NATURE

A WEEKLY

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" *To the solid ground*
Of Nature trusts the mind which builds for aye."—WORDSWORTH

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THURSDAY, NOVEMBER 5, 1874

THE PROSPECTS OF THE ENDOWMENT OF RESEARCH

WITH this number a new volume of NATURE is commenced, and consequently it will not be inappropriate to take the opportunity of presenting some sort of review of the present position of a subject towards which we have always been ready to devote much of our space. We propose to show that the important evidence given before the Royal Commission on the Advancement of Science, and the Reports which that Commission has already issued, have not been without influence in the matter, whilst the publication of the Report of the University Commissioners renders it the more necessary not to relax our efforts in pressing this question continually upon the public. It is most encouraging also to notice as another symptom that ordinary opinion is gradually coming round to the views we have so long advocated, that the daily and weekly press have during the past month opened their columns to articles and correspondence on this subject, and that journalists no longer regard the proposal to endow scientific research as a visionary and wild scheme, but now consider it worthy of much consideration and intelligent criticism. Even at the Universities considerable progress in the right direction seems to have been made, which is the more deserving of attention when it is recollected that the Colleges have in most cases great constitutional difficulties to overcome before that they can carry into execution the smallest reform.

At the end of the first volume of the Report of the University Commissioners there is printed in the Appendix a comprehensive scheme for a redistribution of their revenues, which has in principle been unanimously adopted by the governing body of New College, Oxford. It represents a plan of reform, the most fundamental in its principles and the most elaborate in its details which has yet been offered to the public, and shows in all its features how willing the more enlightened Colleges are to adapt themselves to modern requirements. The date of the adoption of the report of a select committee embodying this scheme is October 8, 1873, and the contents of the report prove no less certainly than the date of its adoption that the labours of the Royal Commission on the Advancement of Science have not been thrown away. "The encouragement of mature learning, as distinct from teaching," is expressly recognised as one of the four objects which College Fellowships should serve; and accordingly, "this purpose is met by providing for the election to Fellowships, and for the retention in Fellowships, of persons who have given proof of real interest and aptitude in literary or scientific studies." These Fellowships are elsewhere described as "held merely on the general condition of study," and the election may be without examination in the case of a person already eminent in literature or science. All the Fellowships to which no educational or bursarial duties are attached are limited to a period of seven years, and the proposed emolument is 200*l*. per annum; but "the College shall have power to re-elect once or more times, for periods of seven years, any Fellow who is engaged in literary or scientific study, which is likely to produce results of permanent value in published writings." These proposals form part of a scheme in which the College committee dispose in various ways of a total annual sum of 16,000*l*., at which amount they estimate their divisible revenue at the end of the present century; and though there may be several details in the entire scheme which suggest criticism, yet New College will always deserve a high meed of praise for being the first college to break through the ancient traditions which have hitherto prevented the corporate revenues of these institutions from being directly utilised for objects disconnected with education. The revised statutes of University College, which have been approved by her Majesty in Council, also deserve notice in that they reserve power to the College to elect to a Fellowship without examination "any person of special eminence in literature, science, or art." It is true that this clause is merely a modification of one which already occupies a place in the ordinances of the majority of the Oxford Colleges, which gives the same power, with the proviso that such person shall have received an honorary degree from the Convocation of the University. But as this clause has never yet, to our knowledge, been acted upon, the necessary inference is that the proviso, which appears sound in principle, is found in practice an insuperable obstacle. It may here be noticed that the revised statutes of Balliol, to which College the outside world is wont to look as the leader in all reform, ordain that all Fellowships shall be filled up after examination, except only in the case of University Professors, or persons eminently qualified to be college tutors. It does not appear from the Report of the Commission that the Cambridge Colleges have yet taken any steps to appropriate definitely any portion of their endowments to the encouragement of scientific research; but it is a matter of common notoriety that at the October election to Fellowships at Trinity College, a candidate was successful whose chief qualification was that he had already accomplished good original work in embryological investigation; and Cambridge men may therefore boast that this one fact is worth all the schemes of the sister University. Both Oxford and Cambridge, however, will have to do much more than they have yet attempted, or than most of their members would appear to have yet conceived, before they can satisfy the public wants and justify the retention of their wealth as it now stands disclosed.

In other respects also we are glad to observe that the objectors to the endowment of research are growing less numerous and less violent, and that the details of a scheme by which this object may be furthered are becoming more acceptable to the general public. The question was brought into prominence by an article in the last number of the *Fortnightly Review*, and the writer of that article has not been slow to strengthen his positions and answer all opponents in the daily and the weekly press. We must confess that we have been fairly surprised to see with what general acceptance his thoroughgoing views have been met, and they merely require the approval of persons eminent in their particular sciences in order that they may carry conviction to all impartial minds. The evening organ of the Conservative party concludes a notice of them with the following judicious sentence, which could not have been written a bare twelvemonth ago:—"The general principle of the need of some sort of endowment for science is generally admitted, and in the main features of the scheme there is much to recommend it to a prudent public." The remaining evening papers, which have all called attention to the scheme, are, if not so laudatory, at least critical rather than hostile; for the time seems to have passed when the matter can be thought deserving of being laughed down with a sneer. We feel bound to refer more particularly to a letter contained in the *Spectator* of October 24, written by the gentleman referred to above, and entitled, "A Draft Scheme for Endowing Research." The intention of the letter is to show that it is practicable, by means of a judicious application of precarious salaries, to train up a class of scientific investigators, and that it is a safe investment to give endowments to young men before they have reached eminence in their studies. This point deserves the more attention because it appears to be now widely granted that sinecure posts ought to be provided for men of science who are already famous for their discoveries, and for this latter object the Colleges have at present sufficient power, if only the will also were there. The essence of this draft scheme is to be found in the principle, at once comprehensive and simple, that no candidate is to establish his claim to a permanent endowment until he has previously served an apprenticeship of some ten years, during which period he must furnish continual proofs of his aptitude and diligence, and will receive regular payment by results amounting to a continuous salary if his work is satisfactory. The candidates would be originally selected on the nomination of the professor under whom they have studied, tempered by a moderate examination to exclude manifest incompetence; and during their long period of probation they will be continually liable to rejection, if it be found by the board to which this duty is entrusted that they are not worth the money they are receiving. This plan, no doubt, is well worthy of trial at a central University, where the prolonged course of study under the superintendence of professors naturally lends itself to its adoption, and it could scarcely be perverted to greater wastefulness than at present characterises the Fellowship system at Oxford and Cambridge. It may, however, be plausibly suggested that something less elaborate in system and more closely adapted to the wants of specific studies would be required in the pecuniary encouragement of research which it is the duty of the nation, independently of the Universities, to undertake.

GRESHAM COLLEGE

IN the previous article we speak of the advancement of of scientific research, and here we wish to refer to an excellent article in Monday's *Daily News* connected with the advancement of education. The misuse and idleness of the untold wealth of the London City Companies we have frequently referred to; but until the *Daily News* unearthed the facts contained in its article, few people were aware of the existence of an institution which is one of the most striking anachronisms of our time, and the uselessness of whose endowments is provoking, now that the importance of scientific education to all classes is beginning to be keenly felt, and when its progress is so much hampered by want of means. The writer in the *Daily News* deserves the greatest credit for the trouble he must have put himself to in obtaining the facts about the institution known as "Gresham College," and for the uncompromising way in which he has stated the facts of the case. It is indeed a hopeful sign of the recognised importance of sound scientific teaching, when the daily press espouses its cause so heartily.

The *Daily News* article begins by referring to the admirable system of lectures to working men during the winter at South Kensington in connection with the School of Mines, and which are so popular that many are shut out from want of room in the lecture theatre. Each Professor now gives a course of six lectures in alternate years, an average of twenty-four lectures being thus given in the course of the year, in the plainest English, by Professors of the first rank, for the nominal fee of one penny per lecture. "More thronged, more silent, or more attentive audiences," to quote the *Daily News* article, "than those which attend these lectures to working men it would be impossible to find, even in the halls of the most learned of learned societies." This, combined with the results of some of the examinations in the Science and Art Department, seems to us to prove the readiness and eagerness of working men to take advantage of instruction in science when there is some guarantee that such instruction is sound and earnest ; and it is a pity, when this is the case, that any time should be lost in devising some system of scientific and technical education suited for the wants of the whole country. At all events the pabulum provided at Gresham College is a sad mockery of this wide-spread craving for knowledge. Again, to quote the writer in the *Daily News*: "While the West is thus enlightened by modern science, in the East a phantasm bedizened in the worn-out rags and tatters of scholasticism provokes contemptuous laughter. In the large lecture theatre which occupies the greater part of the building at the corner of Gresham and Basinghall streets, to an audience composed of perhaps half a dozen persons, who have drifted in from mere idle curiosity, an English divine will read a lecture on astronomy in the Latin tongue, followed an hour later by an English lecture but little better attended. This, with similar curious exhibitions during Term time, is the outcome of Sir Thomas Gresham's bequest, and the functions of those who were once resident Professors have dwindled to the delivery of these almost unattended lectures." The writer then goes on to tell the melancholy history of the Gresham Fund, and he tells it so well that we shall give the story nearly in his own words.

"The atrophy of Gresham College is well worthy of notice. By the will of Sir Thomas Gresham, the great merchant of Elizabeth's time, and the Founder of the Royal Exchange, were bequeathed, in moieties to the City and Corporation of London and to the Company of Mercers, under certain conditions, 'the buildings in London called the Royal Exchange, and all pawns and shops, cellars, vaults, messuages and tenements, adjoyning to the said Royal Exchange.' To the foundation of a college, 'myne now dwelling-house in the parish of St. Helens in Bishopsgate and St. Peters the Poor' was devoted, and the 'Mayor and Commonalty' of the City of London were charged with 'the sustentation, maintenance, and finding' of four persons to read lectures on Divinity, Astronomy, Music, and Geometry in the said dwelling-house—a stately mansion. The Company of Mercers was charged with the maintenance of three Professors to lecture on Law, Physic, and Rhetoric, and on both the City and the Company of Mercers was enjoined the performance of sundry charitable duties towards almsmen, poor prisoners, and the like. Celibacy was pronounced an absolute condition of professorship, and the seven lecturers were to reside in 'myne now dwelling-house,' and were each to receive fifty pounds yearly—no inconsiderable remuneration in the year of grace 1575, when good Sir Thomas set his 'seal with the grass-hopper' to his last will and testament." For a considerable period after the founder's death Gresham College appears to have remained an important institution. Here, on Nov. 28, 1660, the foundation of the Royal Society was decided upon by a knot of philosophers who had assembled to listen to a lecture on astronomy by Christopher Wren, at that time a resident Professor in the old Gresham Mansion, where the chair of Geometry was filled by the celebrated Hooke. Escaping the Great Fire of London, Gresham College, still a flourishing institution, served for a while as Guildhall and Exchange to what was left of the City, but within the following forty years fell into that decadence from which it has never since emerged. In 1706 a memorial was laid before the Lord Mayor and the Court of Aldermen, setting forth grave causes of complaint against the Professors. A dashing pamphleteer of the period also declared that the Professors, albeit "gentlemen of civility, ingenuity, and candour," yet seemed to discover an "unwillingness and reluctancy to perform their work, because it required some pains and attendance, and were so far from the ambition of being crowded with auditors that they seemed rather to desire to have none at all."

"This state of things was bad enough," continues the writer in the *Daily News*, "but worse was to follow. In 1768, with the consent of the Grand Committee of the Gresham Trust—which consisted then, as now, of four aldermen and eight commoners of the City of London, and twelve commoners for the Company of Mercers—the Gresham Mansion and the site on which it was built were alienated to the Crown for the purpose of building a new Excise Office. 'Myne dwelling-house' had been scandalously neglected, and allowed to fall into such a dilapidated condition that its unworthy guardians parted with it in consideration of the payment to the City and the Mercers' Company of a perpetual rent of 500*l.* per annum, the City and Company paying 1,800*l.* down towards the cost of pulling down the ancient building and erecting the new office. By this transaction an estate of great value was sacrificed, the handsomest house in London torn down, and the collegiate establishment entirely subverted. A room at the Royal Exchange was set apart for reading the lectures, celibacy was no longer made a condition of professorship, and residence was dispensed with as a matter of course—the lecturers being each allowed 50*l.* yearly, in lieu of apartments, over and above the original salary of 50*l.* Owing partly to the incapacity of the Professors and partly to the inconvenient hours at which the lectures were delivered, the attendance of the public diminished, until between the years 1800 and 1820 the average number of the audience was only ten at each English lecture and thirteen at all the Latin lectures for the whole year. On the burning of the Royal Exchange Gresham College became a nomad institution, the lectures being mumbled or gabbled over in any hole or corner, until 1841, when the Gresham Committee purchased the present site, and erected on it a handsome lecture theatre at a cost of 7,000*l.* On various occasions attempts have been made to modify the constitution of Gresham College ; but although it was found possible to entirely overturn the provisions of the 'pious founder' in 1768, all subsequent interference has been met by the most determined opposition. It will hardly be credited that a prolonged struggle ensued before the Professors could be brought to issue a syllabus of the lectures to be delivered in each term. Still greater difficulty was experienced in transferring the hours of lecturing to the evening. This innovation was firmly resisted, and it was only by waiting till the tough old irreconcileables were gathered to their fathers that it was at last carried out.

"Very slight improvement has taken place under the new order of things. Shortly before six o'clock on the evenings designated in the syllabus the doors of Gresham College are opened, and a superb beadle looks out to see if any human being will be weak enough to enter the hall of dulness. As the clock hands closely approach the hour a thrill of excitement passes through the lecturer and the beadle. Two misguided persons have strayed into the building, and on the arrival of a third depends the reading of the Latin lecture, which is not delivered to a smaller audience than three. Should the third unwelcome guest put in an appearance the deed must be done—the lecturer must make a show of earning the 4*l.* 3*s.* 4*d.* he gets for reading the Latin discourse. Looking rather flustered—perhaps by the consciousness that three wicked wags have conspired to make him work—he opens a well-dog's-eared manuscript, and, reading at a tremendous pace, dashes through a composition which, as a rule, sets criticism at defiance. The good old traditional policy of driving auditors away is well kept up. Long Greek quotations loosely patched together by a rigmarole of doubtful Latinity, and rattled over with an evident intention of getting to the final *dixi* as quickly as possible, are not calculated to enchain the attention of a modern audience. It is only fair to admit that the lecturer sometimes shows a keen appreciation of the dreary farce in which he is the chief actor, and on these occasions condescends to address a few words—in English—to such of the audience as may be 'in at the death.' Feeling that a lecture in Latin needs not, therefore, be either tedious, stupid, or confused, he acknowledges the miserable quality of the rubbish he has just rattled through, and excuses it on the ground that the attendance is not sufficiently great to encourage the production of a good lecture; adding, moreover, that if more people came more pains would be taken. This solemn mockery is repeated every term, so that if all the Latin lectures were read, the majority of the professors would each deliver twelve English and twelve Latin discourses for his 100*l.* per annum—by no means an excessive rate of payment if the lectures really instructed anybody in anything. Unfortunately, as at present conducted, Gresham College is utterly and completely useless to any human being save only the professors and the beadles, who draw their salaries with commendable punctuality. Another matter for regret is, that not only is the use of a commodious building lost, but that a collection of books, which if placed in the City Library would be accessible to students, lies buried in the unprofitable seclusion of the College. If the Gresham Committee take no interest in the important trust confided to them, it is indeed high time that public attention was directed to an antiquated and transparent sham, a disgrace alike to the age and to the city in which it is perpetrated."

We hope that this unsparing exposure will lead to an inquiry into the abuse, and an appropriation of the valuable funds to a purpose much more consistent with the spirit of the will of the benevolent and well-meaning founder.

HÆCKEL'S DEVELOPMENT OF MAN

Anthropogenie oder Entwickelungsgeschichte des Menschen; gemeinverständliche wissenschaftliche Vorträge, von Ernst Hæckel. (Leipzig: Engelmann, 1874.)

THE new volume of so-called popular lectures by Prof. Hæckel bears somewhat the same relation to "The Descent of Man" which his "Schöpfungsgeschichte" did to "The Origin of Species." Few who are acquainted with Mr. Darwin's writings will agree with the criticism lately put forth from the chair of the British Association that they need an expounder. Those, however, who are dissatisfied with his patient analysis of facts and sober deduction of principles will find abundant exposition and extension in such works of his disciples as "The Beginnings of Life," "The History of Creation," and the present volume.

In criticising the vast system of dogmatic cosmogony which is here built up in lectures before a popular audience, one would not for a moment confound it with the flippant confidence of sciolists who attack or defend the theory of evolution, not on its scientific merits, but because it seems to them to support some theological or antitheological prejudice. But it is a matter of deep concern that so justly eminent a biologist as Prof. Hæckel should allow himself, in treating a subject which above all demands the dry light of impartial judgment, to adopt the style of those "who are not of his school—or any school."

The fact is, that the extremely difficult subject of the philogeny of man, demanding an accurate knowledge of embryology and comparative anatomy, both recent and fossil, is not at all fitted for popular treatment. Popularising science ought to mean persuading people to work at some of its branches until they learn to love it, not altering its character so as to make it please the itching ears of idlers.

The really valuable parts of the "Schöpfungsgeschichte" and the "Anthropogenie" must be at once useless and distasteful to such readers; and if they accept all the "advanced" theories laid cut and dried before them, they will be learning a bad lesson in biology. If they happen to have one set of prejudices, they will denounce all science as an invention of the devil; or if they have another, they will degrade it into a mere instrument to insult the feelings of their neighbours. Prof. Hæckel assures his hearers that the history of development contains more valuable knowledge than most sciences and all revelations; but, whether more or less important, the secrets of nature, like those of revelation, can only be gradually learned with patient ear and reverent spirit: they are meaningless or mischievous when accepted without pains or preparation.

Unfortunately, in these lectures the teacher frankly drops the character of the student of nature and assumes that of the combatant. Even in the preface he attacks the "black International" of Rome, "jener unheilbrütender Schaar," with which "at last—at last the spiritual war has begun." We see "the banners unfurled," we hear "the trumpets blown, which muster the hosts for this gigantic struggle." We are shown "whole ranks of dualistic fallacies falling before the chain-shot of monistic artillery, and libraries of Kirchenweisheit and Afterphilosophie (*sic*) melting into nothing before the sun of the History of Development." But when these metaphors are dropt, we find that the objects of this gigantic strife are to prevent certain (unspecified) teaching in primary schools, to suppress convents and celibacy by law, to expunge Sundays and saints' days from the calendar, and to forbid religious processions in the streets!

After this extraordinary preface, Prof. Hæckel enters on the more serious part of the book by a history of the doctrine of development. Passing rapidly from Aristotle and the founders of biology in the sixteenth and seventeenth centuries, he describes at some length the discoveries of Wolff (published in 1759), which were so long and so unjustly neglected; the scarcely less splendid researches of the now venerable Von Baer (1827), and those of Mr. Darwin, from the appearance of the "Origin of Species" in 1859 to the present time. Among the ontogenists, beside Wolff and Von Baer, whom he justly places in the first rank, due mention is made of Pander, Rathké, Bischoff, Johannes Müller, Kölliker, Remak, Fritz Müller, and Kowalevsky. But while most English embryologists (and histologists too) will probably agree in substance with our author's judgment on the doctrines of Reichert and of His, they would scarcely speak of a distinguished living anatomist as "dieser auserordentlich unklare und wüste Kopf." Among the philogenists who preceded Darwin, particular attention is paid to the speculations of Lamarck, in his "Philosophie Zoologique," which were published in 1809, and thus exactly divided the century which elapsed between the first great work on the subject, Wolff's "Theoria generationis," and the last, Darwin's "Origin of Species;" and also to those of Goethe, extracts from whose writings, both prose and verse, are scattered up and down the volume, not only in the text, but on the fly-leaves and other blank spaces. We venture to think that both here and elsewhere Prof. Hæckel has put too high a value on these pre-Darwinian speculations. He discovers who proves: and neither Lamarck nor Goethe could justify their guesses by facts. They happened to be right, just as among all the random guesses of the ancient Greek cosmologists Thales happened to have hit on the true relation of the sun to the earth, probably from his being less and not more philosophical than his fellows. If some of the assertions of modern spiritualists or phrenologists should hereafter turn out to be true, they would no less deserve the condemnation of a future generation for believing what, on the facts within their knowledge, they had no business to believe.

The chapters which succeed are devoted to a clear and tolerably full account of the development of the human embryo from the ovum-cell to the stratification of the blastoderm. The only fault to find with this part of the book (and its merits need no praise for those who are acquainted with our author's skill in exposition of a difficult subject) is the exaggeration of such phrases as this: "The process of fecundation is very simple, and involves nothing at all peculiarly mysterious." In one sense, of course, this is true; the ultimate mystery of every function, organic or inorganic, is equal: but fecundation, like other organic functions, has the peculiar mystery that we cannot yet rank it with other mysteries. Most of us believe that one day each movement of each particle of the ovum will receive its appropriate physical explanation, but till then we must be content to call them vital, just as we call other movements chemical: and even a popular lecture should not anticipate the advance of science.

The most important position maintained in this part of the book is that in Vertebrata the two primitive blastodermic layers (epiblast and hypoblast of Huxley, exoderm and entoderm) differentiate each into two, as in Vermes, and that the mesoblast (motorgerminal layer of Remak) subsequently arises by coalescence of Von Baer's Fleischschicht or Hautfaserblatt and Gefässschicht or Darmfaserblatt. The various opinions which have been put forth on this difficult subject are discussed, and the author's view illustrated by some coloured figures. In the number of the *Quarterly Microscopical Journal* for last April there is an article by Prof. Hæckel (very ill-translated) on the "Gastræa" theory which was put forth in his valuable work on "Calcareous Sponges;" and there he discusses the homologies of the secondary germ-layers. To it we may refer the English reader as an exposition of this part of the subject, and unfortunately as another instance in justification of what has been said of the dogmatic confidence and undignified personalities which disfigure the present volume.

The description of the further development of the human embryo, including a short account of the origin of the various organs, is an excellent example of how a very complicated subject may be explained and illustrated. The figures from Bischoff, Kölliker, Gegenbaur, and other anatomists are somewhat coarsely reproduced, but are supplemented by some new drawings on stone. These chapters, however, on human ontogeny and organogeny are unexceptionable and somewhat commonplace. They seem to be chiefly introduced for the sake of the philogeny which occupies the third series of lectures. It is the close connection between the known development of the individual and the hypothetical development of the race which it is the merit or demerit of the book to expound to a popular audience, and to this subject we hope to refer in a future article.

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.*]

Migration of Birds

I HAVE to thank Mr. Wallace and Mr. Romanes for their remarks (NATURE, vol. x. pp. 459 and 520) on the article in which I drew attention to this subject. The former especially has laid all ornithologists under an obligation for the characteristic skill with which he has illustrated the way whereby migratory habits have most likely been brought about. I think it is very possible, as he suggests, "that every gradation still exists in various parts of the world, from a complete coincidence to a complete separation of the breeding and subsistence areas," and that "we may find every link between species which never leave a restricted area in which they breed and live the whole year round, to those other cases in which the areas are absolutely separated." Still, I cannot point out any species which I believe to be, as a species, strictly non-migratory. No doubt many persons would at first be inclined to name half a dozen or more which are unquestionably resident with us during the whole year, and even inhabit the same very limited spot. But I think that more careful observation of the birds which are about us, to say nothing of an examination of the writings of foreign observers, will show that none of them are entirely free from the migratory impulse. Perhaps the nearest approach, among British birds, to an absolutely non-migrant may be found in our familiar Hedge Sparrow. Personally, I have never been able to detect any movement in this bird, but one has only to turn to works on the ornithology of the extreme north and south of Europe to see that it is affected like the rest, and even in the Orkneys it is described as an occasional autumnal visitant. However, in most of the

British Islands and the more temperate parts of Europe it is very possibly only the young of this species which migrate, and the adults, having once fixed on a place of residence, may stick to it; so that here we have a case which will almost bear out Mr. Wallace's supposition. With this, however, he stops, and I am sorry to say offers no suggestion as to the way in which migration is effected.

The question which Mr. Romanes puts would be more appropriately answered by Mr. Tegetmeier, and I hope he will be induced to do so. I can only say that that gentleman has repeatedly urged his views on me in conversation and upon the public in his books (see "Pigeons, their Structure," &c., pp. 84, 85, and "The Homing or Carrier Pigeon," pp. 37—42, 105—118) which, being ready of access, I need not here quote. To limit myself to what I am alone answerable for, I would say that when declaring that sight alone cannot be much aid to birds while migrating, I had especially in mind the almost peculiar case of the Scandinavian form of Bluethroat (*Ruticilla suecica*), which winters in Egypt and the Nile Valley, and summers in the northern or mountainous parts of Sweden, Norway, Finland, and Russia; while, though no doubt passing regularly twice a year over the intervening countries of Europe, it is there so singularly scarce as to have been, until of late years, almost unknown to the best of German ornithologists. For the benefit of such of my readers as are unacquainted with the bird, I may add that the cock has a conspicuous and beautiful plumage, a fine song, and habits which, in the spring of the year, cannot be called unobtrusive. If, therefore, it did commonly occur in Germany—where I should state that a kindred form (*Ruticilla leucocyana*) is very well known—it could not escape observation. Wonderful as the feat looks, it would therefore seem as though this Scandinavian Bluethroat passed over Europe at a stretch, and if so, I cannot conceive its flight being guided by any landmarks.

Furthermore, there is ground for believing that some of the migrations of many species, particularly of water-birds, are performed at night, when sight, one would think, can be of little use to them. But, to be honest, I must confess that dark, cloudy nights seem to disconcert the travellers. On such nights the attention of others besides myself has often been directed to the cries of a mixed multitude of birds hovering over this and other towns, apparently at a loss whither to proceed, and attracted by the light of the street-lamps.

One other point only need I now mention; this is Mr. Romanes's assertion that "in the case of all migratory birds, the younger generations fly in company with the older ones," which is at variance with a statement (hitherto, I believe, uncontroverted) of Temminck's:—"On peut pour un fait que les jeunes et les vieux voyagent toujours séparément, le plus souvent par les routes différentes." (Man. d'Orn. ed. 2, iii. Introduction, p. xliii. note.) ALFRED NEWTON

Magdalene College, Cambridge, Nov. 2

Insects and the Colours of Flowers

THERE is one point connected with Mr. Darwin's explanation of the bright colours of flowers which I have never seen referred to. The assumed attractiveness of bright colours to insects would appear to involve the supposition that the colour-vision of insects is approximately the same as our own. Surely this is a good deal to take for granted, when it is known that even among ourselves colour-vision varies greatly, and that no inconsiderable number of persons exist to whom, for example, the red of the scarlet geranium is no bright colour at all, but almost a match with the leaves. RAYLEIGH

Whittinghame, Preston Kirk

Sounding and Sensitive Flames

A SEVERE indisposition, which disabled me from correspondence during nearly the whole of last month, prevented me from acknowledging as soon as it appeared in NATURE (vol. x. p. 244) Prof. Barrett's excellent communication on Sounding and Sensitive Flames, replying to my letter on the same subject at page 233 of this volume. Prof. Barrett supplied me with many useful references, and with one at least the want of which led me to misrepresent his connection with the discovery of sensitive properties in suitably adjusted wire-gauze flames, for which I had sought in magazines and journals for some months previously in vain. A note of the original description of Mr. Barry's experiment in NATURE, vol. v. p. 30, had in the meantime been pointed out to me in another record of very similar experiments, which is itself also, I have no doubt, the same account of "further experiments with the same kind of flame," that Prof. Barrett cites as appearing in the *Journal of the Franklin Institute* for April 1872, to which I have not been able to obtain access. The nearer channel to which I was referred for its perusal is the *Philosophical Magazine* for June 1872, where a paper is briefly extracted from the *American Journal of Science* of the preceding month, describing new experiments with Barry's sensitive flame, by Mr. W. E. Geyer, of the Stevens Institute of Technology, in the United States. By placing a wide tube over the flame at a proper height it became sounding, or, if silent, might be made sensitive in such a way as to sound at the slightest hiss or rustle, and on producing any jingling or tinkling sounds in its neighbourhood. Thus the flame sounded twice on pronouncing to it the word "sensitive," showing its instantaneous affection even by momentary sibilant sounds. By varying the experiment, an opposite condition of the flame was obtained, in which it continued sounding until checked by a hiss or rustle from without. It is observed by the editor of the *American Journal of Science*, in a note to Mr. Geyer's paper, that in the number for September 1871, of the *Moniteur Scientifique*, a form of apparatus and experiment apparently identical with Mr. Barry's is noticed as having been made by Prof. Govi at Turin, and this was a few months prior to the letter in which the account of his experiments is given by Mr. Barry to Prof. Tyndall. Thus the sensitive properties of certain wire-gauze flames, like the property of such flames to excite very readily musical vibrations, may have had many independent discoverers; the value of such discoveries is now, as it must have ever been, the new light which one is capable of throwing upon another. The rapid publication of results urgently requires their frequent collection and comparison together; and this process, pressing and urgent as it is, seldom fails in experienced hands to prove a connection, to bind together a chain of consequences, and to leave a subject in general better explored and embellished with new-found illustrations than it was before. Such was the successful treatment, a few years ago, by Prof. Tyndall, of the question of sounding and sensitive flames, when it was shown by beautiful illustrations of Savart's sensitive water-jets, and by equally ingenious and new experiments with smoke-jets as substitutes for flames, that sensitiveness is a residing property of liquid veins and gas-jets, independently, in the latter case, of their being lighted. The laws of fluid pressure and motion, and apparently foremost of all those of capillary attraction in liquids and of mutual friction and diffusion in gases, and not the energies of heat and combustion of a flame, preside principally over the observed phenomena. The bifurcated head, or low ruffled brush to which the tall wand-like sensitive jet is suddenly reduced, is but the glowing representation of the form which, if it were visible to the eye, the unlighted jet would, under the same circumstances, be observed to take. This is at least in general terms, and perhaps also in plain and fairly accurate statement of the real facts, the simple result which the collection and elucidation of the most brilliant then known experiments illustrating sensitive flames, led a philosopher of Prof. Tyndall's enlightened sagacity and skill in physical investigations to adopt. There can be no doubt of its substantial correctness in the increasing array of cases to which it may be successfully applied. The flame is but an illuminated effigy of some of the lowest parts of the issuing gas column, whether tranquil or disturbed, whose upper parts it removes and replaces by products of combustion. The lower parts are also marred in their form by heat, but not so much as to obliterate the original character, shape, and dimensions of the part of the gas column that it represents. The flame terminates upwards, and ceases to represent the unlighted column further when it has found surface of contact enough with the outer air to effect the complete combustion of the gas. The up-draught of violently heated products of combustion near the base impedes the access of fresh air to parts near the summit of the flame, and it must, besides, deform them otherwise, sometimes even rhythmically, as in the unsteady throbbing flame of an ill-trimmed lamp or of a candle burning in its socket. The noisy roar with which flaring of gas-flames is attended tells us also of the uneven mixture of the gas and air supplies with each other in the flame, and reminds us of the rapid fire of small explosions that must probably introduce new sources of confusion in its form. If these explosions, however, are regularly timed, they can be made to maintain the simple musical note of harmonic flames; and these flames again, wholly dependent as they appear to be on their combustion for the musical sounds that they emit, must, it appears from Count Schaffgotch's and Prof. Tyndall's well-known experiments, when placed in certain circumstances of silence and indifference in an open tube, be aided by the voice at a distance to commence their song. The signal-note first raises certain mechanical vibrations in the gas-current of the narrow jet, that are necessary in the outset to produce commotions enough of the singing flame to make it able to continue and maintain them. The sensitive sounding-flame of Mr. Geyer bears a similar explanation, for not being regularly adjusted, although very nearly so, to continued sounding, a rustle sufficient to flurry the sensitive wire-gauze flame under the open tube creates in it so many brisk explosions, that the resonance of the sounding-tube is excited, and is at once exalted to a loud note by the rhythmical expansions of the flame ; but with the cessation of the external sound the maintaining impulse ceases, and the wire-gauze flame whose commotions must be kept up in order to maintain the note immediately becomes as silent as before.

It is remarkable that the gas-pressure used to obtain Barry's sensitive flame is not sufficient to produce visible sensitiveness in the taper-jet alone ; but if the gauze is raised and lowered over the unlighted jet, a proper position is soon found where the cone of blue flame burning on the gauze above possesses a very high degree of sensibility. The use of smoke-jets instead of flames in this arrangement would perhaps give more positive proofs than may yet have been obtained of the cause of the impressibility. It appears, however, scarcely probable that in the short space of a few inches from the aperture the pin-hole current of unlighted gas can increase its amount of air-mixture so much by the influence of external sounds, that this would account sufficiently for the descent of the conical gauze-flame from the pretty stately eminence of a tall and steadily-burning hill top, to little more than the elevation of a stormy bed of low struggling and bustling flame. The alternative supposition is that the disturbance commences in the meshes of the gauze itself, and that it extends upwards from them with such rapidly increasing agitation that a perfect mixture of the gas-current with the surrounding air, and its complete combustion, are thus enabled to take place at very short distances above the gauze.

I have been led to offer these few reflections on some of the most remarkable examples of sensitive and sounding flames from a wish to distinguish in their action as well as possible between the part which purely mechanical forces, and that which the operations of heat and combustion play separately in their production. The mechanical part of the explanation appears to consist in supposing the sensitive jet, when it is properly adjusted, as being in a state either bordering upon, or of actually existing undulation. The hissing sound of all air-jets, if listened for attentively enough, is a proof of the reality of the disturbance ; and such sounds, it has been suggested by Sir G. Airy, indicate disruptions of continuity in the air round the nozzle of the jet, arising, no doubt, from the rapidity with which particles of the quiescent external air are there carried off by friction with the gas-current of the jet. It is hardly possible that *vacua* so complete (when they exist) should fail to supply the jet with a succession of smoke-rings encircling it and probably travelling up the jet with different speeds according to their magnitude and the depth to which they are involved in the upward current of the gas. If a disposition to regular periodic action exists in the jet (and the smoother its orifice, and the more steady the supply of gas to the jet, the more probable this appears to be), a succession of smoke-rings * of the same size, and of greater or less strength according to the uniform pressure of the gas, may easily be supposed to course each other up the flame, and being gradually consumed in ascending, to leave its tall column to the top with sides as smooth and even as a rod of glass. But if the gas-pressure is much increased, a phenomenon like that of companion cyclones observed in rotating storms, perhaps presents itself at the orifice of the jet, each strong smoke-ring as it is formed being probably followed by a weaker one (a residual offset from the first) travelling after it with less velocity on the outer surface of the flame. The companion rings are probably overtaken and destroyed at a certain height in the flame by the next following strong ring, and the succession being continuous, a puff at a certain height in the flame, where the companion rings collapse, throws it there into a permanent excrescence or confusion. Both rings may be broken by the shock, and if of oval forms, as they must probably be in some jets, the two projecting halves of the stronger ring when struck, on springing outwards may thus appear to divide the flame at a certain height above the jet into two pointed tongues forking outwards from each other to a certain width. This form of sensitive flame was shown to be readily obtainable by Prof. Barrett by means of a tapering glass quill-tube jet, the edges of which on two opposite sides are slightly ground or snipped away into a V-shaped notch. Besides the secondary or companion ring, tertiary and higher orders of following rings may possibly be formed ; and each strong primary ring may have to run the gauntlet of several weaker antagonists before it at last emerges safely, or else is destroyed itself in its conflicts with them. The flame is lowered to a bushy head in the latter case ; but if the primaries outlive their shocks, and if, as might sometimes happen also, the secondaries alone survive, it seems possible that a sensitive flame with a short continuation of steady flame overtopping the region of tumult and confusion, could in this way be obtained. The hypothesis seems equally applicable to gauze flames, as nothing can prevent smoke-rings after smoke-rings from rolling up the contiguous sides of parallel jets nearly in contact with each other. Indeed, the difficulty of access of the outer air to the spaces between the jets must favour the production of *vacua* round the orifices, and accordingly the occurrence of air-whirls. This is perhaps the reason why wire-gauze flames begin to show sensitive properties at gas-pressures so much lower than those found necessary in the case of a single flame burning at a taper jet. The whole array of jets, it may be, in a wire-gauze flame behaves very nearly alike, and the flame as a body burns, whether noisily or silently, in the same manner, but with greatly increased susceptibility, as a single flame-jet from one of the gauze-meshes alone would appear to do. Whatever mechanical distinction may really exist between the mode of action of the common taper jet and the wire-gauze sensitive flames, it appears, therefore, rather to be one of a higher degree of susceptibility at low pressures, than of any more distantly distinct or special kind. Even the mode of operation of external sounds upon them is probably very similar in the two cases, for by rapid vibrations of the external air, such as a hiss or shrill whistle produces, the gas-jet leaving an orifice is shifted bodily to and fro over its edges, and nothing can more certainly produce partial *vacua*, and consequently air-whirls round its circumference, than sudden displacements of an air-jet laterally over the sides of its aperture, even if the tendency to develop them more or less periodically did not exist already in the critical or "sensitive" condition of the jet. Axial vibrations, also, or those impressed by outer disturbances on the gas-current in the orifice in the direction of its flow, cannot be altogether without effect in producing *vacua* and air-whirls at its mouth ; and among the multitudes of them thus occurring from the impressed action of external vibrations in all directions, a rhythmical selection is probably made depending on the form of the burner and the pressure of the gas. It is difficult to imagine how the partial air-vacuum or aspiration constantly existing round the nozzles of blast-apertures can bestow its energy when broken into discontinuity, rhythmical or otherwise, by a turbulent condition of the jet otherwise than by producing, in the peculiar eddy of its position, ring-shaped vortices encircling the blast ; but it is evident that few jets and nozzles can be fashioned so smoothly in their inner and outer surfaces and edges that the ring vortices will often be complete ; mere fragments of rings are scattered from their sides, which, having no stability, collapse with shocks and puffs that give the roaring and blustering character to the stream. With perfectly smoothed orifices there is probably every gradation according to the pressure of the gas, from full continuity of the partial vacuum or rarefaction round the jet, abating gradually and uniformly upwards to ultimate disappearance by friction with the surrounding air, through a condition of gentle undulations of this cone of rarefaction pursuing each other up the stream with slackening strength, and finally losing themselves also by friction as before, to the case of turbulence where the rings of rarefaction are quite intermittent, and separate ring-eddies more or less distinct from each other,

* The word "smoke-rings," as here used occasionally, is not intended to imply the presence of smoke in the jet or flame, but to denote by a familiar phrase an annular air-vortex having its rotation round a circular line or ring of lower pressure than that of the surrounding air. Such annular vortices are most easily seen in liquids by drawing a flat blade through them with its broad side in front; or, indeed, as was lately shown to me by Prof. James Thomson, who supplied me with their explanation, in a cup of tea, by drawing a spoon very gently through it. Only half of the annulus is formed, encircling the edge of the blade or spoon with a curved line of low pressure, round which the liquid spins as in a smoke-ring, and shows a little whirlpool on the surface, one at each point of intersection of the surface with the low-pressure line below it. If an oar-blade is drawn rather rapidly through water, groups of two or three of these ring-vortices following each other in its track can very readily be produced.

of greater or less strength, and travelling up the stream with different speeds, take the place of the more gentle undulations. The distinction between ring-vortices and ring-shaped undulations is perhaps here too strongly and improperly overdrawn, as, besides the improbability that effects so exaggerated as perfect air-whirls are really ever attained in ordinary gas-jets, the properties of the undulations that correspond to and lead up to them in ordinary currents must evidently resemble theirs in all respects, so that the deeper and stronger interior undulations move up the jet more rapidly than open and weaker exterior ones on the surface; for it seems probable that both vortices and ring-waves of strongest rarefaction will generally occur nearest to the centre or axis, and those of weakest rarefaction furthest from it, or nearer to the slow-moving outer surface of the jet. The effect of the collision and destruction of a weaker by a stronger ring-wave, when they overtake each other, is the same as that of perfect circulating whirls; the balance of pressure in one part of the circular wave being broken by a shock, it collapses in every other part, and if both waves are destroyed, the further progress of the jet is intercepted at that point, and it scatters itself in a confused cloud at the point of concourse and disruption of the waves. The long-enduring smoke- or steam-rings often seen projected from the funnels of locomotive engines at starting, or when moving slowly and emitting separate puffs, illustrate apparently the mutual action of closely packed parallel jets like those of an ordinary gauze flame; for the impeded passage to the outer air offered by a number of such surrounding jets, just as by the funnel of the locomotive engine, favours the production of a strong vacuum round the jet-aperture or blast-pipe, and of a strong wave or steam-ring, the moment that the jet or blast takes a side-swing or a sudden leap upwards that calls the action of the partial vacuum into play. A. S. HERSCHEL

(*To be continued.*)

A New and Simple Method for making Carbon Cells and Plates for Galvanic Batteries

SOME time since a correspondent asked for an easy method to construct carbon plates. A paper of mine was read in Section A at Belfast on the subject, and as it describes a process by which any experimentalist can construct not only plates but cells of carbon, I have thought a condensed account of the process may be appropriate for your columns.

With a syrup made of equal quantities of lump-sugar and water, mix wood-charcoal in powder with about a sixth part of a light powder sold by colourmen, called vegetable black. The mixture should hang thickly on any mould dipped into it, and yet be sufficiently fluid to form itself into a smooth surface. The vegetable black considerably helps in this respect.

Moulds of the cells required are made of stiff paper, and secured by wax or shellac. A projection should be made on the top of the mould for a connecting piece. These moulds are dipped into the carbon syrup, so as to cover the outside only, and then allowed to dry. This dipping and drying is repeated until the cells are sufficiently thick. When well dried they are then buried in sand, and baked in an oven sufficiently hot to destroy the paper mould. When cleared from the sand and burnt paper the cells are soaked for some hours in dilute hydrochloric acid, and again well dried, then soaked in sugar syrup. When dry they are then packed with sand in an iron box, gradually raised to a white heat and left to cool. Should some of the cells be cracked, they need not be rejected, but covered with paper or plaster and dipped in melted paraffin.

Rods or plates of carbon can be rolled or pressed out of a similar composition, but made thicker. Carbon thus made will be found to have a good metallic ring and a brilliant fracture.

Barnstaple, Oct. 26 W. SYMONS.

Ingenuity in a Spider

A SPIDER constructed its web in an angle of my garden, the sides of which were attached by long threads to shrubs at the height of nearly three feet from the gravel path beneath. Being much exposed to the wind, the equinoctial gales of this autumn destroyed the web several times.

The ingenious spider now adopted the contrivance here represented. It secured a conical fragment of gravel with its larger end upwards, by two cords, one attached to each of its opposite sides, to the apex of its wedge-shaped web, and left it suspended as a moveable weight to be opposed to the effect of such gusts of air as had destroyed the webs previously occupying the same situation.

The spider must have descended to the gravel path for this special object, and, having attached threads to a stone suited to its purpose, must have afterwards raised this by fixing itself upon the web, and pulling the weight up to a height of more than two feet from the ground, where it hung suspended by elastic cords. The excellence of the contrivance is too evident to require further comment.

Torquay, Oct. 26 JOHN TOPHAM

Note on the Rhynchosaurus Articeps, Owen

REFERRING lately to Prof. Owen's description of the Rhynchosaurus ("Palæontology," p. 264), first discovered by myself in 1838–39, in the New Red Sandstone of Grinshill, near Shrewsbury, I remarked that in speaking of the ichnolites supposed to belong to this animal he says there is an "impression corresponding with the hinder part of the foot, which reminds one of a hind toe pointing backwards, and which, like the hind toe of some birds, only touched the ground." In this account nothing is said of any claw being attached to this hind toe, nor have I met with any description of a claw in other authors. I have therefore thought it worth while to mention that I possess a specimen from Grinshill that shows distinctly the impression of a straight claw pointing backwards. There is also, on the same slab, the impression of another smaller foot of only three toes with strong straight claws, which has behind it a slight impression corresponding with the hind toe of the larger footprints. It is a curious fact that the claws of the larger impression, though larger than those of the smaller footprint, are so much recurved as not to project much beyond the ends of the toes, while on another slab from Storeton there are reliefs with both straight and recurved claws, the latter giving the idea of a foot like that of the Great Anteater. In these Storeton ichnolites the hind toe exhibits no claw, nor am I sure whether certain rounded elevations represent the smaller footprint in the Grinshill specimen. Upon another slab of Storeton stone I have a mark resembling the tail-mark on the slab presented by Mr. Strickland to the Warwickshire Museum, but unfortunately the footmarks connected with it are too indistinct to decide its origin. In a third slab from Storeton, besides several impressions with straight claws, there is one three inches long, the second toe of which has a straight claw $\frac{5}{8}$ in. in length. I have also Cheirotherium footprints with long straight claws from the same quarries.

I have put these few remarks together to fulfil the wish of Prof. Owen "to obtain the means of determining the precise modifications of the locomotive extremities of the Rhynchosaurus." Perhaps by this time this object may have been attained, for at the Congrès des Savans at Paris in 1868 the discovery of two almost perfect skeletons was announced, and drawings of them were exhibited by a professor from Lyons.

T. OGIER WARD

[So far as the photographs can be deciphered, they seem to bear out the writer's statements.—ED.]

*THE ALPINE CLUB MAP OF SWITZERLAND**

IN NATURE, vol. vi. p. 203, we adverted to the non-existence of a map of the Alps on a scale sufficiently large for general purposes, and briefly referred to the map which was then being produced under the direction of a committee of the English Alpine Club with the view of supplying the want. This map, though not yet finished, has been recently published. Three sheets are completely finished, but the fourth is still in outline, and will be exchanged for perfect copies when the hill-shading is added.

We believe this to be, so far as it extends, the most exact map of the Alps which has yet appeared, and probably no map of its size has ever been produced in this country with more beautiful workmanship or with greater

* The Alpine Club Map of Switzerland with parts of the neighbouring countries. Edited by R. C. Nichols, F.S.A., F.R.G.S., under the superintendence of a Committee of the Alpine Club. In four sheets. Scale $\frac{1}{250000}$. (Stanford, 1874.)

elaboration of detail. We could have wished, indeed, that details had been inserted somewhat less profusely. It can never be possible in maps of the scale of this one (about one-quarter of an inch to a mile) to render, with a sufficient degree of clearness, all the minutiæ which are inserted in the great Government Surveys of civilised countries; nor can it ever have been supposed that this map would do away with the necessity of smaller maps of separate districts on a larger scale. Yet we find, in the map under review, in innumerable places, a mass of details which would have been amply sufficient had it been four times its dimensions, and a consequent want of clearness which is not a little perplexing. In some places, even the fantastic passes made in late years by the followers of the high art of mountaineering have been inserted, whilst in others (in the chain of Mont Blanc, for example) they have been almost entirely omitted, simply from want of space. Thus it appears, to those who are not informed, that in some places there are a great number of such passes, and in others scarcely any, when the reverse is perhaps the case. We should have advocated, both for the sake of consistency and of clearness, the omission of all passes except those of distinct utility.

In point of clearness it must be admitted that the English Alpine Club Map is scarcely equal to the reduction of the Carte Dufour which was published last year in Switzerland,* and this is not surprising. The authorities at Bern had to produce a simple reduction of the twenty-five sheet map of Switzerland, which was intended to be useful for general purposes, and to be issued at a low price so that it might be within the reach of everyone, and in this they have succeeded admirably. They had at their command most of the members of the staff who had been employed upon the survey, and thus had little or no difficulty in determining what to omit. This was a great advantage; for it must be obvious to all that, in reducing a map to a much smaller scale, it is more easy to determine what should be inserted than it is to know what should be left out. This simple fact, no doubt, accounts to some extent for the over-elaboration of the Alpine Club Map to which we just now referred. Its projectors also adopted the Carte Dufour as the basis of their map so far as Switzerland was concerned, but they had not the command of the very exact and minute topographical information which was possessed at Bern.

The reduced Swiss map, like the Carte Dufour, is a map of Switzerland, and for the most part stops abruptly at the frontier. The English map, however, is a map of Switzerland *with parts of the neighbouring countries*. It extends everywhere sixteen miles more to the south than the most southern point of the Swiss boundaries, and in some places the country which it embraces (which is *not* included in the Swiss map) is as much as sixty-five to seventy miles from north to south. In the north and in the west the limits of the two maps are nearly the same, but in the east the English one includes the Orteler and several other important groups of mountains, which are not given in the Swiss one. The superficial area of the Alpine portion of the English map is altogether about one-half greater than that of the other, and the chief value of the map will be found to be in the part of it that represents this land beyond, but bordering the Swiss frontiers.

It was a comparatively easy task, notwithstanding the complicated and exceedingly elaborate nature of the engraving, to render Switzerland after the Carte Dufour. The chief difficulty in the production of the map has lain in obtaining the material necessary for its completion towards the south. When it was commenced—now nearly ten years ago—there was no map, even respectably accurate, of the chain of Mont Blanc in existence; and thence, right away to the furthest land in the east which is included, scarcely a square league could be adopted with confidence from any published survey. Hence it was necessary not only to examine every individual mountain and valley, but absolutely to re-survey several large districts. The chain of Mont Blanc, as it appears in the Alpine Club Map, is mainly taken from the special survey of Mr. Adams Reilly;* and so, too, is the whole of the southern side of Monte Rosa, as well as the large district bounded on the east by the Val d'Ayas, on the south by the valley of Aosta, and on the west by the valley of Valpelline.† This last-named district alone includes more than 150 square miles. The Graian Alps were in a state of hopeless confusion when Mr. R. C. Nichols took them in hand, and anyone who compares the map under notice with the best which were published previously will see what radical changes and corrections have been effected. Altogether, there is in the Alpine Club Map not less than a thousand square miles which have been entirely remodelled, and, for the most part, re-surveyed; this, moreover, being some of the most rugged and difficult country in Europe, containing numerous peaks from 12,000 ft. to 13,000 ft. elevation.

Those who have been concerned in the production of the Alpine Club Map of Switzerland have a right to be proud of their work. We have tested it in the Alps, and it has stood the scrutiny extremely well. We cordially hope, though scarcely expect, that it will prove remunerative to its publisher, and that he will be induced to complete it by adding sheets to the east and to the west, so that at length there may be at least *one* map of the grandest and most picturesque chain of mountains in the world. In conclusion, a word is due to the engravers. The work was commenced by the late Dr. Keith Johnston, but the greater and the most difficult portions have been executed by Mr. John Addison. We have rarely seen better hill-engraving; and the wonder is, not that the appearance of the map has been delayed so long, but that a work of such magnitude and extraordinary minuteness should have been completed so soon. E. W

* Karte der Schweiz, in 4 blättern, reduciert unter der Direction des Herrn General G. H. Dufour. Maasstab, $\frac{1}{250000}$. (Bern, 1873.)

* This has also been published separately on a scale of $\frac{1}{80000}$.

† This has been published separately on a scale of $\frac{1}{100000}$.

REPORT OF PROF. PARKER'S HUNTERIAN LECTURES "ON THE STRUCTURE AND DEVELOPMENT OF THE VERTEBRATE SKULL" ‡

VIII.—*Skull of the Common Fowl* (Gallus domesticus).

THE skull of birds is remarkable for the great amount of anchylosis which takes place between its various constituents long before the period of adult life. So complete is this union, that the determination of the separate bones in a full-grown bird is a perfectly hopeless task, without first studying their relation at a period when they retain their original distinctness. It will therefore be convenient to describe the fowl's skull, in the first instance, at the period of hatching, when the chief ossific centres are still separate, although most of the distinctive characters of the adult are already assumed.

In this stage the foramen magnum is surrounded by the four perfectly distinct elements of the occipital segment, between which extensive tracts of cartilage still exist. The basi-occipital is comparatively small, and forms almost exclusively the rounded condyle (Fig. 27 O.C); the ex-occipital and supra-occipital are large and expanded, and into the latter extends the anterior semicircular canal (Fig. 26, a.s.c.), so largely developed in birds. The prootic (Fig. 26, Pr.O) is well seen on the inner side of the cranial cavity, but outside is completely hidden by the great development of the squamosal, which takes a very considerable share in the formation of the side wall of the skull. Two other auditory bones have

‡ Continued from vol. x. p. 446.

appeared—the opisthotic (Op.O) and the minute epiotic Ep.O); the latter attains a much greater size before it fuses, in adult life, with the supra-occipital. The main part of the skull floor is formed by the large, laterally expanded basi-sphenoid, which above is excavated into a deep *sella turcica* for the pituitary body, and in front passes into the interorbital septum and the bony rostrum

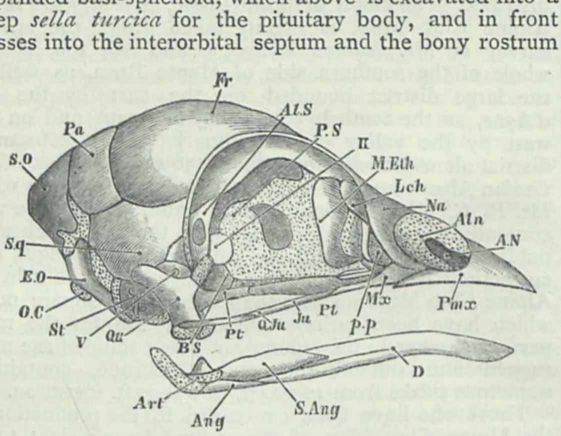

FIG. 25—Skull of Fowl at the period of hatching (side view). p.p, pars plana

supporting it, being, in fact, firmly anchylosed with the latter. A careful study of the earlier stages of development shows that only the upper part of this bone is really homologous with the basi-sphenoid, the lower part being the representative of the hinder part of the parasphenoid. The basi-temporal (Figs. 26 and 27, B.T), as this large membrane bone is called, is firmly anchylosed with the basi-sphenoid, the greater part of the inferior surface of which it completely covers, but is at this period still partially distinct from the representative of the anterior part of the parasphenoid (Figs. 26 and 27, Pa.S), the "basi-sphenoidal rostrum" so characteristic of birds, which is, however, united with the basi-sphenoid.

In front of the depressed basi-sphenoidal region the basis cranii becomes much compressed from side to side, forming a large cartilaginous interorbital septum, the representative of the prepituitary part of the basi-sphenoid and the presphenoid behind, and of the mesethmoid in front. The walls and roof of the brain-case are completed by the squamosals, alisphenoids, parietals, and frontals; the latter also affording support to the fore part of the base of the brain by means of their extensive in-turned orbital processes. The orbito-sphenoids are altogether absent at

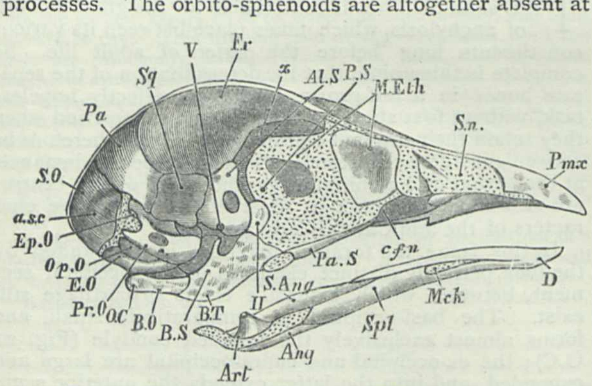

FIG. 26.—Sectional view of the same. B.T, basi-temporal.

this stage, but at a later period are represented by two pairs of insignificant ossifications above the postero-superior edge of the presphenoid in the membranous space marked x in Fig. 26.

A considerable portion of the anterior or ethmoidal part of the interorbital septum is already ossified, forming the *lamina perpendicularis*, or mesethmoid (M. Eth). In front of this the cartilage is continued almost to the end of the beak as the *septum nasi* (Fig 26, s. n), or wall between the nasal sacs, the upper margin of which is produced outward into a wing-like expansion, the alinasal cartilage (Fig. 25, Aln) pierced by the external opening of the nostrils (A. N). A further continuation of the same median cartilages is seen in the slender pre-nasal or basi-trabecular (Fig. 27, B. Tr).

Within the nasal cavity are three pairs of cartilaginous folds, the alinasal turbinals represented by valvular processes of the ala nasi in some mammals, and the upper and lower turbinals, homologues of the structures bearing the same name in the higher class. The sole representative of the middle turbinal is the flat hinder wall of the ethmoid looking into the orbit, and known as the *pars plana* (Fig. 25, p. p).

There is one more point of importance to be noted with regard to the interorbital septum, namely, the cranio-facial notch (Fig. 26, c.f.n), a natural separation between the epi- and cerato-trabecular elements, and of great functional importance in the bird, where the beak is moveable upon a sort of hinge formed by the premaxillæ just above this point.

The membrane bones of the face are yet to be considered. The premaxillæ are large bones partly fused

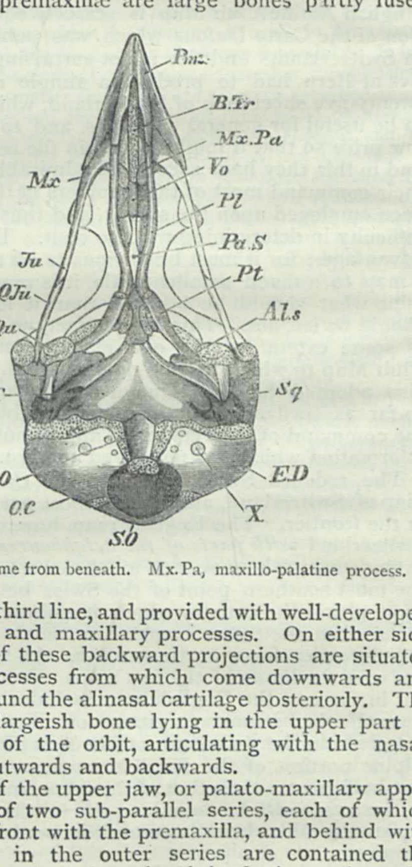

FIG. 27.—The same from beneath. Mx.Pa, maxillo-palatine process.

together in the third line, and provided with well-developed nasal, palatine, and maxillary processes. On either side of the former of these backward projections are situated the nasals, processes from which come downwards and forwards to bound the alinasal cartilage posteriorly. The lacrymal is a largeish bone lying in the upper part of the front wall of the orbit, articulating with the nasal, and directed outwards and backwards.

The bones of the upper jaw, or palato-maxillary apparatus, consist of two sub-parallel series, each of which articulates in front with the premaxilla, and behind with the quadrate; in the outer series are contained the maxilla, jugal, and quadrato-jugal, in the inner the palatine and pterygoid. All the bones in the former category are extremely slender—almost filiform, in fact; the palatines and pterygoids, on the contrary, attain a high degree of development, but neither they nor the maxilla develop palatine plates, the only rudiment of those structures being in the maxillo-palatine processes (Mx.Pa), flat plates of bone proceeding inwards from the maxillæ beneath the palatines to meet the small, single vomer. The palate of the fowl is thus formed on the simplest schizognathous type.

The quadrate is a stout bone, having three well-defined processes, one forming the articular surface for the mandible; a second, answering to the otic process of the primitive suspensorium, articulates with the squamosal; and the third, or orbital process, projecting forwards and upwards, is the pedicle or true apex of the mandibular arch. The otic process, besides articulating with the squamosal, bears a small facet for the prootic; this, in many birds, is developed into a distinct secondary head.

Immediately behind the quadrate is seen the large tympanic cavity; this is banded above by the supra-occipital and squamoid, below by the basi-temporal, behind by the ex-occipital, and in front by the basi-sphenoid; it sends into the latter a diverticulum, the anterior tympanic recess, and a second or posterior recess into the supra-occipital, through the diplöe of which it is continuous, as in the crocodile, with the tympanum of the opposite side. The fowl resembles the ostrich, and differs from most other birds in being wholly devoid of a tympanic bone.

The lower jaw consists of the same elements as already described in the snake, except that the coronary is absent in the fowl, though present in most birds; in this stage the five bones (articular, angular, supra-angular, dentary, and splenial) are perfectly distinct, and Meckel's cartilage yet remains of considerable size.

The upper part of the hyoid arch is separated, as in the snake and frog, to form with the stapes a *columella auris*. From the oval, irregular, plug-like stapes proceeds a slender rod of bone terminated by a triradiate cartilage, of which the slender antero-inferior bar is the infra-stapedial, the broad somewhat expanded central segment the extra-stapedial, and the postero-superior bar the supra-stapedial. The latter is connected by an oblique bar with the extra-stapedial. The stylo-hyal is represented by the free end of the infra-stapedial.

The tongue-bone consists of a body made up of glosso-hyal (formed by the union of the lesser cornua), basi-hyal, and basi-branchial (uro-hyal) arranged in a linear series; and of two pairs of cornua, the anterior or cerato-hyals, very small, and forming more lateral projections to the body, and the posterior or epi- and cerato-branchials (thyro-hyals), long and elastic, and embracing the occipital.

The development of the fowl's skull has been worked out as far back as the fourth day; but even at that early period, when chondrification is only just beginning to set in, it is impossible to demonstrate with certainty the distinctness of many regions which are perfectly separate at corresponding stages in the lower types. At the period mentioned, the indifferent tissue of which the trabeculæ are formed is perfectly continuous with that of the investing mass, and this again with that of the auditory capsules. When, however, the process of conversion into cartilage is complete, the apices of the trabeculæ become perfectly distinct from the investing mass, and form a pair of backward-turned horns (often called the *lingulæ sphenoidales*) on either side of the pituitary space. The ear capsules, on the contrary, remain as undistinguishable from the para-chordal region after chondrification as before, and only acquire distinctness by ossification. This rapid process of fusion which takes place equally between the masses of indifferent tissue constituting the primordial skull, in the subsequently formed tracts of cartilage, and in the various ossifications of a still later period, renders the study of the bird's skull one of the most difficult problems of craniology.

The manner in which the hyoid arch is developed has been worked out more exactly in the house-martin than in the chick, in which, however, the process is essentially similar. At a very early period the upper end of the arch grafts itself on to the auditory capsule, and at the same time becomes split up into three portions. The proximal of these constitutes the columella, a plug of the auditory capsule being before long cut out around its attached end to form the stapes. The middle is the stylo-hyal; it is at first connected to the columella by a tract of tissue, but afterwards fuses with the infra-stapedial element of the latter. The distal portion never becomes chondrified in its upper portion, resembling in this respect the corresponding structure in man (the stylo-hyoid ligament), but below forms the lesser cornu of the hyoid bone, or cerato-hyal.

The mode of formation of the complex basi-sphenoidal region is, perhaps, the most important point which yet remains for consideration. No endogenous ossification takes place in the cartilage of this part of the basis cranii, but a pair of symmetrical ossific centres make their appearance in the thick web of perichondrium which underlies it, a third (median) centre appearing at the same time in front of the other two in the fibrous tissue below the ethmoidal cartilage. These ossifications together represent the dagger-shaped parasphenoid of the frog; the anterior is commonly known as the basi-sphenoidal rostrum; the posterior pair, coalescing, form the basi-temporal. Before they unite, however, ossification extends from them into the overlying cartilage, and thus the true basi-sphenoid is formed in a manner perfectly unique among vertebrata.

THE NEW VINE-DISEASE IN THE SOUTH-EAST OF FRANCE *

II.

HAVING thus far studied the spread of the new vine-disease and the extent of the ravages committed by the Phylloxera, it is time to turn our attention to the insect itself, and to state the results of scientific observation of the manner in which it attacks the vine rootlets, and the various circumstances and conditions which either favour or retard the development of the disease.

The Phylloxera is a very minute insect, measuring, when fully grown, not more than 1-33rd of an inch in length. Its most striking feature is its proboscis, which lies in a sort of groove on the under-side of the insect, and with which it pierces the roots on which it feeds. This proboscis is very slender, and appears to be formed of three tongues, a greater one in the middle, and two more slender and shorter, on the two sides of it; it resembles a brown thread bending round and inserting itself in the tissue. The base of the proboscis is a sort of

The Phylloxera.

flat and sharp-pointed blade, composed of brown parts which prolong themselves into the tongues. The animal raises this blade a little in applying its proboscis to its food. The length of the sucker is equal to about half that of the body of the Phylloxera, which does not bury more than half of it in the bark of the roots. By this sucker the insect fixes itself to the spot which it has chosen, so that it can be made to turn upon it as on a pivot. In colour the Phylloxera, during the summer at least, is yellow, but in the late autumn it turns to a copper-brown tint, which lasts through the winter. The active life of the Phylloxera lasts from the beginning of April till the latter half of October. The insect hibernates through the other months, though previous to the commencement of hibernation the females who have laid eggs during the

* Continued from vol. x. p. 506

past season, die off, leaving only young insects, which, as we have said, turn to a copper-brown colour at this period, renewing their light yellow tint in the spring. The Phylloxeras do not increase much in numbers during the months of April and May, but an extensive reproduction of the insect is clearly marked in June and July, while it assumes prodigious proportions in August and September, in the latter months often covering the root-shoots in a continuous mass, so as to make them appear completely yellow with their bodies. In observing the spots attacked by the Phylloxera, two varieties of the insect—a winged and a wingless—have been generally found; but it would seem (though on this point the reports before us are not quite clear) that the one is but a later development of the other. The wings of the Phylloxera do not appear to be capable of sustained flight, but probably help to carry the insect along from place to place when exposed to the action of the wind, for several specimens of the winged variety have been discovered caught in spiders' webs. Of course the winged Phylloxera spreads over the vineyards, which it attacks without any regard to the nature of the soil, whereas the wingless variety is much affected in its movements, and the extension of its ravages is largely determined by the quality of the ground and the nature of the obstacles to which it is exposed. Passing by, for the present, the observations made on this point, we may say generally that the insect would seem to have no burrowing power, but moves from place to place, from root to root, along the line of the fissures which the soil presents.

M. Maxime Cornu, as a result of his observations, has come to a conclusion contrary to the most commonly accepted theory of the cause of the disease of the vine, which attributes it to the absorption of the sap by the insect, and holds that the Phylloxera does not divert the sap to its own body, basing his conviction on his observations as to the length of the portion of the sucker buried in the rootlet compared with the thickness of the bark. He considers that what the Phylloxera really feeds on is the contents of the cellules of the bark, and perhaps of the cambium layer. An exaggerated power of absorption has, in his view, been attributed to the Phylloxera, and it would rather seem that the flagging and ultimate decay of the vine arises, not from the absorption of the nutritive elements by the insect, but from the formation of new tissues, which divert them from their proper end to nourish abnormal growths. These new tissues or swellings (*renflements*) of the roots are probably caused by an irritation of the cambium layer, the result of which is the hypertrophy of the excited part, while the formation of the swellings brings about the death of the rootlets, and through them the general decay of the vine. A natural conclusion from these observations is that the health of the vine may be improved by any means tending either to produce fresh rootlets or to increase the absorption of nutritive elements by those already in existence, though the only true and radical remedy is to kill or drive away the Phylloxera itself.

When a vine is first attacked by the Phylloxera, a change occurs in the external appearance of the rootlets, which, instead of being nearly cylindrical, exhibit the swellings we have just mentioned of different shapes, which are the first symptoms of the disease. The Phylloxeras may often be seen on their surface. These swellings are hard, and of a greenish or yellowish, or sometimes of a deeper-coloured tint, according to that of the external coat of the root when they are full of sap, but when they rot they become black and flabby, and eventually dry up altogether.

It is interesting to examine and compare in the same root the structure of the part above the swellings with that of the swelling itself, as by these means one can come to a definite opinion, by comparing the diseased with the healthy part, as to what are the new elements which are developed, and what are the characteristics of the altered parts. By making a transverse section above a swelling in the vine, the structure is found to be that of a normal root-shoot; and, with the aid of a microscope magnifying 60 diameters, the following appearances may be observed:—(1) On the outside the external coat (*couche subéreuse*) composed of flattened cells, arranged in rows and brown on the outer side: this tissue peals off in layers of a brown colour, and it is this that gives the rootlets the yellow or brown tint they show according to its thickness. (2) The cortical parenchyma, composed of polygonal cells, full of starch, some of which, larger than the rest, scattered about here and there, contain bundles of raphides, long crystals parallel to each other. These two constitute the cortical coat. (3) The woody portion, composed of fibres and vessels, occupies the centre, and is divided into three, four, or five woody sectors, and between each two of these is a medullary ray—there is no definite pith. (4) Embracing the woody tissue and in contact with the cortical coat is the cambium layer, the flattened cells of which, with their thin walls, full of a thick plasma and always destitute of starch, form on the one side the cortical and on the other the woody tissue. The general contour of the section is circular. To turn to the swellings.—The increase in diameter is due to the formation of new elements, partly cortical, partly woody, the cortical parenchyma becoming much thicker, but otherwise resembling the healthy tissue. It is different with the woody tissue: the woody rays assume very irregular outlines, and swell in all directions unevenly beyond the limit of the single concentric circle which terminates them with its circumference, in the healthy state. The development of the cambium layer is also abnormally increased, and there seem to be no vessels in the new wood formed under these conditions.

This altogether anomalous anatomical constitution is in itself a refutation of those who even now hold that the swellings are the result of normal growth. They really are a purely local hypertrophy produced by the direct action of the parasite.

It is of great importance to the discussion of possible means of extirpating the new insect, to investigate the method it employs in getting from place to place and so spreading its ravages. Putting aside as obvious the movements of the winged variety, which, as we have said, seems to be borne to fresh spheres of mischief by the wind without any direct effort of flight on its own part, we come to the wingless insect. Observation shows that the wingless Phylloxera progresses both along the surface of the earth and follows also the line of the roots or the fissures of a crumbly or broken soil. And first, to deal with the surface-movements of the insect, they appear to be extraordinary occurrences, the results of the concourse of altogether special circumstances, for the exposure to the air and to the sun's rays is very unfavourable to the Phylloxera, which in the dry air dies of desiccation, as may be easily shown by leaving exposed a root covered with Phylloxera. It would seem, therefore, and observation supports this idea, that the reason of the surface-movements of the insect lies in the fact that in getting from vine to vine, or sometimes from rootlet to rootlet, it encounters obstacles which, not being a burrowing insect, it cannot overcome, and therefore from unwelcome necessity it has to mount to the surface, though only to bury itself again when the next fissure shows itself, leading to a fresh and unattacked part. With respect to the movements of the parasite underground, some elaborate observations have been made by M. Duclaux, and it is worth while to examine his results. If one were to ask himself, *à priori*, which kind of soil among those that prevail in the south-east of France offers the greatest difficulty to the movements of the Phylloxera, the answer which would inevitably suggest itself would be that the sandy varieties are the least permeable by it. A clayey soil offers, as observation proves no less than reason, great facilities to the passage of the insect, which is not hindered by its slippery nature when wet, for it can walk without difficulty up the vertical sides of a glass bottle. Such a soil cracks everywhere in drying, and forms fissures in all directions, vertical and horizontal, thus laying bare the roots of the vines in many places; moreover, the digging and dressing of the vine leaves the soil in lumps about the roots, separated by numerous chinks which afford every facility to the passage of the insect. A calcareous soil generally resembles a clayey one with respect to the means it affords for the movements of the Phylloxera; it is only when the limestone it contains is disseminated through it in the shape of sand or small gravel that a calcareous soil at all resembles in its properties a sandy formation. This latter kind it is, which, being always dry, always well settled, constantly enveloping the roots on all sides, puts great obstacles in the way of the circulation of the insect, which can find no chinks large enough for its purposes underground, while on the surface it gets entangled in its movements like a fly in a dish of honey. A soil formed of large pebbles cemented together with clay will not, however, be favourable to the Phylloxera, for it does not crack like the purely argillaceous formation; and though the vine, which can push its way everywhere, does so there also, the insect cannot. A very little clay more or less serves to give very different properties to the earth from the point of view of the Phylloxera, and hence it is that one can explain a phenomenon often noticed, namely, a small portion of a vineyard remaining in a flourishing condition in the midst of general decay. A close examination of the soil in these cases removes all cause for wonder, for a lump of damp earth taken from the diseased quarter and pressed between the fingers may be worked and moulded like dough, while a piece taken from the healthy part crumbles and is less tenacious. Were it otherwise at all doubtful, figures would show that the vines in the south-east of France are healthier or the reverse, according as the soil is less or more clayey. Thus a physical analysis of some earth taken from a vineyard of M. Faucon, at Graveson, where all but one little plot was subjected to the attacks of the Phylloxera, gives the following results:—

	Healthy part.	Diseased part.
Water	2·25	3·20
Nitrogen	0·11	0·12
Sulphate of calcium	0·62	0·42
Chloride of sodium	1·15	0·18
Carbonate of calcium	49·00	42·00
Siliceous sand	23·50	10·20
Clay	17·75	37·50
Organic substances and errors of analysis	5·62	6·38
	100·00	100·00

Among the different varieties of soil which are more or less favourable to it, the Phylloxera as one would suppose without observation shows traces of its presence in a poor dry and shallow soil first of all, then in clayey damp ground, and after that in calcareous tracts, according to the degree of difficulty which vines, planted in these soils, present to its operations; eventually, in the same way, the disease shows itself in other kinds of earth, with a rapidity or the reverse which is in proportion to the amount of strengthening juices which the vine can imbibe from them, and the obstacles which the insect meets with, till at last no vines are left intact but those which are planted on a soil impenetrable to the parasite. This phenomenon, if such it may be called, of the disease, will serve to explain, what we have already discussed in a former article (vol. x. p. 503), the spread of the disease in its earlier years, and the great and alarming increase of the extent of territory affected in 1867-1868. Regarding the observations just made, we can see that probably the Phylloxera was spread over the whole area of the two departments of Vaucluse and Bouches-du-Rhône, which in the two last-mentioned years were so formidably damaged in their vineyards, as early as 1865, when the disease only *appeared* on the plateau of Pujaut. The alternative hypothesis, that the disease radiated from a central point at Pujaut, presents great difficulties, as it does not allow sufficient time for the emigration of the insect to the points where it appeared in 1867-1868, while it makes it leave a district not in any way exhausted, disregarding the known habits of the Phylloxera. It would seem, therefore, that we may put aside any idea of a progressive irradiation of the disease around a single centre, and explain existing facts by attributing them to a general dissemination of Phylloxera, before 1866, over the territory lying along the valley of the Rhône, between the Drôme and the sea, though the insect only showed traces of its presence according to the nature of the soil in different parts, in some sooner, in others later. We may, indeed, regard it as almost certain that the disease began with the invasion before 1865 of a vast surface, in which different points have shown the traces of the insect's presence successively, and that from a cause analogous to that which shows us, when an island emerges from the sea, its highest peaks appearing first, the others afterwards, in the order of their altitude. By the use of this illustration, supplied by M. Duclaux, we can set before ourselves a graphic picture of the history of 1865, 1866, 1867, and 1868 in the vineyards of South-eastern France.

We will not dwell at any length on the different attempts at treatment of the disease, as they have more practical interest for those who live in vine-growing countries. Many of these attempts have been failures, owing to their having been based on false hypotheses as to the origin of the disease of the vine. When, in July 1868, M. Planchon discovered the Phylloxera, attention was naturally turned to the employment of insecticides, but the difficulty lies, not in the discovery of a substance fatal to the insects and harmless to the vine, but in its application underground to all the parts attacked. It was soon found that those insecticides, at least, which are insoluble in water, cannot be applied generally to the seat of the disease, and this fact led to the trial of immersion, in the hope that, instead of being like many remedies suggested, only partial, serving merely to delay the death of the vine, it would prove a radical means of cure. M. Faucon was the first practical vine-grower to employ immersion, as distinguished from the mere watering of the vine; but this method, though entirely successful in his case in the parts where it was applied, is obviously not capable of universal adoption. The physical conformation of the soil, the absence of a water-supply from any river, and the fact that the finest vines grow on slopes, which are not of course amenable to this treatment, to which we may add its great expense, except in very conveniently situated districts, make it only practicable over limited areas. The remedy, therefore, which is to eradicate the Phylloxera and restore to France her full supply of wine, the national drink and the great source of national material prosperity, is still undiscovered. Science throughout France is striving its utmost to discover the potent method of destruction of the Phylloxera, little doubting that some such there is. The thought of thinking minds engaged on this subject should be like that to which M. Faucon so eloquently gives utterance:—"When we feel that we are threatened, and see that we are already attacked, have we no other resource than feverish attempts, barren lamentations, or a resigned submission? Yet help never comes but to those who deserve it, and who, in wrestling with the plague by which they are attacked, are obeying, whatever bigoted minds may think of it, the strict call of duty—nay, we may say a command of heaven itself."

EARLY OPENING OF KEW GARDENS

OUR readers are no doubt aware that a movement has been set on foot for the earlier opening of Kew Gardens, a step which, if taken, would, we believe, wholly alter the character of that institution. It would, we feel assured, seriously interfere with all scientific work, and with the uses which we hope will one day be made of the gardens in the mornings by science schools. Moreover, we doubt if there exists any general desire for their early opening, and are inclined to believe that the movement is quite local in its origin and extent. On this subject we are glad to quote the remarks in a recent number of the *Economist*, both on account of their pertinency and force, and because we rejoice to see the true interests of science advocated by papers not professedly scientific :—

"The question has been mooted of late whether the Royal Botanic Gardens at Kew could not be opened to the public at an earlier hour than the present time of 1 p.m. A little reflection will enable those who ask this question to perceive that it can scarcely be answered in the affirmative without inflicting a serious injury on the real utility of the gardens and on the public service. In the first place, all the real work of the gardens has to be done during the hours when they are closed to the public. As it is, this time is barely long enough for the duties which have to be performed in it. To open the gardens in the morning would require a second staff of gardeners and workmen, as strong, or nearly so, as the existing one. Even with this extra assistance and this greatly increased cost, the work could not be as well executed as it is at present. In the next place, as the name of the gardens implies, they are *botanic* gardens. Besides those who ordinarily frequent the gardens for pleasure, there are many artists and scientific men who visit them for purposes of study; the only time when they can do this with advantage is before the general public are admitted.

"Of late the public has come in rushes of 12,000 to 60,000 in a day. If only 10,000 persons were in the gardens in the forenoon, all work would necessarily be at an end, and it would be impossible to maintain the existing character of the place. As it is, the Botanic Gardens at Kew are more accessible to visitors than any other public institution. Week days and Sundays alike the gates stand open. At the British Museum and the National Gallery—between the hours of opening which and the gardens at Kew comparisons have been drawn—there are many hours and even days when those institutions are necessarily closed to the public for purposes of cleaning, putting in order, and making good the results of the wear and tear of the enormous traffic. But if the heads of those institutions had, like the Director of the Royal Gardens at Kew, to *grow* what they exhibit, they would doubtless require many more close days than they do at present.

"Nor is it merely the work of maintaining the gardens and grounds in their present efficiency which has to be carried on in those hours during which the gates are closed to the public. It should not be forgotten that the Royal Gardens at Kew have performed services to the British Empire which no other public institution could undertake. The successful introduction of the Cinchona tree into India (a resource to that country the importance of which cannot be over-estimated), the efforts being made at the present time to procure fresh and improved coffee for Ceylon—to single out only two from a host of similar instances in which the Director of Kew Gardens has freely placed his botanical science and invaluable practical knowledge at the service of the public—will show how diversified and extensive the operations of the gardens are. To prevent these being carried out as they are at present, would be a serious injury to the public service. The present Director, Dr. Hooker, and his father, Sir W. T. Hooker, who held the same office before him, have done everything in their power, consistently with the proper maintenance of the gardens in due working order, to facilitate the use of them by the public generally; and in the interest of science as well as for the prosperity of the gardens, it is to be hoped that the public will see the desirableness of being satisfied with the present very ample allowance of opportunity for visiting the Botanic Gardens at Kew, and that they will not insist on acting over again the fable of the goose and the golden eggs for the sake of a little present pleasure."

THE GEOGRAPHICAL DISTRIBUTION OF AURORÆ

IN an interesting paper in Petermann's *Mittheilungen* for October, Prof. Fritz gives the results of his extensive researches on this subject. The investigation is beset with difficulties, not only from the deficiency of observations, but from their irregularity. While some observers content themselves with noting only the more remarkable displays, others register the faintest light to the north as an aurora. One observer continues his observations for tens of years, while another, whose zeal has been roused during a period of maximum frequency, allows it to cool when a minimum, with its rare and feeble displays, again returns. The research is further complicated by the fact that the appearance is not only dependent on latitude, but undergoes a periodic change, which in the region of most frequent display manifests itself less in diminished number than in diminished intensity of aurora; and because in some places the phenomenon is far more frequently concealed by a cloudy sky than in others.

As far as possible to eliminate these sources of error, Prof. Fritz compares the mean number of observations for any given place with the mean for mid-Europe between 46° and 55° lat. (or between the English and Scotch boundary and the Alps) for the same period, by the following formula :—

$$M = \frac{C}{172} \cdot \frac{B}{E} = 28\frac{B}{E}$$

where M is the mean calculated frequency for the given place, C the total number of aurora in the author's catalogue for mid-Europe from 1700 to 1871=4830, B the number of auroræ for the period of observation for the given place, and E the number from the author's catalogue for mid-Europe for the same period. Thus, for example, he calculates for Christiania :—

1837-1854	B = 529	E = 581	M = 25·5
1855-1870	B = 436	E = 568	M = 21·9
1837-1870	B = 965	E = 1,149	M = 23·3

As we have already remarked, a complete agreement of the different mean values is not to be expected, both on account of errors of observation, and from the various local influences of climate and situation. Professor Fritz gives tables of the numbers of observed auroræ, and calculated values of M for upwards of 200 places in Europe, Asia, and America; and from these, proceeds to lay down on a chart of the northern hemisphere a series of curves of equal frequency of auroral display, which he calls *isochasmen*. He discusses with great care the probable value of the observations, and lays down the curves so as to include on either side of them as many observations above as below the required value. But a few instances will make his method clearer than any description.

The zone M = 0·1 passes through the southernmost part of Spain, through Calabria, and just north of the south coast of the Black Sea, through the Sea of Aral and Lake Balkchash, south of Saghalien and the Kurile

Islands, north of the Sandwich Islands, through the southern point of California, through Mexico and Cuba, and just north of Madeira. In fact, through its whole course it lies just south of the isoclinic line of 60° inclination and between this and that of 50°; a fact forcibly illustrating Prof. Fritz's remark that the isochasmic curves lie nearly parallel to those of equal magnetic inclination. For this curve we have for the value of M in Madeira, Cadiz, Naples, Smyrna, Teneriffe, and Cuba 0·1, for the Azores 0·15, for Barnaul 0·7, and Nertschinsk 0·6.

It is well known that both in ancient and modern times polar lights have been seen occasionally south of this line, as for instance in the year 502 at Edessa, in 1097, 1098, and 1117 in Syria, in 1621 at Aleppo, and in 1872 over most of North Africa and India.

North of this line their frequency rapidly increases, and we have M = 1 beginning at Bordeaux, through Switzerland and north of Cracow, south of Moscow and Tobolsk, and north of Lake Baikal, through Udsk and the southern point of Kamtschatka, through northern California and the north of Florida. For the values of M for this zone we have for Perpignan, Marseilles, Bordeaux, La Rochelle, and Viviers, a mean of 1·1, for Moscow 1, for Tobolsk 0·9, Barnaul 0·7, and Sacramento 0·8. Singularly enough, probably from climatic or other local causes, the value of M for New Orleans is only 0·14.

The zone for M = 30 passes through the north coast of Ireland, through Scotland near Edinburgh, through the White Sea and the Gulf of Obi, where it attains a latitude of 70°, and then tends a little southward through Werchni, Kolymsk, and the Bay of Anadyr, near Sitcha, Cumberland House, Quebec, and the north coast of Nova Scotia, to the north coast of Ireland.

North of this the frequency of aurora rapidly increases. The zone of M = 100 passes through the Hebrides, Shetland, near Drontheim and Wardon, through Nova Zembla, across Behring's Straits, just south of the Arctic Circle, south of Lake Athabasca, through Hudson's Bay, and just north of Newfoundland.

Only a little further north we reach a zone of maximum frequency, beyond which the intensity of auroral display again declines, contrary to the old idea that its intensity increased up to the poles. This zone passes just north of Faroe and of the North Cape, through the northern part of Spitzbergen, and just north of the Siberian coast, near Point Barrow, Great Bear Lake, and Nain on the coast of Labrador. Iceland, Spitzbergen, and Greenland lie considerably to the north of this zone, and auroræ are not there so frequent, nor especially so brilliant as at Faroe, the north coast of Norway, and Labrador. Of this Prof. Fritz adduces much evidence, and in addition draws attention to the important fact, that while south of this zone of maximum frequency the arches are generally north of the observer, from the north of it they appear to the south, and upon it, indifferently, north, south, or overhead.

It will be noticed that the system of curves tends strongly southward in North America, while in the Atlantic and Pacific Oceans the curves pass rapidly northward and reach their highest latitudes in Central Asia. This is borne out by the fact that the great auroræ of Aug. 28 and Sept. 1, 1859, were not noted in the meteorological registers either of Nertschinsk, Barnaul, or Jekaterinburg, nor were they seen at Tigris in Yozgat (39° N.), Mosul (36° N.), or Kharput (33° N.); whilst in the Atlantic Ocean they were visible at least to 12° N., in Africa to St. George del Mina (28° N.), and in America during the maximum they were frequently observed in the Antilles (20° N.)

The geographical extent of great displays of polar lights is very significant. That of Sept. 1, 1859, was visible in the Sandwich Islands (20° N.), Sacramento (20° N.), San Salvador (13° N.), in the whole Atlantic Ocean to 12° N., in Western Africa to 14° N., and in the whole of Europe. At the same time the southern lights were seen in Australia, South America to 33° S., and in the Indian Ocean to 39° S.

For the southern hemisphere there are as yet too few observations to calculate the distribution as has been done for the north. For Hobarton (43° S.) M = 6, and for Melbourne 15. In low latitudes they have been seen at Cusco (12° S.) in 1744, at Rio Janeiro (23° S.), 1783, at Bloemfontein (29° S.), and Vaal-Fluss (28° S.); in Africa and at Réunion and Mauritius in 1870 and 1872.

Dr. Fritz remarks that his zone of greatest frequency nearly coincides with that given by Muncke (in "Gehler's Wörterbuch), and that the whole curve-system has great similarity to the zone-system of Loomis in *Silliman's Journal*, vol. xxx. The curves cut the magnetic meridians in most places at right angles, and are very similar to the isoclinic curves constructed by Hansteen in 1780, while they noticeably deviate in places from those of Sabine of 1840, and approximate, at least in the best determined portions in East America, the Atlantic Ocean, and Europe, with the isobaric curves of Schouw. It may here be remarked that the curves of increasing frequency in the Atlantic Ocean tend towards the point of lowest barometric presure.

It is also noticeable that throughout the greater part of the northern hemisphere the curves tend to follow the form of the continents, and the limits of perpetual ice which depend upon it; and Prof. Fritz points out that in mean latitudes the magnetic meridians and the direction of visibility of the aurora are coincident, and are mostly (viz., from the Atlantic Ocean to the Asiatic Icy Sea) normal to the limit of ice. The greatest deviations from this rule exist in places where the ice-limit is most irregular, as, for instance, in Hudson's Bay and the Gulf of Labrador. It may here be noted that at Fort Franklin, Fort Normann, and Wardoehus the northern lights begin in spring to be seen most frequently in the south at the same time as the ice-limit deviates furthest in the same direction. At Bossekop, according to the report of the Scientific Commission, the northern appearances are to the southern ones as 3·6 to 1 during the four last months of the year, but only as 2 to 1 in spring. Wrangel, from his observations on the coast of the Arctic Ocean, concludes that the freezing of the sea is favourable to aurora; but remarks that in the east of Asia the appearance is more frequent as the coast is approached, and is most so during the increasing cold of November, while it becomes rarer in January, when the coast ice extends further to the northward. M'Clintock notices that aurora was most frequently visible when water was in sight; and Hayes, that it was more frequently seen in the direction of some piece of open water than of the magnetic north. These observations would rather support a belief common in Scotland that the frequency of the aurora varies with increase and decrease of the Greenland ice, and render it probable, at least, that ice-formation is one of the most prominent local influences by which auroral distribution is affected. It seems not unlikely that the neighbourhood of the Alps may influence the frequent displays in North Italy. These and other points, however, require more systematic observation, and it is especially desirable that some notice should be taken of the relative intensity of different displays. H. R. P.

EDWIN LANKESTER, M.D., F.R.S.

IT is with great regret that we have to announce the death, from diabetes, on Friday last (October 30), at Margate, of Dr. Lankester, the Coroner for Central Middlesex.

Dr. Lankester was born April 23, 1814, at Melton, near Woodbridge, in Suffolk, at which latter town he received his early education and commenced his medical studies. In 1834 he entered University College, London, as a medical student, and took the membership of the College of Surgeons, as well as the licentiateship of the Apothecaries' Society, in 1837. In the year 1839 he graduated at Heidelberg, and was appointed lecturer on Materia Medica at St. George's School of Medicine four years later. In 1845 he was elected to the Fellowship of the Royal Society, and five years afterwards became Professor of Natural History in New College, London. In 1851 he received the degree of LL.D. from Amherst, U.S.; in 1853 was made lecturer on Anatomy and Physiology at the Grosvenor-place School of Medicine; in 1858, Superintendent of the Food Collection, and in 1862 Examiner in Botany to the Science and Art Department of the South Kensington Museum. In 1859 he was President of the Microscopical Society, and in 1862 he was, after a severe contest, elected Coroner for Central Middlesex, which post he retained until his death.

For about twenty-five years Dr. Lankester was secretary of Section D of the British Association, of which he was one of the originators, being a most intimate friend of Edward Forbes, with whom, in his younger days, as a bachelor, he lodged in London. In conjunction with Mr. Busk, he for eighteen years edited the *Quarterly Journal of Microscopic Science*, after which he did so with his son, Mr. E. Ray Lankester, Fellow of Exeter College, Oxford.

Dr. Lankester's contributions to scientific and medical literature are very considerable. He edited the Natural History portion of the "English Encyclopædia," and contributed the article "Rotifera" to Todd's "Encyclopædia of Anatomy and Physiology." In 1849 he published a translation of Schleiden's "Principles of Scientific Botany," and, in 1859, of Kirchenmeister's "Animal Parasites." In conjunction with Dr. Letheby he contributed the article on Sanitary Science to the "Encyclopædia Britannica." Among his most popular works is the well-known "Half-hours with the Miscroscope." His contributions to this journal have been several, and, like all that he wrote, are marked by their admirable style and tone, as well as by the liberal spirit of modern scientific thought, which gives them an almost youthful freshness; we have, not less than others, to deplore the loss that has been sustained by ourselves in his premature decease.

To those who, like the present writer, were acquainted with him, and had the privilege of passing many pleasant hours in his company, Dr. Lankester was always genial and kindly, inspiring others with that hopefulness which was so marked a feature of his own character. He made many sincere friends, amongst whom was Henfrey the botanist, who named the genus of plants (which is grown in many nursery gardens) *Lankesteria*, after him. It was his kindly spirit which directed his attention to questions of social organisation, and he always referred to the articles by himself, in the *Daily News*—when a young man—on Medical Reform, as having been of assistance in the passing of Mr. Wakley's bill. His remains were interred in the churchyard of Hampstead Church on Tuesday last.

NOTES

NEWS concerning three of the Transit Expeditions is to hand. Advices from Capetown of Oct. 6 state that the German screw corvette *Gazelle*, bound to Kerguelen on the Transit Expedition, arrived in Table Bay and left on Oct. 4. The *Gazelle* will visit the Crozette Islands, and proceed from thence to Kerguelen. If circumstances are favourable she will search for a warm current, supposed to exist between 60 and 80 east, and endeavour to reach Wilkes Land. She will then visit the north and west coast of Australia, the coast of Guinea, and several island groups of the Pacific. Lord Lindsay had arrived out and left for Mauritius in his yacht, there to watch the transit of Venus. A Cairo correspondent of the *Daily News*, writing under date Oct. 20, sends a long account of the preparations made by the Egyptian party. General Stanton, the Consul-General, has taken the greatest interest in the expedition, and put himself to considerable trouble to make everything smooth for the party and enable them to make all the necessary arrangements. All the instruments have arrived safely, and Capt. Browne, the chief of the party, has determined to erect his observatories on the top of the Moquattam Hills, a distance of about three miles in a direct line from Shepheard's hotel. They are about 600 feet in height and overlook the whole country. Capt. Browne, who has been carefully observing the atmosphere, finds it free of moisture, at least about sunrise; which is most important, as the maximum altitude that will be observed will be only 15°. It is at present the intention to form a camp on the top of the hill, the tents having been furnished by the Egyptian Government. Mr. Dixon, a civil engineer in Cairo, has been of great assistance in the matter of transit. Capt. Abney was expected to leave for Thebes on the 26th. Admiral Ommaney had arrived at Alexandria, but to what party he would be attached was not known.

THE generally well-informed London correspondent of the *Scotsman* states that another Arctic Expedition will be despatched in the ensuing year under the auspices of the Government and the Royal Geographical Society. He believes that it is so far considered an accepted fact that the expedition will leave these shores in the spring of 1875, inasmuch as it has the approval of the Premier.

SOME time since we pointed out the extreme inconvenience of the form and manner in which our learned societies publish their "Transactions." Anyone who is not a Fellow, for example, of the Royal Society, and who may wish to possess a memoir, say on some physiological subject published in the "Philosophical Transactions," is probably debarred from doing so by finding that he must purchase with the memoir which he wants a number of others belonging to the most diverse subjects, pure mathematics being almost invariably one. We advocated, as the common-sense remedy for this state of things, the sale of separate copies of each memoir. We were not aware at the time that this was actually done by the Linnean Society. After the completion of the twenty-sixth volume of its "Transactions," it was decided by the Council that twenty-five separate copies of each memoir should be kept for sale. Probably because the arrangement is not generally known, the sale of the part of the "Transactions" is still as good, if not actually better than that of the memoirs which they contain. The price is, however, proportionally higher, which may have something to do with this. Thus the part of the "Transactions" containing Prof. Owen's memoir on the King Crab is sold to Fellows for 9*s.*, to the public for 12*s*. The corresponding prices of the memoir itself (of which no separate copies have been sold) are 7*s.* 6*d.* and 10*s*. But the part also contains another paper, the prices of which are 4*s.* 6*d.* and 6*s*. In one case all the available spare copies were purchased by the author.

WE are glad to be able to announce that a considerable portion of the galleries of the late International Exhibition at South Kensington, taken by the India Office, will be devoted to the display of Natural History collections of that department of the Government. The fact of the collections having been kept in an unavailable form for so many years past has always been a great grievance to working naturalists, and has called forth many remonstrances, from ourselves among others.

MR. RICHARD LYDEKKER, B.A., of Trinity College, Cambridge, second in the First Class of Natural Sciences Tripos in 1871, has been appointed to the Palæontological Department of the Geological Survey of India in the room of the late Dr. Stoliczka. Mr. Lydekker left some months since for India, in company with some friends, their expedition having the combined objects in view of sporting and the pursuit of natural history, and has passed most of the interval in Cashmere and Thibet, where he is believed to have made very considerable collections—zoological, botanical, and geological.

MR. MARTIN, Senior in the Natural Science Tripos of 1873, was last week elected to a Fellowship at Christ's College, Cambridge.

GODFREY'S Laboratory, Maiden Lane, Strand, in which the Hon. Robert Boyle worked out his phosphorus experiments, has been converted into a Roman Catholic chapel.

SOME of the Paris newspapers announced that M. Wurtz, Dean of the Faculty of Medicine at Paris, would be obliged to resign; the *Figaro* went so far as to give the name of the intended successor of the celebrated Professor of Chemistry —a M. Depaul. The rumour happily has proved false, and was maliciously spread because a clerk employed in the office of the Faculty had been dismissed for misdemeanour. There is, however, to be a demonstration among the students in honour of M. Wurtz, who is a great favourite with them.

THE Professorship of Applied Mathematics and Mechanism in the Royal College of Science for Ireland (Science and Art Department), vacant by the appointment of R. Ball, LL.D., F.R.S., to the Professorship of Astronomy in the Dublin University, has been filled by the appointment of H. Hennessey, F.R.S.

DR. JAMES APJOHN, F.R.S., has resigned the Professorship of Chemistry in the School of Physic attached to Trinity College, Dublin. Dr. Apjohn still holds the Professorships of Applied Chemistry and of Mineralogy in the University of Dublin. The Provost and Senior Fellows of Trinity College, Dublin, will, pursuant to the School of Physic (Ireland) Act, proceed on the 30th of January, 1875, to elect a Professor of Chemistry. There is a fixed salary of 400*l*. a year, with an additional payment of 100*l*. a year on condition that a number of Senior Sophisters nominated by the Bursar shall have free laboratory instruction. In addition the Professor has the fees for lectures and laboratory instruction, which ought to equal, at the lowest calculation, 400*l*. a year. The Professor will have the use of the college laboratory for analyses bearing on medical chemistry, such as medical and medico-legal investigations, and analyses connected with purposes of public health. Candidates are required to send their names, with the places of their education, the Universities where they have taken their medical degrees, and the places where they have practised, to the Registrar of Trinity College, Dublin, and to the Registrars of the King and Queen's College of Physicians in Ireland, Kildare Street, Dublin, on or before the 23rd of January, 1875.

IN accordance with the wishes of the Professors of the Medical School of Trinity College, Dublin, the Provost and Senior Fellows have resolved that a three months' course of practical instruction in Human Histology shall be added to the curriculum for the degree of M.B., the same to be under the superintendence of Dr. Purser, King's Professor of the Institutes of Medicine. 110*l*. has been voted to buy twenty microscopes, and we presume a room will soon be built for the purpose.

THE competitive system is making daily progress in France Four *Commissaires de Police* being required, the Prefect of the Seine instituted a competition among the police-secretaries, and fourteen candidates offered themselves. A committee of examiners was appointed, the examinations have been held, and the candidates are awaiting the result, which will be issued very shortly. Up to the present time *Commissaires de Police* have been appointed at the discretion of the Prefect, only from amongst gentlemen holding the diploma of Licentiate in Law, and secretaries of police are obliged to possess that qualification before being admitted to the examination.

EACH year the five Paris Academies—the Academy of Sciences, the Academy of Fine Arts, the Academy of Inscriptions, the Academy of Moral Sciences, and the French Academy —hold a general meeting on the 25th of October, the anniversary of 3 Brumaire, an. IV. (25th October, 1795), the day when the French Republic published the law organising the National Institute. During the Restoration the meeting was held yearly on the 24th April, the day when King Louis XVIII. returned to France, with the foreign troops, after the battle of Waterloo. When the Republic was proclaimed in 1848, a decree changed the date of the annual celebration to the 25th October; but when Napoleon III. accomplished his *coup d'état*, he appointed the 19th of August, which was continued to be the date to 1870. The Republic being again proclaimed, the celebration was restored to the 25th of October. Each Academy or Class of the Institute appoints successively the president of the meeting. The turn of the Academy of Sciences having come round this year, M. Bertrand, who is the president in charge, was the chairman of the whole Institute. His being a candidate for the perpetual secretaryship has given much interest to his presidential address, which was printed at full length in all the papers, and largely approved.

THE Prefect of the Seine has appointed a Commission to inquire into the state of lightning conductors—which are in a very imperfect condition on some public buildings—and the best method of testing their efficacy. The institution of this Commission appears to have been suggested by the corresponding committee which was appointed by the British Association, and which existed during two years without any result. It is to be hoped that the Parisian Commissioners will be more successful.

THE Municipal Council of Paris will very likely ask from the Government an authorisation to establish industrial schools in that city.

AT a meeting held a year ago in Islington, a large number of influential gentlemen were appointed a committee to obtain for that large and important district a Public Library and Museum, under the "Public Libraries and Museums Act." A requisition to the vestry and overseers of the parish was circulated for signature, and the scheme has, we believe, met with general approval, so that we hope soon to see it carried into effect.

M. FAYE has officially announced himself a candidate for the post of Perpetual Secretary of the Academy of Sciences, but the chances of M. Bertrand do not appear to have been greatly altered.

THERE will be an examination at Sidney College, Cambridge, on Tuesday, April 6, 1875, and three following days, of students intending to commence residence in the following October, when (provided fit candidates present themselves) two scholarships will be awarded for natural science, one of the value of 60*l*., and one of the value of 40*l*. The scholarships will be tenable, under certain conditions, until the time of taking the B.A. degree, or until promotion of others to greater value.

A COPY of the cœlometer, an instrument invented by Mr. W. Marsham Adams, B.A., late Fellow of New College, Oxford, for the purpose of illustrating elementary astronomy, is to be placed in the Examining Department of the Board of Trade at Tower Hill, and also on board her Majesty's training-ship *Conway*, at Birkenhead. Rear-Admiral Sir A. Cooper Key has we believe, signified his intention of applying to the Admiralty for leave to purchase one for the Naval College at Greenwich, of which he is the president.

WE have just received a paper by Dr. Pietro Pavesi, Professor of Zoology and Comparative Anatomy in the University of Genoa, entitled "Contribuzione alla storia naturale del genere Selaché," in which that naturalist shows that the Rashleigh Shark (*Polysprosopus rashleighanus*) and the Broad-headed Gazer (*P. macer*), described as British by Mr. Crouch in his work on the fishes of our seas, are not, as Dr. Günther suggests in his valuable Catalogue of Fishes in the British Museum, monstrosities of *Selache maxima*, but belong to a species found in the Mediterranean, *Selache rostrata* (Macri), in which the eyes are situated at the base of the elongate, narrow, nasal snout, instead of near the point of the short snout, as they are in *S. maxima*.

WE have received a little book with a very long title, published by Messrs. Ward, Lock, and Tyler. It is called "Arcadian Walks and Drives in the North-west Suburbs of London, for the Pedestrian, Carriage, Horse, and Bicycle," and contains a variety of hygienic and other hints to pedestrians, and forty-two schemes of walks and drives in the north-west district, together with notes on the fauna, botany, &c., of the localities visited. This "booklet" would be much improved and rendered more generally useful by the addition of a map.

A GREAT deal of interest is attached to the last report of Dr. King, the superintendent of the Calcutta Botanic Gardens, for, besides the usual details as to the exchange of plants and seeds with the Royal Gardens at Kew, and other similar colonial and foreign establishments—which exchange, by the way, has not been a light affair, inasmuch as from April 1873 to March 1874, 12,812 plants and 2,532 parcels of seeds were sent to various parts of the world—we have satisfactory accounts of the cultivation of the mahogany tree, the ipecacuanha, and the Para rubber tree. The former, as is well known, is a native of Central America and the West Indies; but there are, as Dr. King tells us, a good many old mahogany trees about Calcutta, which, however, rarely if ever yield perfect seed, so that fresh plants have been obtained direct from their native country. He says, further, that "it has been abundantly proved that the tree will thrive in most parts of Bengal, and that the Indian grown timber is valuable." There are fine mahogany trees in the gardens at Saharunpore and Madras, and Dr. King doubts not that it will grow admirably in almost any part of India in situations free from frost, and where a little moisture can be secured in very dry weather. Of the few trees that were left in the Calcutta Botanic Gardens after the last cyclone in 1867, the mahoganies are by far the finest; they were planted about eight years since, and are now from 8 to 11½ ft. in circumference, 6 ft. from the ground. The quality of the wood of some of the trees blown down in the cyclones of 1864 and 1867 was found to be excellent. Such, then, are the prospects of the successful acclimatisation of one of the most valuable furniture woods known: so valuable indeed is it in European commerce, that about 40,000 tons are annually imported into Great Britain from Honduras, Jamaica, and San Domingo. So far as the increase of the ipecacuanha plants is concerned, the propagation by root and leaf-cuttings has been so successful that there is at present a stock of 63,000 living plants; whereas only four years since there were but twelve cuttings at the Cinchona Gardens, and seven out of these twelve were afterwards accidentally destroyed. Then again, with regard to the most valuable of all the india-rubber producing plants, namely, that of Para—the *Hevea brasiliensis*—six plants of which Dr. King took with him from Kew on his return to India in November last, we are told that already a few plants have been raised from cuttings taken from these six plants, and before the lapse of another year Dr. King hopes "to be able to report a considerable increase." The advantages to be obtained by the successful introduction of these trees into India are many, for besides the great superiority of the rubber over that obtained from the East Indian figs, the principal of which is *Ficus elastica*, and consequently a higher market value, it will add to the Indian revenue by establishing a course of regular industry by a systematic tapping of the trees, and it will perhaps, to some extent, relieve the figs from a continued strain upon them, and probable future exhaustion.

IN a recently issued report on the trade and commerce of Java, we read that the total amount of Cinchona trees of all sizes and ages growing in Government plantations at the end of 1872 was 1,705,542, and the bark crop for the same year amounted to 18,000 kilogrammes.

IT has recently been discovered that the bamboo contains a dangerous poison which the natives of Java extract from the cane in the following manner. The cane is cut at each joint, and in the cavity is found a certain quantity of small fibrous matter of a black colour, which is covered with an almost imperceptible coating of tissue which contains the poison. If swallowed the filaments do not pass into the stomach, but remain in the throat and produce violent inflammation and ultimately death. Experiments are to be made with various kinds of bamboo, to test the existence and nature of this alleged poison.

THE Syndicate appointed last June to collect information as to the space and accommodation required for a new Geological Museum have issued their report. They consulted the present Professor of Geology (Mr. Hughes), who considers it desirable that a very much larger number of specimens should be exhibited under glass than is the case at present; that there should be larger intervals in the arrangement of the collection; that more ample accommodation should be provided for students wishing to work at special points in detail, and for lecturers who wish to bring a class or private pupils; that work-rooms, class-rooms, and library, together with private rooms for the Professor and a Palæontologist, which are wholly wanting at present, should be provided. The estimated space for the museum and necessary offices would be 31,700 square feet. The Syndicate do not regard the estimate as excessive, and there is no difficulty respecting a site, as the ground of the old botanic garden affords one of sufficient dimensions in proximity to the other museums of natural science. The sum of 10,500*l.*, which has up to the present time been subscribed towards a new museum as a memorial to Professor Sedgwick, would be far from sufficient for the erection of a museum such as is indicated by Professor Hughes. The cost of such a museum, with suitable fittings and furniture for every department, could not be estimated at less than 25,000*l.* The Syndicate do not consider by the terms of their appointment that they are called upon to suggest any source from which this sum can be supplied.

THE "Origin of Species" controversy has been resumed by M. Blanchard, a member of the French Institute, in the *Revue des deux Mondes*. The learned naturalist supports strong anti-Darwinian theories.

A TELEGRAM from St. Petersburg has been received at Paris, stating that the Imperial Commission appointed to survey the Sea of Aral has finished its work. The level of that large inland sea is about 165 ft. above that of the ocean.

THE signature to the letter on "Supernumerary Rainbow," in NATURE, vol. x. p. 503, should not be Joseph, but Hugh Blackburn.

THE additions to the Zoological Society's Gardens during the past week include a Bonnet Monkey (*Macacus radiatus*) from India, presented by Mr. S. T. Hughes; a Black-backed Piping Crow (*Gymnorhina leuconota*) from South Australia, presented by Mr. F. Fuller; a Speckled Terrapen (*Clemmys guttata*) from North America, presented by Mr. A. B. Duncan; a White Stork (*Ciconia alba*), two Thicknees (*Œdicnemus crepitans*), European, deposited.

SCIENTIFIC SERIALS

THE *Journal of Mental Science*, October 1874.—This number opens with the address of Thomas Laws Rogers, M.D., president at the annual meeting of the Medico-Psychological Association, Aug. 6, 1874. His object was to procure a fixed meaning for the terms "restraint" and "seclusion," and the clear sense and practical aim of his remarks present a sharp contrast to the rather wandering discussion which followed.—Dr. J. Batty Tuke has a paper on a case in which the clinical history and *post-mortem* examination will, he thinks, support its being designated one of syphilitic insanity.—Dr. Daniel Hack Tuke writes about the Hermit of Red-Coat's Green, and finds him insane, an opinion from which there is little room for dissent. Probably also it would have been well had he individually "been put under the protection of the Lord Chancellor and the inspection of his visitors;" it "would have been better for the neighbourhood, better for his family, and better for the Hermit of Red-Coat's Green himself." But could not those very considerations be urged, and often with greater force, in favour of a curtailment of the liberty of thousands of frivolous, reckless, immoral persons, who are a far greater pest to their family and neighbourhood than poor Lucas was after he became the hermit?—Dr. H. Hayes Newington contributes a thoughtful paper On different forms of stupor.—In an interesting article on the mental aspects of ordinary disease, Dr. J. Milner Fothergill obtrudes his materialism in a way that will be distasteful to many, while to others the thing itself will appear shallow. Thought "is the product of the combustion of what was originally food." The brain of "Robbie Burns transmuted his oatmeal porridge into Tam O'Shanter."—In reviewing Dr. Maudsley's "Responsibility in Mental Disease," Mr. J. Burchell Spring, chaplain to the Bristol Lunatic Asylum, while doing justice to the ability of the work, seems to have the advantage of the author in matters of history. He very cleverly cuts away the ground from under Dr. Maudsley's rather uncalled-for assertion that the brutal treatment of the insane "had its origin in the dark ages of Christian superstition."

Journal de Physique, tome iii., No. 33, September.—This number commences with a description of the "phonoptometer" by M. J. Lissajous. This apparatus consists of an ordinary terrestrial telescope, of which the eye-piece is broken across, and the third lens from the eye (the one which inverts the image formed by the objective) attached to the prong of a tuning-fork. The lens is thus capable of vibrating in a vertical plane, the vibrations of the fork being maintained by an electro-magnet and contact-breaker. The telescope being directed to a distant object presenting a brilliant point, and the electro-magnet put into action, the point becomes a luminous vertical line if at rest, but if vibrating in a direction transverse to that of the motion of the lens, then the composition of the two movements gives rise to the well-known optical sound figures. The author claims for this ingenious instrument the power of determining the velocity of a luminous point on its trajectory, such as luminous projectiles, bolides, &c.—Theory of the phenomena of diffraction observed to infinity or in the focus of a lens, by M. J. Joubert.—On the mutual influence which two bodies vibrating in unison exercise upon one another, by M. A. Gripon. The author describes several experiments illustrating this remarkable action, employing for the purpose collodion membranes, which vibrate in unison with the column of air in the resonance boxes of tuning-forks, organ-pipes, &c. A small pendulum composed of a pith ball suspended by a thread of cotton is attached to such a membrane, and the system is then brought near the resonant case of a vibrating fork, with which the membrane is capable of vibrating in unison. The membrane vibrates strongly when at a distance of one metre, but when brought to within four or five centimetres of the mouth of the case, the sound of the latter undergoes a considerable weakening, and the pendulum of the membrane is scarcely moved. If the vibrations of the fork have but small amplitude, the proximity of the membrane to the resonant case extinguishes the sound altogether. None of these effects are produced if the membrane is not capable of vibrating in unison with the fork. If a membrane of a lower note is placed in front of the case and a current of warm air directed upon it, the weakening of the sound only occurs when the note of the fork is reached. Arrangements for repeating the experiments with organ-pipes are also described.—Graphic representation of the constants of voltaic elements, by M. A. Crova.—Some experiments concerning the effects of magnetism on the electric discharge through a rarefied gas when the discharge occurs in the prolongation of the axis of the magnet, by MM. Auguste De la Rive and Edouard Sarasin. The authors employed in this research a columnar electro-magnet. The tube through which the discharge is transmitted rests on the upper extremity of the magnet, the line of electrodes being a prolongation of the axis of the magnet. Various gases sealed up in Geissler tubes have been experimented with, the discharge from a Ruhmkorff coil being allowed to traverse the gas. Changes occur in the appearance of the luminous discharge where the magnet is excited, these changes being accompanied by a change in the resistance offered to the current by the gas. Thus a tube containing hydrogen permitted the passage of an induced current marking 25° on the galvanometer when the magnet was not excited, but when excited the galvanometer reading was 40°. It seems to be a law that the augmentation in the intensity of the current is greater with a gas which is a good conductor than with one which is an inferior conductor of electricity. The authors confine themselves in this paper to a description of the facts without entering into theoretical considerations.—The number concludes with three papers reprinted from *Poggendorff's Annalen*: On the stroboscopic determination of the intensity of sounds, by E. Mach; Researches on magnetisation, by Holz; O. E. Meyer and F. Springmuhl, On the internal friction of gases.

Zeitschrift der Œsterreichischen Gesellschaft für Meteorologie, Oct. 15.—In an article on the state of development or forwardness of vegetation in Italy compared with that of Giessen, in Germany, Prof. H. Hoffmann expresses his regret that for the greater part of Italy we possess no observations of the kind to which he wishes to direct attention. A knowledge of the relative state of vegetation at many different places would help invalids to the choice of a residence congenial to them, and dispel the false estimates of Italian climate now so common. In the course of a rapid visit to Italy in March and April, 1874, he took a number of observations, and compared them on his return to Giessen with like observations simultaneously taken at that place. The weather was fortunately fine and fairly uniform over Central and Southern Europe during the period of his travels. The average state of vegetation in open situations can be roughly calculated under normal conditions by reckoning for every degree southwards an advance of $3\frac{3}{4}$ days. Direct observation shows this rule generally to hold good. Rome is 8° south of Giessen, Naples 9°; this gives, at the rate above mentioned, an advance for Rome of 30, for Naples of 34 days. On looking at the map which accompanies Prof. Hoffmann's paper, we find the real difference to have been for Naples 35, for Rome 23; and so with many other places in Italy. If we have the number of days' advance in the spring, by doubling it we obtain the relative length of summer, or the period of vegetation. The Riviera di Porrente is quite abnormal, having a warm and early spring. Prof. Hoffmann's method consisted in taking the mean of the number of days' advance before Giessen, of the bursting into leaf or flower of several common kinds of trees in a certain place, and making this number the criterion of climate. In conclusion, he affirms that the extended observation of a single species of tree in the above manner, with regard also to the time of first fruits, would give us a new insight into comparative climatology, and that after various species had been so dealt with, maps might be made, exhibiting for each month a fair example in the development of one of these species. A list of the plants observed is appended. Among the *Kleinere Mittheilungen*, in a communication from Dr. Hildebrandtson, director of the Meteorological Department of Upsala Observatory, we find that he arrives at results similar to those of Mr. Ley respecting the movements of cirrus, this cloud appearing to move away from the centre of a cyclone and towards the centre of an anticyclone.

SOCIETIES AND ACADEMIES

MANCHESTER

Literary and Philosophical Society, Oct. 20.—Edward Schunck, F.R.S., president, in the chair.—E. W. Binney, F.R.S., stated that he had been so fortunate as to find a specimen of *Stigmaria* which he exhibited to the Society, from the bullion coal at Clough Head, near Burnley, having the medulla perfectly preserved.—Mr. R. D. Darbishire, F.G.S., exhibited and described the Palæolithic (French and English drift) implements collected for the *soirée* at the Owens College.—Prof. Boyd Dawkins, F.R.S., brought before the notice of the Society the conditions under which the palæolithic implements are found in the river-strata and in the caves, in association with the extinct mammalia, such as the mammoth and woolly rhinoceros. Although the number of flint implements from the river-strata in various collections was very great, yet it is small when viewed in connection with the enormous quantity of gravel removed in their discovery. They are not evenly distributed, but cluster round certain spots. Their discovery in India along with the extinct mammalia proves that man was living, both in Europe and in Southern Asia from the Ganges to Ceylon, in the same rude uncivilised state, *at the same time* in the life-history of the earth. He also called attention to the art of the hunters of the reindeer and mammoth in the south of France, Belgium, and Switzerland, an art eminently realistic, and by no means despicable; and he inferred from their art and implements and the associated animals that they may be represented at the present day by the Eskimos.—On a colorimetric method of determining iron in waters, by Mr. Thomas Carnelly, B.Sc.; communicated by Prof. H. E. Roscoe, F.R.S.

PHILADELPHIA

Academy of Natural Sciences, June 23.—Dr. Ruschenberger, president, in the chair.—Mr. B. Waterhouse Hawkins gave his views on the construction of the pelvis of Hadrosaurus.—Prof. Cope described a species of Dipnoan fish of the genus Ctenodus, from the coal measures of Ohio.

June 30.—Dr. Ruschenberger, president, in the chair.—Anatomical notes by Dr. Chapman were read, On the disposition of the Latissimus Dorsi, &c., in *Ateles geoffroyi* and *Macacus rhesus*, and On the Flexor Brevis Digitorum in *Ateles geoffroyi*.

On report of the committee to which it was referred, the following paper was ordered to be published:—"On habits of some American species of birds," by Thomas G. Gentry.

July 7.—Dr. Ruschenberger, president, in the chair.—Prof. Persifor Frazer, jun., continued the account of his attempts to reconcile the results of the analyses of minerals by the best chemists with formulas which were constructed on the doctrine of quantivalence, *i.e.*, the known atom-saturating power of the elements.—On change of habit in *Smilacina bifolia*. Mr. Thomas Meehan stated that he had recently seen a case where the stolons had advanced from the ground, and up the trunk of a large chestnut tree, to the height of about 2 ft.; the original stolons for several years back having died away, and the plant taken in a purely epiphytal character. The roots and stolons mostly had penetrated the coarse rough bark of the chestnut tree, the leaves only being chiefly visible.

July 14.—Dr. Ruschenberger, president, in the chair.—Prof. Cope stated that the snakes of the genus *Storeria*, B. and G., are viviparous like *Eutænia* and other tropidonotine genera to which they are allied.—Prof. Cope gave a synopsis of the result of his work in connection with Hayden's United States Geological Survey of the Territories during the season of 1873. He stated that the investigation covered principally the palæontology of the Cretaceous, Eocene, Miocene, and Pliocene periods in Colorado. The whole number of species of vertebrata obtained was 150, of which 95 were at the time new to science. The Cretaceous species were both terrestrial and marine, and the Miocene were most numerous. These numbered 75 species, of which 57 were new.

PARIS

Academy of Sciences, Oct. 19.—M. Bertrand in the chair.—The following papers were read:—On series of similar triangles, by M. Chasles.—Observation of the solar eclipse of Oct. 10, 1874, with the spectroscope; tables of the observations of solar prominences from Dec. 26, 1873, to Aug. 2, 1874, by P. Secchi.—On the dissociation of hydrated salts, by M. H. Debray. This is a reclamation of results published by M. G. Wiedermann in a memoir "On the dissociation of the hydrated sulphates of the magnesian group."—On magnetic condensation n soft iron, by M. A. Lallemand. The author describes a series of experiments illustrating this property of soft iron. The condensation appears to depend on the intensity of the magnetism developed in the iron.—Hypothesis of the imponderable ether, and on the origin of matter, by M. Martha-Beker.—On the distribution of the sugar and mineral principles in beet, by M. Ch. Violette. The author has arrived at the following conclusions:—1. The proportions of sugar contained in the sacchariferous and cellular tissues of beet differ but little. 2. The sugar increases in arithmetical progression along the axis of the root, from the upper extremity to the tip. 3. The mineral constituents do not undergo any regular variation along the axis, but chlorides are more abundant towards the upper extremity than at the tip. 4. Mineral constituents are more abundant in the cellular than in the sacchariferous tissues. 5. Chlorides are considerably more abundant in the cellular than in the sacchariferous tissues. 6. The chlorides are more liable to variation in the two kinds of tissues than the other mineral principles.—Experiments on the circular compass made on board the despatch-ship *Faon* and the armour-plated frigate *Savoie*, by M. E. Duchemin.—Remarks concerning recent notes by MM. Signoret and Lichtenstein on the different known species of the genus Phylloxera, by M. Balbiani. The author points out that *P. Lichtensteinii* recently described by him is specifically distinct from *P. Rileyi*, and again restates his belief that the species seen by M. Lichtenstein on *Quercus coccifera* was not *P. vastatrix*.—Observations relating to a recent note by M. Rommier "On experiments made at Montpellier on phylloxerised vines with M. Petit's coal-tar," by M. Balbiani.—Influence of temperature on the development of Phylloxera; extract from a letter from M. Maurice Girard to M. Dumas. Other communications relating to Phylloxera were received from various authors.—Generalisation of Euler's theorem on the curvature of surfaces, by M. C. Jordan.—Observations relating to a recent note by M. Lecoq de Boisbaudran on supersaturation, by M. D. Gernez.—Researches on the decomposition of certain salts by water, by M. A. Ditte. When water is added to a solution of mercuric sulphate a basic sulphate is precipitated. This basic salt forms the subject of the present research.—The colouring matter of the blood (hæmatosine) contains no iron, by MM. C. Paguelin and L. Jolly. The authors describe the preparation and purification of hæmatosine. By repeated macerations with alcoholic ammonia and subsequent filtration, hæmatosine is at length obtained completely free from iron.—On the movement excited in the stamens of Synanthereæ, by M. E. Heckel.—M. F. Garrigou communicated an analysis of the stalactitic deposits found in the chimneys of iron forges.—During the meeting M. Le Verrier presented the meteorological atlas of the Observatory of Paris, containing observations for the years 1869, 1870, and 1871.

BOOKS RECEIVED

ENGLISH.—Elementary Treatise on Practical Chemistry: Frank Clowes, B.Sc. (Churchill).—Animal Mechanism (International Series): E. J. Marey (H. S. King and Co.).—A Treatise on Magnetism: H. Lloyd, D.D. (Longmans).—Brinkley's Astronomy: Stubbs and Brünnow (Longmans).—A Peep at Mexico: J. L. Geiger, F.R.G.S. (Trübner).—Pharmacographia: Flückiger and Hanbury (Macmillan).—Cave Hunting: W. B. Dawkins (Macmillan).—Telegraph and Travel: Col. Sir F. J. Goldsmid, C.B., K.C.S.I. (Macmillan).—Sun and Earth great Forces in Chemistry: T. W. Hall, M.D., L.R.C.S.E. (Trübner).—Magnetism: H. Lloyd, M.D., D.C.L. (Longmans).—The Protoplasmic Theory of Life: L. Beale (Baillière and Co.)—Leeds Philosophical and Literary Society, Annual Report, 1873–74.—Fiske's Cosmic Philosophy (Macmillan and Co.)

AMERICAN.—Butterflies of North America, Parts I. and II.: W. H. Edwards (Hurd and Houghton, New York).

FOREIGN.—Atti della Reale Accademia Dei Lincei, vol. xxvi.—Mémoire sur la maladie de la Vigne, et sur son traitement: Louis Faucon (Paris).—Etudes sur la nouvelle maladie de la Vigne: Maxime Cornu (Paris).—Etudes sur la nouvelle maladie de la Vigne dans le Sud-Est de la France: M. Duclaux (Paris).—Les Arachnides de France: Eugène Simon (Paris).—Anthropogenie: Ernst Hæckel (W. Engelmann, Leipzig).

COLONIAL.—Elementary Dynamics: W. G. Willson, M.A., &c. (Thacker and Co., Calcutta).—Report of the Meteorological Reporter to the Government of Bengal: H. F. Blandford (Calcutta).—Patents and Patentees: W. H. Archer (Melbourne).

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