THURSDAY, JANUARY 27, 1876

GEORGE POULETT SCROPE, F.R.S.

YET another of the old lights of Geology gone from us!—one that shone out brightly more than half a century ago, and has kept its place and done its work even up to the last. At the ripe age of almost fourscore years, and with his faculties and sympathies still fresh and active, Mr. Scrope has passed away. Living his last years in the quiet retirement of his pretty country-house, he may be said to have taken some time ago his farewell of the scenes of his early scientific friendships. But that he kept up his interest in all his old pursuits was shown by his occasional letters on geological matters, which continued to appear until only a few weeks ago. The friends with whom he corresponded and who saw him from time to time in his retreat will not soon forget the eagerness with which he listened to every new fact in his favourite studies, and the friendly and large-hearted liberality with which he stimulated and assisted younger labourers in his own domain.

As far back as the winter of 1817-18 Mr. Scrope's attention was drawn to geological pursuits by the accident of his residence at that time in Italy when Vesuvius was in a state of constant eruption. Having leisure to indulge his taste, he gave himself up to the task of watching the progress of the Neapolitan volcano. He was led to extend his observations to the relics of older volcanic vents in the same neighbourhood, and in the following year spent some time among the Lipari Islands and in Sicily. Having now learnt a great deal both of existing and extinct volcanoes, he explored the old volcanic tracts lying to the north of Naples and west of the Appennines, and returned to England with a far larger experience of volcanic phenomena than any of his contemporaries possessed.

In this way he came to recognise how important a part has been taken by volcanic action in the past, as well as in the present, history of the earth. He was therefore naturally surprised to find views of a totally opposite kind not only in vogue, but advocated with a force and persistence which refused to consider volcanoes as anything more than modern and abnormal interferences with the settled order of nature, and as of no more real significance than subterranean coal-seams somehow set on fire. These dogmas of the Wernerian school had gained such an ascendency that many staunch adherents of that school—men like G. B. Greenough, the founder of the Geological Society—seemed to regard volcanoes with a kind of personal dislike, and violently opposed any attempt to elevate them into important geological agents. Mr. Scrope, on his return to England, spent some time at Cambridge; and finding his views supported and encouraged there, among others by Sedgwick, he determined to give himself up to the study of a district of extinct volcanoes, where the phenomena to be observed bore close relation to those of the basalts and similar rocks of Britain and Germany, and where, nevertheless, manifest relics of true volcanic cones and craters existed. He selected for this purpose the marvellously interesting tract of Auvergne in Central France, and established himself there in the summer of 1821. A campaign of six months made him thoroughly familiar with the volcanic geology of that region, and enabled him to bring home such a series of pictorial sketches and diagrams as could not, he felt, but carry conviction home to even the sturdiest Wernerian, that the basalt plateaux of Auvergne, instead of being portions of the universal precipitate of a primeval ocean, were in truth only fragments of lava-flows erupted at different times and at different levels in the gradual erosion of the valleys. He prepared a narrative of his researches, and an atlas of most admirable views and sections. But expensive geological works had not yet readily found either publishers or purchasers. He had, therefore, to keep his manuscript beside him for several years.

Meanwhile, however, the eagerness of his volcanic quest had by no means abated. Passing from his labours in France once more into Italy, his enthusiasm for volcanoes blazed out with renewed ardour in the autumn of 1822, when he had the good fortune to be an eye-witness of the great eruption of Vesuvius, which took place in the October of that year. His views of the general principles of volcanic geology had gradually broadened under the influence of the ample experience which he had now gained. He felt himself not only at liberty, but even called upon to put these views clearly before the world as a contribution to sound knowledge and a step towards the demolition of the pernicious errors still prevalent on the subject. Accordingly, after his return to this country in 1823, he prepared, and in 1825 published, a small volume, "Considerations on Volcanoes." It shared the fate of most books which are far in advance of their time; that is, it was regarded as crude, extravagant, and theoretical, and gradually suffered to pass out of mind. And yet, turning back to that early volume, and contrasting its earnest and observant pages with other writings of the same date on similar subjects, it is impossible not to admire the keen powers of observation and the happy faculty of generalisation which its author manifests. Even though some of the speculations are confessedly immature, others have stood well the test of time, and form now part of the familiar knowledge of every geologist. Above all, it must never be forgotten that in this volume, published before Lyell had written one of his works, the broad principle is laid down that the method of explaining the past geological history of the earth by reference to supposed violent and extraordinary catastrophes or general revolutions stops all true inquiry, and effectually bars the advance of science by involving it in obscurity and confusion. Mr. Scrope boldly maintained that instead of such vague guesses as to the possible causes and nature of the ancient changes of the earth, "the only legitimate path of geological inquiry" lay in "examining the laws of nature which are actually in force," and that until existing operations, with all possible variations and every conceivable allowance of time, have been proved to be wholly inadequate to explain the past, "it would be the height of absurdity to have recourse to any gratuitous and unexampled hypothesis." How truly does this passage express the philosophical stand-point of modern geology; and yet how rash and "theoretical" it must have appeared to the first readers of the "Considerations on Volcanoes." Mr. Scrope used not unnaturally to think that his earlier writings had not been without their influence in giving

tone to the "Principles" of his friend and fellow-labourer Lyell.

Two years after the "Considerations" appeared, Mr. Scrope published his great monograph on the volcanic districts of Central France—a work which placed him in a high rank as an accurate and philosophical observer, and one which did more, perhaps, than any other of its day, to destroy the Wernerian prejudice against volcanoes, and to establish the true volcanic origin of basalt rocks of every age. In another respect it marked an epoch in geological literature, inasmuch as it brought forward clear and detailed proofs of the gradual excavation of valleys by the action of the rivers still flowing in them—a doctrine taught indeed by Hutton, but for which there were still needed those very proofs which Mr. Scrope's memoir so admirably supplied.

After this early promise of an active and brilliant scientific career, Mr. Scrope's energies passed over into another and wholly different mode of life. He entered Parliament, and continued an active member for some thirty-four years. So thoroughly did he give himself up to political questions, that for fully a quarter of a century he seems to have retired from science altogether. About twenty years ago (1856), finding that the old notion of Humboldt and Von Buch about volcanic craters being merely big tumours or blisters pushed out by the expansion of the subterranean vapours, was still sufficiently in vogue to call forth an active opposition from Lyell, Mr. Scrope, who had long before exposed the untenability of this dogma, returned to his first love, and produced a paper upon "Craters and the Nature and Liquidity of Lavas." Other papers of a similar kind followed. In 1858 he brought out a second and revised edition of his memoir on the Auvergne volcanic region, and in 1862 he published a second—much altered and improved—edition of his general work on volcanoes. Since then he has communicated from time to time numerous brief letters and notices on his favourite subjects, showing how fully he retained his firm grasp of all that related to volcanic geology, and how young and fresh he could keep his powers.

This brief notice of his labours may fitly end with a tribute to that courtesy and kindliness which ever marked his relations with other men. A more leal-hearted friend could not be. How gladly would he say a kind word when a kind word would be of service! How ready, too, to help with more than words!

The founders of English geology have been truly a noble band—generous, helpful, and enthusiastic; but few of them will be more sincerely mourned than George Poulett Scrope. A. G.

SOMERSET HOUSE AND THE PUBLIC ANALYSTS

EVER since the proposal was first made that disputed cases under the Sale of Food and Drugs Act should be referred to the analysts of the Board of Inland Revenue as adjudicators, there has been a strong feeling in the minds of most persons competent to form an opinion on the subject, that should such a course be ultimately adopted, the probable results would be great dissatisfaction on all sides. It was foreseen that the gentlemen most meritoriously engaged at Somerset House in testing the strength of alcoholic liquors, in examining the genuineness or otherwise of tobacco, tea, and excisable articles generally, and such like pursuits, would have great cause for complaint if work out of their ordinary department were thrust upon them, in the performance of which, even if no discredit should accrue to them by mistakes almost unavoidable in inexperienced hands, a considerable amount of professional odium would be probably incurred. It was clearly evident that the Public Analysts would be unjustly dealt with by the establishment of a system whereby the reports of men, frequently well known in the scientific world, and of great skill and experience in the special work requisite, would be liable to be superseded by those furnished by Government *employés* of far less professional and scientific standing, and specially qualified to a much lower extent. Finally, it was anticipated that a considerable injury to the public at large would be imminent, from the high probability that such an arrangement would lead to results not at all in harmony with the object of the Act. The checks on adulteration, it was feared, would be greatly diminished, partly through the bringing into more or less discredit the analysts appointed under the Act, and thus rendering their existence a far less effectual moral deterrent; and partly through the probable resignation of the higher class of analysts, and hence through the deprivation of the public of the special skill and experience acquired by these gentlemen.

That these dismal forebodings were not wholly groundless is shown by a recent case in the Southwark Police Court, the first, it may be mentioned, in which the Inland Revenue analysts have been appealed to under the new Act. On the 14th of last month, a large cheesemonger in the Borough appeared to answer a summons charging him with selling as butter a substance alleged to contain no butter, but to be a mixture of foreign fats not injurious to health. The proof of the purchase of the substance, and of the delivery of a sample to Dr. Muter, Public Analyst for the district, and the certificate of Dr. Muter to the above effect, were then given. The defendant demurring to the certificate, the case was adjourned in order that the third portion of the sample might be forwarded to Somerset House for examination by the Inland Revenue officers. On the 18th inst. the case came on for further hearing, and a certificate from Mr. Bell, of the Inland Revenue, was put in, stating that in his opinion the substance in question was genuine butter. This certificate was objected to by the presiding magistrate (Mr. Partridge) as being "extremely vague and unsatisfactory," inasmuch as it did not indicate that any analysis at all had been made, but only a cursory inspection. Mr. Bell thereupon gave an explanation of his certificate, stating that he had found the sample to contain water, 9·83; salt, 3·70; casein, 0·93; and fat, 85·54 per cent; that the fat yielded over 88 per cent. of fatty acids, and possessed the same specific gravity as butter fat, whence he concluded that there was no evidence of adulteration. In answer to questions, however, Mr. Bell admitted that although he had previously examined sundry specimens of genuine butter, and had seen some samples of "Bosh," he had never tested any specimen of the various artificial butters sold under the

name of "Butterine." He also stated that his method of analysis was one unknown outside the Inland Revenue laboratory, and that the only test on which he placed much reliance was the specific gravity of the fatty matter, whilst he had been unable from the few experiments he had made to corroborate the statement of Messrs. Hehner and Angell, that genuine butter fat never yields more than about 86 per cent. of fatty acids on saponification.

Although the case could not be reopened, the evidence of several Public Analysts who had examined the sample was taken, and in most respects distinctly showed that the secret method of examination adopted by Mr. Bell was utterly unreliable. Dr. Dupré, F.R.S., Mr. Wigner, and Mr. de Konigh each found that the butter-fat contained close upon 94 per cent. of fatty acids, genuine butter not yielding more than 86, and ordinary fats giving about 95 per cent. On microscopic examination a crystalline structure (evidence of fusion) was noticeable; the melting point was 4° C. lower than genuine butter; the matter mistaken by Mr. Bell for caseine was no such substance, but only fragments of woody tissue and similar vegetable organised matter; the physical structure of the substance was different from that of genuine butter, as it possessed on the tongue the peculiar granular feeling of "butterine," and also tasted like the latter. The same results were also arrived at by other analysts, six having examined the sample, and all agreeing with Dr. Muter that the substance contained either no butter at all or very little.

On the other hand, Mr. Harkness and Mr. Lewes (assistant to Mr. Bell) stated that they could see no crystals under the microscope, but admitted that woody fibre and other vegetable matter was present.

Finally, the case was dismissed, the Vestry being ordered to pay the costs of the Somerset House analysis; the magistrates, however, consented to grant a case for appeal if the Vestry desired to adopt that course.

Comment on the above would seem almost superfluous; but the question naturally arises, of what use is it in Government taking up valuable time in passing Acts, and in counties, districts, and parishes going to the expense of appointing analysts in accordance with these Acts, if the operations of these gentlemen are to be rendered nugatory by being liable to be overthrown by appeal to an authority which, however competent in reference to its own particular department, is nevertheless by its own showing scarcely possessed of sufficient experience, and is certainly not of sufficient standing and position to be admissible as a final adjudicator on such matters? The position of Public Analysts was surely bad enough without this indignity and injustice; most of the offices are grossly underpaid; the appointments are often in the hands of persons utterly incompetent to judge of the respective merits of candidates, and who not infrequently elect, not the applicant of highest scientific and professional standing, but the one who sinks his self-respect lowest by canvassing and flattering the electors. As a consequence many of the best known chemists refuse to have anything to do with such appointments, and the public loses the chance of valuable services. Further, when mistakes and blunders are made by persons who never ought to have been elected at all, there is a general cry against "the incompetence of Public Analysts," and discredit is brought on the whole class, worthy and unworthy alike. The inevitable results of insisting upon the analysts of Somerset House or any other set of men (unless specially trained and adapted for such a position) being made referees whose decisions shall override the results of careful and conscientious chemists, will be that the best and most accurate work of the Public Analysts will be wasted, that they themselves will be brought into contempt, that many of the best of them will be forced to resign their appointments, and finally, that the Act will become to a great extent a dead letter.

HARTLEY'S "AIR AND ITS RELATION TO LIFE"

Air and its Relation to Life. By Walter Noel Hartley, F.C.S., Demonstrator of Chemistry, and Lecturer on Chemistry in the Evening Class Department, King's College, London. (London: Longmans, Green, and Co., 1875.)

OF all the so-called improvements which have been effected from time to time in the means by which we make ourselves comfortable and render ourselves independent of the limitations which nature would impose upon us—perhaps the introduction of gas was hailed and has been looked upon as among the greatest. It wants but little experience, however, of the manner in which people live in towns, to convince us that the reverse of this is the case, and that the pain and misery which it has been the means of inflicting must far outweigh its advantages. If anyone doubts this let him examine his sensations in a morning, after having spent the previous evening in a close room blazing with gas, and compare them with what he feels after having spent the corresponding hours in the open air, or in a fresh room moderately lighted with oil or candles. There are but few people to whom such experience would not show that the effect of the gas was a feeling of lassitude and depression, if not a downright headache; and if they were to repeat the experiment, who would not suffer a general loss of tone. Yet wherever gas is to be procured this is precisely the misery to which people subject themselves. In nine out of ten houses in the neighbourhood of towns, if one goes from the fresh air into a room in which the people are sitting on a winter evening, the first breath is enough to suffocate one, and yet the people within the room are entirely unconscious; they may be more or less restless and depressed, but as this is their normal state they do not recognise the cause. In this way, to say nothing of what takes place in theatres and places of amusement, the evils which gas is answerable for are incalculable, though if they could be estimated they must far outweigh the blessings which accrue from the abundance and cheapness of its light.

The fact is that the money cost of the fuel forms only one part of the expense of light; there is the consumption of oxygen, and in this gas is very extravagant; so that although we now obtain tenfold the light in our rooms which we had before the introduction of gas without any increase of expense in money, we have to pay for it by a tenfold vitiation of the air. Three or four gas flames consume as much air as a moderate fire, yet who would live in a room with a fire or even a pan of charcoal without a chimney. Yet it is a common thing to go into

a room in which three, four, or five gas flames have been burning for hours without either door or window having been open; that the people who live in these rooms escape the evil effects is not to be supposed. The only thing is that they have not sense or courage enough to trace the effects to their cause. Rather than give up their warmth and light they wilfully close their eyes to what follows. When people inflict these miseries on their friends, whether consciously or not, they become a positive nuisance, and are fit subjects to be dealt with by the sanitary inspector. To have to dine with them is a punishment: a headache is sure to follow, however abstemious one may be.

Many of these people are doubtless innocent, but there are those who know the evil, yet who do not make any attempt to remove the cause. They have only to turn down the gas. But no; they clamour for what they cannot get—good ventilation with the gas—and numberless are the quack remedies which one sees applied. But whether impossible or not, it is certain that at present there is no proved means which will supply sufficient air, free from draughts, to keep a room blazing with gas decently fresh. It may be that in time, when the clamour of quacks has sufficiently subsided to allow the voice of reason to be heard, some method of constructing houses with chimneys for gas may be introduced which will allow of all the desired warmth and light, and at the same time ensure a sufficient supply of fresh air. But in the meantime, the obvious remedy is to forego some of the luxuries, to be content with moderate light and warmth, and to set off against the evils (mostly fancy), which arise from occasionally opening a window, the certain and disgusting effects of sitting in a closed room.

The effect of gas is not the only evil to be remedied by improved ventilation. Modern science has brought to light things concerning the origin of disease of which our fathers never dreamed, and which must render people dissatisfied with the state in which they live. But to do this they must be known. Ignorance, if it is not the sole cause of the evils which people inflict on themselves, is at least their excuse. As a rule people have much more faith in what is told them with authority than in that which they themselves dimly perceive, and hence it does not follow that because the evidence of their noses has been disregarded that the voice of a prophet will not be listened to. Unfortunately, the subject of practical ventilation is one which by reason of its complexity has offered little attraction to scientific men, and consequently has been much neglected. It was therefore with great pleasure that we received the work before us. Written in ordinary language, and in a very clear style, this little book contains an account of all that has been done in the way of scientific research on the relation of air to life. It is written from a scientific point of view, but no pains have been spared to trace the possible applications of the science and the practical lessons which may be learnt from it. It is just the book for those who, without any particular chemical or physical training, have undertaken the control of sanitary matters.

In the first two chapters the author gives a very interesting historical sketch of the discovery of the constituents of the atmosphere, in which the experiments which have led to the various discoveries are not only described, but illustrated by very perfect drawings, and thus the reader is conducted by easy steps to a very complete view of the subject, including the most recent discoveries. A very full account is given of the amounts (and the means of determining them) of ozone, carbonic acid, and the organic impurities in the air at different times and in different places. The degree of accuracy to which this class of research has been carried is very striking. Dr. Angus Smith has examined the air under almost all conceivable circumstances, and his methods will compare in delicacy with the sense of smell. Thus in place of our impressions, we have now definite chemical proof as to the degree of impurity in the air which produces evil effects.

Having given tables of the amounts of carbonic acid to be met with in closed places, the author proceeds:—

"Here it is easily seen that the air in the theatres is very bad; but after the doors had been open for a short time between the acts it rapidly improved; indeed, in Covent Garden, in the second case, near an open door, the people exclaimed, by force of contrast, how delightful the fresh air was; nevertheless, this *fresh air* contained 14·8 parts of carbonic acid in 10,000, or from 2½ to three times as much as it should have had. Drury Lane was the first place experimented on; and having entered at the commencement of the performance, the bad effect of the air as it became vitiated was only gradually experienced, but it produced a listlessness and headache. All the audience around were evidently affected in the same manner, and appeared to be constantly sighing and gaping, or, in other words, gasping for breath."

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"The bad effect of carbonic acid in the air alone, without taking into account organic matter, has been shown by Dr. Angus Smith, who ascertained that one part of the gas in 1,000 of air produced in fifteen minutes an increase in the number of respirations from eighteen to nineteen per minute, which increase remained the same up to forty-five minutes; the pulse was lowered in twenty-five minutes from seventy-three to seventy-one beats; while at forty-five minutes it was seventy-two per minute. With 2½ volumes of carbonic acid in 1,000 of air the pulse at first seventy, increased to seventy-three at the end of ten minutes, and at the end of half-an-hour was lowered to sixty-nine, while the respirations increased from seventeen to twenty-one per minute. With five volumes of carbonic acid the pulse at first seventy-six and the inspirations seventeen, at the end of forty minutes were represented by the numbers seventy-one and twenty-four."

The results of this research, therefore, fully bear out the conclusions of experience as to the evils of our present system of lighting our dwellings, and it is to be hoped that, supported by this authority, people will no longer snub their noses and disregard their evidence.

The author then goes on to discuss the laws relating to the motion of gases, and to detail what little is known as to the best means of getting the air into and out of our rooms. He calls attention to the very striking result of some experiments (Pettenkofer's) as regards the quantity of air which passes through the solid walls of a room; and he finishes the chapter by pointing out how in our badly-constructed houses we are drawing poisonous air into them from the ground on which they are built, and the drains beneath them.

The latter part of the book is devoted to setting forth the results of the researches of Dr. Angus Smith, Pasteur, and others, on the power of the air to suspend and

transport living germs, and the many important lessons with which the subject is fraught. This subject has already been so much discussed in the columns of NATURE, that is not necessary to enlarge upon its importance in this review. Suffice it to say, that a knowledge of it is essential to the comprehension of the full importance of having pure air within our houses.

In conclusion, we strongly recommend the book, which, while it contains all the information to be obtained, sets forth nothing but what is based on sound principles, advocates no hypothesis, and in no way attempts to disguise the difficulties and imperfect state of our knowledge of the subject. OSBORNE REYNOLDS

THE RECENT ORIGIN OF MAN

The Recent Origin of Man, as illustrated by Geology and the Modern Science of Prehistoric Archæology. By J. C. Southall. 8vo. Pp. 606. (Philadelphia: J. B. Lippincott and Co.; London: Trübner and Co., 1875.)

THE work published under this title is a laborious compilation of heterogeneous materials derived from history, archæology, and geology, in which the writer attempts to prove "that primeval man commenced his career six or eight thousand years ago in a civilised condition in the temperate regions of the East." In it the irresponsible dicta of anonymous journalists, and the records of local societies in America, Britain, and France, unchecked by criticism, are taken to be of equal value with those facts which have run the gauntlet of the criticism of the civilised world, and not been found wanting. A work written in this manner must necessarily be a huge pile of wheat and chaff, in which the former can only be got at by a process of careful winnowing. In this particular case we fail to discover any wheat which has not been taken out of somebody else's barn.

Mr. Southall tells us, in his preface, that he is the champion of the Bible against the speculations of "Science," and that as such he is very much hurt "that many literary and scientific men should avoid mention of the Hebrew Scriptures." "I do not recollect," he writes, "that 'The Antiquity of Man' even recognises that the Book of Genesis is in existence; and yet every one is perfectly conscious that the author has it in mind and is writing *at* at it all the time." This quotation illustrates the spirit of the book and the one-sidedness of the writer. Why should Sir Charles Lyell include Genesis among his geological evidences as to the antiquity of man, and enter into the barren discussion which has been before the world for the last half century? Mr. Southall does not recognise the fact that even if he proves scientific men to be wrong he does not add to the authenticity of the Scriptures, or that even if man be but six or eight thousand years old, that fact again is a point of small importance, except as relates to Archbishop Usher's chronology. We for our part protest against the assumption in this work that there is any real antagonism between religion and science, and we believe that its writer has contributed perhaps the most elaborately untrustworthy contribution to a dead controversy which has yet been made; for in it are involved, as in a great whirlpool, facts relevant and irrelevant—every waif and stray, in fact, that has come within its reach. And these are carried round so swiftly that it is almost impossible for the reader to see clearly whither the argument is tending. Of course Mr. Darwin and the doctrine of evolution are drawn in, which the author takes to imply "that Napoleon Buonaparte was evolved from a Corsican crab," and which we respectfully decline to discuss in this connection.

In the attempted proof of man's recent origin, Mr. Southall first of all appeals to history. The records of Phœnicia, Babylon, and Egypt go back some three thousand years, more or less, before Christ, and civilisation then was as complete and elaborate as it was at any subsequent time. He argues that there is no graduated process from the savage state in any of these cases, and "that there is not a particle of evidence that man in his earliest seats in the East was a savage." He then asks (it may be jocularly), "Did the pyramids and the Chaldæan astronomy emerge from the Danish Kjokkenmöddings abruptly and instantaneously?" It is certainly true that we have not yet discovered any proof of the gradual development of the arts and of civilisation in those comparatively inaccessible regions, not necessarily because they do not exist, but because the exploration has been imperfect. In them there may be, and probably are, treasures to be revealed by the pickaxe and spade quite as rich as those of Hisarlik, and showing as complete a sequence. The statement that no traces of a rude and imperfect civilisation have been met with in the East is refuted by the discovery of enormous quantities of flint implements in Egypt and of Neolithic axes in Asia Minor and in India. In the river gravels of both these regions Palæolithic *hâches* have been found of the same type as those of Amiens and Abbeville. In the face of testimony of this kind he assumes that there are no traces of savagery, and accounts for the ancient civilisations by the supposition that they were inherited from the antediluvian world through Noah and his sons, and that the long-lived patriarchs were, by virtue of their experience, "very remarkable men." We would hand over this argument as it stands to Mr. Galton, for use in his next edition.

Having fixed the age of the most ancient peoples known, including the Chinese, by an appeal to history, the author assumes that the ancient inhabitants of Western Europe, whom he admits to have been savages, were descended from the same stock as the Babylonians, Egyptians, and Chinese, and that the date of the former is identical with that of the latter—a statement which is equivalent to the saying that children of the same father are always of the same age. Before we leave this part of the work behind, we would remark that Mr. Southall gravely tells us, that Central America had been visited by the Chinese, Japanese, Irish, and Welsh before the voyage of Columbus, as if these were well-authenticated facts. He evidently believes in the Irish legends, and in the story of Prince Madoc.

If, however, history fares badly at the hands of Mr. Southall, archæology fares worse. He devotes one chapter to the "premature announcements of Science with regard to the antiquity of man," in which such statements as the existence of a race of pigmies in Tennessee, proved from the small graves, the presence of man in the Pleiocene age, based on the perforated sharks' teeth in the crag of Norfolk, the asserted discovery of a fossil man in

palæozoic schist in Quebec, are included among the beliefs which have been accepted and then given up by scientific men. Having thus discredited their judgment, he proceeds to contradict himself as to the conclusions of Evans, Lubbock, and Lyell with regard to the division of time past, before the dawn of history, into the stages of rude stone, polished stone, bronze, and iron. A large portion of the book, the entire argument, so far as we can make it out, is devoted to proving that these stages were simultaneous, and not older than the six or eight thousand years of history and tradition. In p. 400 he allows that they are consecutive almost as distinctly as Mr. Evans.

In proving that "the ages" are simultaneous he adopts the same kind of reasoning as that by which Mr. Fergusson arrives at the post-Roman age of the Megalithic monuments, and Mr. Wright concludes that the Britons during the time of the Roman invasion used bronze swords. It is a very simple process. You find a certain set of things in a cave, in a cairn, or a tumulus, or in diggings near a Roman station, and you at once conclude that they were used at the same time by the same people. In every one of the cases cited there is no proof that the deposit in which the articles occur has not been disturbed. Before any association of the kind quoted is of the least value we must be certain that there has been no subsequent disturbance; such proof, for example, as we get in some of the pile-dwellings of Switzerland; such proof as we do not get at Solutré, where a Merovingian cemetery happened to be planted on an old "station" of the Palæolithic age, as the writer of this review was informed by Dr. Broca at the French Association at Lyons in 1873. In this case, which is made the basis of the attack on the high antiquity of Palæolithic man, the human skulls are comparatively modern, and the refuse heap of an untold age.

We have followed Mr. Southall into a labyrinth, and we have been unable to find a single shred of proof of the recent origin of man. We lay down his book with regret that he should have expended so much labour, with the practical result of leading the unwary reader into errors as to facts—for example, that Busk stated the Cave-bear to be identical with the Grizzly, or that Brandt believes that the Irish Elk lived in Central Europe down to the fourteenth century, two cases which occur to us. We trust that few Americans will take the views ascribed to the leading archæologists of Europe, in this handsome and well-printed book, without verification by an appeal to their writings. W. B. D.

OUR BOOK SHELF

The Indian Alps, and how we crossed them; being a Narrative of Two Years' Residence in the Eastern Himalayas and Two Months' Tour into the Interior. By a Lady Pioneer. Illustrated by herself. (London: Longmans and Co., 1876.)

THE plucky authoress of this handsome work makes no pretensions to give any scientific account of that portion of the Himalayas into which she penetrated; this, however, is the less to be regretted as, from a scientific point of view, much of the ground over which she passed has been rendered classic by Dr. Hooker. Her starting-point was Darjeeling, and the first portion of the work describes a pleasant preliminary trip which she and her husband made to the east as far as Dumsong. On returning from this outing, she, her husband F., and a friend C., accompanied by a small army of attendants, set out to penetrate, and if possible cross, the Eastern Himalayas. Their route was westwards by Mount Tongloo, and then almost directly northwards by Mount Singaleelah, the Dumgongla Pass, and onwards as far as the base of Mount Junnoo. The party took a large quantity of provisions with them, but depended upon a chief in the interior to supplement this supply about half-way. The chief failed them, and a guide whom they picked up on their route, after leading them all astray into a most inhospitable region, decamped, leaving them in a most perilous position. Happily, after much murmuring and danger of mutiny on the part of their attendants, they managed to extricate themselves without any loss or serious damage to anyone. Returning by the same route as far as Mount Singaleelah, the venturesome tourists turned eastwards and then southwards, along the Great Rungeet River, and so back again to Darjeeling, after a journey which, notwithstanding a few hardships, all seem to have enjoyed immensely. Although there is no formal attempt to describe either the fauna, flora, or geology of the region passed through, the authoress's descriptions are so minute, and her references to the characteristic animal and plant life of the various stages so frequent, that the reader will have a fair notion of the general features of the line of march. The Lady Pioneer's artistic attainments are of a high order, and her sympathy with nature from this point of view intense; her descriptions are, moreover, so clear and intelligible, and the illustrations are so numerous and well executed, that the book from beginning to end is a delight. A marked feature of the work is the chromolithographs, creditable alike to the artist and printer, affording better than any verbal description an idea of the character of the unequalled Himalayan scenery. The invariable sweetness of the author's style, and we may say of her temper under all circumstances, and her strong sense of humour, add to the charm of her narrative. The reader may learn a great deal from her book about the country passed through and about the various classes and tribes of people she met and mixed freely with, for she is a shrewd observer of men and manners. One cannot help thinking, we may venture to say, that F., whom she dutifully brings to the front on almost every page, is a lucky fellow. As might be expected, there is a good deal of moralising under the awful influences of the "Abode of Snow;" perhaps too much of it, though this natural failing will be overlooked, considering the genuine attractions which the work possesses.

Quite recently we reviewed Mr. Wilson's delightful work the "Abode of Snow," describing a journey which he made through the Western Himalayas; that, along with the present work, is very suggestive of the development of English ideas at least with regard to that class of scenery to which the term "grand" is usually applied.

It is well known that the tourist fever is of quite modern origin. It is only within the present century that an appreciation of wild and mountainous scenery has become anything like general. It would be difficult to find much in the way of admiration for such scenery in any poet who wrote before Wordsworth and Scott; an intelligent and well-educated officer of Engineers who lived in the midst of some of the now most admired Highland scenery in the early part of last century, wrote of it with something like horror; he could see "no beauty in it that it should be desired." While in this country the two poets above mentioned have no doubt had a principal share in originating the modern taste, there are other causes, connected with the general advance in intelligence and elevation of taste, which it would be instructive to trace. We are inclined to believe that the very modern science of geology has something to do with it; and certainly he who has a fair knowledge of the facts and principles of that science, not to mention the other natural

sciences, will be able to read infinitely grander legends in wild and mountainous scenery than he who looks upon it alone through the glamour thrown over it by mythology or genius. At all events, we welcome the spreading love of travel as one of many signs of a great intellectual awakening, although doubtless at present it has a good deal about it which lays it open to the sneer of the cynic, as have all new movements. There is a considerable, and we think ill-natured outcry in certain quarters, that all the accessible tourist grounds will become more and more crowded by the followers of the beneficent Cook. But there will always be some spot to which he who does not wish to be counted one of the common herd of tourists can retreat until he has gained vigour and nerve enough to feel in a mood to mix again with "the kindly race of men." Such a retreat is, and will for long be afforded by the "Abode of Snow" which Mr. Wilson and this Lady Pioneer have so attractively described; by and by, no doubt, it will be made more accessible by roads either from our own or from the other (is it premature to say the Russian?) side.

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 Article "Birds" in "Encyclopædia Britannica"

MR. GARROD'S article on the new edition of the "Encyclopædia Britannica" in last week's NATURE contains the following passage:—

"As another example of the different teaching of the artificial and the natural classifications, the Swifts (*Cypselidæ*) and the Humming Birds (*Trochilidæ*) may be referred to. These two groups, from the details of their internal structure when examined one by one, are most certainly related as intimately as are the Woodpeckers with the Toucans. There is, in fact, not a family difference between them, and yet, from their palates, Professors Huxley and Parker place them in quite different divisions, because the vomer is truncated in the one and pointed in the other."

In a previous part of the article Mr. Garrod refers to my paper on the Classification of Birds, published in the Proceedings of the Zoological Society in 1867, which he criticises as if he had studied it with a care proportioned to the labour it cost. Nevertheless, I can but think that his acquaintance with its contents must be somewhat superficial, inasmuch as any careful reader will find at p. 459, the following passage under the head of *Cypselomorphæ*, or Swift-like birds:—

"This group contains three very distinct families—the *Trochilidæ*, the *Cypselidæ*, and the *Caprimulgidæ*. The first two families have a length of the manus and a brevity of the humerus which is peculiar to themselves."

Thus, so far from placing the Swifts and the Humming Birds in "quite different divisions," I placed them in the same division, and took pains to point out their close affinity; and in asserting the intimate relations of the *Cypselidæ* and *Trochilidæ*, Mr. Garrod is reiterating a view which, unless I mistake, was first definitely put forward by myself, and not, as the readers of his article would be led to imagine, controverting my opinions.

Mr. Garrod takes pains to show that "the structure of the skull does not alone suffice to determine the mutual affinities of birds." The implication appears to be that Mr. Parker and I assert the contrary. I have no right to speak for Mr. Parker, but I may remark that my knowledge of his works would not have led me to Mr. Garrod's conclusion, while it would have compelled me to treat any opinion of his, however much I might be disposed to differ from it, in a manner different from that adopted by Mr. Garrod. As to the facts, so far as I am concerned, those who will take the trouble to read my paper on the Classification of Birds, and an article by the editor of the *Ibis*, with a letter addressed to him by me, published in the *Ibis* for 1868, will see that the classification in question is not based upon cranial structure alone, and that, seven years ago, we went a little deeper into the question of the principles to be followed in taxonomy than the point at present attained by Mr. Garrod.

Jan. 23 T. H. HUXLEY

D-Line Spectra

IN reply to a question propounded to you by a correspondent (vol. xiii. p. 224) as to my reasons for believing that sodium is free in the flame of a spirit-lamp with salted wick, I have to state as follows:—

1. We now know that the flame exercises a specific absorption, and is capable of producing dark D. If this were due to vapour of chloride of sodium, we should expect, in accordance with what observation shows in other cases, that solution of chloride of sodium, or at least the solid chloride, would more or less absorb the orange or yellow part of the spectrum, though not in the same definite way, and we find it does not.

2. We know, by direct experiment, that vapour of sodium does exert the very peculiar absorption indicated by dark D. Different salts of the same metallic oxide agree in the mode in which their solutions absorb light, or at least there is a strong family likeness; but when we pass from one oxide to another of the same metal, there is a complete change. Much more should we expect a complete change when there is such a profound difference of chemical character as there is between sodium itself and chloride of sodium.

3. Lastly, Mr. A. Mitcherlich has proved, by direct experiment, that vapour of chloride of sodium within a tube heated to bright redness neither emits bright D nor produces dark D by absorption (*Poggendorff's Annalen*, vol. 116, pp. 504, 505).

It need not surprise us that sodium should be temporarily free in an ordinary flame, since the metal is prepared by heating carbonate of soda with charcoal, and in the flame we have hydrocarbons at a high temperature. Perhaps the heat alone would suffice to set it free by dissociation. G. G. STOKES

Cambridge

The True Nature of Lichens

THE editorial note on this subject in NATURE, vol. xiii. p. 168, was thoroughly disappointing to those who, like myself, may have had hopes that the confident allusion by the reviewer of Haeckel to the "clearing up" of the "true nature of Lichens" had reference to some demonstration—of which we had not heard—of the part played by *Spermogonia* and *Pycnidia* in *Lichen-Reproduction*. Having long had in contemplation the publication of a volume of "Outlines of Lichenology," it has been my business for years to note carefully all publications of any importance on the Natural History of Lichens. Those of Prof. Schwendener of Bâle and his disciples could scarcely have escaped me; so that I find the papers mentioned in the editorial note aforesaid, as well as others, duly recorded, with abstracts and relative criticisms, in my Lichenological memorandum book.

My opinion of the speculations of Schwendener and his followers has all along been, and still is, that so far from "clearing up" the "true nature of Lichens," they introduce elements of very decided confusion; and that they are to be regarded merely as illustrations of German transcendentalism, comparable to the fanciful notions of his countryman Bayrhoffer, in 1851, concerning Lichen-Reproduction.* The dogmatic assertions of anonymous critics concerning the "clearing up" of the "true nature of Lichens," by mere Speculations notwithstanding—I hold what I have always held—that the Lichens as an Order are quite as natural, important, and distinct as any other Order of the Cryptogamia. And in so saying I do not forget the fact that they overlap both the *Algæ* and the *Fungi*. On the contrary, I have over and over again pointed out, in my own publications on the Natural History of Lichens, the affinities, or points of affinity, between Lichens, and Algæ on the one hand, Fungi on the other. In order that sight might not be lost of organisms of doubtful character, possessing elements of structure usually regarded as both algoid and lichenoid, or fungoid and lichenoid, or either the one or the other, I long since proposed the establishment of *intermediate and provisional groups of Algo-lichenes and Fungo-lichenes*. Such groups would have the advantage of attracting attention to those *passage-forms*, which appear to me to be of the highest interest to the philosophical botanist.

I have not myself had an opportunity of perusing Haeckel's

* "Einiges über Lichenen und deren Befruchtung," von J. D. W. Bayrhoffer, Bern, 1851; an illustrated 4to.

"History of Creation." But, according to a recent reviewer* of the said work, this is what he says of the "true nature of Lichens":—"Every Lichen is really composed of *two distinct plants*: of a low form of *Fungus* (Ascomycetes), which lives as a *parasite* upon the former (?), and upon the nutritive substance prepared by it. The green cells, containing chlorophyll (Gonidia), which are found in every Lichen (?), belong to the *alga*. But the colourless threads (Hyphæ), which, densely interwoven, form the principal mass of the body of the Lichens, belong to the *parasitic fungus*." (Vol. ii. p. 95.) Now, says the reviewer in question, "This doctrine, so dogmatically put forth . . . . is adopted but by a few outside of the extremely Hypothetical school of German botanists; and by the best Cryptogamists of this country and of the Continent is considered a pure Delusion:" a verdict much nearer the truth, it must be confessed, than the assertion that Prof. Schwendener has "cleared up" the "true nature of Lichens." Among "the best cryptogamists of this country" who have expressed themselves as unconvinced by, or opposed to, the dogmata of Schwendener and his admirers, regarding the "true nature of Lichens," are Berkeley, Thwaites, and Cooke—than whom we have certainly no botanists better qualified or entitled to form or to offer opinions on such a subject. The views of Berkeley and Thwaites are referred to in NATURE (vol. x. p. 541) as having been expounded before the Royal Horticultural Society; while those of Cooke are set forth vigorously in his recent "International Scientific Series" volume on "Fungi." See also what the sagacious President of the Linnæan Society (Bentham) says on this subject—*ex cathedrâ*, and therefore summing up judicially—in his anniversary address for 1873 (Proceedings of the Society for May 1873, p. 28):—"There is one part of Sachs' book† (says he) which is an illustration of a very common readiness to take at once as proved any *paradox* or theory opposed to general belief, when a new discovery appears to afford some plausible argument in its favour. In the article *Lichens* . . . he adopts, as an established fact, Schwendener's view that Lichens are Fungi parasitical upon Algæ . . . a series of conclusions founded on a very small number of facts . . . They require much observation and study before the conclusions derived from them can be taught as an established Theory. And whatever be the result, the Group of Lichens is so distinct in its vegetative characters, and at the same time so extensive and varied a one, that it seems more methodical to treat it, as heretofore, as a *distinct class*,‡ than to absorb it in that of Fungi, notwithstanding the close affinity shown by its reproductive organs."

But other German botanists themselves, not inferior in status or experience to Prof. Schwendener, regard, as Bentham does, the Hypothesis that Lichens are the product of a union of Parasitic Ascomycetes with Algæ as far from being proved. For instance, Prof. De Bary, of Halle, and Dr. Stizenberger, of Constance, point this out in the *Botanische Zeitung* for 1870 (pp. 42 and 53). If, by artificial cultivation, such a Union could be made to produce a Lichen, the Theory might be held as proven. But this has not yet been effected, and I venture to think and say it never will be.

There are several difficulties in the natural history of Lichens with which the Schwendenerians have to deal, and which they have not yet, so far as I know, explained away. For instance, the case of Athalline Lichens that have neither Hyphæ nor Gonidia—neither fungoid nor algoid elements—assuming Hyphæ to be necessarily fungoid and Gonidia to be algoid; Lichens that are represented only by Apothecia, which are avowedly lichenoid: though they too may be claimed for the Algæ, inasmuch as Archer has a recent paper "On Apothecia occurring in some Scytonematous and Sorisophonaceous Algæ in addition to those previously known." §

In short, the mantle of Bayrhoffer appears to have fallen on Schwendener; and his Parasitic Theory is merely the most recent instance of German transcendentalism applied to the Lichens!

W. LAUDER LINDSAY

OUR ASTRONOMICAL COLUMN

THE BINARY STAR γ CORONÆ AUSTRALIS.—Professor Schiaparelli has measured this star during the past year with the 8-inch Merz-equatorial of the Observatory of Brera, Milan, where its meridian altitude is less than 8°; an interval of twelve years had elapsed since the last published measures by Powell. The first micrometrical measures were made in 1834 by Sir John Herschel, and from 1847 to 1858 Jacob had given much attention to observations of this star. From the forty-two years' observations thus available, Professor Schiaparelli has calculated an orbit which agrees unusually well with observation, and may be written as follows:—

Peri-astron passage, 1882·774; node, 49° 9′; node to peri-astron on orbit reckoned in the direction of motion, 255° 24′; inclination, 68° 38′; excentricity, 0·6989: semi-axis major, 2″·40; period of revolution, 55·582 years; mean annual motion, −6°·477.

At the calculated peri-astron passage in the autumn of 1882, the distance of the components which was 1″·45 last summer will have diminished, according to the above orbit, to 0″·3. Professor Schiaparelli states that observations are already difficult in his latitude, and will soon become impracticable; the star must therefore be left to the southern observatories, whence measures may be looked for during the interesting period in its revolution now at hand.

It will be seen that γ Coronæ Australis has the shortest revolution of any southern binary, and is fourth on our list in respect of rapid motion.

THE SOLAR ECLIPSE OF 1876, MARCH 25.—It is quite possible that this eclipse, which is given as an annular one in the Ephemerides, may be total for an instant on the North Pacific Ocean in longitude 140° 16′ west of Greenwich, and latitude 35° 39′ north, or near this position it may prove one of those rare phenomena, characterised in our text-books as "total without continuance." The central line traverses the southern and largest island of the Sandwich group, where the eclipse will be annular for a few seconds. At a point in longitude 155° 56′ W., latitude 19° 28′ N., the eclipse commences at 9h. 30m. A.M. local mean time, at 130° from the sun's north point towards the west (direct), and the annulus is formed according to the *Nautical Almanac* elements at 10h. 49m. 10s., and continues ten seconds. This point is a little south of Kaavaroa, by the Admiralty Chart, and close to the spot where the monument to Capt. Cook was erected; the central eclipse leaves this island, Hawaii, near Manienie, also marked on the Admiralty Chart of this group. The eclipse will be central and annular also in Vancouver Island and British Columbia. The central line appears to enter Vancouver at Refuge Cove, Sydney Inlet, leaving it at Orange Point, Duncan Bay, whence its course is to George Point, British Columbia. In Vancouver Island the annulus may continue seven or eight seconds, being formed about 0h. 27m. P.M. local mean time. At New Westminster, British Columbia, calculation gives a large partial eclipse commencing at 11h. 22m. A.M., and ending at 2h. 3m. P.M. local times, magnitude 0·95; here the first impression of the moon upon the sun's disc is made at 127° from his north point towards the west. For further information on the track of the central line over these parts the large Admiralty Chart of Vancouver Island and vicinity should be consulted; the above names of points traversed by the central eclipse are taken from it.

On the central line this eclipse must prove one of very considerable and unusual interest.

BESSEL'S TREATISES.—The first volume of the collective edition of the more important astronomical and other memoirs by the illustrious Königsberg astronomer has been issued under the editorship of Dr. Rudolf Engelmann, of Leipsic. It is a handsomely printed volume in quarto, of nearly 400 pages, and doubtless will find its way into the library of every earnest student of the science.

Amongst the contents of this first volume may be mentioned Bessel's early work, undertaken at the instigation of Olbers, the reduction of Harriot's and Torporley's

* In the *Scotsman* (Edinburgh) for December 3, 1875.
† "Lehrbuch der Botanik," of which a well-known English translation has now been published.
‡ The italics are mine.
§ "Quart. Journal of Microscopical Science," January 1875.

observations of the comet of Halley at its appearance in 1607; his "Development of a general method for calculating the perturbations of comets" from his classical work on the great comet of 1807, published at Königsberg in 1810, and somewhat difficult to meet with now, in its original form; the well-known memoir on the physical condition of Halley's comet with the plates, taken from Vol. 13 of the *Astronomische Nachrichten*; the memoir presented to the Berlin Academy in 1824, entitled "Untersuchung der Theils der planetarischen Störungen, welcher aus der Bewegung der Sonne entsteht;" researches on the Saturnian system, the position of the plane of the rings and their dimensions, the figure and dimensions of the planet, the motions of the Huyghenian satellite and determination of the mass of Saturn therefrom, and the memoir on the theory of this system from Vol. 28 of the *Astronomische Nachrichten*; the Prize Essay "Untersuchung der Grösse und der Einflusses des Vörrucken der Nachtgleichen," to which was attached the motto, "Non frustra signorum obitus speculamur et ortus;" various papers on precession, aberration, &c., which appeared in the *Tabulæ Regiomentanæ*, and elsewhere, and the essay on the "Scheinbare figur eines unvollstandig erleuchteten Planeten scheibe."

The portrait of Bessel after Mandel is prefixed, with reminiscences of his early life, from the correspondence with Olbers, and additional notes by the editor.

The work is entitled "Abhandlungen von Friedrich Wilhelm Bessel herausgegeben von Rudolf Engelmann,—Erster Band, Leipzig, 1875."

*THE FLOWERING OF SPRING PLANTS**

DURING the past twenty years the Scottish Meteorological Society has been collecting data relative to the budding, leafing, flowering, and defoliation of trees and plants, and to the migrations of birds in connection with the periodical return of the seasons, and it was proposed some time ago to discuss the material which has been accumulated. As preliminary, however, to this very difficult line of inquiry, it was resolved to discuss in the first place the observations which have been made by Mr. McNab on the flowering of spring plants in the open air in the Edinburgh Royal Botanic Garden during the past twenty-six years, and which have been published in the Transactions of the Botanical Society of Edinburgh. These observations have been made by the same observer on the same plants, growing in the same situations, during the whole of the twenty-six years.

The average day of flowering of thirty-two spring flowers has been determined, of which the following are examples:—*Galanthus nivalis*, Jan. 25; *Eranthis hyemalis*, Jan. 30; *Hepatica triloba*, Jan. 31; *Corylus Avellava*, Feb. 2; *Rhododendron atrovirens*, Feb. 3; *Crocus susianus*, Feb. 4; *Leucojum vernum*, Feb. 10; *Daphne Mezereum*, Feb. 22; *Narcissus pumilus*, March 10; *Orobus vernus*, March 11; *Muscari botryoides*, March 18; *Ribes sanguineum*, March 22; *Narcissus pseudo-Narcissus*, March 31; and *Fritillaria imperialis*, April 1.

The lateness or earliness of the different springs, as determined from the times of flowering of the thirty-two plants in each year, is considerable. The latest spring was 1855, which was thirty days later than the average, and the earliest 1874, which was twenty-three days earlier, thus giving a difference of fifty-three days between the latest and earliest springs during the past twenty-six years. As regards particular flowers, the deviations are much greater. The largest deviations from the average dates of flowering occur before the time of the equinox, when deviations of from five to seven weeks either way are of repeated occurrence; but after the equinox the deviations are markedly less, seldom reaching three weeks.

The springs of 1855, 1856, 1857, 1865, and 1870 were late throughout; and on the other hand, the springs of 1851, 1862, 1863, 1868, 1869, 1872, and 1874 were early throughout. Great variations have occurred in other springs, such as 1864, which, being preceded by a very mild December, many spring plants came into flower in the end of 1863. But in January the temperature was 2°·0 under the average, and in February, 5°·2, and vegetation was consequently arrested. March was also under the average, and the weather did not improve till April 3, the mean temperature of this month being 1°·7 above the average. The disturbing influence of this abnormal weather on the dates of flowering was in some cases very great. Thus, *Sisyrinchium grandiflorum* flowers on the average eleven days earlier than *Daphne Mezereum*, but in 1864 *Daphne Mezereum* did not come into flower till eighty-six days after *Sisyrinchium grandiflorum* had flowered. It is the occurrence of these disturbances which renders a long series of years necessary in order to arrive at a sufficiently close approximation to the true mean dates of flowering.

As regards Edinburgh, Jan. 11 may be considered as the turning point in the winter temperature, since previous to this date the temperature is, on the whole, falling, and after this date it continues steadily to rise.* Further, after this date the rainfall becomes less, clear weather is of more frequent occurrence, and the increase in the temperature is very largely due to an increase of sunshine. The extremely slow rate at which, up to the end of February, the mean temperature rises, and the small differences among the temperatures up to this date, and the large number of plants—fourteen in all out of thirty-two—which come successively into flower during the interval, suggest that it is not so much absolute temperature that calls for consideration as the accumulated amounts of the preceding daily temperatures, *in the extent to which these rise above freezing*. The accumulated temperatures, thus calculated, are, for *Galanthus nivalis*, 72°·7, and *G. plicatus*, 146°·4; for *Crocus susianus*, 125°·2, and *C. vernus*, 179°·1; for *Rhododendron atrovireus*, 120°·3, and *R. Nobleanum*, 249°·3; and for *Narcissus pumilus*, 347°·0, and *N. pseudo-Narcissus*, 540°·1. Similar data prepared for other places, in this and other countries, would be very instructive in showing how far the order of dates of flowering in Edinburgh is observed in other places, and what is the relation of the dates of flowering at each place to the accumulated temperatures at that place, and what modifications are brought about by purely climatic differences, particularly as these occasion different results as respects the heating and actinic rays of the sun.

The thirty-two plants, whose dates of flowering have been determined, include three varieties of one species, viz., the *blue*, *white*, and *red* varieties of *Scilla bifolia*. Of these three varieties the *blue* flowers first, viz., on March 7; next comes the *white* variety, on March 17; and lastly, the *red* variety, on March 21, the *red* being thus a fortnight later than the *blue* variety.

An interesting question may in this connection be raised with reference to the relation which the colours of flowers have to the dates of flowering. With this view, our British wild plants have been grouped according to the different colours of their flowers and the months in which the flowers usually first expand, the data being taken from Dr. Hooker's "Students' Flora of the British Islands." In classifying the plants, *red* includes pink, crimson, and scarlet; and *green*, all greenish-white, yellowish-green, and greenish-purple flowers. *Grasses*, *carices*, and other groups, characterised by inconspicuous floral envelopes, are excluded. The list examined includes 909 species, of which there are 257 with

* Abstract of a paper read before the Edinburgh Botanical Society on the 13th inst. The paper itself is in type for the Journal of the Scottish Meteorological Society.

* See Prof. Forbes's paper on the climate of Edinburgh, in Trans. Roy. Soc., Edin., vol. xxii. pp. 348-349.

white flowers, 238 with yellow flowers, these two being nearly a half of the whole number; then follow red, 144; purple, 94; blue, 87; green, 51; and miscellaneous, 38. Taking each colour by itself, and calculating the percentages of that colour which has come into flower by each month from April to July, we obtain the following results for the first five classes:—

	April.	May.	June.	July.
Blue ..	16	43	71	93
White	14	36	70	97
Purple	4	28	61	92
Yellow	9	24	61	93
Red ...	9	25	62	94

Thus of these colours, the *blues* are, on the average, considerably the earliest in flowering; then follow in order the *whites* and the *purples*, and lastly the *yellows* and *reds*. It follows that the plants included in the British flora clearly tend to arrange themselves, as regards the dates of flowering, in the order of the colours of the spectrum, the average earliest being those which are nearest the part of the spectrum where the actinic rays are at the maximum. It will be observed that the differently-coloured varieties of *Scilla bifolia* are in the same order of flowering of the plants of the same colours in the British flora. Accurate observations, continued from year to year, of the exact dates of flowering of different plants, and particularly of differently-coloured varieties of the same species, could not fail to contribute valuable data to the inquiry referring to the influence of the solar rays, in the development of the more important of the vital functions of plants in different seasons. Whilst it is quite true, as has been pointed out by Mr. R. A. Pryor in NATURE (vol. xiii. p. 150), that flowers of all colours bloom in any of the spring or summer months, it is plain that it is only the method of inquiry by averages that can guide us in the search for the law or laws which regulate the seasonal distribution of colour among flowers. It is scarcely necessary to refer to the importance of this question in its possible applications in the rearing of early and late varieties of flowers and fruits.

ALEXANDER BUCHAN

THE WORK OF THE "CHALLENGER" AND THE "VALOROUS"

THE Admiralty have just issued Reports on the Soundings and Temperatures taken by the *Challenger* in the Pacific, and by the *Valorous* during her voyage out with the Arctic Expedition and home again.

Captain Thomson's Report is dated from Honolulu, August 8, 1875, and refers to operations in the Inland Sea and to the section from Yokohama to Honolulu. After some days' cruising in the Inland Sea in May, Captain Thomson returned to Yokohama, nothing of interest to the scientific branch having been obtained. The deepest water found in the longitudinal section during the voyage to Honolulu was 3,980 fathoms, whilst that from the turning-point at 156° west longitude down to Honolulu was 3,025 fathoms. The bottom of this section of the North Pacific showed on nearly every occasion red clay, with manganese and pumice-stone in great quantities; the latter greatly increased as the approach to the Sandwich Islands was made.

Staff-Commander Tizzard makes his preliminary Report on the Temperatures of the North Pacific. From Samboangan nineteen soundings and serial temperatures were obtained in the western part of the North Pacific, from which two sections have been constructed, one from the Meangis Islands to the Admiralty Islands, and the other from the latter to Japan. It was found that when the depth exceeded 1,500 fathoms, the thermometer which regulated the bottom temperatures gave the same results as they did at 1,400 fathoms, viz. 34°·4 (corrected). At a little to the southward of Tongatabu, the bottom temperature was 32°·9, and as the U.S. officers appear to have obtained colder temperatures at the bottom than any yet obtained by the *Challenger* in the North Pacific, Commander Tizzard thinks it probable that the bed of the Pacific is divided into at least three deep basins by ridges of a not greater depth than 1,400 fathoms from the surface. In the southern part of the western portion of the North Pacific the surface-temperature varied from 80° to 84°, and that in February and March, considerably higher than any yet registered by the *Challenger* in the open ocean.

The Report contains a table of the soundings in the above sections, and four beautifully-constructed sectional charts. The two first show the soundings and isothermal lines from the Meangis to the Admiralty Islands, and between the latter and Japan. The third is intended to illustrate Staff-Commander Tizzard's remarks on the surface temperature of the section referred to above; and the fourth shows the soundings and isothermal lines between Nosema Head, Japan, and the 180th meridian. One of the most notable features of these charts is the occasional sudden increase in depth; between Japan and the Admiralty Islands, for example, the bottom sinks at one place all at once from about 2,000 fathoms, on both sides, to a depth of 4,500 fathoms.

The *Valorous* on her outward voyage took nineteen soundings in Davis' Straits between 63° 45′ and 68° 57′ N. lat., the depth being found to vary from 58 to 200 fathoms. The bottom was mostly fine grey sand, mixed with shells, gravel, and stones. On returning south, lower soundings were obtained along the Greenland coast, with much the same results as to bottom. On getting clear of Cape Farewell the course was shaped to cross the Atlantic Ocean between the parallels of 59° and 55°, and to join the soundings westward of Ireland obtained in the *Porcupine* in 1862. The greatest depth obtained was 1,860 fathoms in lat. 57° 50′ N., and 44° 52′ W. long., with a bottom of Globigerina ooze, and a bottom temperature of 33°·4. In 56° 11′ N. lat. and 37° 41′ W. long. a depth of 1,450 fathoms was obtained, the bottom Globigerina ooze, and next day in lat. 56° 1′ N., long. 34° 42′ W., a submarine ridge of 690 fathoms was sounded on with the same description of bottom. On the day following this, in lat. 55° 58′, long. 31° 41′ W., the depth increased to 1,230 fathoms, mud; the deep sounding of this day and that of the second day previous being equidistant (103 miles) from the intervening shoaler ridge of 690 fathoms. On reaching the 26th meridian of W. long., a westerly gale commenced, which prevented further proceedings. Globigerina ooze, with occasional fine sand and mud, are the main characteristics of this section. Two sectional charts exhibit graphically the data obtained.

SCIENCE IN GERMANY

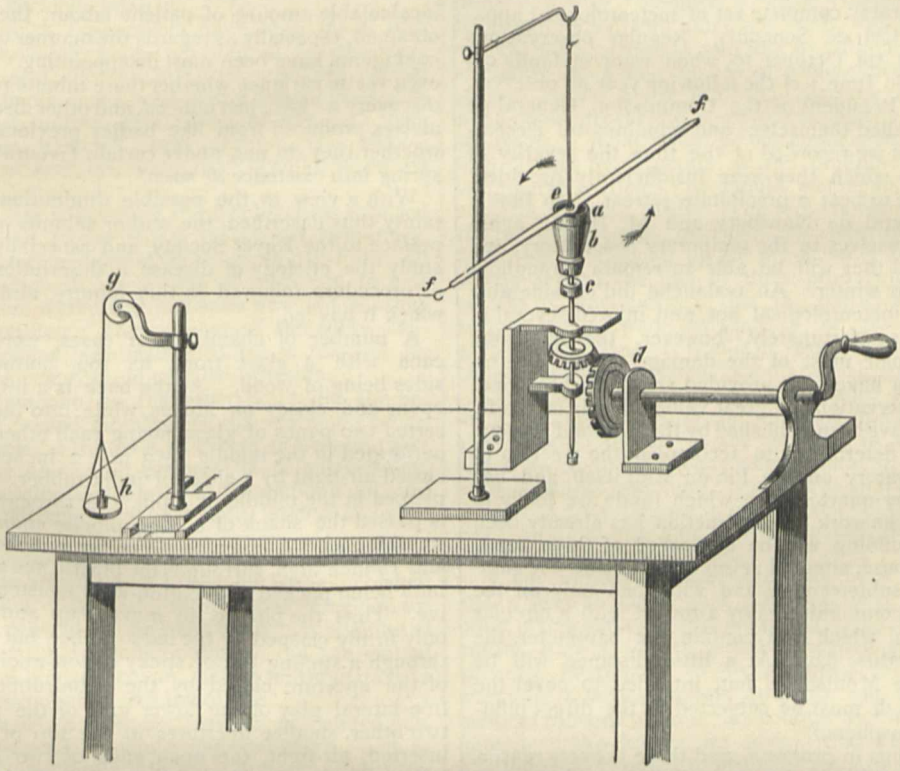
(*From a German Correspondent.*)

M. PULUJ, of Fiume, has recently published a description of a school-apparatus for determining the mechanical equivalent of heat. The apparatus is of very simple construction, and consists of a calorimetrical and a dynamometrical part, which is connected with a rotating arrangement, such as may be found in any physical laboratory.

The calorimetrical part of the apparatus is formed of two truncated hollow cones of cast iron, fitting the one into the other. The inner one, *a*, does not quite reach to the bottom of the outer, *b*, and it projects a little above it. The outer cone, *b*, can be fixed, coaxially, into the spool of the driving machine. The inner cone contains mercury. If, now, the driving machine be set a-going and the inner cone held fast, heat is produced through friction of the touching surfaces of the cones.

For measurement of the work transformed into heat, the arrangement is as follows:—To the wooden lid, *e*, of

the inner cone, is screwed a light wooden beam, *f*, horizontally. Through the beam and lid passes a perforation for receiving the thermometer. At a little distance from the beam, *f*, and at the same height, there is a fixed pulley, *g*, over which is passed a cord with a scale at its pendant extremity, while the other end is attached to the end of one arm of the beam (the second arm of the beam acts as counter weight). When the driving machine is put in action, the cones rub together, and the outer cone tends to carry the inner one and its beam round with it in the direction of rotation. With a certain weight in the scale, the horizontal part of the cord will form with the axis of the beam a right angle. From the length of the beam-arm, the amount of weighting, and the number of rotations, may be deduced the work that is transformed into heat; and from the water value of the calorimeter,



and the increase of its temperature, can be reckoned the quantity of heat produced.

From twenty-eight experiments (in which the amount of heat radiated from the calorimeter was taken into account), the average value obtained for the mechanical equivalent of heat was 425·2, with a mean error ± 5·4. A second series of experiments was made, with the arm of the beam in any position with reference to the cord. A simple arrangement—wooden triangle with arc-division—served for measuring the angle which the axis of the beam-arm formed with its normal position (in which it forms a right angle with the cord). From the observed values of this angle, and from the quantities already referred to, the number obtained for the mechanical equivalent of heat was 426·7, with a mean error ± 5·9.

The apparatus is especially to be recommended for lecture-experiments, because the method of experimenting is extremely simple, and the carrying out of the experiment takes very little time. A single experiment occupies 30-60″.

S. W.

THE PHYSICAL OBSERVATORY ON THE PIC DU MIDI

AT a recent sitting of the Paris Academy of Sciences M. Ch. Sainte-Claire Deville made a communication, with reference to the proposed Physical Observatory on the Pic du Midi, in the Pyrenees. He referred to the increasing importance of meteorology, and to its manifold extensions and development in recent years, and to the growing necessity of establishing numerous fixed stations at as high an altitude as is practicable. This has already been done to a considerable extent in India, in America, and in some parts of Europe; in France, as we have already intimated, the Puy de Dôme Observatory is nearly completed. M. Deville then referred to the importance of having a station on the Pyrenees, and to the difficulty of choosing a suitable site. The Pic du Midi de Bigorre, however, unites in itself all the most favourable circumstances. Situated towards the middle of the chain of the Pyrenees which receive directly the shock of the Atlantic storms, the Pic du Midi stands out from the general crest, and rises to a height of 2,877 metres, only 527 metres below the highest summit of the chain. It commands a magnificent and extensive panoramic view, and is easily accessible from various points. From the sixteenth century downwards it has attracted tee attention of men of science, and during the last and th present century a considerable number of notable ob servers have resorted to the Pic for the purpose of carrying on observations. Darcet, in 1786, obtained from Philippe d'Orleans the promise of 80,000 francs to found an observatory on the mountain, but the political events which rapidly succeeded prevented the scheme from being carried out. Even then a small hut existed on the spot where the Commission, charged by the Ramond Society with carrying out the present scheme, have built another; the former had been built by Vidal and Reboul, who in 1786-7 surveyed the Pic. Ramond, in the early part of

the present century, made about thirty-six ascents of the peak, for the purpose of making barometric observations.

In 1854 a society at Bagnères founded on the Col de Sencours, 511 feet below the Pic, on a hill immediately above the Lake Oncet, a hotel for tourists. It is this hotel which the Ramond Society has used as a temporary observatory, until the Government provide the means of erecting a proper building on the summit of the Pic. On August 1, 1873, the Commission appointed by the Society provided a tolerably complete set of meteorological apparatus on the Col de Sencours. Regular observations were carried on till October 10, when want of funds cut them short. On June 1 of the following year an observer, along with the President of the Commission, General de Nansouty, installed themselves and remained till December 25, when, as we recorded at the time, the severity of the winter, for which they were insufficiently provided, compelled them to beat a precipitate retreat. On June 1 last year, General de Nansouty and M. Baylac again established themselves in the temporary observatory, and it is to be hoped they will be able to remain throughout the whole of the winter. An avalanche did considerable damage to the meteorological hut, and injured several of the instruments; fortunately, however, the observers managed to repair most of the damage done. The instruments which have been provided are of the best kind, and already observations of great value have been made, some of which have been published by the Ramond Society.

This Society determined to accomplish the erection of a proper observatory on the Pic du Midi itself, and has appealed to every quarter from which funds are likely to be obtained. The work of construction has already been begun. The building will be composed of three parts. The dwelling-house, situated seven metres below the summit, is in part subterranean, and will open only on the south side. It communicates by a tunnel with a circular vaulted erection, which will contain the barometer, the magnetic apparatus, &c. At a little distance will be solidly built the Montsouris hut, intended to cover the instruments which must be subjected to the direct influence of the atmosphere.

The work is thus in progress, and there is every reason to believe that it will soon be successfully completed, and the station become one of the most important physical observatories, not only in France, but on the globe.

*PROF. TYNDALL ON GERMS**

THE author refers in an introduction to an inquiry on the decomposition of vapours and the formation of actinic clouds by light, whereby he was led to experiment on the floating matter of the air. He refers to the experiments of Schwann, Schröder and Dusch, Schröder himself, to those of the illustrious French chemist Pasteur, to the reasoning of Lister and its experimental verification, regarding the filtering power of the lungs; from all of which he concluded, six years ago, that the power of developing life by the air, and its power of scattering light, would be found to go hand in hand. He thought the simple expedient of examining by means of a beam of light, while the eye was kept sensitive by darkness, the character of the medium in which their experiments were conducted, could not fail to be useful to workers in this field. But the method has not been much turned to account, and this year he thought it worth while to devote some time to the more complete demonstration of its utility.

He also wished to free his mind, and if possible the minds of others, from the uncertainty and confusion which now beset the doctrine of "spontaneous generation." Pasteur has pronounced it "a chimera," and expressed the undoubting conviction that this being so it is possible to remove parasitic diseases from the earth. To the medical profession, therefore, and through them to humanity at large, this question is one of the last importance. But the state of medical opinion regarding it is not satisfactory. In a recent number of the *British Medical Journal*, and in answer to the question, "In what way is contagium generated and communicated?" Messrs. Braidwood and Vacher reply that notwithstanding "an almost incalculable amount of patient labour, the actual results obtained, especially as regards the manner of generation of contagium, have been most disappointing. Observers are even yet at variance whether these minute particles, whose discovery we have just noticed, and other disease germs, are always produced from like bodies previously existing, or whether they do not, under certain favourable conditions, spring into existence *de novo*."

With a view to the possible diminution of the uncertainty thus described, the author submits without further preface to the Royal Society, and especially to those who study the etiology of disease, a description of the mode of procedure followed in this inquiry, and the results to which it has led.

A number of chambers, or cases, were constructed, each with a glass front, its top, bottom, back and sides being of wood. At the back is a little door which opens and closes on hinges, while into the sides are inserted two panes of glass, facing each other. The top is perforated in the middle by a hole 2 inches in diameter, closed air-tight by a sheet of india-rubber. This sheet is pierced in the middle by a pin, and through the pin-hole is passed the shank of a long pipette ending above in a small funnel. A circular tin collar 2 inches in diameter and 1½ inch high, surrounds the pipette, the space between both being packed with cotton-wool moistened by glycerine. Thus the pipette, in moving up and down, is not only firmly clasped by the india-rubber, but it also passes through a stuffing box of sticky cotton-wool. The width of the aperture closed by the india-rubber secures the free lateral play of the lower end of the pipette. Into two other smaller apertures in the top of the case are inserted, air-tight, the open ends of two narrow tubes, intended to connect the interior space with the atmosphere. The tubes are bent several times up and down, so as to intercept and retain the particles carried by such feeble currents as changes of temperature might cause to set in between the outer and the inner air.

The bottom of the box is pierced with two rows, sometimes with a single row of apertures, in which are fixed air-tight, large test-tubes, intended to contain the liquid to be exposed to the action of the moteless air.

On Sept. 10 the first case of this kind was closed. The passage of a concentrated beam across it through its two side windows then showed the air within it to be laden with floating matter. On the 13th it was again examined. Before the beam entered, and after it quitted the case, its track was vivid in the air, but within the case it vanished. Three days of quiet sufficed to cause all the floating matter to be deposited on the sides and bottom, where it was retained by a coating of glycerine, with which the interior surface of the case had been purposely varnished. The test-tubes were then filled through the pipette, boiled for five minutes in a bath of brine or oil, and abandoned to the action of the moteless air. During ebullition aqueous vapour rose from the liquid into the chamber, where it was for the most part condensed, the uncondensed portion escaping, at a low temperature, through the bent tubes at the top. Before the brine was removed little stoppers of cotton-wool were inserted in the bent tubes, lest the entrance of the air into the cooling chamber should at first be forcible enough to carry motes along with it. As soon, however, as the ambient temperature was assumed by the air within the case, the cotton-wool stoppers were removed.

* On the Optical Deportment of the Atmosphere in reference to the Phenomena of Putrefaction and Infection. Abstract of a paper read before the Royal Society, January 13th, by Prof. Tyndall, F.R.S. (Communicated by the author.)

We have here the oxygen, nitrogen, carbonic acid, ammonia, aqueous vapour, and all the other gaseous matters which mingle more or less with the air of a great city. We have them, moreover, "untortured" by calcination and unchanged even by filtration or manipulation of any kind. The question now before us is, can air thus retaining all its gaseous mixtures, but self-cleansed from mechanically suspended matter, produce putrefaction? To this question both the animal and vegetable worlds return a decided negative.

Among vegetables experiments have been made with hay, turnips, tea, coffee, hops, repeated in various ways with both acid and alkaline infusions. Among animal substances are to be mentioned many experiments with urine; while beef, mutton, hare, rabbit, kidney, liver, fowl, pheasant, grouse, haddock, sole, salmon, cod, turbot, mullet, herring, whiting, eel, oyster have been all subjected to experiment.

The result is that infusions of these substances exposed to the common air of the Royal Institution laboratory, maintained at a temperature of from 60° to 70° Fahr., all fell into putrefaction in the course of from two to four days. No matter where the infusions were placed, they were infallibly smitten. The number of the tubes containing the infusions was multiplied till it reached six hundred, but not one of them escaped infection.

In no single instance, on the other hand, did the air, which had been proved moteless by the searching beam, show itself to possess the least power of producing Bacterial life or the associated phenomena of putrefaction. The power of developing such life in atmospheric air, and the power of scattering light, are thus proved to be indissolubly united.

The sole condition necessary to cause these long-dormant infusions to swarm with active life is the access of the floating matter of the air. After having remained for four months as pellucid as distilled water, the opening of the back-door of the protecting case, and the consequent admission of the mote-laden air, suffice in three days to render the infusions putrid and full of life.

That such life arises from mechanically suspended particles is thus reduced to ocular demonstration. Let us inquire a little more closely into the character of the particles which produce the life. Pour Eau de Cologne into water, a white precipitate renders the liquid milky. Or, imitating Brücke, dissolve clean gum mastic in alcohol, and drop it into water, the mastic is precipitated, and milkiness produced. If the solution be very strong the mastic separates in curds; but by gradually diluting the alcoholic solution we finally reach a point where the milkiness disappears, the liquid assuming, by reflected light, a bright cerulean hue. It is, in point of fact, the colour of the sky, and is due to a similar cause, namely, the scattering of light by particles, small in comparison to the size of the waves of light.

When this liquid is examined by the highest microscopic power it seems as uniform as distilled water. The mastic particles, though innumerable, entirely elude the microscope. At right angles to a luminous beam passing among the particles they discharge perfectly polarised light. The optical deportment of the floating matter of the air proves it to be composed, in part, of particles of this excessively minute character. When the track of a parallel beam in dusty air is looked at horizontally through a Nicol's prism, in a direction perpendicular to the beam, the longer diagonal of the prism being vertical, a considerable portion of the light from the finer matter is extinguished. The coarser motes, on the other hand, flash out with greater force, because of the increased darkness of the space around them. It is among the finest ultra-microscopic particles that the author shows the matter potential as regards the development of Bacterial life is to be sought.

But though they are beyond the reach of the microscope, the existence of these particles, foreign to the atmosphere but floating in it, is as certain as if they could be felt between the fingers, or seen by the naked eye. Supposing them to augment in magnitude until they come, not only within range of the microscope, but within range of the unaided senses. Let it be assumed that our knowledge of them under these circumstances remains as defective as it is now—that we do not know whether they are germs, particles of dead organic dust, or particles of mineral matter. Suppose a vessel (say a flower-pot) to be at hand filled with nutritious earth, with which we mix our unknown particles; and that in forty-eight hours subsequently buds and blades of well-defined cresses and grasses appear above the soil. Suppose the experiment when repeated over and over again to yield the same unvarying result. What would be our conclusion? Should we regard those living plants as the products of dead dust or mineral particles; or should we regard them as the offspring of living seeds? The reply is unavoidable. We should undoubtedly consider the experiment with the flower-pot as clearing up our pre-existing ignorance; we should regard the fact of their producing cresses and grasses as proof positive that the particles sown in the earth of the pot were the seeds of the plants which have grown from them. It would be simply monstrous to conclude that they had been "spontaneously generated."

This reasoning applies word for word to the development of *Bacteria* from that floating matter which the electric beam reveals in the air, and in the absence of which no Bacterial life has been generated. There seems no flaw in this reasoning; and it is so simple as to render it unlikely that the notion of Bacterial life developed from dead dust can ever gain currency among the members of a great scientific profession.

A novel mode of experiment has been here pursued, and it may be urged that the conditions laid down by other investigators in this field, which have led to different results, have not been strictly attended to. To secure accuracy in relation to these alleged results, the latest words of a writer on this question, who has influenced medical thought both in this country and in America, are quoted. "We know," he says, "that boiled turnip or hay-infusions exposed to ordinary air, exposed to filtered air, to calcined air, or shut off altogether from contact with air, are more or less prone to swarm with *Bacteria* and vibriones in the course of from two to six days." Who the "we" are who possess this knowledge is not stated. The author is certainly not among the number, though he has sought anxiously for knowledge of the kind. He thus tests the statements in succession.

And first, with regard to the filtered air. A group of twelve large test-tubes were caused to pass air-tight through a slab of wood. The wood was coated with cement, in which, while hot, a heated "propagating glass" resembling a large bell-jar was imbedded. The air within the jar was pumped out several times, air filtered through a plug of cotton-wool being permitted to supply its place. The test-tubes contained infusions of hay, turnip, beef, and mutton—three of each—twelve in all. They are as clear and cloudless at the present moment as they were upon the day of their introduction; while twelve similar tubes, prepared at the same time in precisely the same way and exposed to the ordinary air, are clogged with mycelium, mould, and *Bacteria*.

With regard to the calcined air, a similar propagating glass was caused to cover twelve other tubes filled with the same infusions. The "glass" was exhausted and carefully filled with air which had passed through a red-hot platinum tube, containing a roll of red-hot platinum gauze. Tested by the searching beam, the calcined air was found quite free from floating matter. Not a speck has invaded the limpidity of the infusions exposed to it, while twelve similar tubes placed outside have fallen into rottenness.

The experiments with calcined air took another form. Six years ago it was found that to render the laboratory air free from floating matter, it was only necessary to permit a platinum wire heated to whiteness to act upon it for a sufficient time. Shades, containing pear juice, damson juice, hay- and turnip-juice, and water of yeast, were freed from their floating matter in this way. The infusions were subsequently boiled and permitted to remain in contact with the calcined air. They are quite unchanged to the present hour, while the same infusions exposed to common air became mouldy and rotten along ago.

It has been affirmed that turnip- and hay-infusions rendered slightly alkaline are particularly prone to exhibit the phenomena of spontaneous generation. This was not found to be the case in the present investigation. Many such infusions have been prepared, and they have continued for months without sensible alteration.

Finally, with regard to infusions wholly withdrawn from air, a group of test-tubes, containing different infusions, was boiled under a bell-jar filled with filtered air, and from which the air was subsequently removed as far as possible by a good air-pump. They are now as pellucid as they were at the time of their preparation, more than two months ago, while a group of corresponding tubes exposed to the laboratory air have all fallen into rottenness.

There is still another form of experiment on which great weight has been laid—that of hermetically sealed tubes. On April 6 last, a discussion on the "Germ Theory of Disease" was opened before the Pathological Society of London. The meeting was attended by many distinguished medical men, some of whom were profoundly influenced by the arguments, and none of whom disputed the facts brought forward against the theory on that occasion. The following important summary of these was then given :—"With the view of settling these questions, therefore, we may carefully prepare an infusion from some animal tissue, be it muscle, kidney, or liver ; we may place it in a flask whose neck is drawn out and narrowed in the blowpipe-flame, we may boil the fluid, seal the vessel during ebullition, and keeping it in a warm place, may await the result, as I have often done. After a variable time the previously heated fluid within the hermetically sealed flask swarms more or less plentifully with *Bacteria* and allied organisms."

Previous to reading this statement the author had operated upon tubes of hay- and turnip-infusions, and upon 21 tubes of beef, mackerel, eel, oyster, oatmeal, malt, and potato, hermetically sealed while boiling, not by the blowpipe, but by the far more handy spirit-lamp flame. In no case was any appearance whatever of *Bacteria* or allied organisms observed. The perusal of the discussion just referred to caused the author to turn again to muscle, liver, and kidney, with a view of varying and multiplying the evidence. Fowl, pheasant, snipe, partridge, plover, wild duck, beef, mutton, heart, tongue, lungs, brains, sweetbread, tripe, the crystalline lens, and vitreous humour of an ox, herring, haddock, mullet, codfish, sole, were all embraced in the experiments. There was neither mistake nor ambiguity about the result. One hundred and thirty-nine of the flasks operated on were exhibited, and not one of this cloud of witnesses offers the least countenance to the assertion that liquids within flasks, boiled and hermetically sealed, swarm, subsequently, more or less plentifully with *Bacteria* and allied organisms.

The evidence furnished by this mass of experiments, that errors either of preparation or observation have been committed, is, it is submitted, very strong. But to err is human ; and in an inquiry so difficult and fraught with such momentous issues, it is not error, but the persistence in error by any of us, for dialectic ends, that is to be deprecated. The author shows by illustrations the risks of error run by himself. On Oct. 21 he opened the back-door of a case containing six test-tubes filled with an infusion of turnip which had remained perfectly clear for three weeks, while three days sufficed to crowd six similar tubes exposed to mote-laden air with *Bacteria*. With a small pipette he took specimens from the pellucid tubes, and placed them under the microscope. One of them yielded a field of Bacterial life, monstrous in its copiousness. For a long time he tried vainly to detect any source of error, and was perfectly prepared to abandon the unvarying inference from all the other experiments, and to accept the result as a clear exception to what had previously appeared to be a general law. The cause of his perplexity was finally traced to the tiniest speck of an infusion containing *Bacteria*, which had clung by capillary attraction to the point of one of his pipettes.

Again, three tubes containing infusions of turnip, hay, and mutton, were boiled on Nov. 2 under a bell-jar containing air so carefully filtered that the most searching examination by a concentrated beam failed to reveal a particle of floating matter. At the present time every one of the tubes is thick with mycelium and covered with mould. Here surely we have a case of spontaneous generation. Let us look to its history.

After the air has been expelled from a boiling liquid it is difficult to continue the ebullition without "bumping." The liquid remains still for intervals, and then rises with sudden energy. It did so in the case now under consideration, and one of the tubes boiled over, the liquid over-spreading the resinous surface in which the bell-jar was imbedded, and on which, doubtless, germs had fallen. For three weeks the infusions had remained perfectly clear. At the end of this time, with a view of renewing the air of the jar, it was exhausted, and refilled by fresh air which had passed through a plug of cotton-wool. As the air entered, attention was attracted by two small spots of penicillium resting on the liquid which had boiled over. It was at once remarked that the experiment was a dangerous one, as the entering air would probably detach some of the spores of the penicillium and diffuse them in the bell-jar. This was, therefore, filled very slowly, so as to render the disturbance a minimum. Next day, however, a tuft of mycelium was observed at the bottom of one of the three tubes, namely that containing the hay-infusion. It has by this time grown so as to fill a large portion of the tube. For nearly a month longer the two tubes containing the turnip- and mutton-infusions maintained their transparency unimpaired. Late in December the mutton-infusion, which was in dangerous proximity to the outer mould, showed a tuft upon its surface. The beef-infusion continued bright and clear for nearly a fortnight longer. The recent cold weather caused me to add a third gas-stove to the two which had previously warmed the room in which the experiments are conducted. The warmth of this stove played upon one side of the bell-jar ; and on the day after the lighting of the stove, the beef-infusion gave birth to a tuft of mycelium. In this case the small spots of penicillium might have readily escaped attention ; and had they done so we should have had three cases of "spontaneous generation" far more striking than many that have been adduced.

(*To be continued.*)

NOTES

M. E. QUETELET has issued a Notice giving a brief account of the recent progress of the Brussels Observatory, which has been established only in the face of great difficulties. In 1833 meteorological observations were commenced to be made, and a few years after astronomical observations were added by the elder Quetelet. The work which is at present being carried on has for its object a general revision of the variable stars. Seventy

thousand positions have already been collected—forty thousand for right ascensions and thirty thousand for declinations. Two-thirds of these observations are published, the rest is calculated, and will be printed as soon as the resources of the Observatory permit. For fifty years a series of observations have been carried on in reference to the variations of the magnetic needle at Brussels, the results of which M. Quetelet hopes to be able by and by to publish. He, however, feels that if Brussels is to keep up with the science of the day, much remains to be done. A Commission appointed in 1874 to report on the Observatory gave in their report at the end of that year, and their principal conclusions are as follows:—To complete the magnetic system of the Observatory by the acquisition of self-registering instruments, to organise the International Meteorological Service, to obtain an equatorial of large dimensions with the accessories necessary to the spectroscopic investigation of the heavens, and to increase the number and improve the position of the observer. The Ministry have, unfortunately, not yet come to a decision on these conclusions, though we hope they may do so soon, and enable the valuable work of the Observatory to be carried on with complete efficiency, and the results be regularly given to the scientific world. Meanwhile, the work of the Observatory is being regularly carried on on the old lines.

THE new Aquarium at Westminster was opened on Saturday last by the Duke of Edinburgh; but though the building is sufficiently complete for concerts to be held, it will be many weeks before the tanks are in a proper condition to receive water. The arrangements connected with the aquarium proper have been under the direction of Mr. W. A. Lloyd, who planned the Crystal Palace and other aquaria. There are in this latest development of aquarium construction two or three new points worthy of attention. The water in flowing from one tank to another will overflow from one and pass down a tube, so that it enters the next at the bottom, by which means a more thorough mixture than has hitherto been attained will be ensured of the water that has been exposed to the surface aëration. The reservoir which occupies the space under the large hall is divided into nine compartments, so that in case of an accident to any part, it can be cleared of the water and repaired while the other sections remain in operation. The total capacity of the reservoir is 600,000 gallons, and the total amount of water in reservoir and tanks together will be 750,000 gallons. For the circulation eight rotary vulcanite pumps are erected, and they are capable of sending 56,000 gallons an hour through the tanks if needed, to meet any emergency, though it is calculated that 15,000 to 20,000 gallons will be about the average amount. The plan of forcing downwards small jets of water into each tank, as at the Crystal Palace, is adopted. In the anemone tanks the water will be periodically emptied, representing, to some extent, tidal action. The salmon will have a fifty-feet run, and so will the wrasse. All the pipes, culverts, &c., are of vulcanite, but the glass fronts of the tanks are fitted in cork, with the exception of some of the limestone rock-work, which may probably be too soluble; everything that forethought could arrange in accordance with our present knowledge seems to have been attended to. It is to be hoped that the scientific results obtained will not be out of proportion to the cost of the undertaking. The official guide-book published on Saturday contains a useful article on aquarium management by Mr. Lloyd, and the *Gardeners' Magazine* of last week has also a contribution from his pen on the rise and progress of aquaria in England; the *Morning Post* of Saturday last contained an interesting article. The cover of the official guide-book is ornamented with a woodcut by Tenniel, which is quite equal to his happiest efforts in *Punch*.

THE Committee of Science of the Irish Academy will meet on Feb. 28 to take into consideration applications for assistance out of the parliamentary grant for the preparation of scientific reports; and it is requested that all such applications be forwarded to the secretary on or before that date.

THE Montsouris Observatory has been supplied with a number of recording apparatuses for barometric pressures constructed on new principles, and instruments for recording thermometric variations have been made on aneroid and bi-metallic principles. A steel needle guided by these dilatations traces a curve on a rotating cylinder. The anemometer records by a magnetic contrivance devised by M. Mangon. M. Marie Davy has also established an apparatus for recording the pressure exerted by the wind. A specially devised mirror has been arranged to indicate the direction of the clouds, which it is rather difficult to discover from direct inspection of the clouds themselves.

DR. SAMUEL BIRCH has been appointed to the Rede Lectureship in the University of Cambridge. He will deliver his lecture about Easter.

AT the January meeting of the Photographic Society, the hon. secretary read a note on the action of eosin on the photographic spectrum, by Captain J. Waterhouse, B.S.C., assistant surveyor-general of India. Tetrabromfluorescin, or eosin as it is termed commercially, is a dye remarkable for its intense fluorescence and beautiful pink colour. Its absorption spectrum is characterised by a very strong band between E and F, which fades off on either side and terminates half way between D and E, and half way between F and G. At the part of the spectrum indicated, photographic action was increased to a marked degree when the collodion was stained with the dye. Captain Waterhouse naturally inferred that greens, *e.g.* foliage, would exhibit more detail if photographed on eosin-stained plates, but this was not the case, the only effect was to make the whole action of the light slower. Vogel's observations have thus been confirmed so far as the spectrum effects are concerned; the want of action when coloured surfaces are photographed is however at variance with his results obtained, we believe, by photographing coloured papers. By the kindness of Mr. John Spiller, to whom Captain Waterhouse's letter was addressed, we have been enabled to see some of his spectrum photographs, and they certainly surpass any results of the kind we have yet seen.

The *Journal d'Hygiène*, No. 8, of Dr. Prosper de Pietra Santa, contains several articles of interest. The *Climat de Pau* gives a brief *résumé* of the meteorological characteristics of this place, in which special prominence is given to the chief feature of its climate, viz. the remarkable calmness of its atmosphere, which, combined with a light porous soil draining away the rains as they fall, and the great beauty of its environs, have made the reputation of Pau as a desirable winter and spring sanatarium. In *L'Emigration dans le Midi de la France* attention is directed to the varied climates of France in their therapeutic relations, which are classed, according to their characteristics in these respects, into sea-climates, such as Cannes, Menton, Ajaccio, and parts of Nice, Hyères, and Alger; hill climates, such as Pau, Orthez, Le Cannet, and parts of Nice, Hyères, and Alger; and mixed or intermediate climates, such as Arcachon, Vernet, and Amélie-les-Bain. The determination landward of sea climates which are considered as consisting in an atmosphere containing a minimum of miasmatic matters, a maximum of oxygen, the air impregnated with fine particles of chloride of sodium, and with a peculiar odour derived from marine plants charged with bromine and iodine, is a point of considerable importance.

THE *Bulletin International* of the Paris Observatory of the 18th inst. is the first number of a new issue, executed by the printing establishment of MM. Yves and Barrel, by the process of photo-engraving, of which a brief account is given. The

whole process occupies only from two and a half to three hours. The greatest care will continue to be taken to make the *Bulletin* a medium of the most recent information relating to astronomy and meteorology, particularly the meteorology of each of the regional districts, so as to secure that unity of action among French meteorologists without which nothing of real importance can be done.

IN the *Bulletin International* of the Observatory of Paris for the 13th inst. is given a table showing the depth of the water of the Seine at Paris on each day during 1875 by two gauges, one placed on the Pont de la Tournelle, and the other on the Pont Royale. The gauge on the Pont de la Tournelle is graduated from the point to which the water of the Seine fell during 1719. The mean height of the Seine during 1875 was 2⅓ feet, the maximum height 10¾ feet on Jan. 28, and the minimum ⅓ foot below the zero of the scale. The greatest flood hitherto recorded was 27 feet in 1658, and the greatest drought 3⅗ feet below zero on Sept. 29, 1865.

IT is announced that the *Atlas Météorologique* for the years 1872-73-74 will appear in a few days, and it is hoped that the *Atlas* for 1875 will be ready for issue in the end of July next.

A MICROSCOPICAL club has been founded at Honolulu, which promises to be very successful. The visit of the *Challenger* to the Sandwich Islands seems to have been the immediate occasion of this laudable step being taken, as the late Dr. Von Willemoes-Suhm is mentioned in connection with it. Already there are forty members, who have subscribed 800 dollars to purchase a large microscope from Beck and Smith of London. The club will find plenty of work in the investigation of the natural history of these interesting islands, and we hope the members will not confine their investigations merely to microscopical subjects.

OUR readers no doubt know that we have a younger French sister who appears under the name of *La Nature*. We have just received from Germany a specimen of another of the family, rejoicing in the name of *Die Natur*. This seems, however, to be a new series of an old-established journal, but whether it has always appeared under its present name we cannot make out. It is conducted by Dr. Otto Ule and Dr. Karl Müller, of Halle, is mainly devoted to natural history, and the number sent us contains several interesting articles ; among these is one on the African Steppes, by Dr. Ule.

AT the Royal Geographical Society, on Monday night, Sir H. C. Rawlinson intimated that Lieut. Cameron was still at Loando, and would remain there until he saw his men safely embarked for their homes in East Africa. He will stay two months in Madeira to recruit his health before returning to England, where he is expected soon after Easter. Sir Henry stated that the map of Cameron's route would probably be ready by the time of the next meeting of the Society, as also the extremely valuable register of his observations. Major-General Sir F. M. Goldsmid then read a paper on the recent journey of Capt. G. Napier on the Turcoman frontier of Persia.

SUCCESSFUL experiments have been carried on by the French Great Northern Railway at Paris with electric lighting. With a steam-engine of three-horse power, a light equal to 100 ordinary lamps, each consuming 150 litres of gas per hour, has been obtained regularly for almost any length of time. It is contemplated by the engineers of the company to place four electric lamps in the large nave, which is 200 metres long and 60 metres high. The lighting of the company's workshops at La Chapelle will also be attempted with ten lamps. The buildings cover forty acres, and are now lighted by 700 gas lamps. It is stated that the Lyons Company will try to make use of Gramme's magneto-electric machines to light up the way.

THERE will be an examination at Gonville and Caius College, Cambridge, on the 4th of April, for two Shuttleworth Scholarships, each of the value of 60*l.* per annum, and tenable for three years. The subjects of examination are Botany and Comparative Anatomy in its most general sense (including Zootomy and Comparative Physiology). Candidates must be registered medical students of the University of Cambridge who shall have kept not less than eight terms, have passed the additional examination required for candidates for honours, and produce satisfactory testimonials of good conduct. For further information apply to the Rev. N. M. Ferrers, Tutor of the College.

THE trustees of the Johnson Memorial Prize, Oxford, propose the following subject for an essay :—"The History of the successive stages of our knowledge of Nebulæ, Nebulous Stars, and Star-clusters from the time of Sir William Herschel." The Prize is open to all members of the University of Oxford. Candidates are to send their Essays to the Registrar of the University under a sealed cover marked "Johnson Memorial Prize Essay," on or before the 31st day of March, 1879.

PROF. DEWAR commences his lectures as Jacksonian Professor at Cambridge on Tuesday next ; the subject is Organic and Animal Chemistry.

WE have received a very significant publication from the Chief Inspector of Mines of Victoria, Australia, in the form of a large sheet printed in Chinese, and containing the provisions of the Regulation of Mines Statute for the colony. There are, we believe, 11,294 Chinese miners in Victoria, many of whom know nothing of the English language. In some of the districts they are employed in quartz and in alluvial mines of great depth, and the Victorian Government have acted wisely in taking this method to make them acquainted with the mining regulations.

THE Report of the Kew Committee for the year ending Oct. 31, 1875, shows that the usual work at the Kew Observatory has been diligently carried on during the past year.

WE have received from their respective publishers "The Year-Book of Photography" (Piper and Carter, Gough Square, E.C.) and the "British Journal Photographic Almanac" (H. Greenwood, York Street, Covent Garden). Both contain many admirable articles on photographic subjects, but it is to be regretted that, failing a more scientific treatment of the art and the development of new methods of manipulation, these annuals, instead of recording progress, serve up the same weary course of glass-cleaning, bath treatment, posing, lighting, and printing, year after year. The frontispiece to the "British Journal Photographic Almanac" is a charming child study by Faulkner, entitled "Simplicity," but is by no means an admirable example of photo-mechanical printing.

A FURTHER attempt is being made to introduce salmon into the Antipodes this year under perfectly new conditions. The New Zealand Government and Sir Samuel Wilson, of the Victoria Acclimatisation Society, had simultaneously asked Mr. Buckland to undertake the task of sending ova to Otago and Melbourne respectively. Mr. Buckland, in conjunction with Mr. J. A. Youl, arranged to make both shipments at once, and the eggs, collected in the Severn, Dart, Ribble, and other rivers, have accordingly been sent out, packed in moss and ice, by steamer, to Melbourne. The passage is estimated to occupy about fifty days. One portion of the eggs will be landed at Melbourne, and the others, if they are in good condition, will be at once repacked and transhipped for Otago, where they are estimated to arrive about a fortnight or three weeks after leaving Melbourne. The eggs were all in proper condition when they left London on board the *Durham*, and there is every prospect of their reaching Melbourne, at least, in safety.

By a curious coincidence, intelligence has just reached us of the safe arrival in Auckland, New Zealand, of 40,000 salmon eggs from the Columbia River, North-west America. These eggs were sent from San Francisco by steamer, consigned to the Napier Acclimatisation Society; but on arrival at Auckland they were found to be so far advanced that it was determined not to risk sending them all to Napier, but to distribute them immediately in suitable localities in the neighbourhood. One half was thus treated, and the remaining 20,000 were sent on to their original destination, Napier. There is every probability that an actual colony of salmon has now been planted in New Zealand, for the fry were in a very healthy condition, and great care was taken by Mr. Firth to protect those placed in the rivers from all possible enemies.

The last issued number of the Transactions of the Institute of Engineers and Shipbuilders of Scotland contains a paper, by Prof. James Thomson, on "Comparison of Similar Structures as to Elasticity, Strength, and Stability."

In a report published by General Chanzy, Governor-General of Algeria, it appears that the organisation of a sanitary service has been completed all over a country which is larger than Great Britain. In every district has been established a *médecin de colonisation*, who is appointed after having passed a special examination, is paid by Government, and is not allowed to take fees.

A paper on the *Batrachia* and *Reptilia* of Costa Rica, with notes on the reptiles of Nicaragua and Peru, by Prof. Cope, has recently appeared in the quarto journal of the Philadelphia Academy of Natural Sciences. Most of the Costa Rican materials were obtained from the researches of Dr. William M. Gabb, who was engaged for several years in exploring that country in behalf of the Costa Rican Government, by which he has added very largely to our knowledge of the geography, geology, general natural history, and ethnology of the region. He has already published many papers in all these departments, and it is to him we owe our only reliable information in regard to the Costa Rican aborigines. The first series of the collections made by Dr. Gabb have all been presented by him to the National Museum, in Washington, and they constitute a highly valued portion of the extensive collections of the establishment. Other collections employed in this memoir are those of Dr. Van Patten and Mr. C. N. Riotti, these covering the region extending from the Atlantic to the Pacific. Eighty-nine species were furnished by Prof. Gabb, of which thirty-seven were new to science. The total number of species known from all investigators in Costa Rica is 132, and it is probable that a large number yet remain to be discovered, showing that the region is rich in terrestrial cold-blooded vertebrates.

The additions to the Zoological Society's Gardens during the past week include a Leopard (*Felis pardus*) from Africa, presented by Mr. F. Elton; a Black Lemur (*Lemur macaco*) from Madagascar, presented by Mr. Dugald Gilchrist; a Common Marmoset (*Hapale jacchus*) from Brazil, presented by Master F. F. Goodliffe; two Gannets (*Sula bassana*), European, presented by Lieutenant-Colonel Dugmore; a Rose Hill Parrakeet (*Platycercus eximius*) from New South Wales, presented by Mr. J. Smith; a Roseate Cockatoo (*Cacatua roseicapilla*) from Australia, presented by Dr. Bree; three Brazilian Caracaras (*Polyborus brasiliensis*) from South America, deposited; a Coypu Rat (*Myopotamus coypus*), a Spotted Cavy (*Cœlogenys paca*), a Central American Agouti (*Dasyprocta punctata*) from South America, a White-spotted Crake (*Porzana notata*) captured at sea off Cape Santa Maria, three Geoffroys Terrapins (*Platemys geoffroyana*) from the Argentine Republic, a Maximilian's Terrapin (*Hydromedusa maximiliani*) from Brazil, purchased.

SCIENTIFIC SERIALS

The current number of the *Quarterly Journal of Microscopical Science* commences with a memoir, by Dr. G. Thin, on the structure of hyaline cartilage as found by immersing it in a solution of caustic potash at 107° F., and otherwise. A successful potash preparation shows flattened polygonal cells adhering to each other exactly like an epithelium. Much manipulatory experience is necessary for the demonstration of these, and it must be mentioned that the author has "a strong conviction of the uniformity of plan in the general structure of the tissues."—Mr. Hugh Price writes on a polystomatous condition of the hydranths of *Cordylophora lacustris*, and figures his specimens. His observations tend to show that the polystomatous condition may be due to injury of the parent hydranth.—Prof. E. R. Lankester, F.R.S., contributes two papers; the first, including further observations on a peach, or red-coloured Bacterium (*Bacterium rubescens*), in which a further account of that organism is given. The second is a valuable account of Prof. Haeckel's recent additions to the Gastræa-theory, illustrated by four important plates exemplifying the letterpress. The following terms are fully explained: Palingeny and Cenogeny, the tendency to recapitulation and to suppress the details of ontogenetic development; Heterochrony and Heterotopy, the perturbations in ontogeny as regards time and space. The conceptions with which these terms are associated must be fully mastered by all who study evolution from its developmental aspect. The four chief types of egg-cleavage and of Gastrula-formation are then explained, and the stages which each undergo, the monerula-, cytula-, morula-, blastula-, and gastrula-stages are recounted, the prefixes archi-, amphi-, disco-, and peri- being applied to the four respectively. The nomenclature, though at first apparently formidable, much simplifies this otherwise complex subject.—Mr. C. S. Tomes, in writing on the development of teeth, gives a summary of the many and important results at which he has arrived in his valuable researches, together with the investigations of others which bear on the subject. Goodsir's primary open dental groove is shown to have no existence. In reality an ingrowth is shown to develop from the deep layer of the epithelium, consisting of a double layer of cells burrowing down into the submucous tisssue, and looking in transverse section like a tubular gland. The next stage consists of an active growth of cells in the deepest end of the epithelial inflection, the immediately subjacent tissue at almost the same time becoming elevated at corresponding points where teeth are to be developed; the subjacent tissue forming a conical papilla, the enamel organ appearing with or even before the papilla. Many important points in the tooth-development of the lizard and fish are also discussed.—Dr. Percival Wright has a note on *Stenogramma interrupta*, in which the author proves that the tetrasporic fruit of that rare and beautiful Alga was described by Dr. W. H. Harvey, contrary to the assertion of Mr. E. M. Holmes.—Mr. W. Bevan Lewis describes the best methods of making preparations of sections of cerebral and cerebellar cortex for microscopical examination.—Mr. H. C. Sorby, F.R.S., has a paper on the evolution of Hæmoglobin, based mainly on the fact that the centres of the hæmoglobin bands from the red blood of *Planorbis* lie two and a half or three millionths of a millimetre nearer the blue end of the spectrum than do those of vertebrate blood.—Reviews of Dr. Klein's "Anatomy of the Lymphatic System," Part II., and of the English translation of Frey's "Histology and Histochemistry of Man," are also given, followed by notes, proceedings of societies, &c.

The number for July 1875 of Siebold and Kölliker's *Zeitschrift für Wissenschaftliche Zoologie* opens with a valuable contribution by Dr. Claus, to our knowledge of the parasitic Copepoda, under the following headings:—The genus Hersilia; the classificatory value of the oral apparatus; the Ergasilidæ; the Nereidicolidæ; the Ascidicolidæ; the Siphonostoma, and the genus Lamproglena. Several excellent plates illustrate the paper. Dr. Claus concludes that a natural classification is at present impossible, because of the gaps in our knowledge of many points in the organisation and development of these remarkable parasites.—Dr. Ludwig Stieda gives a detailed description of the general and microscopic structure of the brain and spinal cord in the Chelonia, derived from the examination of *Testudo Græca* and *Emys Europæa*—a much-needed acquisition.—Dr. Ludwig Graff describes several new species of Turbellaria.—O. Bütschli, in a controversial article on the Infusoria, contests the received interpretations of the phenomena following their conjugation, and endeavours to show that Häckel and Claus have made no real

advance in the morphology of Infusoria by their recent researches.—Prof. Selenka contributes a concise but very interesting account of the development of *Phascolosoma elongatum* from impregnation to the fourth day, beyond which his specimens did not develop. The changes in the first few hours after impregnation are carefully figured at brief intervals; the formation of the alimentary canal by invagination was very clearly made out. Prof. Selenka contemplates publishing a monograph on the Gephyreans.—Prof. H. Nitsche gives a preliminary account of his researches on the structure and budding of *Loxosoma Keferstеinii;* the most important result he claims to have demonstrated is the exclusive origin of the bud from the ectoderm of the parent, so that there is a direct conversion of ectodermal elements of the parent into entoderm elements of the offspring.—Dr. Anton Dohrn gives a full account of the regulations and management of his zoological station at Naples.

The September number of the same journal opens with some very interesting observations made in the aquarium at the Naples Zoological Station by Prof. Kollmann, chiefly relating to the Cephalopods. The most notable paper is one by Dr. Malbranc on the lateral lines and their sense-organs in Amphibia. The positions in which these organs occur are described and figured for a number of species in each main division of Amphibia, the nerves which supply the lateral-organ system are traced, especially the distribution of branches of the vagus, and the microscropic structure of the organs is described and figured. He shows their intimate correspondence in structure with the taste-goblets of the Tadpole, the similarity of the characteristic cells being remarkable. The discovery of taste-goblets in many species of Amphibia is also recorded, and is to form the subject of another paper.—Prof. Kollmann contributes a paper describing his investigations on the circulation in Aplysiæ, Lamellibranchs, and Cephalopods. Among the most important of his conclusions are that Aplysiæ and Lamellibranchs have arterial hearts, and that there is not really any lacunar system in Cephalopods. He has also made very careful investigations as to the admission of water into the blood in many Mollusca.—O. Bütschli gives a brief contribution on the development of *Cucullanus elegans*, showing the formation of its embryo by a process of involution. It is connected in several important characters with the embryo of Sagitta.—Dr. Dohrn has a paper of fragmentary notices on Insect Development, devoted principally to points in the development of the Silkworm and the Mole-cricket.—One of Dr. von Willemoes-Suhm's letters from the *Challenger* concludes the number.

Reichert and Du Bois Reymond's Archiv, Nov. 1875.—This number includes a continuation of Robert Hartmann's contributions to the knowledge of the anthropomorphic primates, dealing with the osteology of a number of specimens of chimpanzee collected by Dr. Schweinfurth; the conclusion of Paul Mayer's elaborate account of the anatomy of *Pyrrhocoris apterus;* and an article by L. Dittmer on the theory of double monsters.

SOCIETIES AND ACADEMIES

LONDON

Chemical Society, Jan. 20.—Prof. Odling, F.R.S., vice-president, in the chair.—Dr. Armstrong exhibited a specimen of pure crystallised glycerin from Messrs. Dunn and Co., of Stratford.—Mr. E. Neison then communicated a note on sebate of cobalt.—After which Dr. C. R. A. Wright gave an abstract of Part IV. of the researches by himself and Mr. G. H. Beckett on narcotine, cotarnine, and hydrocotarnine; on oxynarcotine, a new opium educt, and its relationship to narcotine and narceine.—The last paper was on a method for estimating bismuth volumetrically, by Mr. M. M. P. Muir.

Zoological Society, Jan. 18.—Mr. Robert Hudson, F.R.S., vice-president, in the chair.—Prof. A. H. Garrod read a paper on a peculiarity in the carotid arteries and on other points in the anatomy of the Ground Hornbill (*Bucorvus abyssinicus*).—Mr. Edward R. Alston read a paper on the classification of the order Glires. Lilljeborg's sub-orders *Glires simplicidentati* and *duplicidentati* were recognised, the former being divided into sections equivalent to Brandt's sub-orders *Sciuromorphi*, *Myomorphi*, and *Hystricomorphi*. A third sub-order was proposed for the reception of the fossil form *Typotherium*.—A communication was read from Mr. E. A. Liardet, containing notes on the Land Shells of Taviuni, one of the Fiji Islands, with descriptions of several new species.—Mr. E. A. Schäfer read a paper prepared by himself and Mr. D. J. Williams on the structure of the mucous membrane of the stomach in the kangaroos, in which he gave a minute description of the histological characters of the different portions of this organ.—A communication was read from Mr. W. H. Hudson, containing notes on the habits of the Rails of the Argentine Republic.—The Hon. W. H. Drummond read a paper on African Rhinoceroses, in which he gave reasons for believing in the existence of five species in Africa, including *R. oswelli*, which, however, might probably be merely a variety of *R. simus*.—A communication was read from Mr. E. Pierson Ramsay, containing a continuation of his remarks on the birds met with in North-eastern Queensland, chiefly at Rockingham Bay.—A communication was read from M. L. Taczanowski, containing the description of a spotted deer found in Southern Ussuri, district of Amoorland, for which he proposed the name *Cervus dybowskii*.—Mr. A. G. Butler communicated a revision of the Lepidopterous genus *Teracolus*, with descriptions of the new species.

Geologists' Association, Jan. 7.—Mr. Henry Woodward, F.R.S., vice-president, in the chair.—On the geology of New Zealand, with special reference to the drift of that country, by Dr. Hector, C.M.G., F.R.S. The author first drew attention to the geographical position of the islands, indicating on the South Polar chart their situation relative to known lands of the Antarctic area. Great ice-packs encumber the intervening ocean, circulating around the pole; travelling in a spiral, and thus increasing their distance from the centre. On the meridian of South Shetland, as low as 40° S. latitude, the seas are at all seasons crowded with icebergs, but there is an indentation of the ice-pack opposite Australia and New Zealand, though erratic masses escape sometimes. There are, however, five degrees of latitude off the extreme south of New Zealand, clear of the limit where icebergs are ever found. As regards latitude the islands occupy a position equivalent, in the Northern Hemisphere, to a line between Paris and Algiers. They lie parallel to Australia, 1,200 miles E. by S., and repose on a sub-marine plateau, which, along the west shores of the islands, is submerged to a depth of from 1,200 to 1,300 feet, but further westward terminates in water 6,600 feet deep. The edge of this plateau comes close in shore on the S.W. extremity of the Southern (middle) island. Thus New Zealand is a remnant of a once far more extensive land, whose eastern boundaries are not as yet clearly defined, but the author was disposed to include the Chatham Islands as a portion of it. *North Island.*—The eastern shore is the boldest; foul weather, and consequently denudation, coming from the N.E. The west side is more shelving; but the great volcanic boss of Mount Egmont, which rises at a gentle angle to a conical summit, protrudes its protecting buttresses of lava far into the western sea, and has thus been the means of preserving a great tract of Miocene tertiaries behind it; these constitute some of the best land in the country. *South Island.*—The denudation comes from the west: its western shores also approach nearer to the edge of the plateau, and the mountains of the south-west angle rise from a profound abyss to a height of from 4,000 to 5,000 feet. In the North Island a belt of hard rocks, consisting of the Upper Palæozoics, and the older Mesozoics, constitutes a sort of back-bone, occupying the east-central portions, against which the softer beds of more recent age recline. In the South Island this belt of Upper Palæozoic rocks, constituting the high mountain chain known as the Southern Alps, sweeps down through the centre with an incline towards the west, and then curves round towards the east again quite to the sea on that side. Against these also the Upper Mesozoics and Tertiaries recline. On the west and south of this easterly bend of the belt of the newer Palæozoics a great mass of foliated rocks occur in the province of Otago, constituting the well-known gold-field. In the far south-west we have only crystalline rocks, and these belong to a series which seems to reappear in much of the detached lands of the Southern Ocean, such as Kerguelen's Land, Auckland Islands, &c., where Miocene volcanic rocks also occur. The meteorology of the country, as having an important bearing on the denudation of the surface, was next considered. Referring principally to the Southern Island, we have here the mixing point of the N.E. and S.W. currents. On the west side, at Okitika, the annual range of temperature is 50°; on the east side, at Christchurch, 65°; moisture, west side, 90°, east side, 75°; rainfall, west side, 120 inches; east side, 25 inches; number of rainy days, west side, 202; east side, 91. Much of this enormous precipitation is deposited as snow in the Southern Alps, which

comb out the moisture from the westerly winds; hence the extensive glaciers of the mountain region and the comparative dryness of the Canterbury Plains. Mount Cook has an elevation of 14,000 feet; this is the principal snow area of the Southern Alps, and here the island is narrowest. In shape this snow-field is less compact than that of the Bernese Oberland and of the Mount Blanc region; their respective areas are: snow-field of Mount Cook, 160 square miles; Bernese Oberland, 140 square miles; Mount Blanc, 75 square miles. The crystalline mountains of the south-west do not contain nearly so much snow. The Tasman glacier is 18 miles long, and 2 miles wide at its terminal face; the terminal face of the Godley glacier is 3 miles across. The author then gave a description of the leading features of the glacier scenery, illustrated by very effective pictures; one of Milford Haven, with the half-snowed peaks of Mount Pembroke and its neighbours rising to a height of more than 5,000 feet, was very striking; he also demonstrated the erosive action of glaciers in cutting back cols—an action more energetic formerly, some of the cols having been worn down as low as 1,800 feet. The author pointed out on a map, specially constructed for the purpose, the immense extent of the snow area in former times as contrasted with that now existing. This is proved by the abundance of moraine matter. At present the glaciers on the west side of the Southern Alps are remarkably clean (as was well shown by a splendid series of sketches in colour by the Hon. Mr. Fox and lent for exhibition to the meeting), whilst those on the east side are largely charged with detritus. Following a given section in this direction away from the central ridges we find generally a rock basin, and still lower immense moraines extending to the Canterbury Plains, till they pass under the deposits of these plains, which are referred to Pliocene and Post-tertiary age. In further illustration of the former extent of the snow-fields, the author indicated old centres of glaciers in the north of the island. The reason for this contraction of the ice area is the great question for determination. Was it due to difference of climate the result of a great glacial period? The remains of the past fauna afford no evidence of this. We may, indeed, suppose that the whole fauna migrated to the north, but we must in that case invent the land and bring into play oscillations more extensive than those required for another alternative, viz., the alteration of level within the area itself. We might suppose a general alteration of level, even to the extent of 4,000 feet higher than at present, but the evidence afforded by the shore line is unfavourable to this view. There remains then the theory of unequal elevation, which, combined with a most enormous destruction of surface, the result of ages of glacier action, best explains the phenomenon. There can be no doubt that at present the south-west portion of the island, where the crystalline rocks prevail, is very much depressed in comparison with its position at some former period; the extraordinary depth of the sub-marine valleys proves this. The author was inclined to believe in a period of irregular elevation, the south-west portion having been elevated first, though possibly the Nelson region at a still earlier date. In conclusion, the author stated his belief that there had been no general change of climate, but many changes of relative level, resulting in a great destruction of surface, which had taken place in groups of peaks at different times; the areas of the crystalline rocks have been least affected in their relative changes of level, the oscillation having been greater in the other masses, which have been crumpled up against these.

MANCHESTER

Literary and Philosophical Society, Dec. 28, 1875.—Edward Schunck, F.R.S., president, in the chair.—The following communication from Dr. Joule, F.R.S., was read:—Unsuccessful attempts have recently been made for the purpose of utilising a modification of the common kite as a means of obtaining a view of the surrounding country. The machine in each instance rose only to fall violently to the ground after remaining in the air a very short time. These trials have brought to my recollection some experiments I made more than six years ago, but of which I did not publish the results, imagining that all such matters must have been thoroughly elucidated by the Chinese, if not by our own more juvenile kite flyers. The usual method of making the skeleton of a kite is to affix a rather slender bow to the top of a standard, tying the extremities of the bow to twine fastened to the bottom of the standard. The steadiness of the kite in the air depends on the fact that the wings yield with the wind. If the bow is too stiff and the surface nearly a plane, instability results. A kite ought to have a convex spherical surface for the wind to impinge upon. Such a surface I readily made by fixing two bows crosswise. The string was attached to a point a little above the centre of the upright bow, and a very light tail was fastened to the lower end. The kite stood in the air with almost absolute steadiness. I found that by pulling strings fastened to the right and left sides of the horizontal bow, the kite could be made to fly 30° or more from the direction of the wind, and hence that it would be possible to use it in bringing a vessel to windward. One great advantage of such a mode of propulsion over ordinary sails would be that the force, however great, could be applied low down, so as to produce no more careening than that desired by the seaman.—E. W. Binney, F.R.S., said that in the Isle of Man there had been a prevalence of easterly winds throughout the months of October and November, such as he had never experienced during a residence of ten years. This appears to have influenced the migration of swallows. In the beginning of September the chimney swallows and the house martins assembled in great numbers on his buildings on Douglas Head, as they were accustomed to do prior to their annual departure, and disappeared. On Nov. 5, between 10 and 12 A.M., he observed a dozen house martins (*Hirundo urbica*) in front of his house and between it and the sea, busily employed in pursuing their prey. During the summer months the swift and sand martin are frequently seen in the same locality, but seldom the swallow or house martin, and he was inclined to believe that the presence of the latter was due to their having been driven out of their course by the easterly gales.

Jan. 11, Edward Schunck, F.R.S., president, in the chair.—Note on a method of comparing the tints of coloured solutions, by J. Bottomley, D.Sc.—On explosions of fire-damp, by Mr. Robert Rawson.

CALCUTTA

Asiatic Society of Bengal, Dec. 1.—Mr. Wood-Mason exhibited an interesting collection of crustaceans, including the materials for his monograph of *Paratelphus*, an Indo-Malayan genus of freshwater crabs, all the Italian species of which occur in localities the fauna of which is largely leavened with Malay forms. The three papers read were all by Mr. W. T. Blanford. The first contained a description of some lizards from Western Sind, comprising new species of *Ptyodactylus*, *Stenodactylus*, and *Trapelus*. The species described are *Hemidactylus coctæi; H. Macullatus; H. Persicus; Ptyodactylus homolepis*, sp. nov.; *Gymnodactylus; Stenodactylus orientalis*, sp. nov.; *Agama agitis; Trapilus rubrigulariz*, sp. nov.; *Stellio nuptus; S. Melanura; Mesalina pardalis; Acanthodactylus Cantoris; Ophiops Jerdoni*. Five are new to the fauna of India, and three of these have not, so far as Mr. Blanford could ascertain, been previously described. Two of the three represent genera of *Geckotidæ* not hitherto detected so far to the eastward, and it is doubtful whether either has before been found in Asia. In the second paper, a note on a large hare inhabiting high elevations in Western Thibet, the author shows that the hare previously identified with doubt as *L. pallipes* proves, on comparison with specimens of the latter received from Mr. Mandelli at Darjiling, to be distinct, and is described as new under the name of *Lopus hypsibius*, from its inhabiting very elevated regions. The description is taken from a specimen collected by Dr. Stoliczka, at an elevation of 15,500 feet, in the Changchenmo valley, Ladak. In the third paper Mr. Blanford states that a snake from Purneah with a local pit has been recognised as *Elachistodon*, a remarkable genus with angular teeth. *Platyceps semifasciatus* is identified with *Zamenis ventrimaculatus*, and *Ablepharus pusillus* is recognised as distinct from *A. agilis* (*Blepharosteres Agilis*, Stol.).

BERLIN

German Chemical Society, Jan. 10.—A. W. Hofmann, president, in the chair.—The President announced the formation of a German Committee to further the objects of the Loan Exhibition of Scientific Apparatus at South Kensington, and the decision of the committees of the German Chemical Societies to co-operate with this Committee.—R. Blindow described an improved method of burning diamonds for lecture purposes. He puts the diamond on a piece of magnesium foil, and the latter on a piece of porcelain, into a combustion-tube filled with oxygen. Ignition of the magnesium is produced by a Bunsen burner, and is easily communicated to the diamond.—G. Braylants described a lecture experiment to show the combination of oxide of nitrogen with oxygen.—Th. Zincke has added the following observations to his studies on the action

of zinc on benzol, C_6H_6, and chloride of benzyle, $C_6H_5.CH_2Cl$. Besides diphenyl-methan, $C_6H_5—CH_2—C_6H_5$, two isomeric hydrocarbons are formed of the formula :—

$$C_6H_5.CH_2—C_6H_4—CH_3.C_6H_5,$$

which by oxidation yield corresponding ketones :—

$$C_6H_5.CO—C_6H_4—CO.C_6H_5$$

(dibenzoylbenzol), and two isomeric acids, viz., benzoylbenzoic acid (1 : 4), and benzoylbenzoic acid (1 : 2) :—

$$C_6H_5CO—C_6H_4—COOH.$$

—W. Leppert has succeeded in oxidising dibenzyl :—

$$C_6H_5.CH_2—CH_2.C_6H_5.$$

It yields benzoic acid. Two isomeric dinitrodibenzyls yield both paranitrobenzoic acids. Assuming the position of $CH_2 = 1$ the position of the two nitro groups appears as 4 : 4 and 4 : 2 in the two isomeric dinitrodibenzyls.—H. Salkowsky proved the existence of a double salt of paranitrobenzoate and benzoate of barium, and thinks that Fittica's pretended fifth isomeride of nitrobenzoic acid may be a mixture of nitrobenzoic and benzoic acids precipitated from double salts like the above.—H. Abelganz has studied the action of potassium on benzol. It appears to yield two compounds, C_6H_5K and $C_6H_4K_2$. With water (as well as with bromide of ethyl) it yields diphenyl-benzol, $C_6H_4(C_6H_5)_2$, and a small quantity of diphenyl; also an oil boiling at 222° of the composition $(C_6H_8)_n$.—E. Demole has tried the action of brominated ethylene, C_2H_3Br, on hypobromous acid, HBrO. The chief product appears to be $CHBr_2—CH_2OH$.—A. Hilger has studied hesperidine, to which he gives the improbable formula, $C_{18}H_{21}O_9$, and which he considers as a glucoside of an acid, $C_{12}H_{11}O_4$ (?).—A. Bannow showed a large specimen of solid formic acid in beautiful crystals of more than 5 cm. in length, obtained during the cold weather of the last days in Berlin. The fusing-point is + 2°.—E. Baumann has found in the urine of horses considerable quantities of phenol-sulphate of potassium.—Al. Saytzeff has produced the following interesting synthetical reactions: by the action of iodide of allyl and zinc on oxalic ether; diallyl-oxalic ether, $C(C_3H_5)_2OH—COOC_2H_5$, a liquid boiling at 210°; by the action of iodide of allyl and zinc on acetone; the tertiary alcohol, $C\begin{cases}—CH_3\\—C_3H_5\\—C_3H_5\\—OH\end{cases}$, boiling at 119°; by the action of iodide of allyl and zinc on acetic ether the tertiary alcohol, $C\begin{cases}CH_3\\C_3H_5\\C_3H_5\\OH\end{cases}$.

VIENNA

Imperial Academy of Sciences, Dec. 9, 1875.—The following (among other) papers were read :—On the different excitability of functionally different nerve-muscle apparatus, by M. Rollett. This contains myographic studies on antagonistic muscles, and replies to Fick's objections to former experiments.—Attempts to meet objections lately raised against an increase of temperature with depth in the earth, in connection with the low temperature at great depths in the ocean and in some bore holes, by M. Boué. The cold water must flow under the warmer, and the earth's crust under the sea-bottom must be equal to that in continents. As to the Speremberg hole, infiltration of cold water must be considered; also the fact that many chemical combinations produce cold, and such are very likely to occur in salt and gypsum regions with mineral springs.—On the growth and decrease of crystals in their own solution and in the solution of isomorphic salts, by M. Pfaundler. He discusses objections by Lecoq de Boisbaudran to his theory.—On nitroglycerine and the most important preparations from it, by M. Beckerhin. He determines the specific heat of nitroglycerine and of *Kieselguhr*. Another paper of his gives a determination of the efficiency of blasting agents in a theoretical way.—On the formation of a rational space-curve of the fourth order on a cone-section, by M. Weyr.—On the utilisation of solar heat for heat effects, by a new plane mirror reflector, by M. Güntner.—Discovery of a disorder in the bones analogous to hæmorrhagic infarction of other organs, by M. Chiari. The changes in the bones coincided with disorders in the lungs and the right kidney.—On the laws of nervous excitation, by M. Fleischl—(1) For chemical stimuli nerves are at all parts of their course alike sensitive. (2) For electric stimuli they are more sensitive at higher points than at lower, if the electric currents pass downwards; the case is reversed if they pass upwards. (3) The doctrine of an increase (*Anschwellen*) of stimulus in the nerves is untenable.—On phyllometric values as means for characterisation of plant leaves, by M. Pokovy.

PARIS

Academy of Sciences, Jan. 17.—Vice-Admiral Paris in the chair.—The following papers were read :—Experimental critique on the formation of saccharine matter in animals (continued), by M. Cl. Bernard.—On the *trombe* of Hallsberg (with general conclusions), by M. Faye. The author controverts M. Hildebrandsson's views on the subject.—Action of fuming sulphuric acid on the carburets of hydrogen, by M. Berthelot.—History of attempts at formation of an observatory on the summit of the Pic du Midi de Bigorre, by M. Sainte-Claire Deville. The first to conceive the idea was Plantade, who died on the mountain in 1741.—New considerations on the regulation of slide-valves (concluded), by M. Ledieu.—M. Nordenskjöld was elected correspondent for the section of Geography and Navigation in room of Mr. Livingstone.—Report on the work of M. Revy, English engineer, on hydraulics of great rivers, Parana, Uruguay, and the valley of La Plata.—Mission to Campbell Island, geological constitution of the island, by M. Filhol. During the Upper Jurassic and Lower and Middle Eocene, the land formed part of a large continent; in the Upper Eocene and Lower Miocene it was submerged; in the Middle Miocene it rose again (under volcanic influence), and has since been an island.—On the transit of Venus of December 1874, by M. André.—On a new analogy to the theorems of Pascal and of Brianchon, by M. Serret.—Transformation of cane-sugar in raw sugars and in sugar-cane, by M. Müntz. The reducing sugar in these bodies is generally formed by an inactive glucose, to which are often added variable proportions of normal glucose and of levulose.—On the optical inactivity of the reducing sugar contained in commercial products, by MM. Aimé Gerard and Laborde.—Observations on results already obtained in the magnetism of steels, by MM. Treve and Durassier.—Generalisation of the theory of an osculating radius of a surface, by M. Lipschitz.—On *trombes*, by M. Planté. In one experiment made, salt water is passed through a funnel into a shallow dish over the pole of an electromagnet; and the poles of a battery of 400 secondary couples are connected, one (+) with the water in the funnel, the other (−) with that in the dish. A luminous thread appears in the liquid vein; sparks pass at the bottom, and the water in the dish is put in rotation. This and other experiments described are thought to illustrate the action of *trombes*.—On the spectrum of nitrogen and that of alkaline metals in Geissler tubes, by M. Salet. We shall notice this at length next week.—On new derivatives of anethol, by M. Landolph.—On the synthesis of aniline black, by M. Coquillion (second note).—Crossing of nerve fibres which connect the brain with the spinal cord, by MM. Sappey and Duval.—On the embryogeny of the *Salmacina Dysteri*, Huxley, by M. Giard.—Undulations of the chalk in the north of France, second part; origin and general disposition of these undulations, by M. Hebert.

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