with *Spirifer cultrijugatus* in the Lower. These shales he regards as containing a fauna transitional between that of the Lower and that of the Middle division of the Devonian system. Prof. Gosselet has observed that if the Couvin limestone is bracketed with that of Givet, we must also place there the limestone of Frasne, as was done by Dumont. But M. Malaise replies that Dumont's classification was founded on mere lithological considerations, and that we can now trace palæontological differences among these subdivisions. It is interesting to observe among his fossils from the Upper Devonian] Psammites du Condroz some of the forms which occur in the Barnstaple and Marwood beds of Devonshire, with remains of fishes (*Holoptychius nobilissimus*) of the Upper Old Red Sandstone of Scotland, and of ferns (*Palæopteris Hibernica*) identical with those of Kiltorcan in Ireland.

Geology and Physical Geography of the Aralo-Caspian Basin.—The veteran geologist Count von Helmersen last year presented to the Imperial Academy of Sciences of St. Petersburg an interesting communication relative to the geological changes which have taken place within tertiary and recent times in the remarkable depression in South-Eastern and Asiatic Russia. Considerable activity has for some years past prevailed among Russian officials in regard to railway communication with the new acquisitions in that part of the empire. In June, 1877, the Grand Duke Nicholas placed himself at the head of an expedition which started from Orenburg with the view of exploring the shortest railroad route to Tashkend—the chief point in the central area of Russia in Asia. During the progress of this expedition a sketch-geological map was constructed and a collection of specimens was made which, carefully labelled and accompanied with notes, were sent to Count von Helmersen, whose life-long acquaintance with Russian geology enables him to make the data thus supplied tell a connected and interesting story. He points out that a much larger area of Southern Russia and adjoining lands was covered by the sea in Jurassic than in Cretaceous times; that the expanse of salt water was further diminished in the Eocene and Miocene, and still more in the Pliocene and Post-pliocene periods, and that it is visibly decreasing now in the remnants of it left in the Aralo-Caspian basin. That this should not be regarded as a mere local phenomenon he thinks to be made clear by well-known facts in Northern Russia and the surrounding regions. In Siberia, for instance, the shells of molluscs still living in the Arctic Sea are found southwards to a distance of 700 versts (nearly 500 English miles) from the northern coast, and all round the Baltic recent marine shells are found up to heights of sometimes 600 feet above the present sea-level. Whether this retreat of the sea is to be explained by a general subsidence of the ocean or an elevation of the land, or by both causes combined is, he believes, a question which still awaits solution for the whole northern hemisphere, though it has been studied by so many observers from the times of Linnæus and Celsius down to our own. After the floor of the Miocene sea had been in large measure raised into land, the United Aralo-Caspian Sea must have been connected with the Black Sea, and must have had the form of a large arc, of which the vertex passed through the country of the Turcomans and Khiva, and of which the eastern limb stretched northwards beyond the present Aral Sea. It has been commonly supposed that during some part of the later Tertiary or Post-Tertiary periods a connection existed between this united Aralo-Caspian Sea and the Arctic Ocean. But the Count holds that for this belief there is no proper foundation. At the eastern base of the Ural Mountains, he asserts, there are in the superficial deposits no vestiges of any living species of marine shells. The mollusca cited by Pallas and others from the plains of Western Siberia are all referable to freshwater species. With regard to the probable cause of the subsidence of the level of the Caspian, Count von Helmersen believes that it is to be sought in the gradual sinking of the ground. In the deeper southern half of the Caspian, notably about Derbend and Baku such a sinking is actually proved. Not there only, but over the area of the sea itself, as far as the island Tscheleken, on the eastern shore, an enormous quantity of carburetted hydrogen escapes from the ground, and has perhaps been doing so for thousands of years. The area over which this takes place loses in substance, the ground gets looser, and is unable to withstand the great pressure of the water of a deep sea and of the superincumbent rocks. It is consequently pressed together, and sudden infalls sometimes occur. The wide extent of the area which supplies the gas and naphtha emanations of the Caspian may be understood from the statement that even as far north as Astrakhan carburetted hydrogen gas instead of water has come up in Artesian borings. But besides this subterranean cause of diminution the Count is of opinion that the facts indicate an absolute decrease in the waters of Central Asia. Though the dwindling down of the Miocene and Post-miocene seas gives no certain proof of such a decrease, yet the desiccation of the rivers of the Steppes and the drying up of the lakes point to a change of this nature. The author instances the rivers Sarafscham, Emba, and Irgis, and all the streams descending from the north towards the Lake Balkash. This lake is fed only from the mountainous country lying to the south. Everywhere all over the vast Steppes and across into Persia and Afghanistan ancient wide lakes are now represented by greatly diminished sheets of water, which the rivers in many cases are unable to reach, as their currents are gradually lost in the wastes. An interesting practical question is connected with these discussions. Is it possible to form a continuous water-way from St. Petersburg, by the Volga, Caspian, and Oxus, to Khiva or the borders of Bokhara? Could the ancient channel of the Usboi again be filled with water so as to afford a route from the Caspian eastward? This matter is being investigated by an expedition sent out for the purpose. Count von Helmersen, however, believes that the desiccation of the Usboi is only part of the vast continental diminution of rainfall and water-supply, and that the artificial restoration of that channel is impossible. Still it is difficult sometimes to define what is impossible to modern engineering skill.

GEOGRAPHICAL NOTES

As an example worthy of being followed by our own and other geographical societies, we call attention to the "Memorie della Società Geografica Italiana," vol. ii., parte prima (Rome, 1880), which is the first part of a volume intended to be dedicated entirely to the zoological results of the Italian expedition to equatorial Africa, under the command of the Marquis Antinori, whose portrait serves for frontispiece. It is prefaced by a communication from the Secretary of the Society (Sig. G. della Vedova), giving an itinerary of the expedition, and in connection with this there is a very excellent map showing the route. As is well known, the expedition principally explored the kingdom of Schoa, immediately south of Abyssinia—a district of which we have heard a good deal lately in connection with Egyptian politics, and of which we shall no doubt hear a good deal more. We have here an enumeration of the lepidopterous insects of the expedition, drawn up by M. Charles Oberthür, of Rennes, illustrated by a folded plate, apparently carefully executed after the manner of lepidopterists, on which eight presumably new species are represented. The list of known species shows but little of the palæarctic element; this has already become dissipated, and we enter upon African ground as such; but the species captured were conspicuous, and include several of extremely wide distribution. A note explains that this part is not absolutely original, and that it also appears in the "Annali del Museo Civico di Storia Naturale di Genova," vol. xv., and the introduction indicates that the whole of this zoological volume will receive attention from the naturalists on the staff of, or in connection with, the now renowned Genoa Museum.

At the meeting of the Geographical Society on Monday evening the Rev. Chauncy Maples, of the Universities' Mission, read a paper on Masasi and the Rovuma district of East Africa. Masasi appears to be the name of a district rather than of a town, lying in about 11° S. lat. and 38° E. long., and some 120 miles south-west from Lindi on the coast; it consists of four mountains lying east and west, and rising out of a dense forest. The station of the Universities' Mission, which was formed in 1876, is situated at the western extremity of the region, and to their west again a vast forest stretches away towards Lake Nyassa. In describing the nature of the route to Masasi, Mr. Maples took occasion to remark that if a road should ever be constructed to connect Lindi with Lake Nyassa, it would have to pass along the valley of the Ukeredi, which presents no engineering difficulties. A noteworthy feature of the Masasi district is its great fertility; the cassava attains an enormous size, and the rice, &c., grown are famous for miles round. The water is strongly charged with iron, and salt is obtained in large quantities from the moist ground under the hills. Ironstone is common, and extensively worked. The missionaries have introduced several kinds of fruit, and intend to try wheat. Mr. Maples afterwards described a journey which he made in November, 1877, to the valley of the Rovuma River and the Makonde country. Throughout his paper he furnished many interesting particulars respecting the tribes inhabiting the country between the coast and Lake Nyassa.

The Naples correspondent of the *Daily News* states that a plan has been proposed for an Italian Antarctic expedition, to leave Genoa not later than May, 1881, touch at Monte Video, Terra del Fuego, Falkland Islands, and the South Shetland Islands, remain in the Antarctic region two winters for the purpose of scientific investigation and exploration, making use of the period during which the ice is firm for sledge excursions, and return, touching at Hobart Town or Capetown, to Naples. It is calculated that the sum required will not exceed 600,000 lire. The number of persons on board not to be more than forty, part of them being selected from the Italian Royal Navy, part from the Italian whale-fishers who frequent the Southern Seas.

It is announced that two French explorers, MM. Wallon and Guillaume, have been assassinated while ascending the River Tengung, in Northern Sumatra.

The American Society of Civil Engineers have issued, in pamphlet form, speeches delivered before it in discussing Mr. A. G. Manocal's paper on interoceanic canal projects.

SCIENTIFIC SERIALS

Bulletin de l'Académie Royale des Sciences de Belgique, No. 2, 1880.—On the discovery by Prof. Scacchi, of Naples, of a new simple substance in the lava of Vesuvius, by M. Stas.—A word on some cetaceans which perished on the coasts of the Mediterranean and the west of France during 1878 and 1879, by M. van Beneden.—Researches on the relative intensity of the spectral lines of hydrogen and nitrogen in relation to the constitution of nebulæ, by M. Fievez.—Note on certain covariants of binary algebraic forms, by M. le Paige.

Journal de Physique, March.—Phenomena called hydro-electric and hydromagnetic; fundamental theorems and their experimental demonstration, by Prof. Bjerknes.—Specific heats and fusion points of various refractory metals, by M. Violle.—Magnetisation of liquids (second part) by M. Ziloff.—Areometer giving the density of solid substances, by M. Buignet.—Application of the telephone to electric and galvanic measurements, by Herr Wietlisbach.

Rivista Scientifico industriale, No. 3.—Influence of surface-impurity on areometric measurements, by Prof. Marangoni.—On the nature of the electric current; considerations and experiments, by Prof. Magna.

No. 4.—On two new species of parasite crustaceans, by Prof. Richiardi.—Fossiliferous caverns discovered at Cucigliana, and fossil remains belonging to the genera Hyæna and Felis, by S. Acconci.—Aspirators and compressors, by Prof. Marangoni.—New system of electric illumination, by S. Milani.—Ammonites and belemnites found in the neighbourhood of Narni, by S. Terrenzi.

Atti della R. Accademia dei Lincei, February.—The Fierasfer; studies on the systematic anatomy and biology of the Mediterranean species of that genus, by Dr. Emery.—Comparative researches on the structure of the nervous centres of vertebrata, by Dr. Bellonci.—The living mollusca of Piedmont, by S. Lessona.—On the action of cold and heat on the human blood-vessels, by Dr. de Paoli.—On the first phenomena of development of Salpa, by S. Todaro.—Geological notes on the environs of Civita Vecchia, by S. Meli.—On the vibrations of isotropous elastic bodies (prize memoir), by Prof. Cerruti.

SOCIETIES AND ACADEMIES

London

Mathematical Society, April 8.—C. W. Merrifield, F.R.S., president, in the chair.—Mr. J. Barnard was elected a Member, and Mr. T. Olver Harding admitted into the Society.—The following papers were read:—A (presumed) new form of the equations determining the foci and directrices of a conic whose equation in Cartesian co-ordinates is given, by Prof. Wolstenholme.—The application of elliptic co-ordinates and Lagrange's equations of motion to Euler's problem of two centres of force, by Prof. Greenhill.—Theorems in the calculus of operations, by Mr. J. J. Walker.—On the equilibrium of cords and beams in certain cases, by Mr. W. J. Curran Sharp.—On steady motion and vortex motion in an incompressible viscous fluid, by Mr. T. Craig.—On functions analogous to Laplace's functions, by Mr. E. J. Routh, F.R.S.

Zoological Society, April 6.—Prof. W. H. Flower, F.R.S., president, in the chair.—The Secretary read some extracts from letters which he had received from Mr. W. A. Conklin, of New York, relating to the birth of an elephant which had lately taken place in a travelling menagerie at Philadelphia.—Prof. T. H. Huxley, F.R.S., read a paper on the distinctive characters of the species of the genus *Canis*, as shown in certain points of the structure of their skulls and in the proportions of their teeth.—Dr. Francis Day read a paper on the fishes of Afghanistan, based principally upon a collection which had been made for him in the highlands of Kelat and Quettah, by Dr. Duke.—A communication was read from Prof. Julius von Haast, F.R.S., containing a description of a specimen of a rare Ziphioid Whale (*Epiodon novæ-zealandiæ*), which had been cast ashore at New Brighton, New Zealand, in July, 1878.

Geological Society, March 24.—Robert Etheridge, F.R.S., president, in the chair.—H. T. Burls, Paramaribo, Dutch Guiana; John Allen McDonald, and Rev. Thomas Edward Woodhouse, B.A., were elected Fellows of the Society.—The following communication was read:—The newer Pliocene Period in England.—Part I. Comprising the Red and Fluvio-marine Crag and Glacial Formations, by Searles V. Wood, jun., F.G.S. The author divided this part of his subject into five stages, commencing with—Stage I. The Red Crag and its partially fluvio-marine equivalent. The Red Crag he regards as having been a formation of banks and foreshores mostly accumulated between tide-marks, as shown by the character of its bedding. The southern or Walton extremity of this formation, which contains a molluscan fauna more nearly allied to that of the Coralline Crag than does the rest of it, became (as did also the rest of the Red Crag south of Chillesford and Butley) converted into land during the progress of the formation; while at its northern or Butley extremity the sea encroached, and an estuary extending into East Norfolk was also formed, during which geographical changes a change took place in the molluscan fauna, so that the latest part of the Red Crag proper and the earliest part of the fluvio-marine (both containing the northern species of mollusca and those peculiar forms only which occur in older glacial beds) alike pass up without break into the Chillesford sand and laminated clay which form the uppermost member of the formation. He also regards the principal river of this estuary as flowing into it from North Britain, through the shallow preglacial valley of chalk, in which stands the town of Cromer, and in which the earlier beds of Stage II. accumulated in greatest thickness. The forest and freshwater beds, which in this valley underlie the beds of Stage II., he regards as terrestrial equivalents of the Red Crag; and having observed rolled chalk interstratified with the base of the Chillesford clay in Easton-Bavent cliff, he considers this to show that so early as the commencement of this clay some tributary of the Crag river was entered by a glacier in the Chalk country, from which river-ice could raft away this material into the estuary. He also regards the copious mica which this clay contains as evidence of ice-degradation in Scotland having contributed to the mud of this river. In Stage II. he traced the conversion of some of this laminated clay, occupying sheet 49 and the north-east of sheet 50 of the Ordnance map, into land, the accumulation against the shore of this land of thick shingle-beaches at Halesworth and Henham, and the outspread of this in the form of seams and beds of shingle in a sand originally (from its yielding shells in that region) called by him the Bure-valley bed, and which Prof. Prestwich recognised under the term "Westleton Shingle." As the valley of the Crag river subsided northwards as the conversion of this part of the Chillesford clay into land occurred, there was let in from the direction of the Baltic the shell *Tellina balthica*, which is not present in the beds of Stage I. The formation thus beginning he traced southwards nearly to the limit in that direction of the Chillesford clay about Chillesford and Aldboro'. The Cromer Till he regards as the modification of this formation by the advance of the Crag glaciers into the sea or estuary where it was accumulated, such advance having been due partly to this northerly subsidence, but mainly to the increase of cold. Then, after describing a persistent unconformity between this Till and the Contorted Drift, from the eastern extremity of the Cromer cliff (but which does not appear in the western) to its furthest southern limit, he showed how the great submergence set in with this drift, increasing much southwards, but still more westward towards Wales. The effect of this was to submerge the area of Red Crag converted into land during Stage I., so that the Contorted Drift lies upon it fifty feet thick, and to cause the retreat of the ice which had given rise to the Till to the slopes of the Chalk Wold; whence masses of reconstructed chalk were brought by bergs that broke off from it and were imbedded by their grounding in this drift, contorting it (and in those parts only) by the process. He then traced, in the form of gravels at great elevations, the evidences of this submergence southwards and westwards, showing it to have increased greatly in both directions, but mostly in the western; and he connects these gravels with the Contorted Drift by the additional evidence of one of these marl masses, in which he found a pit excavated near the foot of Danbury Hill, in the London-clay country of South Essex, and which hill is covered from base to top by this gravel. The gravel which thus covers Danbury Hill, of which the summit has an elevation of 367 feet, rises in North Kent to upwards of 500 feet; to between 400 and 500 feet on the Neocomian within the Weald; to 600 feet in North Hants (where it overlooks the Weald), and also in Wilts, Berks, and the adjoining parts of Bucks; to 420 feet in South Hants; to 540 feet in Oxfordshire; to 400 feet in Cornwall; to upwards of 700 (and perhaps 1,000 and more) in the Cotteswolds; to 1,200 feet in Lancashire, and to 1,340 feet in North Wales. Eastwards, through Kent towards France, their elevation falls, and in the North of France appears to be about 130 feet; from whence the evidences of the submergence are furnished northwards by the Campinian sands and the diluvium of North Germany and Holland. In Stage III. the author traced the rise from this depression, the increase of the ice from the greater snow interception, caused by it on the Penine chain, and the consequent advance of the glacier- or land-ice. This advance gave rise to the chalky Clay, which was the morainic mud-bank which preceded this glacier, and was pushed by it as it advanced and the land rose, partly into the shallow sea (where it covered and protected for a time the gravel which was synchronously forming there), and partly on to the land; and by the aid of maps he showed the islands that were overwhelmed by it. He then showed, by a line on a map, the limit up to which this ice, as it thickened, cut through and destroyed this first deposited moraine and the gravel which it had covered, as well as such beds of Stage II. as were formed there, all this material being pushed on to add to later deposited moraine. Outside this line the gravel for the most part remains undestroyed, its contents, particularly in the uppermost layers, showing that it was fed by the approaching moraine. By the level at which the junction of this gravel with the moraine clay occurs he traces the position of the sea-line at this time (towards the end of the formation), and finds it to rise along the south-eastern edge of the clay, from 40 feet in North-East Suffolk to 160 feet in South Essex, and from that along the south-western edge to upwards of 350 feet in North Warwickshire and the parts of Northamptonshire adjoining, all this agreeing with the original increment of submergence in Stage II. He then showed, from evidence afforded by the Yare and Gipping valleys, that this ice, ceasing to advance in East Anglia, shrank into the valleys of that district, exposing the moraine it had previously laid down to the growth of vegetation, and issued only through these valleys to the sea. The Hoxne palæolithic brickearth he regards as the deposit of a lagoon produced from the interception of the drainage of this surface by the glacier-tongue thus passing through the Waveney valley. The Brandon palæolithic brickearth he regards as connected with the same state of things. In Stage IV. he described the plateau and cannon-shot gravels of Norfolk as resulting from the washing-out of the morainic clay by the melting of this ice, which, though shrunken into the valleys of the East of Norfolk, still lay high and in mass in West Norfolk; and showed that, by having regard to the different inclination of the land thus traced, the position of this gravel is reconcilable in no other way. The cannon-shot part of it he attributed to the torrents pouring from this high-lying ice over the west side of the Wensum valley; and the plateau gravels to the deposition of other parts of the same spoil carried into East Norfolk at the commencement of the process and while the ice had not thawed out of the valleys, this gravel afterwards, as the valley-ice thawed, being deposited in them. He also traced the excavation of the trough occupied by the Bain and Steeping rivers in Lincolnshire to the same cause. The finer or sandy part of this material has an extensive spread in South-West Norfolk, forming thick beds; and in a thinner form spreads over North-West Suffolk, where it wraps the denuded edges of the Hoxne and Brandon palæolithic brickearths. In Stage V. he traced the line of gravels that overlie the Chalky Clay where this clay entered the sea. This entry to the sea over the Severn drainage system took place by way of the watershed between the Welland and Avon, and by the valley of the latter. Its entry into the sea over the Thames system was by way of the watershed between this system and that of the great Ouse in South Bucks, as well as by the valley of the Colne, Lea, and Roding, and over the lower part of the watershed in South-East Essex. Its entry into the North Sea was by the valleys of the Blackwater, Gipping, and other Essex and Suffolk valleys, the entry by the Yare and Waveney being far out beyond the present coast-line. He also traced, by similar evidence, the extent to which the sea entered the Trent system after the ice vacated it. This line of gravel (after allowing for the case that the level of the junction of the gravel beneath the clay represents that of the sea-bottom, while that over the clay more nearly represents that of the sea-top), he showed to correspond with that of the junction of the gravel beneath the clay so far as this is not destroyed in the parts where the ice did not shrink into the valleys; and it also agrees with this line, supplemented by the amount of rise in the interval where the ice did so shrink. Along the south-western edge of the clay this line of gravel, subsequent to the clay, falls from near 400 feet in Bucks to 150 feet in South Essex; from whence northwards along the south-eastern edge, it falls uniformly to Ordnance datum in central East Suffolk, and probably continued to fall to 100 feet or so below this at the extreme point where the ice from the Yare valley entered the North Sea far beyond the present coast. Along the north-western edge of the formation this line falls northwards in a corresponding way to that on the south-eastern edge, save that, starting there from near 350 feet, it does not fall below, if even quite down to Ordnance datum near the Wash. He then traced the extent to which the sea on the west, deepening in that direction in accordance with the original depression of Stage II., entered the valleys of the area covered by the ice of the Chalky Clay as this vacated it; the carrying out through the Welland and Avon valleys of the red and white chalk spoil of the Bain-Steeping trough, and its deposition in the Cotteswold gravel up to a high level, coming from the Avon system over the Gloucestershire water-parting into the valley of the Evenlode, a part of the Thames system. All river-gravels north of the point where the line of gravel over the clay sinks below Ordnance datum, he regards as concealed below the alluvium, and at depths proportional to the fall of that line. Examining in detail the grounds for the contrary opinion heretofore held by himself and by geologists in general, that the great submergence succeeded the principal glaciation of England, he rejected that opinion; and no longer regarding the basement clay of Holderness (with its ancient molluscan facies) as identical with the Chalky Clay, but as moraine synchronous with the Till of Cromer, he considered the gravels with shells at extreme elevations in Lancashire to have preceded all glacial clays but these, and to have escaped destruction by the advance of the ice during the rise only at the south end of the western slope of the Penine chain, those on the eastern having been wholly swept away; but that gravels were deposited on the east side of the Penine after the dissolution of the Chalky-clay ice up to the reduced height of the sea-level at that time, and so far as the ice of the purple clay allowed the sea to come. He then relinquished the opinion formerly held by him that the passage of the Shap blocks was due to floating ice, and referred this to the land-ice crossing the Penine chain consequent upon greater snow interception from the progress of the rise; and to the same cause he referred the drift which rises high on the eastern slo e of the Penine ridge north of the Aire. To this crossing of the ice having diverted first a part and then the whole of the ice-supply of the Chalk-clay glacier he attributed first the shrinking of that glacier into the valleys in East Anglia, and afterwards its dissolution by the agencies always rife in the Greenland ice (but which are there balanced by continual reinforcement), when by this diversion its reinforcement by ice from the Penine chain ceased. The purple clay of Holderness, being thus in its lowest part in Holderness coeval with the valley-formed portion of the Chalky Clay of Norfolk and Suffolk (or "third Boulder-clay" of Harmer), was the moraine of this invading ice, which, after crossing at Stainmoor, divided against the eastern moorlands of Yorkshire; and one branch going north of these moorlands through the valley of the Tees, sent off an arm down their eastern flank, the moraine from which is the narrow belt of purple clay which skirts the Yorkshire coast north of Holderness, and spreads out wider in Holderness. This arm, in consequence of the Chalky clay ice not having (from the westerly increment of depression), descended the eastern slope of the Wolds, found sea there covering the basement clay of Holderness, in which sea it stopped between the Humber and the Wash, by means of which the lower part of the purple clay up to the level of about 150 feet, contains intercalated in it beds of sand and gravel, and contains shells and shell-fragments, as does the Lancashire clay similarly extruded beneath the sea. The other branch came south along the western flank of the east moorlands and through the Vale of York, where it ended, and became stationary in the sea as this entered the Trent system on the final dissolution of the chalky-clay glacier. The author discovers no trace of anything like the intercalation of warm periods up to the stage with which he concludes this part of his memoir; and leaves the description of the later beds, as well as an examination how far arboreal vegetation and the coexistence of Pachyderms and Proboscideans can be reconciled with the contiguity of extensive land-ice for the concluding part of it.

Mineralogical Society of Great Britain and Ireland, April 5.—Dr. M. F. Heddle, F.R.S.E., president, in the chair.—Prof. F. J. Wick, of Helingfors, and Mr. Richard Pearce, of Denver City, Colorado, were elected as ordinary members.—Prof. A. Geikie, F.R.S., read a paper on the microscopic structure of some Scottish nitreous basalts. The paper was illustrated by a fine series of drawings and by a number of microscopic sections.—Mr. J. B. Hannay, F.R.S.E., gave an account of his recent experiments in the production of the diamond and other precious stones, and exhibited some fragments of artificial diamonds.—Dr. Heddle announced the occurrence of xonaltite, turgete, martite, and other minerals in Scotland, now discovered for the first time in that country.

Victoria (Philosophical) Institute, April 5.—A paper on life and its physical basis was read by Prof. Nicholson, M.D., F.R.S.E. The paper treated of the physical and chemical properties of the protoplasm, of the phenomena exhibited by simple masses of protoplasm in a living condition (such as the monera, the amœba, and the yeast plant), of the distinction between dead protoplasm and living protoplasm, of the nature of "Vitality," and of the nature of the temporary connection which subsists between protoplasm and life. A communication from Prof. G. G. Stokes, F.R.S., of Cambridge, having been read, several present took part in considering the subject.

PARIS

Academy of Sciences, April 5.—M. Edm. Becquerel in the chair.—The following papers were read:—On some applications of elliptic functions (continued), by M. Hermite.—Application of the theory of sines of superior numbers, &c. (continued), by M. Villarceau.—On some theorems of kinematics, by M. Resal.—On determination of high temperatures, by MM. Deville and Troost. This describes the application of their method to determining the boiling temperatures of cadmium and zinc. With air as the thermometric substance, the results closely agreed with M. Edm. Becquerel's. It is noted that the boiling points for zinc increased in using successively hydrogen, air, and carbonic acid.—On the heat of formation of oxides of nitrogen, by M. Berthelot. This paper relates to the bioxide and the protoxide. He measured the heat of formation of the former by detonating cyanogen (or ethylene) mixed with the bioxide in theoretic proportions, and from the heat of combustion in that case deducting that in the case of the same gas (cyanogen or ethylene) being burnt with pure oxygen. The heat of formation of protoxide of nitrogen was got by burning carbonic oxide with this gas and with free oxygen, and deducting. The numbers arrived at were, for the bioxide − 21·6, protoxide − 10·3. Tables of the thermal formation of oxides of nitrogen, nitrates, and ammoniacal salts, are added.—On the cyclone of January 24 last in New Caledonia, by M. Faye. The wind-movement is not spiraloid or convergent, but purely rotatory or circular. M. Faye remarks on the geometric exactness with which the winds acted, and the importance of good knowledge of the laws of storms as illustrated by the success with which Capt. Reveillere managed the frigate *Dives* in this cyclone.—On the points of the Siberian Arctic Ocean which present most obstacles to navigation, by M. Nordenskjöld. The general opinion that Cape Tcheliouskine presents most difficulty is mistaken; for numerous rivers there cause a current which frees the ice. Most difficulty occurs near the east coast of Novaya Zemblya and in the strait south of Wrangel's-land.—On the manner of presenting the theory of potential in the hypothesis generally admitted of the discontinuity of matter, by M. Boussinesq.—Winter of 1879–80 at Clermont and Puy-de-Dôme, by M. Alluard. In those parts, whenever a zone of high pressures covers Europe, and especially France, there is interversion of the temperature with the altitude (more manifest at night); it is less cold at Puy-de-Dôme than at Clermont, some 1,100 m. lower. M. Faye remarked that this contradicted the notion that areas of high pressure are due to so-called *anticyclones* (with imagined descending motion).—Meteorological observatory of Puy-de-Dôme; glazed frost of November 21, 1879, by M. Alluard.—Continuous gyratory movements produced by a rotative induction machine, by MM. de Fonvielle and Lontin. A star or other shaped piece of soft iron is put on a pivot within the frame of a galvanometric coil, through which coil is sent the current of an induction-coil in which the inductive force of the direct and the inverse current are as equal as possible. A horse-shoe magnet supported above in a vertical plane by a rod may accelerate or stop the rotatory motion of the star according as its polar line is parallel or at right angles to the galvanometric wire.—Metamorphosis of the puceron of the ligneous galls of the black poplar, *Pemphigus bursarius*, by M. Lichtenstein.—Studies on chronometry; compensation, by M. Rozé.—On the algebraic equations whose first member satisfies a linear differential equation of the second order, by M. Laguerre.—On the measurer of energy, by M. Deprez.—On the specific heat and the conductivity of bodies, by M. Morisot. This describes the method (theoretical and experimental) of a new research.—On sulphides and selenides of chromium, by M. Moissan.—Thermochemical study of earthy sulphides, by M. Sabatier. Sulphide of magnesium (MgS) = + 36·8 cal.; of aluminium (Al_2S_3) = + 62·2 cal.; of silicium (SiS_2) = + 20·2 cal.—On crystallised oxalic acid, by M. Villiers.—On the amidised acids of α-oxycaproic acid, by M. Duvillier.—Relation between the sugar and the mineral and azotised matters in normal beets and beets grown to seed, by M. Pellet. It appears, *inter alia*, that the order of utility of substances in manures for beet is (1) phosphoric acid, (2) magnesia, (3) lime; then potash and soda, and lastly, nitrogen. In the two classes of beets referred to the difference exists chiefly in the leaves and stems.—On some alterations of subrenal capsules, by M. Bochefontaine.—On the simultaneous reproduction of orthose and quartz, by M. Hautefeuille. This he accomplishes by using phosphates concurrently with fluorides, producing the minerals associated as in their natural beds.—On an earthquake experienced at Poitiers and in the environs on March 22, 1880, by M. de Touchimbert.

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