THURSDAY, MAY 10, 1883

EDUCATION IN THE UNITED STATES

United States Report of the Commissioner of Education for the Year 1880. (Washington : Government Printing Office, 1882.)

ANOTHER valuable survey of education in the United States has been published, relating to the year 1880; a survey made by the Bureau whose duty and purpose, it is laid down, shall be "to collect statistics and facts showing the condition and progress of education in the several States and Territories, and to diffuse such information respecting the organisation and management of schools and school systems and methods of teaching, as shall aid the people of the United States in the establishment and maintenance of efficient school systems, and otherwise promote the cause of education throughout the country." The Bureau has no authority, it tells us, and seeks none, to interfere with school organisation, but aims to report institutions precisely as they are; and the variety of experiments tried in the States, which in kindred and spirit of government are so close to our own, must make this publication a repertory of experiences of the utmost value to the English educationalist.

The following is the immense provision made for education in the United States:—For public or common schools, every sixteenth section of public land in the older States, and every sixteenth and sixtieth in the newer ones: calculated to equal nearly 68 million acres; for seminaries or universities, two townships, or 46,080 acres in each State, and in some instances a greater quantity. An additional grant in 1862 of 30,000 acres for each senator which each State was entitled to send to Congress was awarded for the establishment and support of agricultural and mechanical colleges, amounting to 9,600,000 acres. Total, 78 million acres!

Yet, with this immense provision, the Old World difficulty is making itself felt strongly now in America as population increases, which was not foreseen when each State laid it down that education should be provided for every child, viz. that a considerable proportion of that population now will not avail themselves of this education. In very few States is the increase in scholars nearly in proportion to the increase in population, and our Report gives serious confirmation to the alarming statistics lately brought forward by the Rev. Joseph Cook in his Boston lectures. Private effort to attract children to school by providing them also with clothing is said now to be "occupying a very important place." Like other signs of "Progress and Poverty" which Mr. Henry George urges so warmly, there is now enough truancy and absenteeism from school to become a serious hindrance to education. In some New England cities truant officers are appointed, but in other cases the popularity of education without class-feeling allows the important business to be left in the hands of the police.

Cities (under which definition are enumerated 244 municipalities of above 7500 inhabitants) contain one-tenth of the teachers and one-sixth of the school population, and expend more than one-fourth of the money. "While the municipal systems of the United States are more defective, more assailed, and doubtless requiring greater efforts to reform them than any other part of the civil machinery, the city school affairs are in the main well systematised." The Boards of Education are variously constituted in different cities. In some cases the members of the Board are elected directly by the people; in some they are appointed by the Mayor; and in the District of Columbia by the Commissioners.

The powers of School Boards in the United States are in some instances restricted to the care and management of the public schools, while in others they extend to the charge of school funds. In nearly all the cities referred to above, superintendents are appointed—with few exceptions men of superior ability and specially adapted to the work of school supervision, who combine a great deal that is done in England partly by the Boards and partly by the Government Inspector at his occasional visits. They bring to bear more special knowledge of the subject than the former, and give far more time to each school than the latter can.

This Report contains a review of education through the decade, and perhaps the most striking thing is the absence of uniformity in the circumstances and changes in the different States. Thus, in Maine and New Hampshire during the last ten years, and in Indiana during the last year, population has decreased, but the attendance at schools has nevertheless increased. In Rhode Island, New York, and Iowa the reverse has taken place; the population has increased, but school attendance has decreased. In Arkansas a change of system made in the middle of the decade has resulted in a reduction of everything; the reduced number of scholars attending, however, having largely increased again the last year. In New Jersey and Pennsylvania there is an improvement every way; while in Massachusetts the attendance equals the school population. In Virginia the increase in every particular has been great. The Maryland schools only suffer from a decrease in the income for public school purposes.

The Report is very satisfactory as to the difficult matter of educating the coloured race. In 1870, out of 2,500,000 above fifteen years of age less than 150,000 had attended school. At the time of this present Report (1880) there is a total attending school of more than 800,000—over 15,000 of whom are, moreover, attending the higher grade schools. Those of them who are attending normal institutes for coloured teachers manifest great interest in the opportunities for improvement thus afforded. There is still, however, great deficiency of such trained teachers, and the poverty of the country is so great that the schools in rural districts are held in their churches, and the duty of assistance to them is urged by the Commissioner upon the national Government that has made them free. Considerable help has been given to the work among them by the Peabody fund, but the religious denominations of all the States have done most—in fact, five-sixths—of the work. Of 44 normal schools, 29 are under their auspices; of 36 institutions for secondary instruction, 31; 13 of the 15 universities or colleges; and all the schools of theology. But in all the States with mixed population now, except Delaware, Kentucky, and Maryland, school funds are devoted to school population without regard to colour.

In our crowded island we need not refer again to the other special difficulty of the United States. The scattered population leads inevitably to small schools: in Maine, 1200 out of 4000 had average attendances ranging from two to twelve; this leads, of course, to low pay; and this to low attainments on the part of the teachers, of whom not more than 4 per cent. have had normal training. A great drawback to teachers also is the uncertainty of their tenure of office. In some States the School Committee have no power to hire teachers for more than a year, and engagements are seldom made for a longer time. In others, men are employed for winter and women for summer terms, thus causing an uncertainty in the profession, which must be highly mischievous. It is a feature in American education, that in both elementary and secondary schools more than half the teachers are women. In this respect the United States differs from every other nation; and a fear is expressed lest it may involve the sacrifice of some of the conditions essential to the development of strong self-reliant characters. As the Transatlantic ladies are supposed not to be wanting in these themselves, let us hope that it may not have such an effect; but that it may be said of this arrangement that—

"Emollit mores, nec sinit esse feros."

The Commissioner in his Report says that, "carefully considering the position of woman in the work of education, what she has done, and may do, as a teacher, what her nature and experience may fit her to do better than man, as an officer, inspector, or superintendent, he has favoured the opening of appropriate offices to her in connection with institutions and systems of instruction." He "regrets to say that women have shown more indifference to this opportunity than he expected." There are 227 women's colleges in which every advantage is offered that men have, but they are not popular. Still he points out that since women were elected in 1873 to the Boston School Board, and subsequently admitted to that and other Boards, the employment of them on sub-committees, for which they were best adapted, has been the introduction of a new force; in other words, it is in the line of progress.

The Report urges the desirability of well-trained teachers, more particularly in the case of scientific knowledge. "Such knowledge finds its application in all arts and industries, and in all measures for the preservation of health and life, and it offers the only means of dissipating the fears and superstitions, and correcting the foolish practices arising from ignorance of the phenomena and laws of nature." It points out also that the general Government is doing more in behalf of scientific work and publications than all the other agencies put together.

Partially, no doubt, the result of a feeling making its way among educationists, but partially also a sign of the moderate level of education reached, is the small number (448) in Ohio who learn Greek. A curious mark of changed relations is to be found in the fact, that still fewer (418) learn French; while nearly 100 times the number (40,813) learn German; against nearly 650,000 who learn spelling.

Where the ordinary primary education is good in America, evening schools of elementary grades are less sought after than those of advanced grade, except in cities where there is a large foreign population. In communities, distinguished alike for intelligence and business enterprise, evening high schools are especially appreciated, the most promising artisans and clerks looking to them for the means of continuing their studies.

The peculiarly American institution of summer schools is being turned to admirable use by teachers occupied with regular school duties during the rest of the year, who go with scientific expeditions and to stations maintained by the universities, and profit by the facilities for study and investigation thus offered them in combination with fresh air and change of scene.

There has been scarcely any increase since 1875 in the number of universities or colleges as they are indiscriminately called, but the new States are many of them overprovided with these higher-branch schools, while deficient in the elementary schools at present more necessary. The disproportion between colleges and preparatory schools in certain States may be judged by the report that while Tennessee has twenty-one colleges, Massachusetts with a larger population reports seven. The former State has two preparatory schools; the latter twenty-three. Under such circumstances it is not strange that some of these universities or colleges should be doing the work of the lower grade schools, as thirteen are reported as doing only.

In 1871 Arkansas established an industrial university which soon after possessed classical, agricultural, engineering, commercial, and normal courses, and a preparatory department. In various other States similar centres of education in practical subjects were opened, and the variety of subjects and arrangements for teaching them, which are to be found in so many independent centres, will be found very instructive to all who are inquiring about technical education, especially agricultural. Several of these courses are such as have been approved of after varied experiment; an advantage which they have over the schools of science not endowed by the national grant, where the will of the founder has had a contrary effect.

Michigan University has inaugurated an excellent work in providing that a faculty will visit once every year any public high school in Michigan on request of its School Board, and report its condition. "If the faculty shall be satisfied that the school is taught by competent instructors and is furnishing a good preparation for any one or more of the regular courses of the University, then the graduates from such preparatory course or courses will be admitted to the freshmen class of the University without examination, and permitted to enter on such undergraduate course as the approved preparatory work contemplated." This is a method of making the same labour serve the double purpose of inciting the school to efforts, and also of matriculating the University students. The matriculation examinations at so many of these universities were naturally of most various standards, and some approach towards a uniform standard has been made between ten principal colleges in New England.

In the Illinois State University a peculiar government has been tried called "The Students' Government," by which every official was selected or appointed by the president whom they had elected, and all the forms of a Republican Government are gone through; forming an excellent practice to the students and probably raising a good *esprit de corps*.

The comparison of the state of medical instruction at the present with what it was ten years ago, although showing great improvement, still draws a discreditable picture of what so important a profession is allowed to remain in America; and quite a romantic tale is told of the means by which men getting a living by selling false degrees were brought to justice. The number of the universities and other bodies which claim the right to bestow degrees makes the tracking down such forgeries very difficult.

The business of nursing the sick is rising to its proper position as that of an intelligent assistance to the profession of medicine. Our Report wisely recounts the good results to be gained by student-nurses, though chiefly moral qualities are inculcated.

In the schools of science, the number of students which increased so largely in 1878, but fell off in 1879, has begun to increase again; the number of institutions as well as teachers having increased steadily all the time. Our Report says:—"The multiplication and growth of schools of science has been a marked feature in the recent history of education in America. Either the stimulus given to them by the national aid, or the sentiment which compelled Congress to give help to higher education, has carried forward and deepened the interest in industrial, scientific, and technical instruction. Students are now more frequently choosing lines of study which lead to a life of business activity or to prominent positions in industrial pursuits. Colleges that a few years since held strictly to a rigid classical course are feeling the new impulse and are striving to add to their efficiency by making provision for special instruction preparatory to definite occupations. Men of wealth are endowing schools of science and technology more richly than other institutions; for they believe that the practical education which has now come to the front will do more than anything else to promote the industry and prosperity of individuals, and to utilise the resources of the nation."

The requirements for admission to the scientific department of colleges and schools of science are not so great as to classical collegiate courses.

It is rather curious that the study of Latin is allowed to be dropped in a law school of Harvard; but the following remarks made upon the value of law schools, as compared with that of articling pupils to lawyers, may well be applied not to them only but to all technical instruction:—"In schools systematic training is received. Less opportunity is afforded for desultory and spasmodic reading. Regular habits of study are required. Examinations to be passed give steadiness and thoroughness to the work. Companions make emulation. The desire for the respect of the professors is a further stimulus to faithfulness, and they are ready to aid in the understanding of intricate questions. Underlying principles are given an attention which corresponds to their relative importance."

Forestry is taught in some of the higher institutions, with plantations of trees arranged in their natural orders; and its value is pointed out, both as a branch of knowledge to the students, and also as adding to the knowledge of the range of possible and profitable cultivation of many species.

A system of teaching the deaf and dumb to read from the lips of others instead of the old finger reading is described as wonderfully successful and fast gaining ground.

Not a small advantage will science gain if the system of making full inquiries into the antecedents of every case of the above, as also of blindness, is patiently and thoroughly carried out. Some generalisations have already been made with regard to the latter. In the case of 100 feeble-minded scholars their weakness is traced to consumption in their stock. An inquiry into colour-blindness in the Boston schools leads to the recommendation that a systematic process of giving instruction in colour, its names, and shades, should be introduced into primary schools.

The importance of reform schools is steadily and strongly upheld. The needs of their inmates are wisely consulted by an education more moral than intellectual being instilled into them, and by a knowledge also of some method of gaining a living when dismissed being carefully given to them. The better feelings are drawn out and encouraged by a system of rewards for all good conduct, instead of only punishments for bad. Two curious observations are recorded: one is, that working among flowers has a softening tendency upon such characters; and the other, that prisoners are, in general, singularly short of mathematical ability.

The increase in the number of free libraries since the previous year's Report alone nearly equals the entire number of them in England, making a total nearly reaching 3000. Though many of these are very small and to be compared with school libraries here, yet they average all through 4000 volumes in each. A large increase also is noticeable in Kindergarten schools, in schools for nurses, in deaf and dumb, orphan, and reform schools.

The Bureau is indebted to private enterprise for a competition on the subject of schoolhouse plans organised during the year by the "Plumber and Sanitary Engineer." It has drawn forth from the committee of award a sketch of the qualifications they believed to be necessary for a public school building in a large and densely populated city. They lay down ten primary requisites which every plan ought to contain; and the Commissioner hopes that an impulse has been given by their report, which will not be lost or wasted.

Education, we are told, has become in every section of the country a matter of more active public interest than usual. City and country papers have given a place in their columns to the subject, besides periodicals discussing them. It is rather curious to us in aristocratic England to find not selfishness and stupidity only but demagoguism also charged with creating discouragements! W. O.

LETTERS TO THE EDITOR

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

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

The Microphone

It is probable that the writer of the note at p. 588 has not had an opportunity of seeing the paper of mine to which he refers, and an abstract of which is given at p. 376 of the present volume of NATURE.

The adhesion between metallic contacts consequent upon the passage of a current has been carefully investigated by Mr. Stroh, who observed it in the case of all of a great number of metals with which he experimented. My first observations on the subject (one of which is mentioned in the paper) were made with the refractory metal platinum, and not with bismuth, as the writer of the note seems to infer; and though Mr. Stroh's explanation—that the adhesion is due to fusion—is quoted, I express no opinion of my own on the matter. Whatever may be the cause, it seems evident enough that such adhesion must necessarily be detrimental to the perfect action of a microphone, though I am not aware that attention has been previously directed to this point.

It is not correct to attribute to me the opinion, as stated in the note, "that the heat generated by the current plays an important part, for in carbon this reduces the resistance, whilst in metals it increases it." On the contrary I give reasons for believing that at least a moderate degree of heat increases the resistance of loose carbon contacts. Increased *current*, however, is accompanied by diminished resistance, and while I am not prepared to say that heat plays no part whatever in the matter, it appears to me probable that the effect is mainly owing to some other incident of the stronger current, *e.g.* greater difference of potential.

My experiments on metals were not, as the writer supposes, entirely confined to bismuth. More than a hundred observations were recorded of the resistance of platinum and copper contacts under different conditions, and some of these are referred to in the paper. Owing, however, to the low specific resistance of these metals, the methods which I had applied with success in the case of carbon were found to be unsuitable, and the results obtained, though not on the whole inconsistent with those yielded by bismuth, were unsatisfactory and inconclusive. Bismuth was chosen for the bulk of the experiments, principally on account of its bad conductivity, which renders changes in the resistance of the contact easier of observation; but since it was my object to contrast the behaviour of metals with that of carbon (which is infusible), its ready fusibility is another advantage. If I had desired to make a good metallic microphone, I should probably have thought with the writer of the note that bismuth was "the very metal which ought to have been avoided." But for experiments conducted with the object of ascertaining the causes of the generally recognised fact that metals, as a class, are inferior in microphonic efficiency to carbon, it is evident that the metal which gives the poorest microphonic effects is *the very one which ought to be selected,* on account of the probability that with such a metal these causes would be most conspicuous.

As a matter of strict scientific exactness I agree with the writer that "no conclusion of any value as to metals in general can be drawn from experiments on bismuth alone." But since the physical properties with respect to which bismuth differs from carbon, and which have any probable connection with microphonic action, seem to be common in various degrees to all metallic bodies, I venture to predict with tolerable confidence, that if the experiments described in the paper are repeated with suitable apparatus, it will be found that all the conclusions arrived at with regard to bismuth (as summarised in the abstract before referred to) are also true to a greater or less extent for any other ordinary metal. SHELFORD BIDWELL

Wandsworth, April 22

[The necessary brevity of the note to which Mr. Bidwell refers precluded lengthy quotations. At the same time it was only natural to draw attention to the weak point in Mr. Bidwell's argument, namely, that the behaviour of the metals generally could not with any certainty be argued from observations made, as Mr. Bidwell admits, on the very metal which for practical ends ought to be avoided. It is greatly to be wished that Mr. Bidwell will so far further improve the capabilities of his apparatus as not only to be able to get conclusive results with other metals, but also so as to enable him to say why his apparatus gave results that were unsatisfactory and inconclusive with good conducting metals such as platinum and copper.]

The Soaring of Birds

FOR more than twenty years I have watched with admiration the soaring of the black vulture of Jamaica (*Vultur aura*). When once well up in the air it rarely moves its wings, except to change the direction of its flight. It can soar whenever there is even a light wind.

I entirely concur with Mr. Hubert Airy in the main point of his general conclusion, as given in vol. xxvii. p. 592. "Variations in the strength and direction of current" can, as he says, be so "utilised" by birds as to enable them to soar. But a high wind is not necessary; and a downward current, even when approaching the perpendicular, may, if of sufficient velocity, be utilised.

Whenever there is a wind there will be ascending and descending currents in some places. This will be so even in a level plain which presents no considerable obstacles, such as trees or buildings, to the stream of air. The plain will be bounded by hills of varying height, and it will vary in breadth. A stream of water would merely flow more rapidly through the narrower channels; but a stream of air, being highly elastic, will also rise and fall, and it will have its eddies in planes more or less inclined to the horizon, and will often acquire a rolling motion. Assuming the existence of ascending and descending currents, the soaring is a very simple matter. *The bird contrives to remain much longer in the upward currents than in the downward.* It will glide along the ascending side of a wave of air and cut across the descending side. It will make many spiral turns in an ascending current of sufficient amplitude. I have often seen the vulture ascend thus for more than 2000 feet, keeping near a steep mountain side. If the bird encounters a descending current, of which it is instantly aware through the diminished pressure on its wings, it will either wheel to the right or left to get out of it, or, altering the pitch of its wings, will descend swiftly so as to acquire the necessary impetus for a rapid escape, or will do both.

It can also avail itself of inequalities in the velocity of horizontal currents flowing parallel to one another at the same elevation. The bird, let us suppose, encounters a strong horizontal current, as warm as it is rapid, issuing from a mountain valley or a cutting through a forest. Instantly throwing its wings into a plane nearly vertical, it receives on them the force of the current, and in a few seconds acquires its velocity. Pitching its wings also for a downward flight it shoots quickly through the current, having acquired a speed more than sufficient for the recovery of its original elevation. If the current be very strong and very narrow, it need not be horizontal, but may approach the perpendicular. The bird will not remain in it long enough to be carried far down, while it acquires an impetus much more than compensating for the slight loss of elevation. It must be remembered that when the bird is gliding at a high rate of speed, the resistance of the air, through its inertia, to any movement except in the plane of the wings, almost equals that of a solid body, and a change of direction causes a very slight loss of momentum.

What rapidity of currents is necessary for soaring must depend in great measure on the structure of the bird. The vulture is, I believe, comparatively heavy, but I think that, having once acquired speed by a short and steep descent, it can glide through still air (or at right angles through air having a uniform horizontal notion) at the rate of twenty miles an hour, descending not more than one in twenty. If, therefore, the bird could be always in an upward current of only one mile an hour, it could maintain itself in the air. A gentle breeze of ten miles an hour, with one mile an hour of ascent—and a much steeper ascent than this must be frequent enough where there are hills—would suffice to sustain the bird; and as an average of ten miles an hour implies local or occasional gusts of greater velocity, of which the bird knows how to avail itself, it could ascend in such a current, and so be able to work to windward. If besides hills of moderate inclination, there are also trees, walls, houses, the air will often be driven upwards, vertically or nearly so, with as great or even greater speed than that of its average horizontal movement; and of this upward movement the birds avail themselves most skilfully. I have frequently seen the vultures working their way thus against a high wind. Their movements are very irregular. Sometimes, to avoid a violent gust, they will drop almost perpendicularly to within a yard or two of the ground, and shooting abruptly sideways with the high velocity gained by the drop, will get into an upward current in which, if ample enough, they will wheel, or else will cross and recross it, till they have gained a sufficient elevation, and then, taking advantage of a lull, will glide to windward.

With a breeze of only five miles an hour, there will be in many places upward currents of high inclination caused by the usual irregularities of surface. Keeping sometimes in these and sometimes in currents more slightly ascending, for, say, twothirds of its time, and utilising also, as I have above explained, the more rapid of the descending currents, the bird can more than sustain itself. It can at will glide to windward at the rate of fifteen miles an hour against the breeze, losing of elevation only one in twenty. R. COURTENAY

L'Ermitage, Hyères (Var), France, April 28

Flight of Crows

I CAN corroborate the observation of Mr. Murphy as to the oblique flight of crows. When I have seen them so flying there has always been a cross current, and they have merely kept their heads a little to the wind.

Cambridge THOS. MCKENNY HUGHES

Sheet Lightning

Du choc des opinions jaillit la vérité. I still adhere to your assertion that sheet lightning is not, at least in most cases, the mere reflection of a common but distant storm. On the highlands of Ethiopia, in the years 1842 to 1848 I was diligently engaged in investigating the electrical phenomena so frequent in that region. The details of my observations were printed in 1858 by the French Institute, and I have published again my results in my "Observations relatives à la Physique du Globe" (Paris, 1873). The following cases may be of interest:—

Near the zenith eight successive flashes of lightning were seen 21 seconds before their thunder, which lasted exactly 12 seconds. Another day it lasted 24·4s. thirty successive times, and, as previously, without any rain. My greatest observed interval was 111·2s., corresponding to a distance of 38,500 metres, &c.

I have seen more than once straight or zigzag lightning unaccompanied by thunder. One afternoon it went to and fro *twice* between two horizontal cloud banks, and ended in sheet lightning which illuminated, not the lower dark bank, but only the under surface of the upper cloud. I have observed frequently thunder without lightning and lightning without thunder.

When in Adwa I recorded silent sheet lightning towards Gondar, 240 kilometres distant, where a violent storm was raging at the same time. Before leaping to a hasty conclusion, let us hear a case bearing pointedly to the opposite opinion: in 1845, at Saga (latitude 8° 11'), a semi-transparent fog which had mantled over the valley, and could not be more than 3500 metres distant, gave out a flash of sheet lightning without thunder.

Although my numerous observations have given me a strong bias in favour of your opinion, I do not wish to impose it on reluctant philosophers, but suggest the following system to clear up the question:—Let two observers, A and B, 40 or 50 miles asunder, mention instances of lightning seen in each other's true bearing. If they can also secure the help of a third observer located on or near the straight line from A to B, and who can watch in two opposite directions, many important results may be obtained. ANTOINE D'ABBADIE

Paris, May 5

The American Trotting-Horse

MR. BREWER's memoir on the evolution of the breed of the American trotting-horse (NATURE, vol. xxvii. p. 609), and the statistical tables that accompany it, are full of interest, but I only propose now to concern myself with the latter, which may be easily and usefully discussed by employing a statistical method that I have long advocated. In explanation I will begin by extracting the final terms of four of the lines of his table, as follows:—

Year.	2.27 or better.	2.25 or better.	2.23 or better.	2.21 or better.	2.19 or better.	2.17 or better.	2.15 or better.	2.13 or better.	2.11 or better.
1871	99	40	17	12	6	1			
1874		98	40	16	11	5	1		
1877			105	51	19	8	2		
1880				106	41	14	6	2	1

The meaning of these entries are, that in the year 1871 there were 99 horses that could trot a mile in 2 minutes 27 seconds, or less; that in the same year there were 40 that could trot it in 2 minutes 25 seconds, or less; and so on. Their significance is that the rate per mile of the hundred fastest American trotting-horses has become 2 seconds faster in each successive period of 3 years, beginning with 1871, and ending with 1880; also that the *relative* speed of the hundred fastest horses in each year is closely the same, though their absolute speed differs.

We may read the table in another way. If the number of horses that can run a mile in 2 minutes 27 seconds or less is 99, we may infer without risk of sensible error that the 99th horse in the order of running accomplishes a mile in *that time exactly*, because the 100th horse certainly takes a longer time, and it is statistically incredible that the rate of the 99th and of the 100th horses should differ by more than a barely perceptible interval. For the same reason we may infer that the 40th horse in that same year runs a mile in 2 minutes 25 seconds, and so on. We can now draw curves, and by graphical interpolation find with the greatest facility the mile rate of the horse in *any* order of running in any year that we please to select. I have selected the 100th, 50th, 20th, and 10th horse respectively for each year beginning with 1874, when we are informed that the returns first begin to be accurate, and have thrown the results into the following simple table. The curves obviously required a little smoothing here and there, and in three or four places the readings have been thereby modified by one or two tenths of a second. Otherwise they are given directly from the rough plottings.

Number of Seconds and Tenths of Seconds in Excess of Two Minutes that are required for Running One Mile by the Horses whose Order in the Rate of Running in each Year is given at the Top of the Columns

Year.	100th.	50th.	20th.	10th.
1874	25·1	23·4	20·5	18·8
1875	24·1	22·5	19·9	18·2
1876	23·5	21·6	19·5	17·7
1877	22·9	21·0	19·0	17·4
1878	22·1	20·2	18·5	17·0
1879	21·3	19·6	18·0	16·6
1880	20·8	19·3	17·6	16·0
1881	20·4	18·8	17·2	15·7
1882	19·9	18·4	17·0	15·4
Anticipated 1890	16·8	15·5	14·4	13·4

Mem.—The first horse runs the mile in about 5 or 6 seconds less than the tenth horse.

It will be found on plotting the figures in the vertical columns into curves, that they run with much regularity and differ little from straight lines. The general conclusion to be derived from them is that the improvement of the running shows as yet little tendency to slacken, though no doubt if the number of horses bred for trotting ceased to increase yearly at the same large rate as hitherto, it might do so. Supposing, however, the conditions to be maintained, I should anticipate that in 1890 there will be about 15 horses that will run a mile in 2 minutes 15 seconds or less, and that the fastest horse of that year will run a mile in about 2 minutes 8 seconds.

FRANCIS GALTON

The Shapes of Leaves

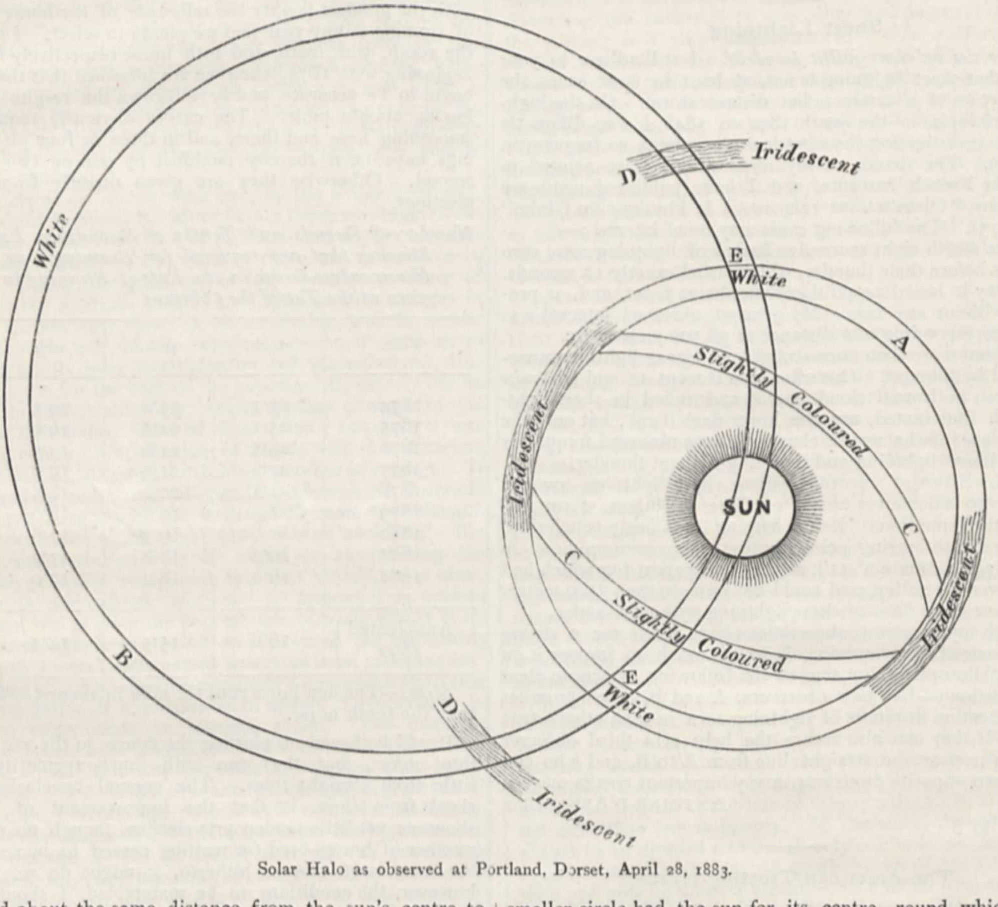
MR. GRANT ALLEN's papers in NATURE will evidently serve to direct attention to a most interesting subject which hitherto appears to have been much neglected. Every contribution of observed facts may tend to throw further light upon it, and I therefore venture to remark that one cause of the frequently filiform character of the leaves of water-plants appears to be the elongating action exercised upon the cells by the pressure of a rapid current of water, since it is obvious that growth must take place in the direction of the least resistance. With a radiate-veined leaf the tendency must be towards lateral pressure, which would compress and elongate, and so give a linear form to the leaf-cells. I have been much interested to observe that on the seashore, in places where Fuci are exposed to this action by the ebbing tide, as when growing on the edge of a large boulder or hanging over its sides, the fronds and even the receptacles become unusually elongated.

On the other hand, where a freshwater stream mingles with the salt water in pools left by the tide, and the endosmotic action of the water set up by its reduced density is greater, the algæ become broader if flat, or of more inflated character if tubular. This is well seen in *Dumontia filiformis*, *Enteromorpha intestinalis*, and *Chondrus crispus*. The influence exerted by the character of the surrounding medium and pressure may also be observed in that interesting genus of freshwater plants, Callitriche. E. M. HOLMES

Solar Halo

I BEG to forward herewith diagram and remarks of solar halo as observed here to-day, thinking it may be of interest, being an unusual phenomenon. The cause depends upon many circumstances necessary for such observations, chiefly a calm reflecting surface of water in front, behind, and around the observer, making their appearance local as well as unfrequent.

The halo marked A, caused by the sun's rays passing through the thin cirri, was reflected from the surface of the water on the English Channel side of the island, producing the large white halo B, and passing over the sun's centre, the non-concentric arcs C being most probably reflected from the harbour side, the bright iridescent arcs at D on the large white halo B being the reflected crossings of the two halos at E. I have fixed the points of the zenith and due south horizon as approximately as possible; the observer facing due south, the iridiscent arc D was nearly



Solar Halo as observed at Portland, Dorset, April 28, 1883.

vertical, and about the same distance from the sun's centre to the estimated centre of large halo B, viz. 12°; the diameter of halo B was a little over double that of A.

Latitude of Verne ... ... 50° 32′ 86″ N.
Longitude of Verne ... ... 2° 23′ 40″ W.

Altitude of highest point of Verne 495 feet above sea-level (Ord. B.M.).

Time (local): first observed at 12.20 p.m.; brightest aspect 12.30 p.m.; duration about three-quarters of an hour. Cloud, thin cirri, with cumulo-stratus low in northern horizon. Amount, 9. Wind, S. E. CARDWELL,

Late Supervisor Meteorological Department, Bombay

Verne Citadel, Portland, Dorset, April 28

I SEND inclosed a diagram of a system of solar halos observed here on Saturday last. If one may credit the oldest inhabitant, the phenomenon is very rare in these latitudes; in fact the ancient mariners frequenting the New Key End declare they never saw the like in all their wanderings.

My attention was first called to it at 12.25 p.m., when it presented the appearance I have depicted; but I am told that earlier in the day a white halo was seen *south* of the sun. The smaller circle had the sun for its centre, round which the sky was of a leaden cast as far as the edge; the fringed portions represent brilliantly coloured partial halos, or coronæ. The larger circle was, as near as I could guess, 40° diam. Its circumference cut the centre of the smaller circle, was brilliantly white, perfectly defined as seen from here, and narrow. I am told that, seen from high ground some four miles from here, it presented the appearance of two horns. The phenomenon lasted after I observed it about an hour, during which time a peculiar haze was drifting over the sky, which, when viewed carefully, seemed to have a hair-like structure, especially when seen passing the bright edge of the larger halo. I may add that the surface wind was southerly, the drift of the haze S.S.E.: a line joining the centres of the circles would point E.N.E. at about one o'clock. THO. B. GROVES

Weymouth, April 30

Mock Moons

THE explanation of the phenomenon observed on the 16th ult., which is given by "Sm." of Rugby, appears to me to be scarcely satisfactory. According to the usual explanation of halos, parhelia, and paraselenæ, which attributes them to refraction by prismatic ice-crystals at high elevations, the parhelia always appear on the horizontal parheliacal ring which passes through the centre of the sun, and generally at the intersection of this ring with the vertical halo. The two parhelia must therefore always lie in a line parallel to the horizon, and at the same elevation as the sun itself. The same laws regulate the appearance of the paraselenæ or mock moons. It therefore surprised me to learn that the left-hand mock moon appeared at a greater distance from the horizon than the right-hand one. It seemed to me to be "unaccountably out of place." That the circle should have subtended an angle of 50°, as stated by "Sm.," is in itself unusual. The normal diameter is understood to be from 44° to 47°. Did "Sm." actually measure it? To my judgment it was considerably more than this, but of course mere estimates are not trustworthy. I do not see how a "change of level of the refracting cloud" should alter the position of the mock moons. This must depend upon the relative positions of the moon and the observer's eye. If the cloud is not in the right place no mock moons will be seen. I should be glad of a satisfactory explanation of the phenomenon recorded.

Birstal Hill, Leicester, May 7 F. T. MOTT

REFERRING to a letter from Mr. F. T. Mott in NATURE, vol. xxvii. p. 606, I find that at midnight on April 16 the moon's apparent altitude at Leicester was not more than 26°; so that after allowing for the difficulty of seeing the actual horizon, and taking also into account the breadth of the halo, it seems improbable that the halo observed by Mr. Mott was of unusual size.

I have, however, seen a description somewhere of a *parhelion* —measured with a sextant about the end of last century—which had a semidiameter of 26°. It would be interesting to know whether such irregularities in the dimensions of these phenomena have been accurately ascertained. R. C. JOHNSON

19, Catherine Street, Liverpool

Sun Pillar of April 6, 1883

IT may be of interest to record the various points from which the above phenomenon was seen. I was at St. David's with a party of geological students, and we watched it for some time as we were returning from the coast at sunset.

Cambridge THOS. MCKENNY HUGHES

Fibreballs

I READ with much interest the letters of Prof. G. H. Darwin and "J. H.," NATURE, vol. xxvii. pp. 507, 580. On the coast of South Australia, especially on the Coorong beach, I have seen fibreballs in great quantity; some larger than a cricket ball, and perfectly spherical, hard, and well-matted; others tapering and having the form of an exceedingly long ellipse. I brought home many specimens. These are now in the Wragge Museum at Stafford; and I shall be happy to have some forwarded for Prof. Darwin's inspection.

Fort William CLEMENT L. WRAGGE

Helix pomatia

ONLY a few more lines to say, in consequence of the communication of Mr. Stokoe in your last number (p. 6), that he will find the mollusca in their geological relations treated in the introduction to my work on "British Conchology," vol. i. p. cix. The distribution of *H. pomatia* in this country and on the Continent is noticed in pp. 177 and 178 of that volume, and in the supplement to the fifth volume. J. GWYN JEFFREYS

1, The Terrace, Kensington, May 4

I HAVE found this freely in the hedge-bottoms of Hertfordshire lanes, where the soil was a dark alluvial mould, certainly not cretaceous. I suspect that even in its known localities it is very local. HENRY CECIL

Bregner, Bournemouth, May 5

IN two of the localities mentioned for this snail—Dorking, Surrey; and Woodford, Northamptonshire—there seems some reason to suspect it to be a modern introduction. From 1849 to 1852 I lived within two miles of Woodford, and often found the shells in a small wood known as Woodford Shrubbery. It was commonly said in the neighbourhood at that time that the snails were brought from abroad by the gentleman—I think General Arbuthnot—who had formed the Shrubbery some thirty years before that date.

I also found, many years ago, shells of the same species about the foot of Box Hill, near Dorking, and was told by a former resident in that neighbourhood that the snails were brought from Italy by Mr. Hope, of Deepdene, who was well known in the early part of this century as a writer on the mediæval architecture of Italy. I give the statements for what they may be worth.

Loughton J. C.

Intelligence in Animals

IN addition to the long list of "emotions which resemble human intelligence as occurring in animals below the human species," as given by your correspondent on the authority of Dr. Romanes (NATURE, vol. xxvii. p. 580), and the instance of "benevolence" subsequently cited, I venture to submit the following as illustrating something very like the emotion of contempt.

Until recently our domesticated animals included two cats—one a very fine tabby (a trimmed male) of somewhat morose nature, and a pretty little black cat, a half-bred Persian (a female) of very gentle character. On a noticeable occasion the tabby cat caught a mouse and ate it all up with much relish in a corner of the room. The proceeding was watched with much interest by the black cat from her place on the hearthrug. After the tabby had finished his repast he also took up his place on the hearthrug. The black cat then went over and smelled the spot where the dainty morsel had been devoured. Upon this the tabby cat came up and "boxed" the black cat's ears once or twice, as who should say, "What business have you with my affairs? catch your own mice!" W. R. HUGHES

Handsworth Wood, near Birmingham, May 5

MAY I contribute another case of higher thought in the lower animals. At the farm of Granton Mains, near Edinburgh, an old cat had become blind; her daughter had kittens. The daughter was observed bringing in a sparrow to the boiler-house, where her blind mother and her half-grown kittens were warming themselves: the kittens came up to get the sparrow, but their mother kept them off and gave the sparrow to her mother, and watched whilst she ate it. She was frequently seen to give other food to her blind mother.

My children have a fox terrier bitch, "Dot." Dot loves to kill anything from a cat to a mouse, and sometimes a wild rabbit gets into the garden, and it is a red-letter day for Dot and the children. But the children have also tame rabbits; of course any one who knows dogs will understand that it is simple to teach them not to touch pets—for instance, the cat of their own house. But Dot had a curious case to decide. The children had found a nest of wild rabbits, and two of the tame rabbits (black and white) had made a hole in a bank and there had young ones. This nest was respected by Dot. The children took the young wild rabbits (gray) and fostered them on the tame ones by slipping them into the nest. A few days after this, Dot must have discovered these gray young ones with the black and white. Had she found them anywhere else, one snap, and they were dead; but this was the line she took: she was found at the front door under the porch with one of the young gray rabbits, quite fifty yards from the nest; it was quite unhurt, although it died afterwards, I believe from cold and exposure at the time. Are we to suppose that Dot wished to ask the question, "May I kill this gray one?" DUNCAN STEWART

Knockrioch, May 2

THE SOLAR ECLIPSE OF 1883

THIS eclipse, as our readers have already been made aware, took place on Sunday last, and we may hope, although we shall not know for more than a month, that the weather was favourable. We shall not hear whether the French arrived in time, but we do know that the English observers met the American party, consisting of Prof. Holden, Dr. Hastings, Mr. Rockwell, Mr. Preston,

Time.	SIDEROSTAT. Hilger.	Rowland grating. 1st order.	Rowland grating. 2nd order.	Prismatic camera.	EQUATORIAL. Slit Spectro-scope. 2 prism.	7 prism. F.	Grating. F. Red 1st order.	Grating. F. Blue 2nd order.	½ in. slide. Dense prism F.	PHOTOHELIOGRAPHS. Large photo-helio-graph.	Corona camera.
Before Totality											
Minutes.											
10						expose	expose	expose			
9											
8									expose		
7									expose		
6	ref. spectrum 30 scs.								expose		
5									expose		
4									expose		
3							exp)se	expose	expose		
2						expose			expose		
Seconds.											
60									expose		
40		expose	expose				run ¼ in.				
20		expose	expose								
2	expose & start clock										
1											
Totality		expose	expose	expose col. plate	expose	expose	expose	expose	expose	expose	expose 1 sec.
280											expose 20 sec.
230				shut							
220				expose gel. plate							expose
210									expose	exp:se	
200		expose	expose								
120				shut							
110				expose col. plate							
100											
90											shut
70											expose 3 sec.
50										expose	
40											expose 10 sec.
20											expose 2 sec.
Just before end		expose	expose	shut	shut	expose	expo e	expose	expose	shut	
After Totality											
Seconds											
1							run ¼ in.				
4		expose	expose								
10		expose	expose								
Minutes											
1		shut	shut				expose	expose	expose		
2	shut										
3									expo e		
5						expose	expose	expose	expose		
7									expose		
9									expose		
10						shut	shut	shut	shut		
	refs. 25				2 sec.	10 sec.	10 sec.	10 sec.	1 sec.	run	run

Lieut. Brown, and Mr. Upton, the first mentioned astronomer being in charge, at Panama. They expected to arrive at Callao on the 20th March last, and to leave either in the *Hartford* or the *Pensacola* within the next few days. That would give them ample time to reach the Caroline Islands, and make the arrangements necessary for the observation. It was the intention of Prof. Holden to take the combined English and American party on to Flint Island if he found that Dr. Jannsen had already established his party on Caroline. This, of course, was a very proper decision, as it would double the chances of favourable weather. We give the time-table for observation supplied to the English observers, which they were instructed to carry out down to its most minute detail, if all the instruments were landed and set up without damage. .

It will be seen that the English attack was to be entirely photographic ; no eye observations were to be made. And if all has gone well, something between fifty and sixty photographs may be hoped for. The table perhaps requires a little explanation, which we will now proceed to give. It followed from work undertaken with that special object in Egypt last year, that eclipse observations can now definitely begin ten minutes before totality, and end about ten minutes after. With an eclipse therefore of about five minutes' duration, as in the present case, the work ranges over a period of five-and-twenty minutes, and if the plates are as sensitive as they can now very well be, it is quite easy to see that a very large number of photographs may be taken. The greatest interest of course attaches to the spectroscopic photographs to be taken by means of a siderostat and the equatorials. As in former eclipses the plates exposed in the photoheliographs will secure the appearance of the corona surrounding the image of the dark moon ; but on the present occasion an attempt was to be made to take these photographs on a much larger scale than usual, a scale of four inches to the moon's diameter. Coming to the spectra themselves, we find four spectroscopes fed by the light reflected by a siderostat of 30 cent. diameter, these four spectroscopes being bracketed together very much like a Gatling gun, and pointed to the siderostat, which has a very excellent clock attached to it. The first spectroscope, called the "Hilger," in the programme, is an integrating one, and will integrate for us the light of the whole region round the sun during the entire period of totality on a plate which is allowed to fall very slowly by means of a clock-work arrangement. If any change, therefore, takes place in the spectrum of these regions during this period, it will be recorded on this moving plate in historical sequence, so that, the beginning and end of exposure being known, the time at which any definite change takes place can be determined. The Rowland grating coming next on the list, which was generously given to Mr. Norman Lockyer by Professor Rowland, is one of ten feet focus, and has a large surface with 14,000 lines to the inch, forming of course a most excellent and simple prismatic camera, the first and second order spectra both being utilised. The prismatic camera and slit spectroscope of two prisms were two instruments arranged by Capt. Abney for the eclipse last year. They are on the model of the instruments designed for the eclipse of 1875 in Siam, but have the advantage of possessing plates which are sensitive to the whole of the spectrum. The work to be done by the equatorial is of a very similar nature to that to be attempted with the siderostat, except that it was intended by varying the time of exposure from long to very short periods to make certain of something. All the cameras, except the "Hilger," in which the plate moves by clockwork, are fitted with long plates, of which only small strips are exposed at a time, and the exposure is managed, not by changing the plate as in the ordinary method, but by turning a screw. The word "expose" in the table therefore shows the precise moment, at which, if the instructions are carried out, a new strip of plat will be exposed to the action of the light before, during, and after totality, and it will be seen that the exposures are varied both before and after totality, so as to get the greatest possible difference in time during which each part of the plate receives its impression. From a letter received by Mr. Norman Lockyer from Messrs. Lawrance and Woods, we know that the American astronomers intended giving them all possible facilities for carrying out the combined Royal Society and Solar Physics Committee's programme; and that the attention of the English observers will be concentrated on the siderostat and equatorials, as two officers of the American ship have been told off to work the photo-heliographs and look after the eclipse clock, which is so arranged that it keeps all the observers together by indicating to each one of them the exact number of seconds still left for his work, with the additional advantage that each number of seconds announced by the officer in charge is a distinct order to do a certain thing, as in the case of the various exposures indicated in the list.

LECTURES TO WORKING MEN

THE three courses of Lectures to Working Men given at the Museum of Practical Geology, Jermyn Street, during the present session, by the staff of the Normal School of Science and the Royal School of Mines, came to an end last Monday, and, as on former occasions, it gave rise to regret that more cannot be done in this direction, both with regard to the number of courses given, and the number of persons accommodated in each case. The theatre at Jermyn Street restricts the audience to something over 600, while of late years the applications for tickets have never been less than 2,000. The tickets for each course—for which sixpence is charged as a registration fee—are given only to *bonâ fide* working men, who must bring with them a paper on which is stated their name and occupation. Some of the lectures of the last course—that given by Mr. Norman Lockyer, on "The Earth and its Movements"—were listened to by the Japanese Minister, and an official connected with the Education Department of Japan. At their request a list was drawn up showing the trades of the audience. This list, in the case of 500 who attended the last course, we are permitted to give, and we think our readers will find it an interesting one. Seeing that there is this anxiety on the part of working men to learn, and that less than one in three of those so desirous of learning can have an opportunity of doing so, we trust that in future years the Lecture Theatre at South Kensington will be utilised in this direction, as well as that at Jermyn Street. There is little doubt, of course, that a Liberal Government, represented by the Treasury officials, naturally anxious in all ways to protect the public purse against all claims, whether good or bad, might object to this being done at the public cost, but seeing that the lectures are given as a labour of love by the various professors such an objection would scarcely be urged, and we confess too that we should not only like to see the theatre at South Kensington utilised in this way, but the theatres at University College, King's College, and other institutions that might be named. We do not believe that the professors at these institutions are less anxious for the progress of knowledge among the working classes than those who are connected with the Government School, and this being so, we may hope to see at some future time a united effort to supply what is at present a great want, and a gap in our educational programme.

Trades of 500 of the audience at the last course of Lectures to Working Men, April and May, 1883:—

1 Bag Maker.	6 Iron Founders.
6 Bakers.	23 Instrument Makers.
2 Basket Makers.	37 Jewellers.
28 Boot and Shoe Makers.	1 Lamp Maker.
1 Brewer.	1 Lead Glazier.
2 Brush Makers.	3 Lithographers.
1 Billiard Table Maker.	1 Locksmith.
6 Builders (Foremen).	4 Stonemasons.
1 Butler.	1 Mattress Maker.
3 Brass Finishers.	2 Milkmen.
2 Bricklayers.	6 Opticians.
7 Bookbinders.	9 Pianoforte Makers.
6 Cabinet Makers.	3 Perfumers.
52 Carpenters and Joiners.	6 Photographers.
8 Coach Painters.	1 Picture Frame Maker.
9 Compositors.	16 Plumbers.
8 Carvers.	2 Pocket Book Makers.
1 Cigar Maker.	2 Polishers.
4 Chemists and Druggists.	10 Porters and Messengers.
13 Clerks.	6 Portmanteau Makers.
3 Curriers.	6 Plasterers.
6 Dentists.	1 Quarryman.
4 Designers.	6 Salesmen.
1 Die Sinker.	5 Saddle & Harness Makers.
1 Draper.	1 Saw Maker.
2 Draughtsmen.	1 Soda Water Bottler.
25 Engineers.	7 Shop Assistants.
2 Engravers.	4 Stationers.
1 Envelope Maker.	1 Smith.
1 Fishing Rod Maker.	1 Stoker.
5 Gasfitters.	2 Storekeepers.
1 Gardener.	17 Tailors.
7 Gilders.	4 Teachers.
1 Greengrocer.	1 Traveller.
2 Grainers.	6 Tinmen.
3 Glasscutters.	5 Turners.
4 Gun Makers.	1 Twine Spinner.
7 Hatters.	2 Umbrella Makers.
1 Hairdresser.	6 Upholsterers.
1 Hinge Maker.	8 Watch Makers.
1 Hammerman.	1 Warehouseman.
1 Hemp Dresser.	3 Wheelwrights.
23 House Painters.	7 Zinc Workers.

CIRRIFORM CLOUDS

IN a "Note on a Proposed Scheme for the Observation of the Upper Clouds" the Rev. W. Clement Ley has written an abstract of part of a large work on clouds, which he is now preparing for publication. This note has been circulated with a view of obtaining suggestions on the scheme of classification, observation, and telegraphy, which the writer has submitted to his colleagues of the Committee on Cirrus observations, nominated by the International Meteorological Committee in 1882.

The author follows the primary outlines of cloud-classification proposed by Luke Howard, dividing the objects of observation into cirriforms, cumuliforms, stratiforms, and composites; while in the subdivision of these primary types he has been induced by reasons, the cogency of which he hopes to demonstrate, to deviate very considerably from Howard's classification. The true cirriforms, to the discussion of which the note is restricted, are divided by Mr. Ley as follows: cirrus, cirro-filum, cirro-velum (with its variety mammatum), cirro-nebula, and cirro-granum. The author has been, "after many years devoted to the consideration of the subject, reluctantly compelled to give up the employment of the two terms 'cirro-stratus' and 'cirro-cumulus.' Their use has led to endless confusion. In point of structure the clouds usually called cirro-cumuli belong essentially to the higher stratiforms, consisting of nubecules separate, or partly coalescing, occupying a layer of atmosphere of very small vertical thickness, but of very great horizontal extent, and they are not formed in nature by those processes which are productive of clouds either of the cirrus or of the cumulus type. They are not, in fact, either in appearance or in mode of physical formation, either compounds of cirrus with cumulus or hybrids between cirrus and cumulus. Therefore in practice the use of the word cirro-cumulus has led to a large number of clouds of no great elevation being classified among the cirriforms, a result which was of little consequence when the laws regulating the upper currents of the atmosphere had received no examination, but which must be absolutely fatal to a scheme based upon those laws, according to which new and most valuable results will be attained. The name cirro-stratus is almost equally objectionable, and for similar reasons."

Six pages of this note are devoted to instructions on a system of observing and reporting by telegraph the structure and movements of the upper clouds; and the author shows that, if this system be adopted on an extensive scale, results of great practical importance may be anticipated. The indispensable pre-requisite is a clear and scientific classification of clouds according to physical structure.

SCIENTIFIC PROGRESS IN CHINA AND JAPAN

VARIOUS steps in the progress of China and Japan in the adoption of Western science and educational methods have from time to time been noticed in these columns. To the popular mind the names of the two countries are synonymous with rigid unreasoning conservatism and with rapid change respectively. The grave, dignified Chinese, who maintains his own dress and habits even when isolated amongst strangers, and whose motto appears to be, *Stare super vias antiquas*, is popularly believed to be animated by a sullen, obstinate hostility towards any introduction from the West, however plain its value may be; while his gayer and more mercurial neighbour, the Japanese, is regarded as the true child of the old age of the West, following assiduously in its parent's footsteps, and pursuing obediently the path marked out by European experience. There is considerable misconception in this, as indeed there is at all times in the English popular mind with regard to strange peoples. Broadly speaking, it is no doubt correct to say that Japan has adopted Western inventions and scientific appliances with avidity; that she has shown a desire for change which is abnormal, and a disposition to destroy her charts and sail away into unsurveyed seas, while China remains pretty much where she always was. She is now, with some exceptions, what she was twenty, two hundred, perhaps two thousand years ago, while a new Japan has been created in fifteen years. All this, we say, is true, but it is not the whole truth. China also has had her changes; not indeed so marked or rapid, not so much in the nature of a *volte-face* on all her past as those of her neighbour. The radical difference between the two countries in this respect we take to be this: that while Japan loves change for the sake of change, China dislikes it, and will only adopt it when it is clearly demonstrated to her that change is absolutely necessary. To the Japanese change appears to be a delightful excitement, to the Chinese a distasteful necessity; to the former whatever is must be wrong, to the latter whatever is is right. As a consequence of this difference between the two peoples, when China once makes a step forward it is generally after much deliberation, and is never retraced. Japan is constantly undertaking new schemes with little care or thought for the morrow, but with the applause of injudicious foreign friends. In a short time she discovers that she has underrated the expense or exaggerated the results, and her projects are straightway abandoned as rapidly and thoughtlessly as they were commenced. Swift suggested as a suitable subject for a philosophical writer a history of human projects which were never carried out; the historian of modern Japan finds these at every turn. Where, for example, are the results of the great surveys, trigonometrical and others, which were commenced in Yezo and the main island about ten years ago? A large, expensive, but highly competent foreign staff was engaged, and worked for a few years; but suddenly the whole survey department was swept away, and the valuable instruments are, or were recently, lying rusting in a warehouse in Tokio. The same story may be told of scores of other scientific or educational undertakings in Japan. An able and careful writer, Col. H. S. Palmer, R.E., who has recently, with a friendly and sympathetic eye, examined the whole field of recent Japanese progress, in the *British Quarterly Review*, is forced to acknowledge this. "Once having recognised," says this officer, "that progress is essential to welfare, and having resolved, first amongst the nations of the East, to throw off past traditions and mould their civilisation after that of Western countries, it was not in the nature of the lively and impulsive Japanese to advance along the path of reform with the calmness and circumspection that might have been possible to a people of less active temperament. Without doubt many foreign institutions were at first adopted rather too hastily, and the passing difficulties which now beset Japan are to some extent the inevitable result." It would be blindness to deny that the net result of the Japanese efforts is progress of a very remarkable kind, but it is a progress which in many respects lacks the firm and abiding characteristics of Chinese movements.

The proverb, *Chi va piano va sano*, which was recommended ten years ago to Japanese attention by an eminent English official, and apparently disregarded by them, has been adopted by their continental neighbours. To the blandishments of pushing diplomatists or acute promoters, the Chinese are deaf. However we may felicitate ourselves on our inventions, scientific appliances, "the railway and the steamship and the thoughts that shake mankind," our progress, the newspapers, the penny post, and what not, China will not adopt them simply because *we* have found their value and are proud of them. But if, within the range of her own experience, she finds the advantage of these things, she will employ them with a rapidity and decision surpassing those of the Japanese. A conspicuous instance of this will be found in her recent action with respect to telegraphs. For years the Chinese steadily refused to have anything to do with them; the small land line which connected the foreign community of Shanghai with the outer world, was maintained against the violent protests of the local authorities, and the cable companies experienced some difficulty in getting permission to land their cables. But during the winter of 1879-80, when war with Russia was threatening, the value of telegraphs was demonstrated to the Peking Government. The Peiho at Tientsin was closed by ice against steamers, and news could only be carried to the capital by overland couriers from Shanghai. Before a year elapsed a land line of telegraph was being constructed between this port and Tientsin; in a few months the line was in working order, and the Chinese metropolis is now in telegraphic communication with every capital in Europe.

This conservatism, respect for antiquity, conceit, prejudice, call it what we will, has something in it that extorts our respect. Let us imagine a dignified and cultivated Chinese official conversing with a pushing Manchester or Birmingham manufacturer, who descants on the benefits of our modern inventions. He would probably commune with himself in this wise, whatever reply Oriental politeness would dictate to his interviewer: "China has got on very well for some tens of centuries without the curious things of which this foreigner speaks; she has produced in that time statesmen, poets, philosophers, soldiers; her people appear to have had their share of affliction, but not more than those of Europe; why should we now turn around at the bidding of a handful of strangers who know little of us or our country, and make violent changes in our life and habits? A railway in a province will throw thousands of coolies and boatmen out of employment, and bring on them misery and starvation. This foreigner says that railways and telegraphs have been found beneficial in his country; good, let his countrymen have them if they please, but let us rest as we are for the present. Moreover, past events have not given us such faith in Europeans that we should take all they say for wisdom and justice." A day will undoubtedly come when China also will have her great mechanical and scientific enterprises; but what we contend for here is that nothing we can say or do will bring that time an hour nearer. European public opinion is to China a dead letter; she refuses to plead before that tribunal. Each step of her advance along our path must be the result of her own reflection and experience; and our wisest policy would be to leave her to herself to advance on it as she deems best.

SINENSIS

PROF. LINDSTRÖM ON OPERCULATE CORALS [1]

THE extinct stony corals, the calicles of which are provided with calcareous opercula, have ever been a puzzle to naturalists, since they are almost entirely without parallel amongst existing Anthozoa. The genera and species are not numerous, and are all of Palæozoic age. By far the finest and best preserved specimens of the most important forms are found in the Silurian strata in the Island of Gothland in the Baltic, and are collected for the National Museum at Stockholm, where they come under the care of Prof. Lindström, the author of the present memoir, so justly distinguished for his palæontological researches generally, and especially for those on corals. In this memoir he gives a *résumé* of all the forms of operculate corals as yet known, embodying an immense amount of important new information derived from his own prolonged investigations on a series of most remarkable specimens which I had the advantage of seeing and having explained to me by him in the summer of last year. The whole paper forms a most valuable contribution to our knowledge of these especially interesting and peculiar corals.

FIG. 1.—*Goniophyllum pyramidale* (*mutatio secunda*), viewed from above, with the opercular valves *in situ* of the natural size.

The first operculate coral described was *Goniophyllum pyramidale*, which Bromell in 1729 placed amongst the corals. The best known, and the one concerning which there has been the greatest difference of opinion, is *Calceola sandalina*, which was first figured in 1749 from the collection of Rosinus of Hamburg, by Brüchmann, who pointed out the resemblance of the coral to the front of a woman's slipper.

Brüchmann referred Calceola to the corals just as Bromell had Goniophyllum, but this was mainly because neither he or other early authors following him were acquainted with the opercula belonging to the specimens. Linné placed Calceola with the Mollusca as *Anomia sandalina*. Later it was referred to the Brachiopoda, a position in which a large number of eminent modern authorities retain it. If Calceola stood alone, the gravest doubts might certainly be entertained as to its having any relations to the corals; but now that a series of clearly allied forms such as Goniophyllum and Rhizophyllum, also bearing opercula, have had their structure so fully and satisfactorily worked out as has been done by Prof. Lindström, it is hardly possible not to follow him in placing the whole amongst the Anthozoa. The curious arrangement of the septa in Calceola closely resembles that in Goniophyllum as regards the septa both in the calicles and on the opercula. It is almost impossible to doubt the Anthozoan nature of Goniophyllum, whilst both it and Rhizophyllum, which has like Calceola an operculum of a single piece only, demonstrate their close relation to numerous recognised Palæozoic corals by exhibiting intracalicynal gemmation, and developing, like many other corals, abundance of roots.

The author divides the *Anthozoa operculata* into two families—

I. Calceolidæ (or Heterotœchidæ), distinguished by having the septa on the inner face of the operculum not alike and a median septum the largest.

II. Aræopomatidæ (or Homotœchidæ), with the septa on the operculum all alike and no defined median septum.

The Calceolidæ include all those forms in which the operculum, whether composed of one or four valves, has this valve or valves marked inside with a stout prominent median septum.

The family falls into two groups—the one in which the operculum consists of a single valve containing three genera, namely, the well-known Calceola, distinguished by not multiplying by budding, being thus never compound, by having no root-tubes, and not showing vesicular structure internally; and two others—Rhizophyllum and Platyphyllum—in both of which calicynal gemmation occurs and the internal structure is vesicular, somewhat as in Cystiphyllum.

In Rhizophyllum, a genus founded by Lindström, the

[1] "Om de Palæozoiska Formationernas Operkelbärande Koraller." Af G. Lindström, Bihang till K. Svenska, Vet. Akad. Handlingar, B. 7, No. 4.

corallum is very much like that of Calceola in shape, but more elongated. It may be simple or form large masses by two modes of budding—either calicynal budding, or budding from the abundant rootlets. In the specimen of

FIG. 2.—*Rhizophyllum elongatum.* View of the interior of the calicle to show the six young calicles developing as buds within it.

Rhizophyllum here figured, six young corals are seen in the act of developing as buds in the interior of the calicle.

In consequence of budding taking place from the "rootlets," the author advances the new suggestion that these bodies, the nature of which has always been doubtful, are to be regarded as stolons. The operculum of Rhizophyllum, by which the mouth of the calicle is completely closed, is, as in Calceola, of a semicircular shape, with a prominent ridge-like median septum on its inner face. In *Rhizophyllum attenuatum*, a compound form from Louisville, in Kentucky, first described by Mr. V. W. Lyon under the genus Calceola, the stolon tubes partly serve to connect together adjacent calicles, partly become themselves developed into fully-formed calicles. Specimens of *Rhizophyllum Gothlandicum* are found in abundance in the Island of Gothland with their opercula detached. The separate opercula are also common; specimens with the opercula *in situ* are comparatively rare. A remarkably perfect one is shown in the accompanying figure.

FIG. 3.—*Rhizophyllum elongatum.* View of the calicle with the operculum, a single valve only *in situ.*

The second group of the Calceolidæ contains only a single genus—Goniophyllum—in which the mouth of the calicle is rectangular in form, and four opercular valves are present which, with their bases resting on the four sides of the mouth of the calicle, slope inwards to meet one another, and form a four-sided pyramidal roof over

FIG. 4.—*Goniophyllum pyramidale* (*mutatio prima*). View of the mouth of the calicle, with the opercular valves *in situ*, the dorsal right and left valves being entire, the ventral incomplete.

the calicle. From Gothland Prof. Lindström has been able to obtain two or three specimens with all the four opercular valves *in situ.* So that doubts as to the connection of the valves with the coral calicle are now inadmissible. On careful study of these specimens and numerous others with a fewer number of valves *in situ*, he finds that the four valves always present well-marked differences and form, and septal striation, so that it is possible to distinguish with certainty an anterior and posterior, or ventral and dorsal, and a right and left valve, and pick these out from any collection of well-preserved loose valves. The anterior and posterior valves are trapezoid in form, the lateral triangular. A most remarkable discovery he has made is that these corals must have shed their valves periodically, and replaced them, and that when shed the valves frequently happened to become attached to the wall of the calicle, and fused with it. In the accompanying figure of *Goniophyllum pyramidale*, seen from behind, a well-formed operculum is seen near the base firmly attached to the wall of the calicle near its base. Such

FIG. 5.—*Goniophyllum pyramidale*, viewed from the ventral side to show the shed opercular valve (*a*) coalesced with the wall of the calicle near its base.

specimens are not uncommon in Goniophyllum, but in another genus, a new one, Aræopoma, belonging to the second family of operculate coral, devoid of a median septum, and which has four triangular valves like Goniophyllum, very many specimens bear numerous valves fused to their outer walls, the valves being of increasing size from below upwards, in accordance with the growth and expansion of the coral and the mouth of its calicle. In one abnormal specimen of *Goniophyllum pyramidale* there are five opercular valves present, a minute extra triangular valve being interpolated at one of the corners.

Prof. Lindström, whose important researches on the development of the septa in so-called Rugose corals are familiar, has been able to trace the development of the corallum in *Goniophyllum pyramidale.* He finds that in the youngest stage of the calicle there is no septum present at all, then that one septum is formed on what may be termed the dorsal side of the calicle, and since in this genus and several others it remains conspicuously prominent, it may be termed the primary septum. Two further septa, the light and left median, are next formed, and last of all the ventral septum, long after the others. He points out that a similar process of development is followed in most Rugose corals, and that it is therefore erroneous to treat of four septa as primary in these forms.

In Rhytidophyllum shaped somewhat like Calceola, but belonging to the Aræopomatidæ, by reason of the absence of a defined median septum on the operculum there is only a single opercular valve. A further genus of the group is possibly represented by a single broken operculum, of which further specimens have not yet been found.

In connection with the operculate corals, Prof. Lindström describes certain coral forms in which remarkable exothecal structures are present, which may be considered as more or less homologous with opercular valves. In *Pholidophyllum tubulatum*, a compound coral, first described as *Tubiporites tubulatus* by Schlotheim in 1813, and which has lately been made a subject of research by G. von Koch, the costæ are in solitary specimens clad each with a longitudinal rib composed of a double row of rhomboidal calcareous scales placed close together at an angle to one another as shown in the figure. These rows of scales form an almost complete outer covering to the corallum. The scales seem to be wanting in colonial specimens. They are extremely conspicuous and definite in some of the best preserved solitary specimens, and their regularity of disposition is such that it is impossible to believe that they do not definitely belong to the coral. They are shown enlarged in the figure. In vertical sec-

FIG. 6.—*Pholidophyllum tubulatum.* A calicle viewed from the side to show the rib-like prominences formed upon the costæ by the double rows of calcareous scales.

tions of the coral they are seen to be attached at their bases to the wall of the calicle. In *Syringophyllum organum* similar scales occur covering the exterior of the corallum, but these have a remarkable definite form somewhat like that of the bowl of a teaspoon with the handle cut off short.

As an illustration of the possibility of Anthozoa bearing opercula and scales, but not as implying any direct relationship between the Operculata and the Alcyonaria, Prof. Lindström points to the structure of *Primnoa lepadifera*, and figures one of the polyps viewed from above, showing how eight of the valve-like calcareous scales present in this species close in over the summit of the polyp, forming a conical operculum over it somewhat as in Goniophyllum, whilst the remaining scales form a representative of the calicle. He shows that, as in Goniophyllum, the opercular valves differ in form and size according to their position when *in situ*.

In his concluding paragraph he states that he considers the Calceolidæ to be probably nearly allied to such forms as Omphyma and Chonophyllum, whilst the Aræopomatidæ, on account of their vesicular internal structure, approach more nearly to Cystiphyllum. He does not consider the presence or absence of an operculum in corals to be necessarily of an important classificatory value, and cites the case of the presence and absence of opercula in Gastropoda as a parallel one of minor systematic importance. In this it is rather difficult to agree with him. Of course the opercula in Gastropods and corals are alike only in name, and as they occur so rarely in the latter the suspicion naturally arises that the two groups of the operculate corals may be more closely allied than he suspects. However, no man knows them better than he, or has a better right to an opinion on the subject, and his conclusion, guarded as it is, must be treated with all respect.

A very interesting result attained and given in tabular form on p. 91 is that in successive Upper Silurian strata a series of three modifications of form of *Goniophyllum pyramidale*, starting from *Goniophyllum pyramidale, primigena,* the form occurring in the lowest beds can be traced succeeding one another in time. Similarly *Rhizophyllum Gothlandicum, forma primaria* passes by a modification, *R. G. mutalia*, into *R. Gervillei*, of specific rank in the Devonian formations. Other operculate corals show similar modifications in progress of geological time. Prof. Lindström's important memoir cannot here be followed farther. It is illustrated by nine lithographic plates most beautifully executed in Stockholm, from which the engravings here given are copied, and are some of the most excellent ever published of corals.

H. N. MOSELEY

BARON NORDENSKJÖLD'S EXPEDITION TO GREENLAND

[THE following Programme, drawn up by Baron Nordenskjöld for his expedition to Greenland, has been kindly placed at our disposal by Mr. Oscar Dickson, who, with his well-known enlightened liberality, provides all the expenses. The Programme has not hitherto been made public, even in Sweden, as Baron Nordenskjöld did not wish to be interrupted in his preparations with correspondence on his plans and theories. The expedition leaves Sweden in the *Sofia* on the 20th instant, and will call at Thurso, where Baron Nordenskjöld will join the vessel.]

NINE centuries have elapsed since the Norwegian, Erik Röde, discovered Greenland, and founded Scandinavian Colonies; from these, Norwegian navigators some ten years after sailed south to "Vinland," the fecundus, *i.e.* to the shores of the present Canada and the United States, thereby acquiring the honour for the Norse race of being the real discoverers of the New World. It is not known whether these voyages led to any fixed settlements being established in America, but we know, on the other hand, from a number of Icelandic sources, that the colonies in Greenland became very flourishing. There were upwards of three hundred farms, "Gaarde," of which about two hundred, embracing twelve parishes, were situated in the "Österbygd," and about one hundred, embracing three or four parishes, were situated in the "Vesterbygd." During four centuries the country formed a bishopric, from which funds towards the Holy Wars were even contributed. Unfortunately, the connection between the colonies and the mother country ceased after a couple of centuries, while Greenland's ancient Norse population was extirpated, either through plagues or by "Skrællings," *i.e.*, the Eskimo who descended from the North. Another explanation of their disappearance is that they lost their nationality, and were absorbed into the Eskimo population, during their contact with the more numerous tribes of the Polar regions, whose mode of living was more suited to the climate of the country and the resources at their disposal. However that may be, there remains the fact that one of the most distinct and enterprising peoples in the world have been annihilated, or, perhaps, absorbed in one distinguished as among the lowest, both physically and intellectually. The old country, belonging to the Norwegian Crown, was even so far forgotten, that it was only Columbus's discovery in the south which recalled the attention of the Norsemen to the fact that they had once colonised a part of this world, which was being parcelled out among the southern nations by "Bulls" from Rome, as if it had just been discovered.

By the aid of traditions and old journals of navigation several attempts were made to reach the old, forgotten colonies from Iceland, but these were frustrated by the enormous masses of drift ice, which then seemed to inclose the shores of Greenland's east coast, more than formerly. Eventually, John Davis, in his attempts to find the north-west passage, discovered that the west coast was easily reached, and that the seas around it offered a fine hunting-ground for the profitable whale-fisheries. This, with the reported discovery of gold in the country resulted in the despatch of several Danish hunting and commercial expeditions, which did not, however, meet with much success, until the Norwegian, Hans Egede, by his zeal for bringing the blessings of the Gospel to the descendants of the old Norse colonists, caused trading and missionary stations to be established on the west coast. These were subsequently considerably augmented and extended, and henceforth held by the Danish crown, under "The Commercial Association of Greenland."

Greenland was thus inhabited by Norsemen from 983 until the 15th century, and its west coast has, during the last hundred and sixty years, been a place of sojourn for many able Danish administrators and missionaries. Besides this, nearly all expeditions which have been bound for the American Polar sea have stayed here more or less, while the west coast has on many occasions been the object of carefully prepared expeditions of research. This part of Greenland is, therefore, scientifically and ethnographically one of the best-known of the Arctic lands. But in spite of this we encounter here several of those *lacunæ* in the knowledge of the globe which it is of great importance that we should fill up, and some of these it is now my intention to deal with.

The east coast of Greenland was visited in 1822 by the Englishman, Scoresby, jun., and in 1823 by Sabine and Clavering, in 1829-30 by the Dane, W. A. Graah, as well as by the second German expedition under Koldewey in 1868-69, and also by some whalers. It is, however, in its greatest extent wholly unknown, a circumstance, which must be detrimental to the proper understanding of the history of the first Norse colonisation of Greenland, and of early voyages of conquest and discovery therefrom to the shores of America. Thus, until the east coast of Greenland is fully explored, one must continue to doubt the very forced explanation of the site of these colonies which is now predominant in the world of science. And it is, on the other hand, not worthy of the geographical discoveries of the 19th century, that a coast-line extending south to the latitude of Stockholm should be so utterly a *terra incognita*.

The interior of Greenland is even less known than the east coast, and here we encounter a purely scientific problem, whose great importance is apparent from the circumstance that the unestablished theory,—that the interior of the island is one continuous mass of ice,—forms one of the corner stones in glacial science, which again is closely connected with several of the fundamental principles of modern geology. If we except a trip on the inland ice of Greenland in 1751, in lat. 62° 31′ by the Danish merchant Lars Dalager, who penetrated nearly thirteen kilometres across a comparatively even plateau, and the unsuccessful attempt by Whymper in 1867, in lat. 69° 30′, where no progress was possible, in consequence of the difficult nature of the ground, only two serious attempts have been made to explore the interior of Greenland. The first of these was made by Dr. Berggren and myself between July 19 and 26, 1870, in lat. 68° 30′. Favoured by the most magnificent weather, we were able to penetrate nearly fifty kilometres across a country at the outset very difficult and rent by bottomless abysses, but which gradually improved in condition the further we advanced. We had on starting the company of two Eskimo, but they left us after two days' journey. As those who claimed to know the coast glaciers of Greenland had advised me not to waste time and labour on such a hopeless undertaking as that of penetrating over the inland ice, my outfit was very incomplete; we were in want of ropes, tent, suitable sledges, and on the Eskimo leaving us we could not even carry the utensils necessary for cooking. I could not therefore on that occasion get very far, but I certainly came to the conclusion, that I should have been able, with a couple of smart sailors or Arctic hunters and a suitable outfit, easily to have extended my wanderings to 200 or perhaps 300 kilometres. I may also mention here that in the month of June, 1873, I effected with Capt. Palander and nine sailors a journey of more than 190 kilometres over the inland ice of Spitzbergen, which journey was of special interest to me from the circumstance that I here learnt to know the character of inland ice before thaw sets in, as well as the difficulties which are at such a time attendant on journeys on the glaciers of the Polar regions. This experience, I believe, will be of great use to me during the journey now in course of preparation, as I shall have to cross portions of the inland ice which, on account of the altitude, will still be covered with snow at the time of my visit.

The second journey of research on the inland ice of Greenland was made between July 14 and August 4, 1878, in lat. 62° 40′, by the Danes, J. D. Jensen and A. Kornerup. This expedition was carefully equipped, but the country being much fissured, and the weather unfavourable, it did not reach much further inland than the Swedish of 1870.

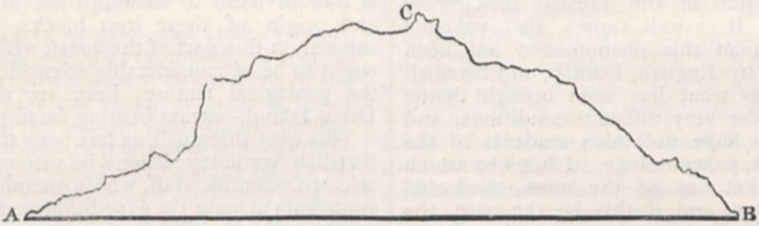
None of these expeditions saw any limit to the ice desert from their farthest point, but to infer from this that ice covers the whole interior of Greenland appears to me to be entirely unjustifiable. On the contrary, the following reflections seem to demonstrate that it is a *physical impossibility* that the whole of the interior of this extensive continent can be covered with ice, under the climatic conditions which exists on the globe south of the 80th degree of latitude.

The ice masses of the glaciers are commonly termed "permanent," a denomination which was once taken so literally that certain *savants* asserted that the ice in course of time was transformed into mineral crystals, such as those which are so frequently found in the clefts of the Alps. We know now that this term is entirely erroneous. The glacier which seems century after century to fill the same valley is not only in constant, although imperceptible, motion, by the ice masses which slowly advance from higher to lower elevations, but is also subjected to a change in its form by the circumstance that the lower stratum melts away through contact with the mountain on which it rests; while the surface on one side wastes away by thawing in the warm season and evaporation in the cold, and on the other is added to by falling snow, which latter after a time changes from snow dust to granular snow, then to crystals of ice, and eventually to a compact homogeneous mass of ice. And, if the advancing glacier is "fed" by enormous ice-fields, or what I may term "ice-lakes," situated so high that snow always falls there copiously, it can penetrate far below the border of the perpetual snow, yea, even to parts where the snow-fall is far from sufficient to make up for the loss of melting and evaporation. It is therefore clear, that glaciers, or other constant ice-masses, cannot form in places where they cannot be "fed" by descending ice, or where the snow-fall is less than the quantity which appears and disappears yearly; a circumstance which, among others, explains why no glaciers exist in the vicinity of the north polar coasts of the new or old world.

With regard to Greenland it is not difficult to demonstrate that the above-described conditions for the formation of glaciers do not exist there, if the country does not rise gradually both from the eastern and the western shore to the centre, and thus be like a loaf of bread in shape, and with sides slowly and symetrically terminating in the ocean. Such a land-formation is, however, not found in any part of the orography of the known world, and one may therefore safely conclude that neither is it to be found in Greenland. In fact, the geological nature of Greenland, very similar to that of Scandinavia, seems to indicate a similar orographical formation, viz., a formation formed of mountainous ridges alternating with deep valleys and plains; while one may even assume that the culminating line of the land in Greenland runs, as in England and Sweden, and in both American continents, along the west coast.

The winds, therefore, which should produce snow in the interior, must, if coming from the Atlantic, have in the first instance, crossed the broad ice-belt generally encircling the east coast of Greenland, and then the mountains on the coast, some of which we know are very high, and, if coming from Davis Sound, the mountain ridge itself. In both cases the wind would assume the character of the "Föhn" wind, *i.e.*, it must, after passing the mountain-chains on the coasts, be *dry and comparatively warm.* The law of the "Föhn" is, as is generally known, dependent on the circumstances explained below.

If *ACB* indicates a mountain, and a wind so dry that no deposit of moisture takes place on the top passes from *AC* to *B*, the air will certainly be chilled in passing *C*, in consequence of the lower barometric pressure and consequent expansion of the air; but the same cause which produces the lowering of temperature when the wind ascends has also the effect of liberating its heat, and the air will become warmer as it descends from *C* to *B*. The compression and rise of temperature are in the latter case precisely analogous to the expansion and fall of temperature in the former, and the dry air, in passing



the mountain, has, therefore, on reaching *B*, not suffered any change whatever in temperature or quantity of moisture. Quite different will, however, be the result if the air ascending at *A* is saturated with moisture, as, for instance, air passing a great expanse of water. In that case the air will expand and become colder, just as it ascends from the water surface to the mountain top, but, at the same time, part of the moisture will be condensed on the top, whereby the latent heat of the hydrogen will be set free and a rise of temperature take place, and this will, to a certain extent, minimise the fall of temperature caused by the expansion of the air. The air will retain the heat thus set free, even after it has reached, in a dry state, the point *B*, and the air, originally moist, has, when it has passed the mountain, attained a higher degree of heat, but less moisture than at the moment of ascending. *It is in fact dry and warm.*

These causes are not only the reason of the dry warm "Föhn" winds in Switzerland, and the very remarkable circumstance that it is under winds from the snow-covered mountains that the snow disappears in Swedish Lappland, but they play also an important part in the climatic conditions of the whole globe. They are, for example, the cause of the difference in climate and flora of the two sides of the Andes, of the east and west coasts of Tierra del Fuega, and the eastern and western parts of Australia. They are the chief cause of the deserts which cover the interiors of Asia, Australia, the northern portion of Africa, and certain parts of America, while in Sweden they produce the constant western winds, and the consequent prolonged drought which invariably occurs in spring time in the central part of the country. The same laws of the temperature and moisture of the air must also prevail in Greenland. Here too the ocean winds must be moist, and this moisture is usually deposited in the form of snow on the mountains along the coast, whereas all those reaching the interior, whether from east, west, north, or south, must—if the orographical construction of the country is not entirely different from that of others on the globe—be dry and comparatively warm. And in consequence of this circumstance, the snow-falls in the interior of Greenland cannot be sufficient for maintaining a "perpetual" inland ice.

It cannot, however, be asserted that the country should here form a deserted, treeless tundra; one encounters in Siberia forests with giant trees under climatic conditions far more severe than those we may assume are to be found in the interior of Greenland. That the country should prove true to its name has besides been asserted by the celebrated botanist Hooker, from his studies of the flora of Greenland, and even the natives on the west coast themselves have a suspicion that such is the case, from the large herds of reindeer which from time to time are seen to migrate across the inland ice to the west coast.

It is most probable that the interior, if free from ice, is like a North European high plateau, with a flora far more copious than that of the coast.

But this I maintain, that whether the interior of Greenland is richly covered with forests, as the land round the frigid pole of Siberia, or is a treeless, ice-free tundra, or even a desert of perpetual ice, the solution of the problem of its real nature is so important, and of such consequence to science, that there could hardly, at the present moment, be conceived an object more worthy of an Arctic expedition than to ascertain the true conditions of the interior of this particular country.

Besides the object of penetrating to the interior of Greenland, the expedition will have several others in view, of which I may mention the principal:—

To Fix the Limit of the Drift-ice between Iceland and Cape Farewell, and to take Soundings and Dredgings in the Adjacent Seas

This part of the Atlantic has hardly ever been subjected to any other kind of examination than that made on laying the first cables. A knowledge of the same is, however, of great importance, both for completing the missing link in the hydrographic chain of the Ocean dividing Europe and America, and for the discovery of the causes of the change in the ice-conditions in the seas of the east coast which seem to have taken place since Greenland was first discovered. Without much waste of time the expedition may be occupied with these researches during the voyage from Iceland to the Greenland promontory, which will take place in a season when fine weather may be presumed to reign here, while they may, although with less probability of being favoured by this condition, be effected during the return journey.

The Collection of Fresh Specimens of the Flora of the Ice and Snow

Professor Wittrock is at present engaged in publishing a very interesting and important work on the microscopic flora, with several varieties, whose home is in the snow and ice-fields of the Alps and the Polar regions, for which materials have been brought home from the latter by the Swedish Arctic expeditions. My expedition will, during the coming visit to Greenland, be in a position to gather further materials for researches, which have already revealed to us the startling fact, that even snow and ice can form the bed for a flora regular in development, and of many varieties.

New Systematic Researches of the Strata which in Greenland contain Fossil Plants

From the previous Swedish Arctic expeditions, and through the publications in the *Journal* of the Swedish Academy of Sciences of articles by Prof. Oswald Heer, of Zurich, we know that students of science have received during the last twenty years from the sandstones and slates of North Europe an additional abundant material for determining the pre-historic climatic conditions of the earth ; as well as a knowledge of the certainly variable, but even in the last geological era copious, flora which during these ages existed in the present ice-covered regions of the pole. It is well known, that valuable materials for the study of this phenomenon has been collected in Greenland by English, Danish, and Swedish explorers ; but hitherto what has been brought home has been gathered under very difficult conditions, and generally by men who have not been students of the science in question, viz., palæontology. I hope to attach to my coming expedition one of the most celebrated students of this science, and if this be the case, the expedition will undoubtedly bring home novel and circumstantial details relating to this important chapter of the history of the earth. This task is so much easier to accomplish as the richest fields for the discovery of such fossil objects are situated just where it is my intention to invade the inland ice. During the period I shall be absent wandering on the ice, the other members will be occupied in this pursuit.

The Collection of New Data Connected with the Fall of Cosmic Dust

It is clearly demonstrated by the discovery of cobalt containing iron particles in fresh snow in Europe, and the carbon-dust, also containing cobalt-iron, which is found on the ice-fields north of Spitzbergen, as well as by the appearance of metallic iron in "krykonit," a remarkable dust which I brought home from the Greenland ice, that the fall of a small quantity of cosmic dust always takes place, regularly or periodically, most probably in every part of the globe. But that there is a greater variation in the nature of this fall than is generally assumed, is clearly indicated by the discoveries which were made in the *Vega* expedition, viz., of tiny yellow crystals in the snow on an ice-plateau near the Taimur peninsula. This certainly necessitates fresh researches into this phenomenon, in order to settle questions of great moment to geology and cosmology. It is very difficult to investigate this feature of cosmology, in consequence of the small quantities of dust which falls, and when it takes place in closely populated districts, covered by dwellings and factories, and where the ground is perhaps only clad in snow during a short period of the season. The Polar countries, on the other hand, are particularly suited for researches of this kind, both in consequence of the purity of the air and the absence of terrestrial dust, and by the ease with which the dark dust-particles are noticed on pure snow. The coming expedition will, while steaming along the ice-belts between Iceland and Greenland, and during my wanderings on the ice, be able to direct a great deal of attention to these captivating problems.

Should the conditions of the ice in Baffin's Bay be favourable, and the vessel, when in the vicinity of Disco Island, have sufficient coals for a journey northwards, or should it be possible to obtain a sufficient supply from the beds found in these parts, it would be highly desirable that the members remaining on board whilst I am away on the inland ice make an excursion along the west coast as far as Cape York.

There are, according to statements made to the Arctic explorers Ross and Sabine, lying here on a mountain, Savilik, *i.e.*, the iron mountain, lat. 76° 10′, a couple of large, round, solitary iron blocks, from which the natives obtain the little supply of iron which they require for hunting implements and domestic utensils. The metallic constituents of these blocks are, according to an analysis made of one of these utensils brought home, iron and a small percentage of nickel, and, to judge from the descriptions by the Eskimo, these blocks are of the same nature as those which I discovered in 1870 at Ovifak, on Disco Island. It is very strange that the remarkable descriptions by Ross and Sabine should not have been the object of investigation by the many Arctic explorers who have passed this spot. An opportunity is now at hand to ascertain the much-disputed nature and origin of these iron blocks, while a few days' sojourn on this part of the coast, which is so little known, ought to be of considerable scientific value, especially as the geological features here are similar to those on Disco Island,—strata bearing fossil plants.

This expedition will, as has been the case with previous Swedish Arctic expeditions, be accompanied by a specially selected scientific staff, whose members will individually contribute to make the expedition worthy of earlier achievements, and who will lose no opportunity of adding to our knowledge of the Polar regions. They will attempt to solve some of the many problems which await investigation in the far north. It is, however, impossible to detail at length the researches which may be undertaken, as these must depend on the nature of the special studies to which the members have devoted their time.

There is, however, one more object of research to be mentioned, which should not be lost sight of by any expeditions to Greenland, viz., to attempt to solve the question : Where were the former Norse colonies, Eriksfjord, Brattelid, Garda Cathedral, Herjolfsnæs, and others situated ? This question has already been answered by the most eminent students of the early history of Greenland, who maintain that the ancient Österbygd lies west of the southern part of the island, between Cape Farewell and lat. 61°, and the Vesterbygd, a little north of the west coast. But it appears to me that, if the Icelandic Sagas are examined carefully, and without any preconceived opinion, it will become apparent that former investigators of this problem have been led astray, and that the true Eriksfjord, with its cathedral and numerous parishes, has never been found, but must be sought for on the inaccessible east coast north of Cape Farewell.

With the experience I have of the conditions of the ice in other parts of the Polar seas, I believe that this coast may be reached, without much difficulty, by sailing in the autumn from the south in the ice-free channel, which I have every reason to believe forms along this coast. This journey will, however, not be begun until the commencement of September, and this circumstance will exactly fall in with the plan in view, viz., on returning from the inland ice to attempt this voyage of discovery.

With the premises I have here detailed before me, I now have to suggest the following plan for the journey of the expedition :—

The expedition should leave Sweden near the end of May in a suitable, but not too large, steamer built of Swedish iron and constructed with water-tight compartments. And although the journey is intended for the summer months only, it should be provisioned for one year, and be provided with the necessary winter outfit, with the scientific instruments desirable, and accoutrements which would be of service for the journey on the inland ice. The steamer should be navigated by a man accustomed to sailing in the Arctic seas, whilst there ought also to be on board as ice-master a skipper who has hunted in the Arctic. The scientific staff should, besides the commander, consist of four persons, the doctor included.

From Sweden the steamer should steam to a port in Scotland, where more coals are to be taken on board, and the journey continued to Reikiavik in Iceland. There a stay will be made for a few days, when the edge of the ice in the west will be made for, which will be followed southwards, but no attempt should then be made to penetrate the pack. Only in case there should be found an open lead, which is not expected, this will be entered. The probability of this is, however, very small. After having passed Cape Farewell, the vessel will call at Ivigtuk, where again it will be coaled from the depots which have been laid up here for the use of the steamer. The course will then be shaped for the west coast of Greenland, probably calling at Egedesminde, to the Auleitsivik Fjord, from the bottom of which the ice-journey will be commenced.

This latter will occupy, it is estimated, thirty to forty days, and should be finished thus by the middle of August next. During this time the vessel will steam through the Waigatt to Omenak, where the many deposits of fossil plants will be visited. If the ice and coals should permit, the vessel will steam northwards, if possible as far as Cape York, whereby an excellent opportunity will be offered for geological, mineralogical, botanical, and zoological studies. In the middle of August the vessel will again be due in the Auleitsivik Fjord, and taking the members of the ice-expedition on board, will steam south to Ivigtuk, where a few days' stay will be made for coaling, etc. From here the vessel will steam round Cape Farewell, along the east coast in the open channel, which I expect to find there at that season; and my intention is then, with due reference to the old geographical descriptions of the Icelandic Sagas, carefully to search the fjords which may be accessible.

At the end of September the return journey will be commenced outside the belt of pack-ice to Reikiavik and home.

The distances the vessel will cover are, in round figures, these:—

			Nautical Miles
Gothenburg ...	to	Thurso	500
Thurso	„	Reikiavik	700
Reikiavik	„	Ivigtuk	870
Ivigtuk	„	Auleitsivik Fjord	540
Auleitsivik Fjord	„	Omenak	330
Omenak	„	Cape York	400

A. E. Nordenskiöld

NOTES

The Fifty-third Annual Meeting of the British Association will commence on Wednesday, September 19, 1883, at Southport. The President Elect is Arthur Cayley, LL.D., F.R.S., Sadlerian Professor of Mathematics in the University of Cambridge. The Vice-Presidents Elect are the Right Hon. the Earl of Derby, the Right Hon. the Earl of Crawford and Balcarres, the Right Hon. the Earl of Lathom, Prof. J. G. Greenwood, LL.D., Prof. H. E. Roscoe, LL.D., F.R.S. The General Treasurer is Prof. A. W. Williamson, Ph.D., F.R.S., University College, London. The General Secretaries are Capt. Douglas Galton, C.B., F.R.S., and A. G. Vernon Harcourt, F.R.S. The Secretary is Prof. T. G. Bonney, F.R.S. The Local Secretaries are J. H. Ellis, Dr. Vernon, T. W. Willis; and the Local Treasurer the Mayor of Southport. The Sections are the following:—A.—Mathematical and Physical Science.—President: Prof. Henrici, F.R.S. Vice-Presidents: Prof. Balfour Stewart, M.A., LL.D., F.R.S., F.R.A.S.; Prof. Stokes, M.A., D.C.L., LL.D., Sec.R.S. Secretaries: W. M. Hicks, M.A.; Prof. O. J. Lodge, D.Sc.; D. McAlister, M.A., M.B., D.Sc. (Recorder); Prof. Rowe, M.A., B.Sc. B.—Chemical Science.—President: J. H. Gladstone, Ph.D., F.R.S. Vice-Presidents: Hugo Müller, Ph.D., F.R.S., For. Sec. C.S.; Prof. T. E. Thorpe, Ph.D., F.R.S., F.C.S. Secretaries: Prof. P. Phillips Bedson, D.Sc., F.C.S. (Recorder); H. B. Dixon, M.A., F.C.S.; H. Foster Morley, M.A., B.Sc., F.C.S. C.—Geology.—President: Prof. W. C. Williamson, F.R.S. Vice-Presidents: Prof. W. Boyd Dawkins, M.A., F.R.S., F.S.A., F.G.S.; J. W. Hulke, F.R.S., Pres.G.S. Secretaries: R. Betley, F.G.S.; C. E. de Rance, F.G.S.; W. Topley, F.G.S. (Recorder); W. Whitaker, B.A., F.G.S. D.—Biology.—President: Prof. E. Ray Lankester, F.R.S. Vice-Presidents: Prof. Gamgee, M.D., F.R.S.; W. Pengelly, F.R.S., F.G.S.; Prof. Schäfer, F.R.S.; W. T. Thiselton Dyer, M.A., B.Sc., F.R.S., F.L.S. Secretaries: G. J. Haslam, M.D.; W. Heape; Prof. A. M. Marshall, M.A., M.D., D.Sc.; Howard Saunders, F.L.S., F.Z.S. (Recorder); G. A. Woods. Department of Anthropology: W. Pengelly, F.R.S., F.G.S. (Vice-President), will preside. Secretaries: G. W. Bloxam, M.A., F.L.S. (Recorder); Walter Hurst. E.—Geography.—President: Lieut.-Col. H. H. Godwin-Austen, F.R.S., F.G.S., F.R.G.S. Vice-Presidents: Sir Rawson W. Rawson, K.C.M.G., C.B., F.R.G.S.; The Rev. Canon Tristram, M.A., LL.D., F.R.S., F.L.S. Secretaries: John Coles, F.R.A.S., F.R.G.S.; E. G. Ravenstein, F.R.G.S.; E. C. Rye, F.Z.S. (Recorder). F.—Economic Science and Statistics.—President: R. H. Inglis Palgrave, F.R.S., F.S.S. Vice-Presidents: Prof. R. Adamson, M.A., LL.D.,; J. Heywood, F.R.S., F.G.S., F.S.A., F.S.S. Secretaries: Prof. H. S. Foxwell, M.A., F.S.S.; J. N. Keynes, M.A., B.Sc.; Constantine Molloy (Recorder). G.—Mechanical Science.—President: James Brunlees, F.R.S.E., F.G.S., Pres. I.C.E. Vice-Presidents: W. H. Barlow, F.R.S., M.I.C.E.; Prof. Osborne Reynolds, M.A., F.R.S. Secretaries: A. T. Atchison, M.A., C.E.; Edward Rigg, M.A.; H. T. Wood, B.A. (Recorder). The first general meeting will be held on Wednesday, September 19, at 8 p.m., when Sir C. W. Siemens, D.C.L., LL.D., F.R.S., F.C.S., M.I.C.E., will resign the Chair, and Prof. Cayley, M.A., LL.D., F.R.S., V.P.R.A.S., President Elect, will assume the Presidency, and deliver an address. On Thursday evening, September 20, at 8 p.m., there will be a soirée; on Friday evening, September 21, at 8.30 p.m., a Discourse on Recent Researches on the Distance of the Sun, by Prof. R. S. Ball, LL.D., F.R.S., Astronomer Royal for Ireland; on Monday evening, September 24, at 8.30 p.m., a Discourse on Galvani and Animal Electricity, by Prof. J. G. McKendrick, M.D., LL.D., F.R.S.E., Professor of Physiology in the University of Glasgow, and in the Royal Institution of Great Britain; on Tuesday evening, September 25, at 8 p.m., a soirée; on Wednesday, September 26, the concluding general meeting will be held at 2.30 p.m.

The number of members of the British Association who have announced their intention of being present at the proposed meeting at Montreal in 1884, continues to increase, and now exceeds 410. It is stated that Lord Rayleigh has accepted the presidency for the Canadian meeting.

Prof. Huxley has been elected a Foreign Member of the U.S. National Academy.

From a list of seven names proposed by the Incorporated Societies throughout the colony, the following gentlemen have been elected honorary members of the New Zealand Institute:—Sir William Thomson, F.R.S., Professor of Natural Philosophy, University of Glasgow; Dr. W. B. Carpenter, F.R.S., C.B., of London; and Mr. R. L. J. Ellery, F.R.S., Government Astronomer at Melbourne.

Prof. Tyndall has resigned his position as Scientific Adviser to the Board of Trade and the Lighthouse Boards.

We are glad to see the ample recognition of music during the present week by the conferring of knighthood on Messrs. Sullivan, Grove, and Macfarren in connection with the New College of Music. Let us hope that the science of music as well as the art will receive due cultivation in the new institution; with Sir George Grove's well-known wide sympathies, however, this may be taken for granted.

THE first eclipse news comes from Lima, under date May 7; the sky was overcast on the 6th, preventing any observation of the eclipse. It is to be hoped the conditions were more favourable on the other side of the Pacific.

THE proposal to open museums and galleries on Sundays was, we regret to say, lost in favour of Lord Shaftesbury's compromise to keep them open in the evenings on two or three nights a week, which does not in the least meet the case of the working classes.

M. RICHI, Professor in the Paris School of Medicine, was nominated Member of the Academy of Sciences on Monday, to fill the place vacated by the death of M. Sedillot. Another election will soon take place in the same section of medicine and surgery.

MR. A. H. KEANE proposes, as soon as he obtains a sufficient number of subscribers, to begin the publication of "A Classification of the Races of Mankind," copious materials for which have now been collected. It will form two large octavo volumes of about six hundred pages each. The publication will probably extend over two years, and at least five hundred names will be required to justify the undertaking, although subscribers to the first need not be committed to purchase the second part also. Subscriptions will be received by Mr. Edward Stanford, 55, Charing Cross, or by Mr. Keane, at University College, London. With regard to the scope and contents of the work, it may be briefly stated that its aim will be to place in the hands of the ethnological student a comprehensive treatise on the races of mankind harmonising with the present state of anthropological inquiry. In the general introduction such broad questions will be dealt with as the evolution of man, the antiquity and specific unity of the species, the present varieties of mankind, the physical and moral criteria of race, the fundamental human types, their evolution and dispersion, the peopling of the continents, the origin of articulate speech, the morphological orders and families of speech, the problem of specific linguistic diversity within the same ethnical group. The great physical divisions of the human family will then be dealt with *seriatim*, and here the same arrangement will be adhered to as that observed in Mr. Keane's ethnological appendices to the Stanford Geographical Series. Each of the main sections of mankind will thus be treated in three separate parts. In the first the salient physical and moral characteristics of the type will be discussed. The second will be occupied with the several main branches of each, and here the proper work of classification will be carried out in detail. Lastly, the third part will consist of an alphabetical index, comprising, as far as Mr. Keane has been able to collect them, all the known races, tribes, and languages of each main division, briefly described, and with copious references to authorities. The price of the work will be 16*s*. per volume to subscribers.

THE Dutch Polar ship *Willem Barents* started again on Saturday from Amsterdam, under the command of Capt. Dalen, for the Arctic regions, to try to discover the Dutch expedition in the *Varna*. Mr. Leigh Smith was present, as well as Mr. Clements Markham, to wish the *Willem Barents* "God speed." Sir Allen Young went over to express his best wishes to the crew of the Dutch ship. Mr. Leigh Smith presented to Capt. Dalen two magnificent silver cups, bearing as an inscription the following words, taken from his journal: "August 3d, 1882; Matotchkin Skarr, Nova Zembla, 10.0 a.m. A sail! A sail! The *Willem Barents*."

THE Danish expedition to Greenland left Copenhagen on Wednesday last week. Its purpose is to explore the east coast of Greenland; and it will probably be away for two years.

THE Sanitary Institute of Great Britain held its annual meeting at 9, Conduit Street, on Monday, Prof. de Chaumont, M.D., F.R.S., in the chair. A report was presented by the Council on the progress of the Institute and on the work at the Congress and Exhibition held by the Institute at Newcastle last autumn. The Chairman gave an address, and the officers for the ensuing year were elected, the President being the Duke of Northumberland, and the trustees Sir John Lubbock, Bart., Mr. Thomas Salt, M.P., and Dr. B. W. Richardson.

THE Prince of Wales opened the Indian Institute at Oxford last week.

TWO divisions of the pupils of Sainte Barbe left Paris on May 4, one for London, and the other for Germany, where they are to stay for three months under the care of their professors, for the purpose of obtaining practical knowledge of the English and German languages.

REAR-ADMIRAL MOUCHEZ is leaving Paris within a few days. for Algiers, where he will establish an observatory at Coubar. This site is deemed excellent for observations.

WE have received the announcement of an aëronautical exhibition, to be held from June 5 to 15 at the Trocadéro, Paris.

THE Whit Monday excursion of the Geologists' Association will be to Hunstanton; and on May 26 to Ealing and Perivale.

THE well-known explorer of the fauna and depths of Lake Baikal, Dr. Godlevsky, who is now in Kamchatka, writes to the East Siberian Geographical Society, from Petropavlovsk, that last summer he transported on board of a steamer of the company Hutchinson, Kool, and Co., fifteen reindeer, of which eleven were males and four females, to Behring's Island. The reindeer were brought to Petropavlovsk from the west coast of Kamchatka in a flock of 150, and the journey took no less than two and a half months, as it was made across the mountains in order to avoid the mosquitos of the valleys. On board the steamer the reindeer were fed with stems and leaves of birch, as also with fresh grass kept in casks with water. Afterwards they also ate hay, and even bread, contrary to the affirmations of the Lamuts, who said that reindeer never eat grass that has been gathered by man. The steamer-journey was made in two days, and the reindeer arrived in good health.

WHEN leaving Yakutsk for the mouth of the Lena, M. Yurgens distributed a number of thermometers to different persons. The *Izvestia* of the East Siberian branch of the Russian Geographical Society now publish the meteorological observations made at Markha, in the province of Yakutsk, district of Viluisk, during the four months of August to November last, by an exile, M. Pavloff. The rapidity with which the cold weather sets in in those latitudes is very interesting. In August the thermometer rose at 1 p.m. as high as 31° Cels. (on August 1), and reached 14° to 20° during the second half of the month. The first frosts were experienced (at 7 a.m.) in September, and already in the first days of October the thermometer sunk (at 7 a.m.) as low as −11° to −20°; and as low as −30° to −35°, and even −39°, during the second half of October. In November it never rose above −32°, and usually stood at seven o'clock in the morning between −39° to −50°; even at 1 p.m. it did not rise, during the whole of the month, above −31°, and usually stood between −33° to −42°, occasionally sinking to −48° and −50° Cels. The underground thermometer, placed at 1·5 feet below the surface, decreased with a remarkable regularity, from 6°·8, on August 1, to 0° on September 12 to 17, to −2° on October 17, to −6° on November 1, and to −17° on November 30.

A CORRESPONDENT points out that at the conclusion of the address by Prof. Du Bois Reymond on "Darwin and Copernicus"

(NATURE, vol. xxvii. p. 558), it is stated that "Charles Darwin lies buried in Westminster Abbey among his peers, Newton and Faraday," whereas Faraday lies buried in the unconsecrated ground at Highgate, and not in Westminster Abbey.

ACCORDING to information received from the United States, some wonderful telephonic feats are being performed by the new Hopkins arrangement. It seems that two operators—one at New York and the other at Chicago, 1100 miles apart—had no difficulty, not only in talking to each other, but in listening to music, and fulfilling other tests. Even the noise produced by changing the diaphragm at New York was distinctly heard at Chicago.

THE Institute of Agriculture at South Kensington completed the work of its first session on Monday, the 7th inst. The Earl of Aberdeen, Chairman of the Council, presided, and distributed Certificates of Merit to 103 students. Notice was given of largely increased opportunities for study during the next session, which commences on October 1.

THE National Eisteddfod of Wales is not without an appreciation for science; in its list of prizes three are offered in natural history, one of 10*l.* 10*s.*, open to all comers, being for the best model of a skeleton of Plesiosaurus. Length of model not to be less than 4 feet, each bone to be separately modelled and removable except those of the cranium and phalanges. Competitors may obtain information and aid on application to Prof. Sollas, University College, Bristol.

THE statue of Leibnitz, intended for Leipzig, has recently been cast by Herr Lenz of Nuremberg, after the model of Prof. Hähnel, and the casting was a complete success. Herr von Miller of Munich has received an order for a colossal statue of Columbus, destined for the city of Cincinnati.

WE hear of a curious incident occurring on Siemens' electric railway at Portrush. Owing to the fact that as yet only part of the line is furnished with electric conductors, a steam-engine is still used as well as the electric locomotive. A few days ago the steam-engine while drawing its load along the line came to a stand through the accident of bursting a boiler-tube. News of the disaster having been sent to the terminus, the stationary dynamo-electric machine which supplies the current was set into action and the electric locomotive despatched to the rescue. It returned an hour later bringing the disabled steam-engine behind it.

M. FOUSSEREAU has lately measured the electric resistance of glass by charging a condenser from a known battery through a given thickness of the glass, and observing the time required to raise the potential of the condenser to a given degree. Bohemian glass was found to be from 5 to 20 times as good a conductor as ordinary glass, whilst flint glass was from 1000 to 1500 times as good an isolator. M. Foussereau found also that annealing the glass increased its resistance in some cases elevenfold.

AT a special general meeting of the Entomological Society of London, held on May 2, Prof. J. O. Westwood, M.A., F.L.S., was elected titular life-president of the Society by acclamation, the occasion being the fiftieth anniversary of the meeting at which steps were taken to establish the Society.

OUR readers will remember the accounts given last autumn of the electric launch which was successfully tried upon the Thames last autumn. This little craft has been running at intervals all the winter and is still in good trim. We learn that the Electrical Power Storage Company have three other electric boats on hand; one of them for the British Government.

A STRONG earthquake shock, with an undulating motion, was felt on the morning of the 8th, at Biancavilla, Sicily.

REPEATED shocks of earthquake were observed in various places in the Spanish province of Valencia on April 14 and 16. Some were of 2 to 3 seconds' duration.

LITERARY piracy would appear to be one of the institutions of the West to which young Japan has taken rather kindly. According to the *Japan Gazette*, the practice of pirating patents, stamps, and labels, in order to palm off spurious imitations for the genuine article, has been carried on for years, and the evil is extending in every direction. Recently a native company called the "Tokio Bookselling Company" was established in the capital, and its chief business appears to be the pirating of English and American schoolbooks. Todhunter's well-known Elementary Algebra, Euclid, and other mathematical books have already been reproduced, as well as several American books, Mill's "Liberty," and other volumes. These are published as much like the originals in size, covers, &c., as possible. The Company affixes its imprint to the titlepages, but offers no explanation as to the publication in Japan, and indeed they have no hesitation in reprinting (probably through ignorance) the foreign publishers' notices, such as "Entered according to the Act of Congress in the year, &c., &c." An examination of the reprint of Todhunter's Algebra shows letters upside down, wrong fount letters, letters misplaced, and words improperly spelt, testifying to the slovenly way in which the books have been printed. There is said to be scarcely a page in the book which does not contain one or more errors in orthography, and the mathematical formulæ, which always require such care at the printers' hands, must be in a bad state when ordinary words are so neglected. The direct damage to foreign authors, patentees, and manufacturers by these petty thefts cannot be very great; the real injury is to the Japanese people themselves. Among well-known English labels, that of Bass and Co. has for many years been the subject of innumerable depredations. The striking red diamond on white ground lends itself easily to imitation, while to people who cannot read English letters at all, any strange marks below the diamond are sufficient to represent the names of the eminent brewers. Large quantities of some decoction brewed in Tokio are thus passed off in the interior as Burton ale. A patent law is wanted in Japan, not so much for the protection of foreign inventors (the Japanese Government is far too advanced to think of such a minor consideration as this) as for the protection of the pockets and stomachs of the Japanese themselves.

WE are pleased to observe that the *Chrysanthemum* magazine of Yokohama has commenced its third year with a more ambitious flight. The size is considerably enlarged, as is also the number of subjects treated and the staff of writers. The theological discussions appear to be wholly eliminated, to the increase of the general interest of the journal. The first two numbers of the new issue are now before us, and exhibit no lack of mental power. The literary treatment of the varied subjects discussed is in most cases excellent. The most powerful recruit appears to be Capt. Brinkley, R.A., who writes a serial tale with Japanese characters and scenes, as well as a serial history of Japanese keramics, which deserves more attention in this country than it is likely to get. Higher education in Japan is elaborately treated by Dr. Groth, while Capt. Blakiston, probably the best authority on the ornithology of Japan, writes on that subject. Mr. A. H. Cole is responsible for a popular paper on the Darwinian theory, and Prof. Summers describes some ancient caves near Osaka. These are but a few of the papers in the first numbers of the new magazine, the editor of which appears determined at least to deserve success. We may, however, draw his attention to one defect, surely a very grave one in a scholarly publication such as this, viz. the notices of current literature, which so far have been quite unequal to the other departments.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mrs. Florence A. Hill; a Common Rhea (*Rhea americana*) from Uruguay, presented by Mr. F. R. S. Balfour; a Common Kestrel (*Tinnunculus alaudarius*), British, presented by Mr. A. Lidbury; a Wood Owl (*Syrnium aluco*), British, presented by Mrs. W. Duncan; two Horned Lizards (*Phrynosoma cornutum*) from Texas, presented by Mr. John G. Witte; two Marbled Newts (*Triton marmorata*) from France, presented by Mr. G. H. King; two Viverrine Cats (*Felis viverrina*), an Indian Otter (*Lutra nair*), an Indian Darter (*Plotus melanogaster*), a Hamilton's Terrapin (*Clemmys hamiltoni*), three Indian Gazelles (*Gazella bennetti*) from India, deposited; two Natterjack Toads (*Bufo calamita*), four Marbled Newts (*Triton marmorata*), four Short-nosed Sea Horses (*Hippocampus antiquorum*), from France, purchased; a Black Wolf (*Canis niger*) from India, received in exchange; an Eland (*Oreas canna* ♀), born in the Gardens.

OUR ASTRONOMICAL COLUMN

D'ARREST'S COMET.—Although M. Leveau's elements of this comet for the approaching return to perihelion were communicated to the Academy of Sciences of Paris on January 22, they were unaccompanied by predicted places, and it would appear that the ephemeris has had only a very limited circulation, being confined, if we are rightly informed, to those observers who are in possession of the larger instruments. Hence comparatively few persons may have become acquainted with the circumstances under which this return of the comet to perihelion takes place, and it may not be without interest if we briefly examine the conditions as compared with those of former appearances.

Assuming as usual the intensity of the comet's light (I) to be represented by the reciprocal of the product of the squares of the distances from the earth and sun, we find the following values:—

	I.
1851. Last observation at Berlin, Oct. 6	0·590
1858. Last observation at the Cape, Jan. 18 ...	0·151
1870. Last observation at Athens, Dec. 20 ...	0.154
1877. Last observation at Athens, Sept. 10 ...	0·127

The greatest distance from the earth at any of these dates was 1·93 on January 18, 1858.

M. Leveau's elements for the approaching return apply to 1883, June 12·0 M.T. at Paris; neglecting, of course, the small effect of perturbation in the interval, the perihelion passage is found to take place 1884, January 13·5765 M.T. at Greenwich. The coordinate constants for apparent equinox of 1883, May 1, are:—

$$x = r . [9·99502] \sin (v + 50° 13'·7).$$
$$y = r . [9·99308] \sin (v + 321 48·0).$$
$$z = r . [9·36631] \sin (v + 280 38·1).$$

Hence we have the following approximate positions and distances of the comet, with the corresponding values of the theoretical intensity of light, taking dates near the time of new moon:—

12h. G.M.T.	R.A. h. m.	Decl. ° '	Distance from Earth.	Distance from Sun.	I.
June 6 ...	13 9·6 ...	+12 48 ...	2·037 ...	2·615 ...	0·035
July 4 ...	13 13·7 ...	+10 12 ...	2·185 ...	2·415 ...	0·036
Aug. 2 ...	13 37·0 ...	+ 5 42 ...	2·321 ...	2·204 ...	0·038
Nov. 29 ...	17 58·6 ...	−16 55 ...	2·281 ...	1·427 ...	0·094
Dec. 29 ...	19 45·7 ...	−18 8 ...	2·244 ...	1·338 ...	0·111

Whence it will be seen that even when most favourably circumstanced, towards the end of the year, the intensity of light will be less than the lowest value at which the comet has hitherto been observed, viz. 0·127. On November 29 the comet sets about 2h. 8m. after the sun. It was missed at the return in 1864, and the chances of observation at its present visit are by no means encouraging.

Mr. Common informs us that he has made a thorough search or the comet with his large reflector, but without success up to May 7. He remarks that the number of faint nebulæ about its track is surprising.

The orbit of this comet almost intersects that of the lost comet of De Vico, 1844; in heliocentric longitude 339°·37', with the elements of 1851, the distance between the orbits was only 0·0055 or 507,000 miles.

TEMPEL'S COMET, 1873 II.—The corrected elements of this body by M. Schulhof, from observations at its last appearance in 1878, indicate that, neglecting perturbations, it may be again in perihelion about November 20. The positions calculated on this assumption show that the comet will be very unfavourably placed for observation, and it may escape detection at this return.

RULES AND REGULATIONS FOR THE PREVENTION OF FIRE RISKS ARISING FROM ELECTRIC LIGHTING[1]

THESE rules and regulations are drawn up for the reduction to a minimum, in the case of electric lighting, of those risks of fire which are inherent in every system of artificial illumination, and also for the guidance and instruction of those who have, or who contemplate having, electric lighting apparatus installed on their premises.

The difficulties that beset the electrical engineer are chiefly internal and invisible, and they can only be effectually guarded against by "testing," or probing with electric currents. They depend chiefly on leakage, undue resistance in the conductor, and bad joints, which lead to waste of energy and the dangerous production of heat. These defects can only be detected by measuring, by means of special apparatus, the currents that are either ordinarily or for the purpose of testing, passed through the circuit. Should wires become perceptibly warmed by the ordinary current, it is an indication that they are too small for the work they have to do, and that they should be replaced by larger wires. Bare or exposed conductors should always be within visual inspection and as far out of reach as possible, since the accidental falling on to, or the thoughtless placing of other conducting bodies upon such conductors, would lead to "short circuiting," and the consequent sudden generation of heat due to an increased current in conductors not adapted to carry it with safety.

The necessity cannot be too strongly urged for guarding against the presence of moisture and the use of "earth" as part of the circuit. Moisture leads to loss of current and to the destruction of the conductor by electrolytic corrosion, and the injudicious use of "earth" as a part of the circuit tends to magnify every other source of difficulty and danger.

The chief dangers of every new application of electricity arise from ignorance and inexperience on the part of those who supply and fit up the requisite plant.

The greatest element of safety is therefore the employment of skilled and experienced electricians to supervise the work.

I. THE DYNAMO MACHINE

1. The dynamo machine should be fixed in a dry place.
2. It should not be exposed to dust or flyings.
3. It should be kept perfectly clean and its bearings well oiled.
4. The insulation of its coils and conductors should be practically perfect.
5. All conductors in the dynamo room should be firmly supported, well insulated, conveniently arranged for inspection, and marked or numbered.

II. THE WIRES

6. Every switch or commutator used for turning the current on or off should be constructed so that when it is moved and left it cannot permit of a permanent arc or of heating.
7. Every part of the circuit should be so determined, that the gauge of wire to be used is properly proportioned to the currents it will have to carry, and all junctions with a smaller conductor should be fitted with a suitable safety fuse or protector, so that

[1] Recommended by the Council of the Society of Telegraph Engineers and of Electricians in accordance with the Report of the Committee appointed by them on May 11, 1882, to consider the subject. Members of the Committee:—Prof. W. G. Adams, F.R.S., Sir Charles T. Bright, T. Russell Crampton, R. E. Crompton, W. Crookes, F.R.S., Warren De La Rue, D.C.L., F.R.S., Prof. G. C. Foster, F.R.S., Edward Graves, J. E. H. Gordon, Dr. J. Hopkinson, F.R.S., Prof. D. E. Hughes, F.R.S., W. H. Preece, F.R.S., Alexander Siemens, C. E. Spagnoletti, James N. Shoolbred, Augustus Stroh, Sir William Thomson, F.R.S., Lieut.-Col. C. E. Webber, R.E.

no portion of the conductor should ever be allowed to attain a temperature exceeding 150° F.

8. Under ordinary circumstances complete metallic circuits should be used; the employment of gas or water pipes as conductors for the purpose of completing the circuit should not in any case be allowed.

9. Bare wires passing over the tops of houses should never be less than seven feet clear of any part of the roof, and all wires crossing thoroughfares should invariably be high enough to allow fire-escapes to pass under them.

10. It is most essential that joints should be electrically and mechanically perfect and united by solder.

11. The position of wires when underground should be clearly indicated, and they should be laid down so as to be easily inspected and repaired.

12. All wires used for indoor purposes should be efficiently insulated, either by being covered throughout with some insulating medium, or, if bare, by resting on insulated supports.

13. When these wires pass through roofs, floors, walls, or partitions, or where they cross or are liable to touch metallic masses, like iron girders or pipes, they should be thoroughly protected by suitable additional covering; and where they are liable to abrasion from any cause, or to the depredations of rats or mice, they should be efficiently incased in some hard material.

14. Where indoor wires are put out of sight, as beneath flooring, they should be thoroughly protected from mechanical injury, and their position should be indicated.

N.B.—The value of frequently testing the apparatus and circuits cannot be too strongly urged. The escape of electricity cannot be detected by the sense of smell, as can gas, but it can be detected by apparatus far more certain and delicate. Leakage not only means waste, but in the presence of moisture it means destruction of the conductor and its insulating covering, by electric action.

III. Lamps

15. Arc lamps should always be guarded by proper lanterns to prevent danger from falling incandescent pieces of carbon, and from ascending sparks. Their globes should be protected with wire netting.

16. The lanterns, and all parts which are to be handled, should be insulated from the circuit.

IV. Danger to Person

17. Where bare wire out of doors rests on insulating supports, it should be coated with insulating material, such as india-rubber tape or tube, for at least two feet on each side of the support.

18. To secure persons from danger inside buildings, it is essential so to arrange and protect the conductors and fittings that no one can be exposed to the shocks of alternating currents of a mean electromotive force exceeding 100 volts, or to continuous currents of 200 volts.

19. If the difference of potential within any house exceeds 200 volts, the house should be provided with a "switch," so arranged that the supply of electricity can be at once cut off.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

Cambridge.—Dr. Humphry has formally resigned the Professorship of Anatomy, after having taught anatomy in the University for thirty-six years, at first as assistant to Prof. Clark, and since 1866 as Professor. The Electoral Board for the Professorship consists of Professors Huxley, Allen, Thompson, Flower, Paget, Newton, and Liveing, Dr. Michael Foster, and Mr. J. W. Clark.

The Honorary Degree of LL.D. will be conferred in June upon Count Menabrea, formerly Italian Ambassador to England, Prof. Pasteur, Prof. Michaelis (Strasburg), Sir A. Grant, Bart., Principal of Edinburgh University, Sir John Lubbock, Bart., Sir J. A. G. Ouseley, Bart., Professor of Music at Oxford, Sir Richard Temple, Bart., Lieut.-Gen. Walker, Surveyor-General of India, Mr. Matthew Arnold, Prof. W. W. Goodwin (Harvard, U.S.), Mr. Reginald S. Poole (British Museum), Prof. H. E. Roscoe (Owens College), and Mr. G. F. Watts, R.A.

The Graces creating a Professorship of Surgery without stipend, and authorising the immediate appointment of a Professor of Physiology, are to be voted on to-day (Thursday).

The City and Guilds of London Institute has decided to make a grant of 300*l.* a year for five years, for the purpose of supporting a Chair of Mechanical Engineering in connection with Firth College, Sheffield.

SOCIETIES AND ACADEMIES

London

Royal Society, March 15.—"Atmospheric Absorption in the Infra-Red of the Solar Spectrum." By Capt. Abney, R.E., F.R.S., and Lieut.-Col. Festing, R.E.

Any investigations on the subject of atmospheric absorption are of such importance in the study of meteorology, that we have deemed it advisable to present a preliminary notice of certain results obtained by us, without waiting to present a more detailed account which will be communicated at a future date. From 1874, when one of us commenced photographing the spectrum in the above region, till more than a year ago, the extremely various manners in which the absorption took place caused considerable perplexity as to their origin, and it was only after we had completed our paper on the absorption of certain liquids [1] that a clue to the phenomena was apparently found. Since that time we have carefully watched the spectrum in relation to atmospheric moisture, and we think that more than a year's observations in London, when taken in connection with a month's work at an altitude of 8500 feet on the Riffel, justify the conclusions we now lay before the Society.

A study of the map of the infra-red region of the solar spectrum,[2] and more especially a new and much more complete one, which is being prepared for presentation to the Royal Society by one of us, shows that the spectrum in this part is traversed by absorption lines of various intensities. Besides these linear absorptions, photographs taken on days of different atmospheric condition show banded absorptions superposed over them. These latter are step by step absorptions increasing in intensity as they approach the limit of the spectrum at the least refrangible end. In the annexed diagram [3] Fig. 4 shows the general appearance of this region up to λ 10,000 on a fairly dry day: the banded absorption is small, taking place principally between λ 9420 and λ 9800: a trace of absorption is also visible between λ 8330 and λ 9420. On a cold day, with a north-easterly wind blowing, and also at a high altitude on a dry day, these absorptions nearly if not quite disappear. If we examine photographs taken when the air is nearly saturated with moisture (in some form or another) we have a spectrum like Fig. 1. Except with very prolonged exposure no trace of a spectrum below λ 8330 can be photographed. Fig. 2 shows the absorption-bands, where there is a difference of about 3° between the wet and dry bulbs, the latter standing at about 50°. It will be noticed that the spectrum extends to the limit of about λ 9420, when total absorption steps in and blocks out the rest of the spectrum. Fig. 3 shows the spectrum where the difference between the wet and the dry bulbs is about 6°. Figs. 5 and 6 show the absorption of thicknesses of 1 foot and 3 inches of water respectively, where the source of light gives a continuous spectrum. With ⅛-inch of water all absorption-bands except that commencing at λ 9420 are absent. It will be seen that there is an accurate coincidence between these "water-bands" and the absorption-bands seen in the solar spectrum, and hence we cannot but assume that there is a connection one with the other. In fact, on a dry day it is only necessary to place varying thicknesses of water before the slit of the spectroscope and to photograph the solar spectrum through them, in order to reproduce the phenomena observed on days in which there is more or less moisture present in the atmosphere. It is quite easy to deduce the moisture present in atmosphere at certain temperatures by a study of the photographs. There does appear a difference, however, in the intensity of the banded absorptions in hot weather and in cold about up to 50°. In the former they are less marked when the degree of saturation and the length of atmosphere traversed are the same as in the latter.

The accepted view, we believe, of absorption of vapours is that they give linear absorptions in certain thicknesses, and as the thickness increases or the density becomes greater, the lines

[1] "The Influence of the Atomic Groupings of the Molecules of Organic Bodies on their Absorption in the Infra-Red Region of the Spectrum." *Phil. Trans.*, Part III., 1881.

[2] *Phil. Trans.*, 1880.

[3] The black lines given in the diagram are merely lines of reference, and do not represent the aqueous absorption under consideration.

blacken, new lines appear, and gradually total absorption sets in in the region where the lines are most numerous and close. It is in the range of possibility that the presence of a small quantity of vapour might show itself as a haze over some region of the spectrum; if, however, the quantity was gradually increased, the haze would give place to lines, and the phenomena just described would be repeated. Suppose several localities of absorption to exist, the absorptive power of the vapour increasing the further down in the infra-red the locality was situated, it might happen that, whilst one locality showed only a haze of absorption, one further down might show total absorption, and some locality between these two should show linear absorption.

In the case of the absorptions in the solar spectrum we find a very different state of things existing. A comparison of the photographs taken in London on days of different dryness, and with those taken at the Riffel, shows that the linear absorptions are not increased in number or intensity; except so far that the blackness of the lines is increased by the blackness of the banded absorptions, and the same blackness can be induced by placing a certain thickness of water before the slit of the spectroscope: another point is that the Fraunhofer lines in certain regions (say λ 9420 to λ 9800) are so irregularly distributed as to preclude the idea that they all belong to the absorption of aqueous vapour, yet all are equally darkened by the band, and they do not spread out as the blackness of the band increases. This is against the view of the bands being formed by aqueous vapour, as we know it.

The question then arises as to what these "water-bands" can be due—if not due to vapour. This we consider an open question, and one which should be discussed. All we can state is that the absorptions shown are similar to those of water (liquid) and they do not seem to point to the watery stuff existing as vapour,[1] if we take the visible spectrum as a guide. An intense blue sky at sea-level is often indicative of moisture in the atmosphere, and it also seems to be indicative of finely suspended matter of some kind. If this be the case, can this suspended matter be suspended water stuff? for if it be not, there is no reason why the sky should be bluer on a moist day than on a dry day. We would remark that the deep blue sky at sea-level is of a different colour to the black-blue of high altitudes where, if they exist, the fine suspended particles would be largely diminished in number, and the coarser particles which cause white haze would also be fewer. The great difference of

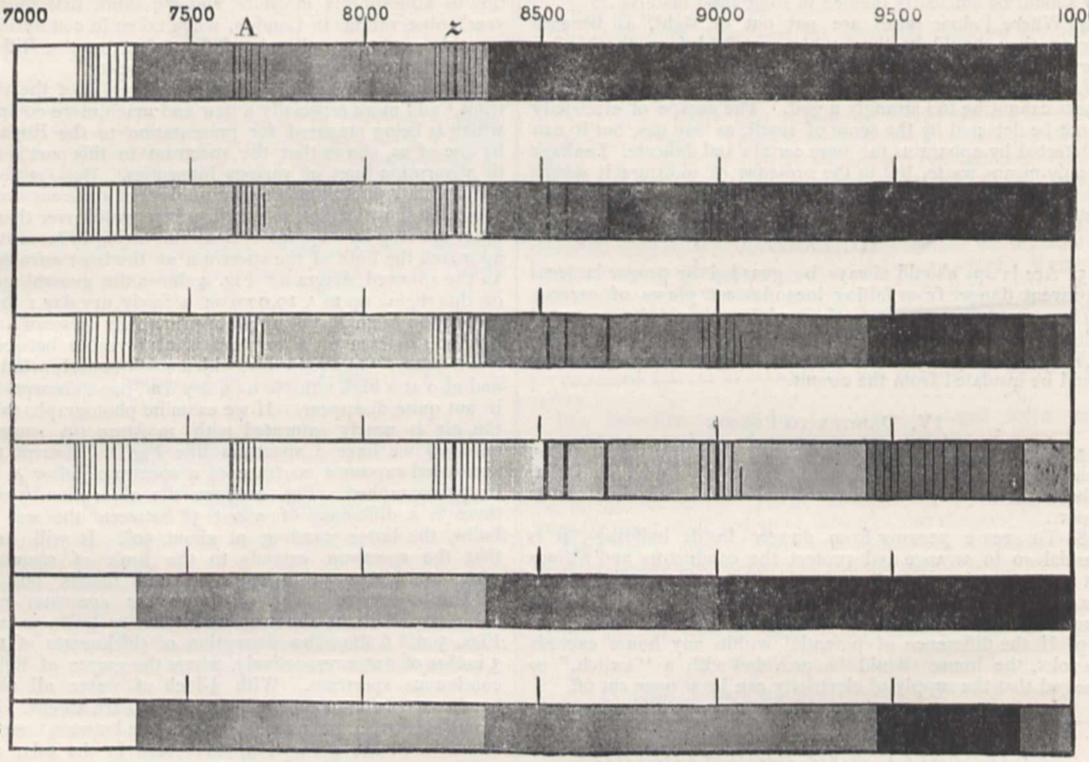


Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.

the intensities of the light from the blue sky in England and at 10,000 feet was determined by one of us and communicated to the British Association at Southampton, and the enormous disparity between the two has some bearing on the question we have been discussing.

In the above paper we have described the absorption due to "water stuff" in the atmosphere to λ 9800, as it is only to that wave-length to which the normal spectrum has been as yet published. We wish however to add that there are bands in the solar spectrum commencing at[1] λ 9800, λ 12,200, and λ 15,200, and giving step by step absorptions from one wave-length to the next, as in the diagram, which also corresponds with *cold* water bands. The absorption in the locality from 12,200 downwards is usually total, and it is only on dry cold days or at high altitudes that rays of sufficient amplitude can penetrate to cause photographic impression to be made.

April 5.—"Observations on the Colouring-matters of the so-called Bile of Invertebrates, on those of the Bile of Vertebrates, and on some unusual Urine Pigments, &c.," by Charles A. MacMunn, B.A., M.D. Communicated by Dr. M. Foster, Sec.R.S.

In this paper the result of a systematic examination of the bile and various extracts of the so-called liver of Mollusca and Arthropoda, and of the pyloric or radial cœca and other appendages of the digestive system of Echinodermata is described. The universal distribution of one colouring-matter, which by appropriate experiments is shown to be a chlorophyll pigment, is proved. It occurs in the above organs, and can be detected in the bile of specimens of *Helix* after a six months' fast; for this colouring-matter, since it is found in the appendages of the enteron, the name enterochlorophyll is proposed. The slight differences observable in different cases are shown to be due to the probable greater or less amount of the usual chlorophyll constituents, blue chlorophyll, yellow chlorophyll, and chlorofucine, and the presence of xanthophyll, lutein, or tetronerythrin. Enterochlorophyll is shown to be much more abundant in the liver of Mollusca and in Echinodermata than in Crustacea, as the livers

[1] These wave-lengths are taken from the map from the *Phil. Trans.*, 1880, and are only to be considered approximate.

[1] Unless it be held that the water itself holds vapour in solution.

of the last generally contain more lutein, or sometimes tetronerythrin may be present.[2]

The presence of reduced hæmatin is also demonstrated in the bile of the crayfish and in several pulmonate Mollusca, and its respiratory and other uses discussed.

The conclusions which these observations and others led to are summed up as follows:—

(1.) The existence of enterochlorophyll in the so-called liver, or other appendages of the enteron in Invertebrates is definitely established.

(2.) This pigment occurs in greatest abundance in Mollusca, it occurs less frequently in Arthropoda, and its presence in Vermes is not proved.

(3.) The pyloric cœca of starfishes contain it in great abundance, also the intestinal appendages of *Echinus*, which fact shows that the former function like the so-called liver of other Invertebrates.

(4.) The bile of the crayfish and that of most pulmonate Mollusca contains hæmochromogen; in the latter it is generally accompanied by enterochlorophyll, and appears to be concerned more in aërial than aquatic respiration.

(5.) The so-called liver of Invertebrates is a pigment-producing and storing organ, as well as being concerned in the preparation of a digestive ferment.

(6.) The presence of hæmochromogen in the bile of Invertebrates is apparently determined by their mode of living, and it does not appear to be distributed according to purely morphological considerations.

The remainder of the paper deals with vertebrate bile pigments, and contains some observations on abnormal urinary colouring matters, mainly with regard to their spectroscopy. The various bile pigments of Städeler are first dealt with, and some remarks on the bile spectra of animals follow; here it is shown that urobilin can be extracted from the liver of *Salamandra maculata* by means of alcohol, that it is absent from reptilian bile during hibernation, and that the liver of some fishes may contain tetronerythrin which can be extracted from them by suitable solvents. The latter fact suggests an analogous function to that of the liver of Invertebrata.

The results of the examination of a green hydrocele liquid are detailed, which showed beyond doubt that biliverdin was present, and since in that case its origin could be traced to blood pigment, the origin of biliverdin from blood pigment is demonstrated.

The identity of stercobilin and hydrobilirubin got by the action of nascent hydrogen on bilirubin is proved, and a difference between them and febrile urobilin shown to exist.

The statement that the absorption-bands of sheep bile are the same as those which occur in Gmelin's reaction is shown to be erroneous, and a brief description of the method of isolating the colouring-matter of sheep bile and the wave-lengths of its different solutions given. Chlorophyll is shown to be absent.

Under the head of urinary pigments it is shown that the feeble bands described by me in a former paper in the spectrum of febrile urobilin are not due to impurities, but are as much part of the spectrum as the band at F. Urohæmatin and its difference from hæmatoporphyrin and its pathological significance are discussed. A simple method for the detection of indican in urine, some remarks on uroerythrin, and on a peculiar red colouring-matter in pale urine, somewhat like urrhodin, follow. The deductions from this part of the paper cannot be very well given in the form of conclusions, and are therefore scattered throughout the paper.

A drawing of the microscopic structure of the liver of Limax, showing the enterochlorophyll within the liver cells, and maps of the most important absorption spectra described, accompany the paper. All readings are reduced to wave-lengths.

Physical Society, April 28.—Prof. Clifton in the chair.—A paper on colour-sensation, by Mr. H. R. Troop, was read by Mr. Walter Baily, secretary. The author showed that more than three colour-sensations were consistent with the theories of Maxwell and Helmholtz, and explained that four primary separate colour-sensations, in couples, served the theory as well as three. The author gave reasons for the existence of a fifth sensation—that of white. Mr. Stanley mentioned that his father was colour-blind to green, and saw it as a brown. He considered partial colour-blindness very common. Mr. Lewis Wright stated that he found in optical experiments a partial colour-blindness from time to time, and between one of his eyes and the other. He recommended the study of this partial and variable blindness to colours. Prof. Clifton stated that he had found similar variations amongst his students, and considered that one in three was unfit for delicate optical experiments.—Sir John Conroy exhibited a new photometer, which is a modification of Ritchie's, the white screens not meeting at an angle, but almost meeting, and one projecting a little beyond the other, so that the eye could see the outer side of one and a little of the inner side of the other, both visible surfaces being illuminated by the lights. The screens were inclosed in a blackened box.—Mr. Walter Browne then read a paper on the causes and consequences of glacier motion. After reviewing the various theories of glacier motion and criticising each, the author gave reasons for preferring that of Mr. Moseley, namely, expansion by heat. He showed that the regelation theory now commonly accepted appears inadequate, inasmuch as it does not explain the state of flow at low temperatures. Mr. Stanley pointed out that Forbes in his work on Norway gives expansion as a cause of glacier motion. Prof. Perry referred to the experiment of Mr. Bottomley (in which a wire, weighted at the ends, cuts its way through a block of ice) in support of the regelation theory; and Prof. Guthrie described an experiment he had made of the same kind, using a copper wire and a silk cord of the same thickness, equally weighted, on the same block of ice. The wire cut through, but the silk did not. Prof. Ayrton explained this on the assumption that the wire conveyed heat from the air, and enabled the weighted wire to lower the temperature of the ice to the melting point, whereas the silk could not do so without more pressure, that is weight. Mr. W. Coffin referred to the ice-houses of Lake Superior, where he has seen heavy iron implements lying on blocks of ice at a low temperature, without sinking in. Sinking took place when the sun shone on the ice. Prof. G. Forbes said that below forty feet in rock variations of temperature were imperceptible, and probably it was the same with ice. Prof. Macleod, Mr. G. R. Griffiths, Mr. W. Baily, and the President also took part in the discussion.—Prof. Fuller then took the chair, and Prof. Clifton exhibited a new spectrometer of his design. In the spectrometer it is important that the axis round which the prism turns and the axis round which the telescope turns should not be inclined, and in the new instrument these axes are coincident. A single cone, turned very true, has the telescope piece, the circle, and prism plate fixed upon it.

Institution of Civil Engineers, April 24.—Mr. Brunlees, president, in the chair.—The paper read was "Resistance on Railway Curves as an Element of Danger," by Mr. John Mackenzie, Assoc. M. Inst. C.E.

BERLIN

Physiological Society, March 30.—Prof. Du Bois Reymond in the chair.—Instead of the condensed milk, which, owing to its large percentage of sugar, has not kept its place as a food for children, a preparation of milk has lately been introduced into the market from Switzerland, which is protected against fermentation and decomposition by previous cooking. Dr. A. Baginski has chosen the relation of this new infants' food to the digestive ferments as the subject of a comparative investigation, which is not as yet concluded, but which has elicited some physiologically interesting facts about the action and occurrence of these ferments. The rennet ferment is well known to act upon milk both when it is sour and when its reaction is neutral or alkaline, but the rapidity of the curdling when acted upon by the ferment is different for different temperatures. At the temperature of the room the milk curdled only after twenty or thirty minutes; at a temperature of 20° to 25° C. the curdling was already completed in five minutes; at from 30° to 35° C. the curdling lasted about one minute, and it took place at still higher temperatures up to 55° C. in still shorter time. On the other hand, at 60° C. and at higher temperatures the action of the rennet was delayed, and soon ceased altogether. In previously boiled milk rennet also failed to bring about curdling. The rennet ferment was found not alone in the stomach, but also in the small intestines and in several plants, *e.g.* in *Carica papaya*, in artichokes, and in figs. In other plants it was sought for in vain. Decomposition ferments had various actions upon rennet; sometimes they destroyed its action, at other times they did not; the former was particularly the case when the fluid was strongly alkaline. Pepsin had no disturbing influence upon the activity of the rennet, although trypsin had to a marked degree. Dr. Baginski made similar observations upon the effect of decomposition ferment, pepsin, and trypsin upon each other.—Prof.

Brieger reported upon the results of his attempts at a more accurate study and determination of the violent poisons which develop out of animal substances, and which not unfrequently bring about sudden death after eating stale cheese, stale sausage, or stale fish. Prof. Selmi made the first step towards the knowledge of these poisons by preparing powerfully acting bodies out of corpses and decomposing animal matter. These he described under the name of "ptomäin." Prof. Brieger has now investigated their occurrence in analogous substances by means of the reactions that Prof. Selmi gave for these ptomäins, and he has found, among other things, that neurin when exposed to the air very soon develops such a ptomäin, which, like the rest, kills frogs and rabbits with the symptoms of coma. If the neurin remains a long time exposed to the oxidising influence of the air, the violent poison disappears. Further, a poisonous body belonging to the same group was found in a number of artificial peptones, but not in all, and here also this substance was soon destroyed by further alterations taking place in the peptone. This fact could be quite universally established, viz. that a further progressing decomposition in dead bodies destroyed all poisonous substances. Prof. Brieger next approached the task of isolating these easily decomposable and violently poisonous bodies. He succeeded, by working on large masses of dead animal bodies with a series of chemical processes, in preserving the poison in beautiful, large, needle-shaped crystals. He has not as yet determined whether these consist of the poisonous body pure, or whether they also contain other bodies. Therefore the chemical composition of the ptomäins has not yet been certainly determined.

PARIS

Academy of Sciences, April 30.—M. Blanchard in the chair.—The following papers were read:—On the reduction of the barometer and the pendulum to the sea-level, by M. Faye. While Poisson's correction for attraction of a continental mass may be suppressed, the attraction of a hill or mountain on which observations are made must not be neglected. At a station in mid-ocean, such as a volcanic or coral island, the attraction of the island must be considered. Correction for masses like the Alps or Himalayas is much more difficult.—On the pyro-electricity of quartz, by MM. Friedel and Curie. They dissent from Herr Hankel's views as to the distribution of electric tensions in crystals.—On a quaternary base derived from oxyquinoleine, by M. Wurtz.—Prolonged anæsthesia obtained by protoxide of nitrogen at normal pressure, by M. Bert. The new method he has tried on animals is to cause anæsthesia first with the pure protoxide, then give a mixture of the protoxide and oxygen (the blood then recovering the oxygen necessary to it); then the pure protoxide may be given again. Thus both asphyxia and return to sensibility are obviated. A dog was kept insensible half an hour. A mask and two caoutchouc bags are all that is necessary.—On the project of the African interior sea, by M. de Lesseps. He replies to M. Cosson.—On a theorem of partitions of complex numbers contained in a theorem of Jacobi, by Prof. Sylvester.—*Résumé* of meteorological observations made during the year 1882, at four points of Haut Rhin and the Vosges, by M. Hirn. *Inter alia*, the greatest actinometric differences do not always correspond to the most limpid skies. The slight mist or dust, which stops part of the luminous rays, does not absorb the calorific rays.—A new general formula for the development of the perturbative function, by M. Baillaud.—Observations of solar spots and faculæ at the Royal Observatory of the Roman College during the fourth quarter of 1882, by M. Tacchini. After the secondary minimum in August, the spots increased to a considerable maximum (relatively) in November, then decreased suddenly to a minimum in December. During 1882 there appears a greater activity than in 1881. The mean of faculæ is slightly greater in 1881 than in 1882.—Observations of solar protuberances, faculæ, and spots at the Royal Observatory of the Roman College, during the third and fourth quarters of 1882, by the same. The number of protuberances *per diem* was nearly the same as in the first half-year, but the height and extension were somewhat greater. The minimum was in September and October. Spots, faculæ, and protuberances were more numerous near the equator than in the previous half-year.—Observation of the transit of Venus at St. Thomas in the Antilles by the Brazilian Commission, by M. de Teffé. The third and fourth contacts were observed.—On the use of a birefringent glass in certain observations of spectrum analysis, by M. Cruls. By giving the crystal an alternative motion of rotation the extraordinary spectrum is displaced, and the eye is thus helped to see peculiarities better than if the spectrum were at rest. Again, the two spectra of a faint star may be so juxtaposed that the bright parts of the one correspond to the dark channellings of the other, so that vision is aided.—Determination of a particular class of surfaces, &c. (continued), by M. Darboux.—On continuous periodic fractions whose numerators differ from unity, by M. de Jonquières.—On the generalisation of the theorem of Fermat, by M. Lucas.—On the same, by M. Pallet.—On the groups of linear equations, by M. Poincaré.—On some double integrals, by M. Goursat.—On the Eulerian functions, by M. Bourguet.—On the cycle of motors with explosive gases, by M. Witz.—On the transmission of sound by gases, by M. Neyreneuf. With a sensitive flame arrangement he proves that carbonic oxide has about the same transmitting power as air; carbonic acid much greater. He finds Hauksbee's law inexact.—On the analogy that exists between the allotropic states of phosphorus and of arsenic, by M. Engel.—Research on the metallic derivatives of amides; means of distinguishing a monoamide from a diamide, by M. Gal.—On a process of hardening soft calcareous stones by means of fluosilicates with a base of insoluble oxides, by M. Kessler.—On a means of foreseeing liberations of firedamp, by M. de Chancourtois. On the supposition that movements of the earth's crust often cause such liberation, he proposes the use of delicate seismographic apparatus.—New histological researches on the termination of the biliary conduits in the lobules of the liver, by M. Kanellis.—On the structure of the nervous system of Hirudineæ, by M. Saint Loup.—On the incubation of eggs of a hen affected by cholera of fowls, by M. Barthélemy. The eggs contained germs of the microbes; these were only developed with aërial respiration when the allantoid yielded to the blood the oxygen necessary. (The development of the embryo stopped between the eighth and the tenth day.)—Comparison between the bacilli of tuberculosis and of leprosy (continued), by M. Babes.—M. Common presented a negative photograph of the nebula in Orion (taken January 30). An equatorial reflector of three feet aperture was used, and the dry plate was exposed 39 minutes.

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