THURSDAY, DECEMBER 31, 1874

GALTON'S "ENGLISH MEN OF SCIENCE"

English Men of Science; their Nature and Nurture. By Francis Galton, F.R.S., author of "Hereditary Genius," &c. (London: Macmillan and Co., 1874.)

IT would be difficult to overrate the exact and scientific spirit in which Mr. Galton proceeds with his investigation into the origin of genius and the antecedents of successful promoters of science.

The work of M. de Candolle upon the history of two hundred scientific men who have lived during the two last centuries appears to have suggested the character of the present work in some degree. But Mr. Galton has attacked the problem in a novel manner, by going directly to men living in the present day, and presenting a series of questions as to their parents, characters, and education. He began by carefully selecting a list of scientific men, which, though not intended in any way to be exhaustive, should at least not include any but those who have shown true ability. For this purpose he adopted election to the Royal Society, since the method of election was reformed, as the first test; and out of the considerable number of such Fellows he next selected those who had earned a medal for scientific work, had presided over a learned society or section of the British Association, had been on the Council of the Royal Society, or, finally, had acted as professors in some important college or university.

The list thus framed was found to contain 180 names. Incidentally Mr. Galton inquires what fraction this number forms of the total number of scientific men living in the United Kingdom and possessing the same general scientific status. By various tests he arrives at the conclusion that the total number would be three hundred, and he estimates that their proportion to the male population of the same ages would be about that of one in ten thousand. Of course Mr. Galton must be aware that his definition of scientific men is purely arbitrary, and that the circumscribing line might have been drawn more or less strictly, and made to include almost any number.

For the purposes in view, however, Mr. Galton's procedure must be considered perfectly satisfactory. To every one of the 180 men he forwarded elaborate printed forms, covering seven large quarto pages, and containing an immense number of minute inquiries. Each man was requested to state his parentage and descent, the religious opinions, occupations, birthplace, political party, health, stature, complexion, temperament, size of head, and a great many other particular facts concerning both his parents and himself. Inquiries were also made regarding his brothers and sisters, and their salient characteristics. The numbers and principal achievements of more distant relatives, grandparents, uncles and aunts, cousins, nephews, and nieces were also to be stated. Finally, the mode and duration of education of the scientific man himself was to be described, and the causes of success of which he was conscious were to be analysed.

In order to estimate the degree of intensity of characteristics, Mr. Galton devised a very ingenious and highly scientific method of class notation, founded on the law of error or divergence from a mean. This method was employed in his work on "Hereditary Genius," and was also described in his lecture before the Royal Institution in 1874. Instead of saying that a person's memory was remarkable, or prodigious, or moderate, or poor, the answerer was to attempt to define with some numerical precision the proportion which persons of each degree of memory bore to the whole population, by assigning him to one or other of certain defined classes. If such definite answers could have been obtained, the theory of probability could have been directly applied and the amount of the influence of heredity mathematically investigated. Such a method would constitute a distinct advance in statistical inquiry. Unfortunately, few definite answers of the kind seem to have been received, and this branch of the inquiry had for the present to be abandoned.

When we consider the elaborate and careful manner in which Mr. Galton conducted his investigation, it is difficult not to feel some slight disappointment at the results as stated in this volume. The book is certainly one of very great interest and not devoid of amusing points; but it seems to me to fail in establishing many truths in a definite manner. Not a few of the results derived were known beforehand almost as accurately as they are proved by the contents of this volume. We learn, for instance, that scientific ability is undoubtedly hereditary in some degree. Now, I should hold that such a proposition needs no new proof. It was sufficiently established in Mr. Galton's former work, and he seems as if he were always combating the objections of some imaginary opponents. I am not aware that anyone in the present day ever denies the hereditary character of personal peculiarities. Hardly is the infant ushered into the world than the nurse and the admiring relatives begin to discover the features of the father, or mother, or uncles, or aunts. Mr. Galton writes as if he were making a discovery whenever he attributes the character of a man to his descent. He says: "I have numerous returns, in which the writer analyses his own nature and confidently ascribes different parts of it to different ancestors. One correspondent has ingeniously written out his natural characteristics in red, blue, and black inks, according to their origin—a method by which its anatomy is displayed at a glance." I should have thought, however, that there was nothing novel in such analysis. Every family of intelligence must frequently have discussed the descent of characteristics, features, or diseases. We cannot hear that a youth has turned out badly without inquiring into the way in which the bad strain came into the family. What we really want are accurate estimates of the comparative power of heredity and education in shaping the character, and such results we hardly obtain.

Mr. Galton gives, indeed, the number of notable relatives of each grade which scientific men on the average possess. Thus, 100 scientific men have 28 notable fathers, 36 brothers, 20 grandfathers, and 40 uncles. It is curious that this series of numbers closely corresponds to what Mr. Galton obtained with regard to divines in his former work; but the falling off in the ability as we proceed from a distinguished scientific man to his distant relatives is less rapid, compared with his previous results, as the distance of the kinship increases. The influence of the paternal and maternal lines is found to be approximately equal. Thus, 100 scientific men have 34 distinguished relatives on the paternal side, and 37 on the maternal side.

The greater part of Mr. Galton's present work consists of a discussion concerning the mental characteristics and education of scientific men and their parents, and it is full of interesting particulars. We have many returns showing that the energy, both bodily and mental, of these men, is above the average in their own opinion. Not a few correspondents describe with evident pleasure their feats of strength :—

"Travelling almost continually from 1846 up to the present time. Restless. All life accustomed to extremely rough travel : often months without house or tent." "Strong when young—walked many a time fifty miles a day without fatigue, and kept up five miles an hour for three or four hours." "At the age of twenty-six, during fourteen days, was only three hours per night in bed, and on two of the nights was up all night." "I seem to possess the same unweariedness as my father, and find myself trotting in the streets as my father used to do." "At the age of sixty made a tour, chiefly pedestrian, of four weeks in the Alps. . . . Æt. 67, grouse shooting and deer stalking."

Such are a few of the very abundant statements showing that great power of work is a general characteristic of successful scientific men. Forty-two instances are adduced of energy above the medium, and only two men complain of the want of energy. It may perhaps be objected that such results hardly tell us more than we might have expected to hold true of any group of remarkable men. As a general rule men do not become eminent in the eyes of their contemporaries until they have lived a good long life, and done a considerable amount of work. I do not find that Mr. Galton gives us the average age of his correspondents, but half of them are stated to be between fifty and sixty-five years old, and many who speak of their great energy are very old men. If we inquired into the energy and power of work of all the Lord Chancellors or Attorney-Generals, we should doubtless find it very high, simply because a man cannot be a successful lawyer unless he can stand much work. We get from such inquiries, so far as I can see, no estimate of the comparative influence of quality and quantity of work. *Cæteris paribus*, the great worker has the odds in his favour if he can live and work long enough. Where, however, is the account of those who fall out and perish on the way? Where, too, is the account of the energetic men who, finding their first efforts in science less esteemed than they expected, devote their energies to some other career? When Mr. Galton proceeds, as I am glad to infer that he is doing, to investigate the antecedents of other classes of distinguished men, he will doubtless find that successful physicians are also men of great energy ; but where is the estimate of that subtle tendency which leads the energy into scientific study rather than practical life?

Perhaps the most interesting and immediately important part of the book is that in which Mr. Galton discusses the education of his selected men, and their own remarks as to its excellence or defects. We find that thirty-two men complain of a narrow education. Several of them make very strong remarks on the loss of time in classical studies :—"Enormous time devoted to Latin and Greek, with which languages I am not conversant." "Omission of almost everything useful and good, except being taught to read. Latin! Latin! Latin!" "Latin through Latin—nonsense verses." "In an otherwise well-balanced education, three years . . . were spent on Latin and Greek—a blank waste of time." Many complain of the want of mathematical training, and others deplore the omission of natural science. Two or three, on the other hand, think that a too exclusively mathematical training at Cambridge was injurious to them. There is, in fact, a very strong concurrence of opinion in favour of a varied education. Out of eighty-seven answers, ten distinctly praise the width, and thirty-two deplore the narrowness of their training, while others of the answers more or less imply a similar view.

This result seems to me of great importance as regards the vexed question of the London University Matriculation Examination. It is commonly objected that the University expects candidates to get up an impossible, or at least injurious, number of subjects—dead and living languages, history, mathematics, physical science, applied mathematics. The whole circle of the sciences and arts has to be studied in one style or another by the luckless candidate of sixteen years of age, before the University will admit him to have a place in its books. But if our object is to produce conspicuously useful men, Mr. Galton's book supplies strong evidence that this wide range of study is approved by those who look back upon their early education. We must remember, too, that even those who condemn the devotion of time to Latin or Greek form no fair specimen of people in general. Conspicuous ability in one direction is not unfrequently conjoined with inaptitude for other studies. If Mr. Galton interrogates eminent scholars, he is hardly likely to find the same severe condemnation of grammar. Moreover, much depends upon the way in which languages are taught. The mere grammar-school method of drilling grammar into the mind by rote may repel those who would be deeply interested by a more scientific method of teaching.

Language is rapidly becoming one of the most extensive and instructive fields for strictly scientific investigation. We can never too strongly and frequently protest against the evident tendency to interpret *science* as meaning *physical science*, whereas in the immediate future, if not in the present day, there are wider and more important fields for the application of scientific method in human than in external nature.

Some of those who are so strongly advocating the efficacy of physical science would do well to take note of the fact that few of Mr. Galton's picked men advocate study of physical sciences at all in a conspicuous way. Judicious mathematical training and a rational mode of teaching modern languages are advocated almost equally with the sciences of observation.

"Omission of mathematics, German, and drawing." "Want of education of faculties of observation ; want of mathematics and of modern languages." "Neglect of many subjects for the attainment of one or two." "Want of the modern languages and of chemistry." "Want of logical and mathematical training." In these and many other replies too long to quote, the correspondents carefully couple two or more branches of study together in their recommendations. Very few complain that their education was too general and desultory, and one of these adds that it nevertheless "gave wide interest." It is worthy of notice that a large proportion of those who praise their education were brought up in Scotland.

The conclusions which Mr. Galton adopts as to the best course of education according to the opinion of his correspondents are as follows:—"To teach a few congenial and useful things very thoroughly, to encourage curiosity concerning as wide a range of subjects as possible, and not to over-teach." This nearly coincides with the saying attributed to De Morgan, that a good education consists in teaching "everything of something, and something of everything." But when Mr. Galton describes the best curriculum as compounded of mathematics, logic, observation, theory and experiment in at least one branch of science, accurate drawing, and mechanical manipulation, he seems to underrate the degree in which the study of modern languages was advocated. Mr. Galton would leave these languages to be picked up in the vacation "in the easiest and swiftest manner, with the sole object of enabling the learners to read ordinary books in them." There are, I think, very few boys who would learn any but their native tongue in this way. Most people will hold that languages should be substituted for mechanical manipulation in the school course, and that a boy may safely be left to teach himself carpentering, or other mechanical pursuits, if he only be supplied with a good set of tools.

It is of course impossible adequately to notice, in the limits of an article, the contents of a book which is far more interesting in its details than in its general conclusions. I should have liked to discuss Mr. Galton's investigation of the "origin of taste for science" in his correspondents. We find that a considerable preponderance of men believe that they had an innate taste or tendency towards science. No less than fifty-nine of them make distinct statements to this effect. In other cases, fortunate accidents, opportunities, professional influences, encouragement at home, the influence of teachers or friends, are mentioned as the determining or contributing causes. The reader who carefully studies the interesting answers elicited by Mr. Galton will probably agree with him that they are reliable as far as they go, but it is impossible to suppose that they allow of a real analysis of the causes of scientific taste and zeal. As Mr. Galton remarks, the *fortunate* accidents referred to by some correspondents will generally indicate the previous existence of a tendency, for similar accidents are continually happening to thousands of other persons without any similar effects. Are there not multitudes, again, encouraged by their parents, friends, or teachers, incited by the prospect of pecuniary advantage, or otherwise influenced towards science, who nevertheless do not yield, or, if yielding, never attain great success? A further great difficulty consists in distinguishing between the origin of great general ability and the circumstances which throw that ability into a particular groove of study. One correspondent says that his taste for botany is not innate. "I trace the origin of my botanical tastes to leisure; to the accidental receipt of De Candolle's 'Flore française' whilst resident in that country; and to encouragement from my mother." These accidental circumstances may have bent the twig, but was there not a vigorous hereditary power of growth which enabled that twig to develop itself?

In some cases it may well be doubted whether a correspondent has not mistaken the effect of imitation and friendly encouragement for innate tendency. One geologist writes as follows:—"Decidedly innate as regards coins and fossils. My father and an aunt collected coins and geological specimens, and I have both coins and specimens which have been in my possession since I was nine years old." He apparently thinks that the love of fossils and coins was an hereditary instinct, which would be a truly remarkable instance of heredity. But is it not much more likely that the instinct was that collecting instinct so strongly manifested among the youth of the present day as regards postage-stamps, and which seems to be a kind of abnormal development of the love of property which has been growing in the human race for several thousands of years? The passion for collecting often leads to the study of the objects collected, as is testified by several correspondents; and in this particular case there must have been a further influence in the examples of the father and aunt.

An objection which may be in some degree urged against Mr. Galton's results is the insufficient number of instances which can be adduced in any one branch of science. Granting that one hundred cases is enough for the drawing of an average, we must yet remember that the hundred include men of such different pursuits as abstract mathematicians, naturalists, botanists, practical chemists, statisticians. The kind of intellectual power which makes a man eminent in one branch may be very different from what is most conducive to eminence in another branch. Mathematical power is probably much more a gift of nature than interest in statistics. In treating the origin of taste for science Mr. Galton does classify his correspondents according to the branches of science recognised in the sections of the British Association, but in regard to education he makes no such division. Now, if the division be made, the instances in most of the branches become too few to give a satisfactory average; whereas if the division be not made, it may be objected that we are averaging results which are not drawn from a uniform basis. The correspondents who supplied answers capable of being utilised did not much exceed one hundred, which is really too small a number when spread over nine different regions of science. The body of scientific men can hardly be considered so homogeneous as would be an equal number of artists, or musicians, or engineers, or bankers of eminence.

The interest and value of Mr. Galton's results would have been much greater had we similar results concerning other groups of men to compare with them. The inquiry ought, in fact, to have been conducted on the differential method, and directed to disclose the peculiarities of scientific men as contrasted with men in general, or with widely different groups. The labour of the inquiry must have been great as it is, and it may seem a heartless thing to say that Mr. Galton should have made it many times greater. But there would have been many advantages in collecting the fresh and unbiassed opinions of eminent men in many walks of life, not only of artists, musicians, engineers, but eminent lawyers, judges, administrators, scholars, divines. No doubt it is possible that some of these classes would have failed to appreciate the necessity for answering the queries addressed to them, and the answers might have proved scanty; but, if obtained, the comparison must have afforded most interesting results.

Though I have spoken of Mr. Galton's conclusions as being in some degree disappointing, it ought not for a moment to be supposed that they are not worth the trouble incurred by the investigator and his correspondents. It is the extreme difficulty of the problem attacked which makes Mr. Galton's efforts seem less successful than some might have expected. The origin of genius or conspicuous success is the last thing which will be explained in the long progress of science. All that ought to have been expected was that Mr. Galton might form some comparative estimate of the several component tendencies which usually contribute to its production. If we look to practical conclusions, the inferences to be drawn from the answers concerning education are alone worth all the labour spent upon the book. The fact that about a hundred of the leading scientific men of the day are mostly in favour of a wide and varied range of studies in the school and college curriculum, seems to me a conclusion of great significance.

W. Stanley Jevons

GREEN'S "HISTORY OF THE ENGLISH PEOPLE"

A Short History of the English People. By J. R. Green, M.A., Examiner in the School of Modern History, Oxford. With Maps and Tables. (London: Macmillan and Co., 1874.)

WE deem this work to come within the province of a scientific journal for two reasons:—First, Mr. Green, so far as we know, is the first who, throwing aside with just contempt the "drum and trumpet" method of writing history, has attempted to trace the various influences or forces that have combined to mould the English people and make them what they are at the present day; second, because he has noticed in detail certain important episodes in the history of English science. The only work we know of that approaches in plan the history of Mr. Green is Knight's "Pictorial History of England;" but it is only on the surface that any resemblance exists. Knight's history is divided into sections, each of which deals with one of the various ways in which English energy has found scope—in politics and war, in literature and science, in commerce, agriculture, religion, and social life; but no attempt whatever is made to show the result of the combined influence of the forces acting and reacting through these departments on the English people as a whole. In reality, the distinction drawn between these various spheres of human energy is as arbitrary as the distinction between ancient and modern history; one might as well attempt to show the resultant of any number of physical forces, by attending separately to the action of each, without paying any heed to their action in combination. Mr. Green deserves all the credit due to the originator of a bold and happy idea, and still greater credit for having worked out this idea with marvellous success. His history he calls a "short" one, but in the space of his 800 pages we venture to say he conveys a fuller and juster idea of the progress of the English nation than any previous author has done; nay, in very few instances has the whole life of any one period been more clearly and adequately set forth than will be found to be the case in these pages.

"At the risk," Mr. Green says in his preface, "of sacrificing much that was interesting and attractive in itself, and which the constant usage of our historians has made familiar to English readers, I have preferred to pass lightly and briefly over the details of foreign wars and diplomacies, the personal adventures of kings and nobles, the pomp of courts, or the intrigues of favourites, and to dwell at length on the incidents of that constitutional, intellectual, and social advance in which we read the history of the nation itself. . . . I have restored to their place among the achievements of Englishmen, the 'Faerie Queen' and the 'Novum Organum.' I have set Shakspere among the heroes of the Elizabethan age, and placed the scientific inquiries of the Royal Society side by side with the victories of the New Model."

Mr. Green begins his history in "Old England," as he happily calls Sleswick, the fatherland of the English people; and with charming clearness and simplicity and well-sustained enthusiasm, traces step by step their ever-widening development from the time the original conquering colonists landed in Kent down to the present century. Mr. Green's power of discovering and bringing into bold relief the true causes of events, and of exhibiting in few and telling words the real characters of the multitude of actors that have played their busy parts on the restless stage of English history, is rare. We can only repeat that his work is the only existing history of England that has been written on anything like scientific principles.

Throughout his work Mr. Green gives prominence to the intellectual development of the people; in an interesting section on the Universities, in chap. iv. (1215—1217), in conection with the origin and growth of Oxford, a masterly sketch is given of the life and work of Roger Bacon, and the premature birth of English scientific research. Again, in a chapter on "the Revolution," a more detailed and thoroughly intelligent account is given of the scientific work of Francis Bacon, and of the "Beginnings of English Science," including the birth of the Royal Society. These sketches show that Mr. Green has not only mastered his authorities, but is also perfectly competent to trace the various stages by which science has attained its present all-important position. And, as the world progresses, historians of this class will be more and more in demand, for if things hold on in their present course, it will become more and more clearly recognised that the only satisfactory history of a people is the history of the growth of science, in its widest sense, among that people.

As an example of Mr. Green's method and style, we quote the paragraph, in connection with Francis Bacon, on the "Beginnings of English Science":—

"It was this lofty conception of the position and destiny of natural science which Bacon was the first to impress upon mankind at large. The age was one in which knowledge, as we have seen, was passing to fields of inquiry which had till then been unknown, in which Kepler and Galileo were creating modern astronomy, in which Descartes was revealing the laws of motion, and Harvey the circulation of the blood. But to the mass of men this great change was all but imperceptible; and it was the energy, the profound conviction, the eloquence of Bacon, which first called the attention of mankind as a whole to the power and importance of physical research. It was he who by his lofty faith in the results and victories of the new philosophy nerved its followers to a zeal and confidence equal to his own. It was he who above all gave dignity to the slow and patient processes of investigation, of experiment, of comparison, to the sacrificing of hypothesis to fact, to the single aim after truth, which was to be the law of modern science. But, in England at least, Bacon stood—as we have said—before his age. The beginnings of physical science were more slow and timid there than in any country of Europe. Only two discoveries of any real value came from English research before the Restoration; the first, Gilbert's discovery of terrestrial magnetism in the close of Elizabeth's reign; the next, the great discovery of the circulation of the blood, which was taught by Harvey in the reign of James. But apart from these illustrious names, England took little share in the scientific movement of the Continent; and her whole energies seemed to be whirled into the vortex of theology and politics by the Civil War. But the war had not reached its end when a little group of students were to be seen in London, men 'inquisitive,' says one of them, 'into natural philosophy and other parts of human learning, and particularly of what hath been called the New Philosophy . . . . which from the times of Galileo at Florence, and Sir Francis Bacon (Lord Verulam) in England, hath been much cultivated in Italy, France, Germany, and other parts abroad, as well as with us in England.' The strife of the time indeed aided in directing the minds of men to natural inquiries. 'To have been always tossing about some theological question,' says the first historian of the Royal Society, Bishop Sprat, 'would have been to have made that their private diversion, the excess of which they disliked in the public. To have been eternally musing on civil business and the distresses of the country was too melancholy a reflection. It was nature alone which could pleasantly entertain them in that estate.' Foremost in the group stood Doctors Wallis and Wilkins, whose removal to Oxford, which had just been reorganised by the Puritan Visitors, divided the little company into two societies. The Oxford society, which was the more important of the two, held its meetings at the lodgings of Dr. Wilkins, who had become Warden of Wadham College, and added to the names of its members that of the eminent mathematician, Dr. Ward, and that of the first of English economists, Sir William Petty. 'Our business,' Wallis tells us, 'was (precluding matters of theology and State affairs) to discourse and consider of philosophical inquiries and such as related thereunto, as Physick, Anatomy, Geometry, Astronomy, Navigation, Statics, Magnetics, Chymicks, Mechanicks, and Natural Experiments: with the state of these studies, as then cultivated at home and abroad. We then discoursed of the circulation of the blood, the valves in the *venæ lacteæ*, the lymphatic vessels, the Copernican hypothesis, the nature of comets and new stars, the satellites of Jupiter, the oval shape of Saturn, the spots in the sun and its turning on its own axis, the inequalities and selenography of the moon, the several phases of Venus and Mercury, the improvement of telescopes, the grinding of glasses for that purpose, the weight of air, the possibility or impossibility of vacuities, and nature's abhorrence thereof, the Torricellian experiment in quicksilver, the descent of heavy bodies and the degree of acceleration therein, and divers other things of like nature.'

"The other little company of inquirers, who remained in London, was at last broken up by the troubles of the Second Protectorate; but it was revived at the Restoration by the return to London of the more eminent members of the Oxford group. Science suddenly became the fashion of the day. Charles was himself a fair chemist, and took a keen interest in the problems of navigation. The Duke of Buckingham varied his freaks of rhyming, drinking, and fiddling, by fits of devotion to his laboratory. Poets like Denham and Cowley, courtiers like Sir Robert Murray and Sir Kenelm Digby, joined the scientific company to which in token of his sympathy with it the king gave the title of 'The Royal Society.'"

The maps, and without maps no history ought to be tolerated, will be found greatly useful. Should Mr. Green utilise the large amount of material he must have collected for the purpose of writing a similar history on a much larger scale, no doubt he will say something about the physical environment of the English people,—those external conditions which have had their own share in shaping the history and character of our nation. His present work ought to become the school history of England.

FEHLING'S NEW CHEMICAL DICTIONARY

Neues Handwörterbuch der Chemie. Unter Mitwirkung von Bunsen, Fittig, Fresenius, &c. Bearbeitet und redigirt von Dr. Hermann v. Fehling, Professor der Chemie in Stuttgart. Erster Band. (Braunschweig: Druck und Verlag von Friedrich Vieweg und Sohn, 1874.)

TEN years have passed since the completion of the great work of Liebig, Poggendorff, and Wöhler, the "Handwörterbuch der Reinen und Angewandten Chemie." These years have witnessed great changes in our chemical knowledge; not only have theories which in the year 1864 occupied but an inferior place in the general system of chemistry now come to the front, but also a vast array of new facts demands a place in the system, which must therefore be extended so as to include them all.

The book which ten years ago was looked upon by all as a standard authority has now necessarily become somewhat antiquated, and the desire for a new edition has naturally arisen in the minds of the German chemists. The first fruits of this desire we have now in the goodly volume of 1,200 pages which lies before us.

As in most of the productions of the German mind, so in this, there is no lack of thoroughness, nor of breadth of view and treatment of the subject. The names of the contributors of the various articles are alone sufficient to inspire trust in what they have to tell us. A few of that old band of chemists who made the first *Handwörterbuch* famous still lend their aid to the success of the present volume; while among the younger men are Fittig, Kekulé, Hofmann, Victor Meyer, Tollens, Zincke, and others, who have already made for themselves a name in science.

Whether this be the proper time for the publication of a large and all-embracing treatise on chemistry is perhaps a question which admits of more than one answer. Chemical theories at present seem to be nearing that stage at which they are to be embraced within the larger theories of mechanical science. If this be true, the interpretation to be put upon chemical facts will in some years be greatly modified, and hence the publication of somewhat elaborate treatises will be demanded. In such a volume, however, as this, we have the material out of which the chemist of the future will elaborate his general theory of chemical action; and not only this, but we have a storehouse from which the student of our science may draw rich supplies of knowledge, and to which he may always refer, well assured that he will not be sent away empty.

The arrangement of the new *Handwörterbuch* is very similar to our own "Watts' Dictionary." Amid the variety and excellence of the articles, it is difficult to choose any for special mention.

The articles on Equivalents and Atoms are especially to be commended, the former by Prof. Kekulé, the latter by Prof. Fittig. In the former article the author defines the correct and true meaning of the word "equivalent"; he shows how vague oftentimes are the grounds upon which we pronounce that such a substance is equivalent to such another, and he clearly points out the great advantages possessed by the modern atomic notation as compared with the old and vague so-called equivalent notation.

In the article on Atoms we have a clear and succinct account of the modern chemical theory, and an interpretation of the way in which the older ideas of equivalency are applied to the newer atomic doctrines.

The articles on Analysis are generally full and satisfactory. It is strange, however, that such an excellent method of qualitative testing as that presented by "Bunsen's Flame Reactions" should be overlooked.

There are excellent monographs on Aniline and Benzol, by Prof. Hofmann and Zincke respectively; while on such subjects as the Respiration of Animals and Plants, and Zoö-chemistry in general, we have articles from the pen of Prof. v. Gorup-Besanez. The woodcuts are admirable; in this respect the German work is far ahead of our English Dictionary. Let us hope that the work will be completed as promised in the prospectus, and that the volume already published will not add another to the already too long list of great German scientific works the opening volumes of which stand waiting for their successors, but seemingly waiting in vain.

M. M. PATTISON MUIR

OUR BOOK SHELF

Die fossilen Bryozoen aes österreichisch-ungarischen Miocäns. Von Prof. Dr. A. E. Ritter von Reuss. I. Abtheilung. Pp. 50. 4to. (Wien: 1874.)

Geologischer Bau der Insel Samothrake. Von Rudolf Hoernes. Pp. 12. 4to. (Wien: 1874)

THESE publications are extracted from the Transactions of the Imperial Academy of Sciences. Dr. v. Reuss's paper describes the Salicornaridæ, Cellularidæ, and Membraniporidæ, a number of the species being new; and gives twelve excellent plates of the fossils. According to Herr Hoernes, the island of Samothraki consists of abrupt hill-masses of ancient crystalline rocks, such as granite, clay-slate, hornblende rock, &c., overlaid, especially in the north-west and north, with deposits of Eocene age, and diluvial and recent accumulations. A coloured sketch-map accompanies the paper.

Über die palaeozoischen Gebilde Podoliens und deren Versteinerungen. Von Dr. Alois v. Alth. Erste Abtheilung. Pp. 78. (Wien: 1874.)

Über die triadischen Pelecypoden-Gattungen, "Daonella" und "Halobia." Von Dr. E. Mojsisovics v. Mojsvár. Pp. 38. (Wien: 1874.)

BOTH these publications are issued by the Austro-Hungarian Geological Survey, being extracted from the "Abhandlungen, Band vii." This mode of republishing in a separate form the papers contributed to their Transactions cannot be too strongly commended. Dr. A. v. Alth's paper relates to the region which lies between the rivers Bug and Dnieper. It is illustrated by five lithographic plates of fossils, a number of which are new species of Pteraspis, Scaphaspis, Cyathaspis, Beyrichia, &c. Dr. Mojsisovics' paper is also illustrated by five lithographic plates of a number of new species of the genera Daonella and Halobia, which are described and named by himself.

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.*]

On the Inventor of Clock Movement applied to Equatorials.—Suum Quique

IN a pamphlet by Col. Laussedat, "On the Horizontal Astronomical Telescope," in which he claims for himself the invention of applying a heliostat to direct the light of any object into a fixed telescope, I find at p. 2 this statement in speaking of the equatorial: "The idea of so endowing a telescope with a moving power which annuls, or, to speak more exactly, compensates the motion of the earth, is due to a French watchmaker of the last century, named Passemont."

I am sure the distinguished writer would not knowingly have done to another the injustice of which in his own case he complains; but in fact this invention belongs to a much earlier date, and to one of far greater fame, the illustrious Robert Hooke, who describes it, with a figure, in his "Animadversions on the Machina Cœlestis of Hevelius" (my copy bears date 1674). It was primarily intended to facilitate the process of measuring directly the distance of two stars, a process which was then much in vogue, but which must have been very troublesome from the difficulty of following them. It consists of a strong polar axis, adjusted at its lower bearing by screws, and carrying at top a cross arm, one end of which bears a counterpoise, and the other a quadrant or sextant with a ball-and-socket support, by which its plane can be made to coincide with that passing through two stars. But Hooke expressly stated that a telescope may be similarly attached there. The polar axis carries an octant whose limb is ratched, and driven by a screw connected with a clock. The clock is regulated by a conical pendulum; and he describes the mode of altering its rate for the sun, moon, and planets. Of the date or details of M. Passemont's re-invention there is no trace in Lalande. But, as I find in Rees' Cyclopædia (art. "Passemont") that he was born in 1702, and that his first publication appeared in 1738, it is by at least half a century later than Hooke's.

It also deserves notice that Col. Laussedat's invention is described by Hooke in his treatise on Helioscopes two years later (1676). His words are: "I explained at the same time to the Royal Society several other ways of facilitating the use of very long glasses for other objects in the heavens (he had been speaking of the sun) by the help of one reflecting plate only, and that was by a tube fixed either perpendicularly, horizontally, or obliquely; for it mattered not, whether as to the seeing the object in any part of the heaven, and the object could be as easily found as by the common telescope of the same length. But of these elsewhere."

I have not, however, been able to find any further notice of it in his works.

This invention leads me to a suggestion which may be interesting to astronomers. The Royal Society possesses two Huyghenian object-glasses, one of 120 feet focal length, the other of 200. Some years ago a question was raised by M. O. Struve as to the defining power of the first-named of these, in reference to a discussion on the rings of Saturn, and the Society appointed a committee to examine. It was tried at the Kew Observatory, and defined a watch-dial as well as a good 3·75-inch achromatic. This was considered sufficient without incurring the great expense of such a scaffolding or building as would have been required to use it for celestial observations. These, however, can be easily managed by Col. Laussedat's arrangement. If successful, these object-glasses would probably give matchless solar photograms. The 120 feet has 6 inches aperture, and would give a solar picture 13·4 inches diameter. R.

The Potato Disease

I AM afraid I cannot regard the letter of your anonymous correspondent "Inquirer" as written in altogether good faith. He first misrepresents what I stated in my letter of Nov. 20, which he professes to quote, and then proceeds to ask me a question which, if he had even glanced at my letter, he would have seen was already answered.

If I beg your indulgence for some further remarks suggested by "Inquirer's" letter, I hope that they will be the last it will be necessary to make.

The number of NATURE for Nov. 19 gave what purported to be an account of the "Report of the Potato Disease Committee of the Royal Agricultural Society." It contained the following passage:—"Prof. de Bary has worked out the scientific questions that occur as to the origin of the disease. It is owing to a fungus (*Peronospora infestans*), which attacks the leaves first, and after absorbing the nutriment of them, utilises the petiole, and thus reaches the tubes" (*sic*). It appeared to me, as it did to others, that the only meaning which could be attributed to this was that we owed to Prof. de Bary all the knowledge we at present possess with regard to the disease.

I therefore thought it fair to point out in the following number "that all this and a good deal more was ascertained by the Rev. M. J. Berkeley in this country, and by Montagne in France, and published by the former in a paper contributed to the first volume of the Journal of the Horticultural Society in 1846." It is almost incredible that anyone with my letter before him should say that I had asserted "the *discovery* by the Rev. M. J. Berkeley of the fact that the potato disease was due to the attacks of a parasitic fungus," and should proceed to ask me for "a *more exact reference* to the records."

The potato disease appeared on the Continent a few years before it worked such ravages in the British Isles. The mould had been detected upon the foliage in France and Belgium, but opinion was divided as to the part it really played. And we have Mr. Berkeley's authority for asserting that even Montagne, to whom "Inquirer" attributes the discovery that the potato disease was due to the attacks of a parasitic fungus, did *not* support the "fungal theory."

In this country Mr. Berkeley maintained it almost single-handed against men of such weight as Lindley and Playfair. His paper, which appeared in the Horticultural Society's Journal in November 1845 (the whole volume is dated 1846), really, however, settled the matter.

It is perfectly easy to trace what Mr. Berkeley did by referring to the horticultural papers of the time. Thus, he wrote to the *Gardener's Chronicle*, August 30, 1845 (p. 593): "The malady by which potatoes are so generally affected this year, both in this country and on the Continent, does not appear to prevail in this neighbourhood. . . . I have this morning received from Dr. Montagne, of Paris, some leaves affected with the mildew. . . . The parasite of the potato does not appear to have been observed before by systematists." On Sept. 6 (p. 608): "You will be interested to learn that the mould upon the potatoes which you sent me is identical with that upon the leaves, and the same with what I have received from Paris. It appears, then, that *the decay of the tubers is produced by the same cause which affects the leaves*, viz., by the growth of a mould whose development has been promoted by excessive wet." On Sept. 20 (p. 640): "In every case I find the *Botrytis infestans* [now called *Peronospora infestans*] preceding the work of destruction."

All this is given with very full details by Mr. Berkeley in his later paper. What I wish, however, particularly to point out is that the admirable observation (contained in the words I have italicised) of the identity of the fungus which attacks the foliage with that which destroys the potatoes was made absolutely independently by Mr. Berkeley. Morren appears to have made it about the same time. It is a sufficient proof of the estimation in which his investigations were held at the time, that Montagne relinquished the intention of writing upon the subject, and transmitted his materials to Mr. Berkeley, by whom the use of them is duly acknowledged. W. T. THISELTON DYER

Mr. Cuttell and Section Cutting

IN your number of NATURE just issued you have given an extract from the annual address of the President of the Royal Society, in which reference is made to my labour of section cutting. It is perfectly true that I have prepared more than a thousand sections of coal plants, but it would be unfair to a very efficient auxiliary not to mention the help he has afforded me in this work. I require many sections of a much larger size than my machinery is capable of cutting, and these have been prepared for me by the skilled hands of Mr. Cuttell, of New Compton Street, London.

In each of two instances, also, I am indebted to the same experienced lapidary for obtaining three sections out of small but precious fragments, not more than from three-sixteenths to a quarter of an inch in thickness. I am anxious to recognise these services, and not to monopolise Mr. Cuttell's share of the credit for the labours to which Dr. Hooker's report refers so kindly.

W. C. WILLIAMSON

Fallowfield, Manchester, Dec. 24

Snakes and Frogs

IN reading the letter of your correspondent, Mr. Mott, on the cry of the frog, it struck me as curious that there should be resemblances which people in countries wide apart should pitch on the same phrase to indicate. Now, there could not be a better way of conveying a sound which frequently greets one's ears in the country in Bengal during the rains, than that which your correspondent makes use of, "the cry of a new-born infant." Few residents in the country here, we take it, who have lived anywhere near jungle, will have failed to hear, and that tolerably frequent, the unspeakably plaintive wail which indicates that the remorseless ophidian has seized his prey, and that deglutition has commenced. If one be tolerably quick he may, as I have frequently done, guide himself to the very spot by the sound of the frog, and the snake will then, in his alarm and anxiety to escape, frequently let the frog go, though he as often slides off with it protruding from his mouth. We have the batrachians in great force here, and of all sizes and noises, from the great swamp frog which, as soon as the lands are drenched in the heavy rainstorms of May, commences its nocturnal bellowing, down to the bronze tree frog with gilt eyebrows that keeps up its metallic tink.

The frog is connected with some of the religious ceremonies of the country; and one may see here, as well as in Assam, the curious custom of "bathing the frogs" in a cage. This is done in time of drought to propitiate the rain god. Grain is sometimes put out on a mat to sun, and to prevent the crows from making away with it, a frog is tied by the leg to a stake; his constant hopping about acts as a deterrent to the crow. Hence the native proverb denoting vicarious and unmerited suffering, "The crow steals the grain, and the string is round the leg of the frog." C. B.

Budderpore, Eastern Bengal

THE ANDERSON SCHOOL OF NATURAL HISTORY

MOST of our readers, no doubt, have heard of the School of Natural History established by the late Prof. Agassiz, in conjunction with some of his American friends, shortly before his lamented decease. The first report of the trustees of this institution, which has lately been received in this country, gives a fuller account of its foundation and subsequent progress than has yet reached us.

The plan of the school was first put forward by its originator in a circular issued in December 1872, from the Museum of Comparative Zoology at Cambridge, U.S.A. It was proposed that courses of instructive lectures in various branches of natural history should be delivered by the sea-side, at Nantucket—an American bathing-place—during the summer months, by Agassiz himself, and by other naturalists belonging either to the same institution, or to other scientific establishments in the United States, who had combined together to assist him. The object of these courses was chiefly for the benefit of teachers proposing to introduce the study of natural history into their schools, and for such students as were preparing to become teachers. Besides the lectures it was proposed to provide a number of aquariums, as also the necessary apparatus for dredging in deep water, so that the pupils might be practically as well as theoretically instructed.

Whilst Prof. Agassiz was appealing to the public to support his beneficent scheme, the attention of Mr. John Anderson, a wealthy merchant of New York, was attracte l to it. Mr. Anderson, "although not possessing himself any intimate acquaintance with natural history," "sympathised warmly" in the professor's project for making that department of science a branch of education, and in aid thereof offered to hand over to trustees for the benefit of the scheme a whole island situated in Buzzard's Bay, in Massachusetts.

We need hardly say that the munificent offer was gladly accepted, and Penikese Island, containing 100 acres of great fertility, several springs of fine fresh water, and a mansion house, constituting altogether a "most attractive location for a summer residence," became, instead of Nantucket, the seat of the proposed institution, which was appropriately named after the donor, the "Anderson School of Natural History."

A few days after the acceptance of this noble gift by Prof. Agassiz, Mr. Anderson gave a further proof of his liberality by presenting the sum of $50,000 for the equipment and current expenses of the institution, which was thus enabled to make a start under very favourable circumstances.

When matters had progressed thus far, it was hardly in accordance with the national characteristics that much delay should take place in commencing work. So, although the island of Penikese was only presented to Prof. Agassiz on the 22nd April, 1873, a site was selected for the school, the plans were arranged, and the contract actually signed for the necessary works on the 16th May, and the 8th July was appointed for the building to be ready. In vain the architect and builder declared that it was impossible, and urged the postponement of the opening until the following year. Prof. Agassiz, perhaps with a presentiment of the future, was inflexible, and a commencement was actually made on the appointed day. During the summer a second building, containing another numerous set of working rooms and dormitories and a lecture room connecting it with the former edifice, was nearly completed, together with the interior arrangements of the whole school.

During the first session, 1873, the pupils were from forty to fifty in number, consisting chiefly of teachers (both male and female) in colleges and schools and other public institutions. Prof. Agassiz lectured nearly every day. Mr. Galloup, a citizen of Boston, sent his yacht to Penikese, and handed it over to Count Pourtales, who took charge of the dredging parties during the whole session. Ten or twelve of the pupils went out every day, thus obtaining instruction in the use of the implements, and at the same time obtaining many specimens for the lectures which could not have been collected from the shore.

Other efficient workers were Dr. A. S. Packard, jun., Prof. Jordan, Dr. Brewer, Prof. Wilder, and Prof. Guyot. Full instruction was thus given in various branches of natural history, in geology, in physical geography, and especially in zoology.

So successfully was this scheme carried out, that for the succeeding session a much larger number of applications than accommodation could be provided for was received, when the untimely death of the founder occurred and somewhat imperilled the continuance of his noble plans. Fortunately, a worthy son succeeded to a worthy father, and under the direction of Mr. Alexander Agassiz, the Anderson School of Natural History has, we believe, continued in its career of prosperity, although details of its second year's working have not yet reached us.

When we consider what has thus been done in the United States, it is no slight reproach to us that nothing of the sort has been attempted in England. The great aquariums which have recently been built in several places offer unusual facilities for such an institution. But, alas! Brighton, Sydenham, and Southport are, we fear, wholly given up to ten per cent. The only counterpart of Prof. Agassiz in Europe is Anton Dohrn, whose "Zoological Station" at Naples is a worthy rival of the Anderson School of Natural History—perhaps even more complete in its organisation. We trust, however, that before long a similar scheme may be started in this country.

THE LAST TYPHOON AT HONG KONG

THE typhoon at Hong Kong of September 1874 is the greatest calamity that has visited the crown colony since its establishment in 1841. In each of the years 1859 and 1865 one of these desolating storms occasioned a great deal of damage to shipping in the harbour and vicinity; in 1867 two occurred, the second of which raged with great violence during the day, and was consequently observed with considerable interest; on Sept. 2, 1871, a still more striking instance is recorded;* but the whole of these phenomena sink into utter insignificance when compared with the furious typhoon which swept over the island during the night of the 22nd and the morning of the 23rd of September last. Without speaking of the dire effects produced by the latter, tenfold more terrible than any hitherto experienced, one far more crucial test may be adduced as evidence of the truth of our assertion.

It is an admitted fact that the force of the wind during a cyclone or typhoon is always in direct proportion to the height of the mercury in the barometer. Now, the lowest reading of the barometer previously recorded at Hong Kong was during the typhoon of 1871, viz., 29·15; whilst at Macao, on the same occasion, the mercury fell to 28·39. But during the recent event, the reading at Hong Kong at 2.15 on the morning of the 23rd was 28·75 according to one barometer, and 28·73 according to another; whilst at Macao the mercury actually fell to 28!—a fall we believe to have been altogether unprecedented in the history of atmospheric reading in China. Hence we conceive this to have been one of the most severe instances, if not the severest, of a typhoon on record. The fact that the readings *at Macao* were lower in 1871 than *at Hong Kong* in 1874 does not affect the question, for, as we shall see presently, the first-mentioned place always suffers more severely than the latter, owing to the greater concentration of the power of the wind *at its turning point.*

Many points of interest are connected with the late typhoon. It was observed that the clock upon the clock tower at Peddar's Wharf in Hong Kong stopped shortly after two, and it has been stated upon good authority that five or six other pendulum clocks stopped at the same hour. Now, this was exactly the time when the most violent throe of wind that was experienced throughout the entire night took place; hence we are justified in assuming that, at the precise moment when the typhoon was at its height, a shock of earthquake probably occurred, pointing to the conclusion that the atmospheric disturbance induced physical disturbances in the crust of the earth. The possibility of the existence of such a condition has been argued at length by Prof. Lyell in his "Principles," where he states that the inhabitants of Stromboli are said to make use of the island "as a weather-glass," its volcanic disturbances "increasing during tempestuous weather," so that "the island seems to shake from its foundations." He considers that extreme changes in the atmospheric pressure exerted upon a vast superficial area might well be deemed to influence the confined gases and liquids interposed between the

* See NATURE, vol. v. p. 166.

successive layers of strata. That earthquakes are the result of movement amongst these gases and liquids there seems little reason to doubt.

We gather, from the various accounts to hand, that the characteristics of the recent typhoon were very similar to those of the event of 1871, viz., that it came from an easterly quarter, and, after sweeping over Hong Kong, reached Macao somewhat later, there culminating; and, describing a portion of a circle so as to present all the appearances of a whirlwind, eventually dissipated itself along the coast upon contact with the high land. This typhoon, as might have been expected, crossed the estuary of the Pearl River from Hong Kong to Macao in less than half the time occupied by the typhoon of 1871. The distance is almost forty-five miles, and the lowest readings of the barometer were as follows:—In Hong Kong at 2.15 A.M. and at Macao at 3.15 A.M. during 1874, against 11 P.M. and 1.30 A.M. during 1871. The rate of progression in the late instance was moreover twice as great as that of the West Indian hurricanes, which has been computed at twenty to twenty-five miles per hour.

Before we dismiss the subject it may not be out of place to dwell for a few moments upon the probable causes which give rise to these "freaks of nature." At Hong Kong the S.W. monsoon blows from April to September, and the N.E. monsoon from September to April. It is during the *change* from S.W. to N.E. that typhoons usually occur. The theory is this. When the cold N.E. monsoon sets in suddenly it strikes upon a vast tract of land in Southern China, and on a portion of the China Sea warmed by the mild breezes of the opposite monsoon, occasioning rapid precipitation or condensation of vapours, and, as a necessary consequence, an extensive vacuum where the rarefied air formerly was. Other air then rushes violently in to fill the vacuum, and strong breezes, sometimes developing into typhoons, are the result. The mingling and collision of the various currents at their point of contact also assists the disturbance of the atmosphere. The reason of the gale as a rule blowing from the east is apparent. Inland of the coast line is a towering range of mountains, extending down to Cochin China, and effectually arresting the rush of air from that quarter. The open sea, therefore, is the only free point of access. The prevailing direction of typhoons at Hong Kong is, in point of fact, very nearly that of the N.E. monsoon just commencing, but possibly slightly diverted by the remaining influence of the opposite monsoon. Hong Kong, Amoy, and Macao being just opposite to the opening between Formosa and Luzon, the full sweep of the wind rushes in unhindered towards them from the Pacific Ocean. Macao, however, fares worst, for it is situated precisely where the typhoon is arrested by the high land of the coast. The lowest readings of the barometer are invariably therefore recorded at Macao.

ENCKE'S COMET

I HAVE received this morning, from the Observatory of Pulkowa, copies of Dr. von Asten's ephemeris of this comet, in which the accurate effect of planetary perturbation to the approaching perihelion passage (about April 13·0 Greenwich time) is included. His positions differ less than five minutes of arc from those I have already communicated. The comet arrives at its least distance from the earth on the night of May 3, about which time it may be a bright object for the observatories of the southern hemisphere. In these latitudes it will probably be observed, as in 1842, to the end of the first week in April. If not detected during the next period of absence of moonlight, as I believe to be probable, there can be no doubt of its visibility before the February moon interferes.

J. R. HIND

Mr. Bishop's Observatory, Twickenham, Dec. 22

FERTILISATION OF FLOWERS BY INSECTS[1]

IX.

Alpine Orchids adapted to Cross-fertilisation by Butterflies

NO family of plants, as far as is known, offers more various adaptations of flowers to insects of different orders than the Orchids, which have called general attention to the relation between flowers and insects since the admirable description by Mr. Darwin.[2] Of thirty-four species of Orchids found up to the present time in Westphalia, five[3] have been observed to be fertilised by humble-bees, and partly also by other Apidæ; two[4] by humble-bees and Diptera; one[5] by species of Andrena; one[6] by Vespa; one[7] by Apidæ, Diptera, and Sphegidæ; one[8] principally by Ichneumonidæ; one[9] exclusively by Diptera; two[10] by minute insects of different orders; and four[11] by Lepidoptera. Although the fertilisers of the sixteen remaining species[12] have not yet been observed, still it may fairly be deduced from the structure of their flowers that none of them, except, perhaps, *Habenaria viridis*, is fertilised by butterflies. Of thirty-four species, then, growing in the plain and lower mountain region, four, or at the most five, that is to say 12 to 15 per cent., are fertilised by Lepidoptera; whereas of five species of Orchids growing in the higher Alpine region near the Ortler, three,[13] or perhaps four,[14] that is to say 60 to 80 per cent., are adapted to cross-fertilisation by butterflies, a proportion which strongly corroborates my view that the predominant frequency of butterflies in the Alpine region must have influenced the adaptations of Alpine flowers. As two of these five species of Alpine Orchids are not mentioned in Mr. Darwin's classical work, nor have yet been described with regard to their contrivances for fertilisation, I will give here a brief account of them.

Gymnadenia odoratissima (Figs. 58, 59) produces its honey in a nectary only $3_{\frac{1}{2}}$ mm. in length, but the narrowness of its entrance (*n'* Fig. 59) proves it to be accessible only to butterflies. These, when inserting their proboscis into the nectary, cannot fail to attach to its upper side the two viscid discs (*d, d*) which lie close together immediately above the mouth of the nectary, and to which the pollinia are fixed by their caudicles. Hence a butterfly, when flying away from the flower first visited, bears a pair of pollinia upright on the upper side of its proboscis. When these are exposed to the air, the membranous discs to which their caudicles adhere contract (just as described and drawn by Mr. Darwin at p. 80 of his work), which causes the pollinia to move downwards and outwards in such a degree as exactly to strike the stigmatic surface when the butterfly inserts its proboscis into the nectary of a second flower.

Near the cataracts of the Adda, between the second and third Cantoniera, 2,200 to 2,400 metres above the sea-level, I found (July 14) plenty of these flowers, which, in accordance with their name, struck me by their highly attractive sweet smell; but although many butterflies were visiting a large number of the surrounding flowers, some of which were scentless, others but slightly scented,

1 Continued from p. 112.

2 "On the various contrivances by which British and Foreign Orchids are fertilised by insects." London, 1862.

3 *Orchis Morio, O. mascula, Epipogum Gmelini, Goodyera repens, Spiranthes autumnalis.*

4 *Orchis maculata, O. latifolia.*

5 *Cypripedium calceolus.*

6 *Epipactis latifolia.*

7 *Epipactis palustris.*

8 *Listera ovata.*

9 *Neottia nidus-avis.*

10 *Gymnadenia albida, Herminium monorchis.*

11 *Orchis pyramidalis, Gymnadenia conopsea, Platanthera bifolia, P. chlorantha.*

12 *Orchis laxiflora, coriophora, militaris, fusca,* and *variegata; Habenaria viridis, Ophrys muscifera* and *apifera; Cephalanthera pallens, ensifolia,* and *rubra; Epipactis atrorubens, viridiflora,* and *microphylla; Malaxis paludosa, Liparis Loeselii.*

13 *Nigritella angustifolia, Gymnadenia odoratissima, conopsea,* and *albida; Habenaria viridis.*

14 *Nigritella angustifolia, Gymnadenia odoratissima* and *conopsea,* and perhaps *Habenaria viridis.*

Gymnadenia odoratissima remained almost entirely overlooked, some specimens of *Crambus coulonellus*, Dup.,* being the only visitors I succeeded in observing during several hours. As the possibility of self-fertilisation has been lost by the flowers of this plant, it must be supposed that its cross-fertilisation by insects happens frequently enough to make self-fertilisation useless. Therefore, from the rare diurnal visits and from the pale colour of the flowers, I am inclined to infer that *G. odoratissima* is more adapted to fertilisation by crepuscular and nocturnal than by diurnal Lepidoptera.

A curious observation on *G. odoratissima* remains to be noticed. In this species, as in most Orchids, the labellum (*n'*, Fig. 58), properly the upper petal, assumes

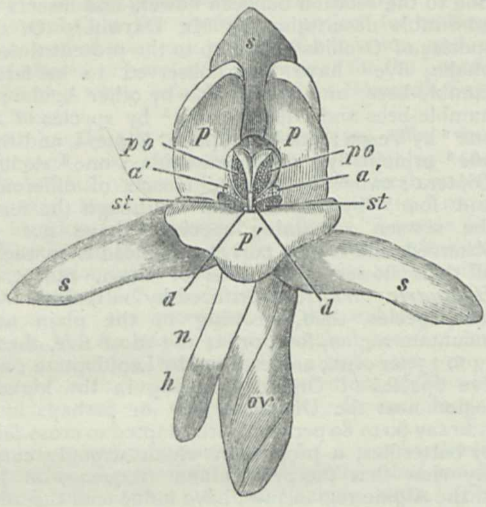

FIG. 58.—*Gymnadenia odoratissima.* Front view of the flower 7 : 1).

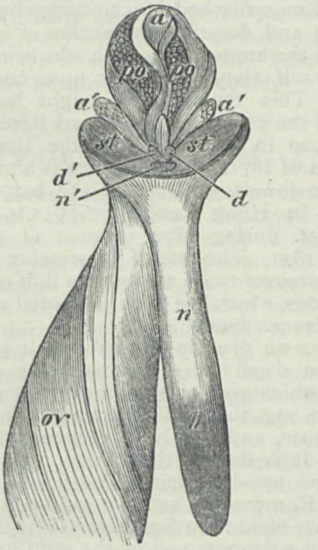

FIG. 59.—Front view of the same flower (14 : 1), with all the sepals and petals removed except the nectary.

(*ov*, ovary ; *s*, sepals ; *p*, *p*, petals ; *p'* labellum ; *a*, developed anther ; *d d*, viscid discs ; *a' a'*, rudimentary lateral anthers ; *po*, pollinia ; *st*, stigma ; *n*, nectary ; *n'*, orifice of the nectary ; *h*, honey.)

its position as the lower lip by the torsion of the ovary ; but in some specimens which I found, the torsion of the ovary had stopped half way in all the flowers, so that they occupied a transverse position, directing the labellum and the nectary to the right hand, one of the sepals downwards, the other upwards. A slight approximation to this position is shown by Fig. 59 if compared with Fig. 58. This exceptional imperfection of the torsion of the ovary of *G. odoratissima* seems to me to be of some interest, if we compare it with the normal condition of the flowers of *Nigritella angustifolia* (Figs. 60-62), in which the ovary is not at all twisted, so that the flowers occupy just the contrary position to what they do in other Orchids. In consequence of this also the function of the upper and

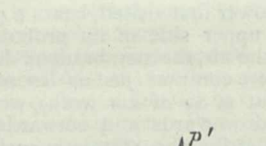

FIG. 60.—*Nigritella angustifolia.* Perfect flower viewed laterally, with the labellum (*p'*) in its natural position, upwards (3 : 1).

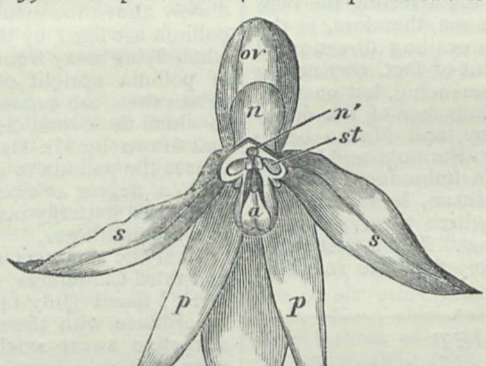

FIG. 61.—The same flower viewed in front, with the labellum removed (7 : 1).

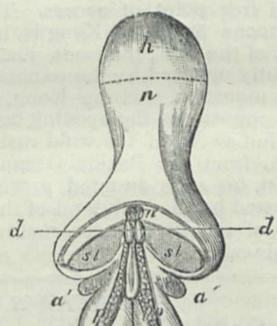

FIG. 62.—Sexual organs and nectary of same flower, in their natural position.

All letters have the same significance in Figs. 60, 61, 62, as in Figs. 58, 59. By the dotted line in Fig. 62 the limit of the honey is marked.

lower sepals and petals is inverted ; the labellum (*p'*), being turned upwards, here protects the organs of fructification, and the sepals and petals opposite to the labellum (*s'*, *p*, *p*, Fig. 61) afford a landing-place for insects. When a butterfly inserts its proboscis into the narrow entrance of the nectary (*n'* Figs. 61 and 62), it attaches the viscid discs (*d*, Fig. 62) to its under side ; and when it flies away, the pollinia, in consequence of the drying up of the discs to which they are affixed, undergo an upward and outward movement so as to strike the stigmatic surface of the flower next visited. Nigritella has probably in-

* According to Dr. Speyer's determination.

herited the peculiar position of its flowers from the ancestors of the family of Orchids, which undoubtedly, like the most nearly allied families, possessed an untwisted ovary, and the imperfectly twisted condition of the ovaries of some individuals of *G. odoratissima* may be looked at as an effect of atavism.

Nigritella differs from *Gymnadenia odoratissima* in the position of its flowers, and in being fertilised in the day-time. Whilst the latter seems to be fertilised especially by crepuscular and nocturnal Lepidoptera, the former, on the contrary, is easily seen to be fertilised by diurnal butterflies. In contrast to the pale flowers of *G. odoratissima*, those of Nigritella are of a dark purple red colour, shining magnificently in the sunlight, whilst at the same time they exhale so remarkable a vanilla-like odour that I have more than once recognised this species sooner by smell than by sight. I have never met with any other flower which attracts diurnal Lepidoptera more efficaciously than this. When descending from the pass of Fluela, towards Zernetz (July 9), during about an hour I collected in a small locality the following species, having observed them all fertilising the flowers of Nigritellas. (*a*) Rhopalocera: (1) *Lycæna semiargus* Rott., frequently; (2) *Melitæa Athalia* Rott.; (3) *Argynnis Euphrosyne* L.; (4) *Hesperia serratula* Ramb. var.? (*b*) Sphingidæ: (5) *Ino statices* L., Alpine varieties, in great number. (*c*) Noctuæ: (6) *Agrotis ocellina* W. V., several specimens; (7) *Prothymia œnea* W. V. (*d*) Crambina: (8) *Botys aërealis* Hb., var. *opacalis* H.; (9) *Diasemia litterata* Scop., in great number; (10) *Crambus dumetellus* H. var., very frequently. (*e*) Tineina: (11) *Butalis* species.* In the subnival region round "Quarta Cantoniera," besides Nos. 3 and 5, I observed (12) *Melitæa Parthenie* Bkh., var. *varia*; (13) *Zygæna exulans* Reiner, both not only perseveringly seeking for the honey of Nigritella in the sunshine, but also lodging after sunset in the heads of their favourite flower, from which in the evening and morning numerous individuals could easily be taken off which had been killed or benumbed by the cold.

HERMANN MÜLLER

* For all the names I am indebted to Dr. Speyer, of Rhoden.

THE TRANSIT OF VENUS

DURING the past week a few additional telegrams have appeared in the *Times*; these, with the *Times'* notes upon them, in a condensed form, we give here.

From the Hague we learn that the Government has received advices from the Dutch expedition sent to Réunion for observing the Transit of Venus. The sky being cloudy, the expedition was only partially successful.

The Astronomer Royal has received the following telegram from the Sandwich Islands:—

"Transit of Venus well observed at Honolulu and Atooi; cloudy at Owhyhee. Sixty photographs; Janssen failed; internal contact uncertain several seconds; complete disc of Venus seen twelve minutes before; 120 micrometer measures."

From New York intelligence has been received that the observation of the Transit of Venus made by the British astronomical party at Honolulu has been successful, except as regards the photographs, which failed.

It will be seen that the bad news for the English plans from New Zealand is fortunately not followed up from the Sandwich Islands. There the ingress, at one end of a base line stretching to Kerguelen's Land, has been secured, and if the observations have been successful at the latter place, Delisle's method can be applied for the ingress.

The telegram from New York is enough to give rise to some uneasiness. The first telegram stated that the Transit was well observed at Honolulu and Atooi, while there were clouds at Owhyhee; and then followed some statements which might have applied either to Owhyhee solely or to the whole attempt. From the last telegram we learn that the photographs failed at Honolulu, where in the telegram to the Astronomer Royal it was stated that the Transit had been well observed. There is, therefore, a distinct strengthening of the idea that the remarks "Janssen failed," "internal contact uncertain several seconds," apply to all the stations. We sincerely trust this may not be so, for the whole value, to the English plans, of the occupation of Kerguelen's Land is that observations of ingress may be made there to correspond with those made in the Sandwich Islands,—the ingress being accelerated in these latter and retarded at Kerguelen. A long experience with transits of Mercury and solar eclipses has now convinced astronomers that corresponding observations mean observations made by similar instruments under similar conditions. For instance, it will be useless to compare an eye observation of a contact made at the Sandwich Islands with photographs of the contact made by Janssen's beautiful contrivance at Kerguelen, whence we are not afraid of hearing that "Janssen failed," for Father Perry, in whose charge the revolving apparatus is, is one of the very few men long practised with astronomical instruments who form part of the English staff.

Lord Lindsay telegraphs to Lady Lindsay from the Mauritius:—

"Transit observed; last half satisfactory. Good photographs, measures, and time determination. Altogether well satisfied."

The private expedition of Lord Lindsay to the Mauritius deserved to succeed. We regret that the degree of success obtained is not so high as that which Lord Lindsay's energy, skill, and care had merited. Had observations been secured here and at Réunion at the *commencement* of the Transit, both Mauritius and Réunion would have been Delislean stations for observations of ingress—almost, indeed, as good as Kerguelen's Land, where it is to be hoped the official astronomers have obtained observations to pair with those made at the Sandwich Islands. But, as Lord Lindsay saw nothing of the beginning (ingress), and as the sky was cloudy at Réunion, the parties at Kerguelen's Land are now the only hope of the Delisleans, and this makes one regret all the more that the Americans were foiled in their attempt to occupy the Crozets. But Lord Lindsay's hopeful telegram evidently means that he has obtained enough photographs and measures to employ with advantage the direct and heliometric methods of determining the least distance of centres; these methods being precisely those which the German parties, also in the Mauritius, were to employ, obtaining corresponding observations at Chefoo, in the north of China.

The *Times* Malta correspondent writes under date Valetta, Dec. 15:—"The Transit of Venus was distinctly witnessed at Malta on the 9th inst. The external egress of the planet from the sun occurred precisely at 7.26 A.M. local mean time."

"*Melbourne, Dec.* 29.—Intelligence from New Zealand announces that the American astronomer, Prof. Peters, was successful in his observation of the Transit of Venus. The German expedition to the Auckland Isles also achieved satisfactory results."

THE SPECTROSCOPE AND THE TRANSIT OF VENUS

A RECENT article in the *Times* (Dec. 24) speaks of the application of the spectroscope to the observations of transits; it is so much to the point that we reproduce a portion of it here:—

The news from Malta which we gave yesterday of the unhoped-for observation of external egress there under good conditions, coupled with the further information which we published on Tuesday, detailing the care taken at Jassy to insure the accuracy of the observation of external contact at egress by Doctors Weiss and Oppolzer, furnishes a good opportunity of referring to the whole question of such contacts, and of pointing out an almost general omission in the scheme of observations. . . .

A few general considerations will show how, in the opinion of some competent judges at all events, there is a remedy for such a state of uncertainty as we have described in the case of external contacts. We have first the essential consideration which underlies the various methods of utilising a transit, that when Venus is as near to us as she is on the occasion of a transit—Venus, of course, is always nearest to us when she is between us and the sun—unless she be exactly between us and the sun, so that we can use the sun as a screen or background, and see Venus moving like a black spot upon it, she will not be visible to us at all, as her bright side will be turned away from us. To point this statement we may remark that this is not the case with Mars, the path of which planet lies outside ours. Mars, in fact, is brightest and best visible when nearest to us, and his distance has been measured, as astronomers have just measured the distance of Venus, by using the longest possible base line on the earth and determining the apparent change of place of Mars among the stars as seen from the opposite points, thus using the stars as a background. The processes, it is true, are different in their details, but the same in intention. The special observations of ingress, egress, nearest approach to sun's centre, and the like, in the case of Venus, arise out of the fact that the only available screen is a limited one and of a certain shape, and, it may be said, are so many contrivances which enable us to use the centre of the sun's disc, as we use a star in the observations of Mars. In either case, of course, whether we determine the distance between the earth and Mars or the earth and Venus, we determine the distance of the sun and the dimensions of the whole solar system.

Now, within the last few years it has been established that the sun, with its sensibly circular boundary which we see every day—the screen which we use in the case of transits of Venus—is by no means the whole of the sun; it is only the central brighter portion of it. An exterior nebulous mass, feebly luminous compared with the central one, lies outside it, and in consequence of its feeble light it is quite invisible to us, except during total eclipses of the sun, when the moon cuts off the brighter light of the central portion, and allows us to see the exterior, irregularly-bounded one, extending for hundreds of thousands of miles away into space in all directions.

Although, as we have said, this exterior portion cannot be seen, except during eclipses, in consequence of the strong illumination of our atmosphere near the sun's place, the lower brighter parts of it can yet be rendered visible without an eclipse by the use of a spectroscope, and it is no exaggeration to say that by the aid of this instrument a large part of the sun outside that part of it ordinarily visible can be seen as sharply and as conveniently as any part of the sun's surface can be observed by a telescope.

The method by which this is accomplished will be easily understood by anyone who will take the trouble to look at the flame of a candle, the wick of which has been almost covered with common salt, through one of those "drops," triangular in section, which form part generally of a common lustre or a chandelier. A small prism will, of course, be better still. If the "drop" or prism be held close to the eye and upright, some four or five yards from the candle, at such an angle that the flame can be seen through it, a perfect yellow image of the wick and flame will be seen. Besides this image there will be a blaze of colour to the right and left of it, but the yellow image of the flame will be brighter than the rest.

Now, common salt is a compound of sodium with chlorine, which compound is decomposed by heat; and it is the vapour of the metal sodium set free which gives us, at the heat of the candle flame, light of one colour only, which cannot be dispersed or split up by the prism. The flame of the candle, on the other hand, gives out white light, which, being composed of light of all colours, is split up by the prism; so, while the prism has no action on the one, it has an enormous action on the other, and as a result gives us a perfect image of the flame, built up by the simple light of sodium vapour, brighter than the spectrum of the flame itself in that region. Further, the white light of the candle gives us no clear image, because in fact there are millions of images of every tint superposed; so that we get but a confused rainbow effect, due to the white light. The exquisite sodium image of the flame is due to the fact that there is no overlapping; and again, the reason that the addition of the salt to the flame, while it scarcely increases the light of the candle, gives us a spectral yellow image brighter than the background, is easily explained by the fact that in this part of the spectrum, as the coloured band is called, the sodium light is helping the yellow light of the flame, which gets no such help in other parts of the spectrum.

Now, we know as a matter of fact that the exterior regions of the sun give a spectrum similar in character to that given by the sodium vapour in the candle flame, and that the sun itself gives us a spectrum similar to that of the ordinary flame of the candle, and that it is because our air is illuminated by light of this kind stronger than the light of the external part of it that it is invisible to us.

To see, then, the external regions of the sun to which we have referred, the physicist looks at them through a prism, as in the candle experiment; in fact, he uses many prisms to spread out to the utmost the sun-light reflected to us by our intervening atmosphere, which sunlight, as we have seen, has a spectrum similar in its nature to the spectrum of a candle flame. When he has done this he sees the images of the strange forms in these external regions, as the yellow image of the candle was seen, the light producing which was concealed by the brighter light of the flame till the prism was brought into play. Of course, he knows now exactly in what part of the spectrum the light which they give out is to be found. He knows that all round the sun there is an atmosphere of vividly bright hydrogen, the light of which is red; he therefore looks in the red part of the spectrum, and the atmospheric veil being withdrawn by the prism in the way we have stated, he is enabled to trace by the red light given out by the hydrogen exactly what the hydrogen is doing, and where it exactly is. He knows that magnesium is sometimes ejected from the sun with terrific force into this sea of hydrogen, and he knows that the light of magnesium vapour is green, so he examines the green part of the spectrum and so observes the exact size and shape of these volcanic bursts of magnesium vapour.

We then come to the point of this long digression. When we bring the spectroscope into play the sun is made larger; outside the round disc there is discovered a continuous envelope extending to various heights, which we can observe. Our screen, therefore, is increased, and exterior contacts are exterior contacts no longer, if we can manage to see Venus passing over the newly-discovered region before she reaches the disc.

How, then, can this be accomplished? There are three ways in which this can be accomplished. We have first that ordinarily employed in observations of the chromosphere—as the newly-discovered region which surrounds the sun and can be spectroscopically observed without an eclipse is called. We have next a method devised by

Father Secchi; and still a third, independently hit on by several investigators.

In the method ordinarily employed, in order to avoid as much as possible the overlapping of images of sensible breadth (which prevented the white light of the candle flame from giving us even a distant approach to a pure spectrum), the light is allowed to fall on the prism through a very fine slit of a certain height. On this slit an image of the sun is thrown by a fine telescope. If the whole length of the slit is immersed, so to speak, in this image, we shall see nothing but the spectrum of the part of the disc which falls on the slit. If it is only half immersed in it, we shall see less of the spectrum of the disc, but we shall see also the spectrum of the chromosphere, as the obliterating effect of the reflection of the sunlight by our air has been destroyed by the prisms.

This spectrum will consist of bright lines, and if we can manage to place the slit on the precise spot occupied by Venus the lines will be broken, as the chromosphere will be eclipsed in this part by the planet; and we can follow the planet's motion until the break in the line travels down to the spectrum of the sun; this will mark the instant of exterior contact at ingress. At egress the problem is simpler, as the actual place occupied by the planet prior to external contact can be seen by an observer set to watch the sun's image on the slit of the spectroscope.

An obvious objection to this method, if a better one can be found, lies in the fact that Venus has, as it were, to be "fished for" prior to external contact at ingress, and that the slightest error in following the planet's motion would render the mode of observation useless.

The next method is one devised by Father Secchi. Using a spectroscope as before, instead of throwing a simple image on the slit, by an object-glass merely, he throws a spectrum of the sun on the slit by means of prisms, placed either before the object-glass or between it and the slit. He states that by this method the solar disc is seen with its spots and edge quite clearly defined, and that the spectral lines of the chromosphere are also seen. Further, the slit can be opened wider with advantage than under the first method. It is clear, therefore, that when Secchi's method is employed, if it does all that he says it does, observations of exterior contact would be easy.

The third method is a photographic one, and if it succeeds at all would do away with the main objection to the first two. A reference to the candle experiment will make it quite clear. If we imagine for a moment the white light of the ordinary flame of the candle to be abolished, it is clear that we should see nothing but the pure yellow image due to the monochromatic vapour of sodium. Similarly, if we imagine the light of the sun abolished, we should see the whole ring of the chromosphere if we looked at it through a simple prism, *as a ring*, or as a series of rings, according to the kinds of light given out by the vapour of which it is composed (the rings taking the place of the lines when we use a slit). In this way the chromosphere and the coronal atmosphere which lies outside it were actually seen in their true ring-like form by Prof. Respighi and Mr. Lockyer in the Indian eclipse of 1871, the light of the sun being temporarily abolished by the interposition of the moon.

In the third method, then, instead of a slit, a disc is used. All the sun is thus hidden, with the exception of a very small ring at the extreme edge, underlying the chromosphere. It is certain that the whole ring of chromosphere can thus be photographed every day the sun shines, as it is now observed on every such day by Mr. Seabroke at the Temple Observatory at Rugby School; and it is believed that the lower surface of the chromosphere can be thus photographed as *hard* as the outline of the sun itself, for there are many favouring conditions which, however, it would take us too long to enter upon in this place.

It is clear that by the application of this method there is a possibility of obtaining a whole series of photographs both before and after Venus is seen on the sun, and it is also clear that the method can only be tested on the occasion of a transit.

We know that Lord Lindsay's expedition, which has been organised with a completeness which puts our official programme into the shade, is to test Secchi's method, and that Dr. Janssen was to use some spectroscopic combination. The Italian parties, as we have already mentioned, were to limit themselves to external contacts as observed by the spectroscope, but their Government subsidy came so late that it is certain they were not equipped in the most complete manner, and it is probable that their original programme has been considerably curtailed.

Although the spectroscope forms no part of the equipment of the English parties, as it certainly should have done, seeing that they intended to observe contacts more than anything else, we may still hope that some of the methods will have been tested, and that the value of the aid they bring to observations of external contact may be determined.

NOTES

THE Belgian Academy of Sciences have conferred upon Prof. Huxley, Sec. R. S., the dignity of Foreign Associate. Such a step on the part of so very Catholic a body may make amends for the anathemas of the Irish prelates.

WE are glad to be able to contradict a statement which has appeared in some of the papers that Prof. Bunsen was about to leave Heidelberg. He has, we learn, no intention of doing so. The loss of Professors Kirchhoff and Königsberger is one which this University will feel most severely, and we cannot help wondering what the authorities at Carlsruhe were about to render it possible for two such men to be tempted away. Prof. Kirchhoff has declined the directorship of the Solar Observatory at Potsdam, and goes to Berlin as free Academician and as Professor in the University; Prof. Königsberger has accepted the post of Professor at the large Polytechnic School in Dresden.

THE scientific results to be obtained from Arctic exploration will be carefully attended to in making the arrangements for the forthcoming Arctic expedition. Each officer will take up a special branch of scientific investigation, and will devote himself, during the interval between his appointment and the sailing of the expedition, to acquiring such knowledge as will enable him to exert his energies most usefully. There will also be a civilian naturalist or geologist in each ship, who will be carefully selected with reference to special knowledge and other qualifications. It is possible also that an Engineer officer may accompany the expedition, with charge of magnetic and pendulum observations. Some of the men forming the ships' companies will also be selected for their special qualifications. Among these, a dog-driver, named Karl Petersen, formerly cooper at the Danish settlement of Upernavik, has already been entered. There will also be three ice quarter-masters in each ship, chosen from the crews of the whalers, and one of the first duties of Capt. Markham on his arrival in England will be to proceed to Dundee for the purpose of selecting and entering these men. Capt. Markham was telegraphed for to Lisbon on the 20th, and is expected to arrive in London this week.

LIEUT. BELLOT, brother of the unfortunate Bellot, the Arctic explorer, to whom we alluded in a recent number, has obtained leave from the French Government to volunteer for the English Arctic Expedition.

ON Dec. 11, at 4.45 A.M., a severe shock of earthquake was felt by Gen. Wansouty and two friends, who intended to spend the whole of the winter on the top of the Pic du Midi, one of the highest summits of the Pyrenees. It is curious to notice that at the same moment, Dec. 10, 10.30 P.M., a similar shock was felt in America, round Winchester, on the Washington heights, alongside the banks of the Hudson. Are these two commotions related to each other?

THE weather has lately been so dreadfully boisterous in the Pyrenean ranges that the Meteorological Observatory situated near the crest of one of the peaks has been almost demolished, Gen. Wansouty and his two friends being obliged to leave the place on the 18th at daybreak. They managed to reach on the same day at midnight, after sixteen hours travelling in the snow, a small inn at Grisp, where they received every attention and were quite safe.

THE advices from the south are unanimous in stating that unprecedented masses of snow have fallen, not only in the Pyrenees and the Alps, but also in Spain, where they have put a stop to the warlike operations. On Thursday, Dec. 24, a thaw occurred in Paris, as well as in London and many other places, with an unprecedented rapidity.

THE number of railway accidents which befell English travellers on Christmas-eve has created quite a sensation in France. It is worthy of notice that in that country there is a regular staff of accomplished engineers, duly qualified by previous instruction, and paid by the Government to inspect the several lines and ascertain whether all proper measures for security have been taken by the companies. Nothing is left to haphazard, but everything is subject to a close and severe examination. The consequence is, that although the traffic on certain French lines is not less than on some of the main English ones, the accidents are less frequent and not attended with such disastrous results.

IN reference to the fact that German plants were found in French soil after the German invasion, we may state that a similar phenomenon has been observed before. *Lepidium draba* was introduced into England by the English troops who failed in the attempt to land on Walcheren in 1809. The gain from the herb was probably greater than the loss from the war. In 1814 many plants from the Don became acclimatised in the Rhone valley and vicinity of Paris. The most notable improvement on record of any spontaneous flora is perhaps the addition to the Alsatian grasses by the introduction of Algerian species. These plants, although coming from a warm climate, have secured a firm footing in their new home, and rendered fertile a number of places which had remained up to that time barren and fruitless.

ON Dec. 23, the French Geographical Society, under the presidency of Admiral La Roncière le Nourry, held its annual dinner. Toasts were drunk with enthusiasm to the union of nations by science, and to the crew and officers of the *Challenger*.

AT the last meeting of the Paris Academy of Sciences, M. de Lesseps announced the capture of a female shark in the Suez Canal, containing in its abdomen (?) twelve young sharks, all living, and varying in length from twenty to twelve centimetres. This fact, adds M. de Lesseps, tends to show that the shark is truly viviparous.

A FEW days ago the French Government received from Belgium four hundred carrier pigeons presented by a columbophile of that country. These animals will be sent to the acclimatisation gardens, where a central dove-house is to be erected for the Ministry of War.

IN the printed book department of the British Museum, constant complaints have been made for years by the *employes* regarding the injurious effect of the atmosphere on their health. Quite recently Mr. Warren, head of the transcribing department, has died, apparently from no other cause than the poisonous effect of the foul air he was compelled to breathe for many hours every day. His frequent complaints were listened to with apathy by his superiors, and notwithstanding the medical testimony by which he was backed, no attempt was made to remedy the evil. Mr. Warren's is a very hard case. He was only thirty-eight years of age, and leaves a widow and two young children, besides others who were dependent on him for the means of life. He had been in the Museum for twenty years, was a most efficient *employé*, and a general favourite. We hope the attempt which is being made to get a pension for his widow from the Civil List will be successful. He, however, has not been the only sufferer. The young men in his room are all more or less affected, some of them being under medical care. We certainly think that an investigation ought to be made into the justice of the frequent complaints as to the bad ventilation of many parts of the Museum, not even excepting the spacious reading-room. It is even said that had it not been for this cause, the accomplished Emanuel Deutsch might yet have been among us. Indeed, it is hinted that the entire management of the printed book department requires looking into; the public money being by no means spent there to the best advantage.

A VERY interesting letter appears in Monday's *Times* from a correspondent on board the *Challenger*, describing the voyage from Cape York to Hong Kong. Details are given of visits to several islands in the Malay Archipelago, in which collections of animals and plants were made. The results so far are said to be very satisfactory, and the *Challenger* has arrived in port with every store bottle and case in the ship filled up. With regard to the temperature of these eastern seas visited by the *Challenger*, the *Times* correspondent says:—"They are, in fact, a chain of sunken lakes or basins, each surrounded and cut off from the neighbouring waters by a shallower rim or border. The water, down to a depth equal to that on the border, is able to circulate freely, and gradually cools as we descend; but the whole mass below, having no means of communicating with the outer waters, remains at the same temperature as that of the water flowing over the floor of the rim; or, in other words, the icy-cold water travelling north along the floor of the ocean from the Antarctic Seas, which is found in all the deep open channels, cannot obtain admission through or over the surrounding rim. Thus, we can now affirm with certainty that the sea immediately east of Torres Straits, although having a depth of 2,450 fathoms, is surrounded by an elevated rim, having no deeper water over any part of it than 1,300 fathoms, all the water below that depth being at a steady temperature of 35°. The Banda Sea, which is 2,800 fathoms deep, is cut off at a depth of 900 fathoms; the Celebes Sea, which is 2,600 fathoms deep, is cut off at a depth of 700 fathoms; the Sulu Sea, which is 2,550 fathoms deep, is cut off at a depth of only 400 fathoms, all the water below that depth being at a temperature of 50°. On the other hand, we find that the Molucca passage is open to at least the depth of 1,200 fathoms, and the China Sea to 1,050 fathoms, the greatest depth yet obtained in them."

THE following is a list of the Council elected at the recent anniversary meeting of the Institution of Civil Engineers:—President, Thomas Elliot Harrison. Vice-presidents—William Henry Barlow, F.R.S., John Frederick Bateman, F.R.S., George Willoughby Hemans, and George Robert Stephenson. Members—James Abernethy, Sir William George Armstrong, C.B., F.R.S., Sir Joseph William Bazalgette, C.B., George Berkley, Frederick Joseph Bramwell, F.R.S., George Barclay Bruce, James Brunlees, Sir John Coode, William Pole, F.R.S., Charles William Siemens, D.C.L., F.R.S., Sir Joseph Whitworth, Bart., F.R.S., and Edward Woods. Associates—Major J. M. Bateman-Champain, R.E., John Head, and Col. Charles Pasley, R.E.

FROM the Indian papers it appears that the expedition despatched from British Burmah to Yunan was to travel, not by any new route, but by the one which Major Sladen followed some six years ago. It was to start, in fact, from his point of departure, Bhamo, proceeding thence to Momein and Talifu. From the last-named city, once more subject to a Chinese governor, it will sail down the mighty Yangtse, with Shanghai for its final goal. The exploring party is commanded by Col. Horace Browne, one of the most distinguished officers of the Burmah Commission. Mr. Ney Elias is a member of the expedition, and Dr. John Anderson, who goes as scientific officer, with a small staff of Eurasian and native collectors, is already well known as a member of the former expedition to Bhamo and Yunan. If the present party succeed in reaching Shanghai, they will be the first Europeans who, at least since the days of Marco Polo, have ever made their way through China from the West.

IT is with somewhat mingled feelings that we have perused the Report of the "Botanical Locality Record Club" for 1873. Any addition to our knowledge of the geographical distribution of British plants is very valuable, and the Recorder and his correspondents have industriously compiled much useful and interesting observation. But what chance remains of the permanence of our rarer plants when their localities are published in this way? We are glad to find that one of the rarest and most interesting of British plants, the Lady's Slipper, *Cypripedium Calceolus*, has been found in several other localities in the woody magnesian-limestone denes of Durham, besides the original one of Castle Eden; the exact spots are wisely withheld.

MR. R. ROUTLEDGE, B.Sc., F.C.S., has been appointed to the Professorship of Natural Philosophy at the Bedford College, York Place. Lecture rooms and a chemical laboratory fitted with the requisite appliances for the practical teaching of physical science are in course of preparation; but pending the completion of these, arrangements have been made to commence the next session with an elementary course of experimental lectures on heat, in another apartment of the College.

SURGEON-MAJOR DAY, F.Z.S., Inspector of Fisheries in India, has recently issued a second report on the fisheries of India and Burmah, which treats of the sea fisheries of those countries, and of the principal customs affecting the supply of fish. The case of the fisheries in the East is entirely different from that in this country. In India, the chief subject of investigation is how to augment the working of the sea fisheries; in Great Britain, one of the main objects of the Legislature in the various inquiries that have been made has been to see if they were being overworked, and to devise means for their preservation and protection. Although certain customs exist which, if observed on a large scale, would seriously affect the fisheries of India, still the general facts seem to prove that there are not sufficient means for properly capturing and utilising the natural supplies of fish. One of the principal defects is the want of quick means of carriage of the fish to the inland towns; to secure a supply of fish in the interior, it is necessary to salt them, and a great impediment to the trade in salt fish is the Government tax on salt. On this point Dr. Day's remarks are very important. He says: "It may be well to decide whether it is humane or even prudent, in a sanitary point of view, to make the price of salt so excessively high that it cannot be used to preserve fish with, and thus compel the people to go without or consume it putrid or rotten. We read that 'in Bergen there are two large hospitals devoted exclusively to the treatment of patients suffering from a peculiar form of disease brought on by eating badly-cured fish; the disease is a mixture of leprosy and elephantiasis' (both common in Orissa). In Ireland, in 1645, we are told that the leprosy was driven out of Munster by the English, the disease being due to the people eating foul salmon or those out of season. This was prohibited, and the prohibition enforced 'whereby hindering these barbarians against their will to feed on that poisonous meat; they were the cause of that woeful sickness which used so mightily to reign among them, but hath in time been almost abolished.' The collector of Ratnagiri states that the high duty on salt is undoubtedly a source of epidemics and other serious illnesses induced by eating imperfectly prepared fish. I think the foregoing extract sufficient to show that compelling a population to eat rotten fish may be a rather impolitic act."

THE Council of the Society for the Promotion of Scientific Industry, the head-quarters of which are at Manchester, has decided to give gold, silver, and bronze medals for excellence and novelty in the various classes of exhibits at the exhibition of implements, machines, and appliances for the economising of labour, which is to take place in Manchester in 1875. The arrangements for the Exhibition are progressing satisfactorily, and space has been secured by many high-class engineering and other firms.

THE tenth number of the third volume of the Bulletin of the Museum of Comparative Zoology consists of an article on the *Ophiuridæ* and *Astrophytidæ*, old and new, by Theodore Lyman, in continuation and rectification of previous memoirs on the same subject. Many new species are indicated, principally from the Philippine Islands, where they were collected by Dr. Semper, from whom they passed into the possession of the Museum of Comparative Zoology. The memoir is illustrated by seven plates, showing the anatomy of the *Ophiuridæ*, the growth of spines, hooks, and stumps, the formation of armed spines, &c., and the characters of the new species.

THE additions to the Zoological Society's Gardens during the past week include two Hardwicke's Mastigures (*Uromastix hardwickii*) from India, presented by Lieut.-Col. C. S. Sturt; a Nicobar Pigeon (*Calœnas nicobarica*) from the Nicobar Islands, presented by Capt. R. J. Wimberley; two Bonnet Monkeys (*Macacus radiatus*) from India, presented by Mr. L. Miller and Miss J. Watt; two Mazame Deer (*Cervus campestris*) from South America, purchased; a Paradise Whydah Bird (*Vidua paradisea*), a Pin-tailed Whydah Bird (*Vidua principalis*) from West Africa, received in exchange.

THE PRESENT CONDITION OF THE ROYAL SOCIETY

(*Extracted from the President's Address at the Anniversary Meeting.*)

IT has been represented to me that, the Royal Society being now, after eighteen years of temporary accommodation, settled in quarters of which we hope to retain undisturbed occupation for some generations to come, an account of the present position of the Society in respect of our more important possessions, foundations, and functions, and our relations to the Government, would not only be generally acceptable, but might even be required of me by that large and increasing class of Fellows who live far from our doors. This class now numbers as nearly as possible one half of the Society, few of whom can be even occasional attendants at our meetings; and if to this class of absentees be added the large number of residents within the metropolitan district whose avocations prevent their attending, it will not surprise you to hear that (as I have ascertained by careful inquiry) a very large proportion of our fellow members know little of the Society's proceedings beyond what appears in our periodical publications, nor of our collections, nor of the tenure under which we occupy our apartments under the Crown—and that many have never heard of the funds we administer, whether our own or those voted by Parliament in aid of scientific research, nor of the fund for relief of the necessitous, nor of the gratuitous services rendered by the Society to various departments of the Government.

Unlike the great Academies of the Continent, the Royal Society has never published an almanack or annuaire containing information upon its privileges, duties, constitution, and management. Particulars on these points are for the most part now accessible to the Fellows only by direct inquiry, or through the Council Minutes; and these, to non-resident Fellows, are practically inaccessible. In my own case, though I have long been a resident Fellow and had the honour of serving on your Councils for not a few years, it was not until I was placed in the position I now hold that I became aware of the number and magnitude of the Society's duties, or of the responsibility these impose on your officers.

It is upwards of a quarter of a century since an account of the foundations that then existed and the work the Society then carried on was published in Weld's valuable but too diffuse "History of the Royal Society." These have all been greatly modified or extended since that period; and many others have been added to them; so that the time has now arrived when a statement of the large funds applicable to scientific research which the Society distributes, the conditions under which these are to be applied for, and other particulars, might with advantage be published in a summary form and distributed to the Fellows annually.

Finance.—After the financial statement made by the auditors, you will, I am sure, conclude that there is no cause for apprehension in respect of the Society's funds or income; and when to this I add that the expenses of removal from the old house, including new furniture, amount to 1,300*l.*, and that the volume of Transactions for the presest year will contain eighty-six plates, the largest number hitherto executed at the Society's cost within the same period, you will also conclude that there is no want of means for providing illustrations to papers communicated to us for publication.

The landed property of the Society, as stated in the printed balance-sheet now before you, consists of an estate at Acton, in the neighbourhood of London, and an estate at Mablethorpe, Lincolnshire, each yielding a good rental. The Acton estate, at present on lease to an agricultural tenant, is planned to be let as building land, for which it is favourably situate, and will thus become increasingly valuable.

The subject of the tenure under which the Society holds the apartments we now occupy was brought up on a question of insurance. That question has been satisfactorily settled by reference to the Treasury; but it may still be worth while briefly to state the facts which the Council considered as furnishing valid grounds for appealing against the requirement to insure, and for at the same time requesting an assurance that the permanence of our tenure is in no way weakened by our removal to this building. These are: that when the apartments in Somerset House were originally assigned to the Society by command of George III., they were granted "during the pleasure of the Crown, without payment of rent or any other pecuniary consideration whatever;" that the Society was not required to insure either in Somerset House or old Burlington House; that when the Society removed at the request of the Government from Somerset House and accepted temporary accommodation in Burlington House, it was under the written assurance of the Secretary of the Treasury, addressed to the President of the Society, that the claims of the Society to "permanent accommodation should not be thereby in any respect weakened;" that in the debates on the estimates in 1857, the Secretary of the Treasury stated, in his place in Parliament, that "the Society could not be turned out of Somerset House without its own consent," and that "it was entitled to rooms by royal grant."

To this appeal the Lords Commissioners returned a satisfactory answer; and their letter, dated October 27th last, assures us "that there is no intention on the part of the Treasury to alter the terms on which the Royal Society holds its appointments under the Crown; the conditions of the Society's tenure will therefore be the same as those on which it occupied rooms in Somerset House, and was subsequently transferred to Burlington House."

While feeling it my duty to lay these details before you, I must accompany them with the assurance that nothing has occurred during this correspondence to disturb the unbroken harmony that has existed between her Majesty's Government and the Royal Society, ever since our occupation of apartments under favour of the Crown.

On every occasion of change of quarters the Society has received abundant proofs of the regard shown by the Government for its position, requirements, and continued prosperity; and there is, I am sure, every disposition on the part of the Government to recognise the fact that the privileges conferred on the Society are fully reciprocated by the multifarious aid and advice furnished by your Council in matters of the greatest importance to the well-being of the State.

The practice of electing Fellows of the so-called privileged class whose qualifications were limited to accident of lineage or political status, has been viewed with grave dissatisfaction by many, ever since the election of ordinary Fellows was limited to fifteen. The Council has in consequence felt it to be its duty to give most careful attention to the subject, which it referred to a committee, whose report has been adopted and embodied in a by-law.

The privileged class consisted, as you are aware, of certain royal personages, peers of the realm, and Privy Councillors (Statutes, Sect. iv. cap. 1); and they were balloted for at any meeting of the Society, after a week's notice on the part of any Fellow, without a suspended certificate, or other form whatever.

The committee reported that it was desirable to retain the power of electing, as a "privileged class," persons who, while precluded by public duties or otherwise from meeting the scientific requirements customary in the case of ordinary Fellows, possessed the power and had shown the wish to forward the ends of the Society, and recommended that the class should be limited to the princes of the blood royal and members of her Majesty's Privy Council. And with regard to the method of election, they recommended that a prince of the blood royal might be publicly proposed at any ordinary meeting, and balloted for at the next; that, with regard to a member of her Majesty's Privy Council, he might be proposed at any ordinary meeting by means of a certificate prepared in accordance with chap. 1. Sect. iii. of the Statutes, membership of the Privy Council being the only qualification stated—the certificate being, with the Society's permission, suspended in the meeting-room till the day of election, which should fall on the third ordinary meeting after suspension.

Having regard to the eminent services to the State which have been rendered by Privy Councillors, and to the fact that all peers who do render such services are habitually enrolled on the list of Privy Councillors, it was believed by the Council that the effect of thus limiting the privileged class would be that the doors of the Society would remain open to all such peers as desire and deserve admission, but who have not the ordinary qualifications for fellowship; while all such peers as might appear with claims which compete with those of ordinary candidates would prefer owing the fellowship to their qualifications rather than to their birth.

The Council hopes that by this means the so-called privileged class will be reinforced, and that statesmen who may have considered themselves ineligible through want of purely scientific qualifications, or who have hesitated to offer themselves from the fear of interfering with the scientific claims of others, will in future come forward and recruit our ranks.

A passing notice of the manner of proposing candidates for the ordinary class of fellowship may not be out of place. Theoretically this is done by a Fellow who is supposed to be a friend of the candidate, is versed in the science on which his claims are founded, and is satisfied of his fitness in all respects for fellowship. It is most desirable that the Fellow who proposes a candidate should take upon himself the whole duty and responsibility of preparing the certificate, should sign it first, and himself procure the signatures of other Fellows in whose judgment of the candidate's qualifications the Council and the Society may place implicit confidence. It is unsatisfactory to see attached to a candidate's certificate an ill-considered list of signatures, whether given from personal or from general knowledge; and the happily rare practice of soliciting signatures and support, directly or indirectly, by the candidate himself, cannot be too strongly deprecated. For obvious reasons the president, officers, and other members of the Council have hitherto during their periods of office abstained from proposing a candidate of the ordinary class, or from signing his certificate, but have not withdrawn their signatures from certificates sent in before they took office. The Council and officers will probably not feel the same objection to signing the certificates of candidates of the privileged class, as these will not be selected for ballot by the Council, but will be elected by the Society at large at their ordinary meetings.

In carrying on the business of the Society the Council is much indebted to committees appointed annually for special purposes, or to whom an occasional question is referred. The annual appointments include the Government Grant, the Library, the Soirée, and the Acton Estate committees. The temporary committees of the past year have been the Circumnavigation, the Transit of Venus Expeditions, the Arctic, the House, the Brixham Cave, the Privileged Classes, and the Davy Medal committees. Besides these there are two permanent committees, the Meteorological and the Scientific Relief, to which fresh members are appointed as vacancies occur. From these designations, it will be understood that some of the committees have been occupied with questions connected with the Government service, while others have devoted themselves exclusively to the business of the Society.

I shall now mention such of the labours of these committees as seem to be most worthy of your attention.

The Meteorological Committee of the Board of Trade, as it ought to be called, discharges in all respects the most arduous and responsible duties of any, controlling as it does the whole machinery of the British Government for the making, registering, and publishing of especially oceanic meteorological phenomena throughout the globe.

The primary purpose for which this and all similar offices were established was the acceleration of ocean passages for vessels by an accurate investigation of the prevalent winds and currents. In other words, their great object is to aid the seaman in what Capt. Basil Hall called "one of the chief points of his duty"—namely, "to know when to find a fair wind, and when to fall in with a favourable current." The first impulse to the formation of an office for this purpose was given by the late General Sir J. Burgoyne, who in 1852 started the idea of land observations to be carried out by the corps of Royal Engineers.

Shortly afterwards our Government corresponded with the United States Government on the subject of co-operating in a scheme for land observations, which was followed by a suggestion on the part of America that the operations should be extended to the sea.

The correspondence was referred to the Royal Society, which warmly approved the scheme of sea observations, but saw many difficulties in carrying out that for the land. The Brussels Conference followed in 1853, when representatives of most of the maritime nations assembled and adopted a uniform plan of action. Soon after this, Lord Cardwell, then President of the Board of Trade, established the Meteorological Department of that office, and placed the late Admiral Fitzroy at the head of it—the Royal Society, at the request of the Government, supplying copious and complete instructions for his guidance, which were drawn up mainly by Sir Edward Sabine. Admiral Fitzroy's zeal and his great labours are known to all; he worked out the system of verifying and lending instruments, planning surveys, registering observations, publishing results; and, lastly, himself originated the plan of predicting the weather, and establishing storm-signals at the sea-ports along the coast.

On Admiral Fitzroy's death in 1865 the Royal Society was again consulted as to the position and prospects of the office. Its report, which did not differ materially from that of 1855, was in 1866 referred to a committee, composed of a representative of the Board of Trade, of the Admiralty, and of the Royal Society. This committee supported the previously expressed views of the Society, and suggested the placing of the office under efficient scientific superintendence; upon which the Society, in the same year, was requested by the Government to undertake the superintendence of what had been the Meteorological Department of the Board of Trade. To this request the Council of the Society so far acceded as to nominate a committee of eight Fellows (subsequently increased to ten) to undertake the entire and absolute control of the office; and a parliamentary grant of 10,000*l.* per annum was provided to maintain it.

This is in brief a history of the connection between the Royal Society and the Meteorological Office on the one hand, and between the office and the Government on the other. It is a very anomalous position, and has been greatly misunderstood. It has led to the misconception on the part of some that the Society controlled the office, and by others that the Government (Board of Trade) controlled it, and by more that the annual grant of 10,000*l.* is made to and in support of the Royal Society, or of its own objects, whereas the grant is paid direct to the director of the office as soon as voted. The Society's action is confined to the selection of the committee, which superintends the office, while the Board of Trade, leaving to the committee the details of their operations, exercise only a general control. The labours of the committee are entirely gratuitous, and no part of the 10,000*l.* is touched by them or by the Royal Society.

I believe there is no parallel to such an organisation as this in any other department of the Government. It has its advantage in securing to the office absolute freedom from that disturbing element in the public offices, that their heads are chosen partly on political grounds and change with every Government, and its disadvantage in wanting the support of direct Government authority and prestige. Hitherto, owing to the care of the committee, which meets almost weekly, to the zeal and efficiency of the director (who is also secretary to the committee) and of the Marine Superintendent, it has worked well. Into its working it is not my purpose to enter; its efficiency and value are fully acknowledged by the public. No more practical proof of this can be cited than the general desire, supported by memorials presented to Parliament, for the restitution of the storm-signals, which were discontinued after Admiral Fitzroy's decease, on the ground of their trustworthiness having been called in question. It is no little testimony to the foresight of that zealous officer that they are not only now re-established and in full working order at 100 stations on the coast of Great Britain, but that the very warnings issued from Paris to the coast of France by the Government of that country are actually sent to Paris from the Meteorological Office in London. The same warnings are transmitted along the whole European coast, from Norway to Spain; and the system has been extended to Italy, Portugal, and Australia.

The Kew Observatory, which is used also as the central observatory of the Meteorological Committee, is supported by a grant from that committee, and by the munificence of our Fellow, Mr. Gassiot, who has settled on it a fund which produces 500*l.* a year for the carrying on of observations chiefly magnetical.

The Circumnavigation Committee.—The scientific results of the *Challenger* Expedition have far exceeded our most sanguine anticipations. The Temperature Survey of the Atlantic may, as Dr. Carpenter informs me, be truly characterised as the most important single contribution ever made to Terrestrial Physics, presenting as it does the whole thermal stratification of an oceanic area of about 15 million square miles and with an average depth of 15,000 feet. Nor are the results of the Pacific Survey less important. Some of these were laid before you at our meeting of the 26th inst. in Prof. Wyville Thomson's "Preliminary Notes on the Nature of the Sea-Bottom in the South Sea," which reveal the existence of hitherto unsuspected processes of aqueous metamorphism at great depths in the ocean, and throw an entirely new light upon the geological problem of the origin of "azoic" clays and schists.

Valuable papers on new and little known marine animals have been contributed to our Transactions and Proceedings by Mr. Willemöes-Suhm, Mr. Moseley, and other members of the civilian scientific staff of the *Challenger*; and a number of the Journal of the Linnean Society is devoted to the botanical observations and collections made by Mr. Moseley during the course of the voyage.

Transit-of-Venus Committee.—Upon the representation of your Council, her Majesty's Government has attached naturalists to two of the astronomical expeditions sent out from this country to observe the Transit of Venus. The stations selected were the two most inaccessible to ordinary cruisers, and at the same time most interesting in regard to their natural productions—namely, the island of Rodriguez in the Mauritius group, and Kerguelen's Land in the South Indian Ocean.

The objects and importance of these appointments were laid before the Government in the following statement:—

"It is an unexplained fact in the physical history of our globe that all known oceanic archipelagos distant from the great continents, with the sole exception of the Seychelles and of a solitary islet of the Mascarene group (which islet is Rodriguez), are of volcanic origin. According to the meagre accounts hitherto published, Rodriguez consists of granite overlaid with limestone and other recent rocks, in the caves of which have been found the remains of recently extinct birds of a very singular structure. These facts, taken together with what is known of the natural history of the volcanic islets of Mauritius and Bourbon to the west of Rodriguez and of the granitic archipelago of the Seychelles to the north of it, render an investigation of its natural products a matter of exceptional scientific interest, which, if properly carried out, cannot fail to be productive of most important results.

"As regards Kerguelen's Land, this large island (100 by 50 miles) was last visited in 1840, by the Antarctic Expedition under Sir James Ross, in mid-winter only, when it was found to contain a scanty flora of flowering plants, some of which belong to entirely new types, and an extraordinary profusion of marine animals and plants of the greatest interest, many of them being representatives of north-temperate and Arctic forms of life.

"H.M.S. *Challenger* will no doubt visit Kerguelen's Land, and collect largely; but it is evident that many years would be required to obtain even a fair representation of its marine products; and though we are not prepared to say that the scientific objects to be obtained by a naturalist's visit to Kerguelen's Land are of equal importance to those which Rodriguez will yield, we cannot but regard it as in every respect most desirable that the rare opportunity of sending a collector to Kerguelen's Land should not be lost."

I may further state as a matter of great scientific interest, that Rodriguez contains the remains of a gigantic species of land-tortoise allied to those still surviving in some other islands of the Mauritius group, and that the nearest allies of these are the gigantic tortoises of the Galapagos Islands in the opposite hemisphere of the globe, as one of our Fellows, Dr. Günther, has shown in a paper read last session to the Society. Very valuable collections of these fossils have been made by Mr. Newton, the Colonial Secretary of Mauritius, during a brief stay which he was enabled to make in Rodriguez; but the materials are far from sufficient for obtaining all the information we want.

In accordance with your Council's recommendation, the Treasury sanctioned the appointment of four naturalists—three to Rodriguez, and one to Kerguelen's Land. Those sent out to Rodriguez are:—Mr. I. B. Balfour, son of Prof. Balfour, of Edinburgh, F.R.S., who, besides being educated as a botanist, has worked as a field geologist in the Geological Survey of Scotland; he is charged with the duties of botanist and geologist; Mr. George Gulliver, son of one of our Fellows and a pupil of Prof. Rolleston, in Oxford, who goes out as naturalist; and Mr. H. H. Slater, who has had great experience as a cave explorer, and who will devote his attention especially to the collection of fossils.

The Kerguelen's Land duties are undertaken by the Rev. A. E. Eaton, M.A., a gentleman most favourably known as an entomologist, and who had made very important collections in Spitzbergen, which he visited for the purpose of studying its fauna and flora. These gentlemen had, by the last accounts, all proceeded to their destinations.

(*To be continued.*)

FRENCH ACADEMY OF SCIENCES.—ANNIVERSARY MEETING

THIS Anniversary took place on the 28th December, the president being M. Faye, who delivered an able address, giving some interesting details as to the history of the prizes offered for competition by the Academy.

One of the first ever offered was a sum of 4,000*l.* given by Philippe d'Orleans, then Regent of France, in 1716, to be awarded to the person or persons who should invent a method of determining longitude at sea. This handsome sum was not awarded to anyone up to 1793, when the Academy was suppressed; M. de Choiseuil, French Ambassador to England, having made fruitless exertions on behalf of Harrison, the well-known chronometer maker, in 1763.

A circumstance connected with these old prizes is worth noting. La Condamine, about 100 years ago, offered a prize for an essay on the question "why so many differences of colour were noted between the male and female livery in quadrupeds as well as in birds." The question being deemed useless, the money was not accepted by the Academy.

In the last century almost all the prizes were won by Euler and Bernouilly, but now scarcely any of the prizes, amounting to 160*l.*, are awarded; sometimes nobody competes for them.

Although the distribution this year is both for 1872 and 1873, only two of the competitive prizes have been taken, one for 1873 by M. Mascart, professor in the Collége de France, for a paper on the modification which the light of the sun undergoes in consequence of the motion either of the sun or of the earth. M. Mascart failed to observe any modification, but the prize was given to him owing to the care and ingenuity displayed in his experiments. One prize was also won by M. Balbrain for a paper on the reproduction of animals that present parthenogenetic phenomena.

The proceeds of the 4,000*l.* offered by M. Breaut to the person who should discover a cure for the cholera was divided between several partly successful essayists for 1872 and 1873, but it is not likely that the sum itself will ever be parted with by the Academy.

The prizes offered for general excellence or voluntary work on a certain subject have been a great deal more fortunate, so that the method adopted by the Royal Society promises better results than the old academical competitive system, even in Paris. The Plumly prize of 120*l.* for the best paper on the improvement of steam navigation was gained for 1872 by M. Zaurines, who has carefully investigated propulsion by the Archimedean screw; in 1873 by M. Bertin, for a paper on the best method of ventilating steamers.

The Lalande prize in astronomy has been gained for 1872 by the brothers Henry for the discovery of a number of small planets at the Paris Observatory, and in 1873 by M. Coggia, of the Observatory of Marseilles, for his discoveries among comets.

The Poncelet prize has been given for 1872 to M. Mannheim for the general excellence of his geometrical disquisitions, and in 1873 to Sir W. Thomson for his magnificent works on the mathematical theory of electricity and magnetism.

The Godard prize for 1872 has been awarded to Dr. Pettigrew for his work "On the Muscular Arrangements of the Bladder and Prostate, and the manner in which the Ureters and Urethra are closed."

The aggregate sum to be awarded yearly, exclusive of the Breaut prize, is 4,400*l.*, and the number of prizes nineteen, only a few being for subjects specially proposed by the Academy. The competition is open to all nations. The names of competitors must be placed in sealed envelopes, which are opened only in the case of those who succeed; but, except in the case of prizes given for general excellence, papers must be written either in Latin or in French.

SCIENTIFIC SERIALS

Jahrbuch der k.k. geologischen Reichsanstalt. Band xxiv. Nos. 1 and 2.—The first article in No. 1 is by Dr. A. Redtenbacher, and treats of the stratigraphical relations of the mesozoic formations as developed in the district of Gams, near Hieflau. The second paper, by Dr. C. Doelter, gives some account of the Siebenbürgischen metalliferous mountains. The district described lies south of the river Arranyos, between Offenbánya and Bistra, as far as the Maros. The formations developed in this district consist of (1) crystalline, metamorphic, and eruptive rocks (gneiss, crystalline limestone, granite, diorite, syenite); (1) Jurassic and cretaceous (limestone, melaphyre and augite porphyry, sandstone, chalk, &c.); (3) Tertiary (comprising, besides various fossiliferous deposits, such igneous rocks as hornblende-andesite, augite-andesite, basalt); (4) alluvium. A sketch-map accompanies Dr. Doelter's communication.—Herr R. Hörnes contributes a paper entitled "Tertiary Studies," in which he gives an account of the mollusca met with in various Tertiary deposits (as at Kischeneff, Jenikale, &c.) A number of the species described are new to science. Four excellent plates illustrate the paper.—Dr. E. Mojsisovics, whose contributions to the *Jahrbuch* are both frequent and valuable, gives us a long paper on the Triassic period in the East Alps. He discusses the distribution of the Triassic fauna, and shows that the formation itself may be divided into zones, each characterised by certain well-marked species; further, he describes at length the nature of the deposits, and points out that the trias is characterised throughout by the constant presence of poorly fossiliferous limestone and dolomite and richly fossiliferous marl and calcareous marl.—The only geological paper in No. 2 is one by Dr. Guido Stache, On the palæozoic regions of the East Alps. The auther describes in considerable detail the structure of the rock-masses forming the Alpine lands of Austria, and gives a coloured geological map of the regions described, and two plates of horizontal sections.—Amongst the mineralogical papers accompanying these numbers of the *Jahrbuch* may be noted one by Dr. Doelter, On the trachyte of the Siebenbürgischen metalliferous mountains, in which a number of analyses are given.—Herr Kalkowsky furnishes an account of the microscopy of the felsite and pechstein of Saxony.—A new mineral (Ludwigite) from Banat is described by Tschermak; and a

Report of the volcanic eruptions and earthquakes that took place during last year, is given by C. W. Fuchs. The latter author furnishes a translation from the Swedish of Nauckhoff's paper On the occurrence of native iron in a basalt vein at Ovifak, in Greenland, in connection with which we note also a paper by the editor (Tschermak) On the meteorite-find in Greenland.

Astronomische Nachrichten, No. 2015, contains a detailed statement of observations made at Washington by Cleveland Abbe on the position of Coggia's comet, together with the form of the tail, its length, and other details.—F. Tietjen gives elements of Dr. Paliser's planet (139), together with an ephemeris for November and December.

Memorie della Societa degli Spettroscopisti Italiani.—Father Secchi sends an account of his observations on the solar eclipse of October last. He observed the contacts of the limbs of the sun and moon by the spectroscopic method, and discusses its advantages over the ordinary method with the simple telescope. —The same author sends drawings of the chromosphere from December 26, 1873, to August 2, 1874, and he remarks on the continual diminution in the frequency and height of the prominences in accordance with the diminution in number of sun-spots. The sun appears to have been seen, on an average, rather oftener than every other day.

Annali di Chemica applicata alla Medicina, vol. lix., No. 3, September, opens with a paper in the Pharmaceutical Section by Prof. Borsarelli, of Turin, entitled "General and Comparative Study of the Pharmacopœias of Europe and America."—In the same section is a paper by Dr. C. Girard, On protoxalate of iron, and one by Leger, On a tartrate of magnesium lemonade. —In Hygiene there is a paper by Cunningham, On the microscopical examination of the air.—Drs. Lanzi and Terrigi communicate a paper to the Pathological Section, on palustrine miasma.

SOCIETIES AND ACADEMIES

LONDON

Linnean Society, Dec. 17.—Dr. Allman, president, in the chair.—The President read a paper on the Diagnosis of new Genera and Species of Hydroids. Several very interesting collections of Hydroida had recently been placed in the author's hands for determination. One of the most important of these is from the zoological museum of the University of Copenhagen, and consists entirely of gymnoblastic forms obtained from various parts of the world, but principally from the Scandinavian shores. The author is indebted for it to Prof. Lütken, of the University of Copenhagen. Another collection, consisting of calyptoblastic forms, was made in the Japan seas by Capt. St. John, of H.M.S. *Sylvia*, and sent to the author for determination by Mr. J. Gwynn Jeffreys, by whom it is destined for the British Museum. For another valuable collection, containing many new species, the author is indebted to Mr. Busk; while a collection, belonging chiefly to the family of Plumularidæ, was made by Mr. Holdsworth in Ceylon, and contains several curious forms; and, lastly, for a small collection from the shores of Spitzbergen, the author is indebted to the Rev. Mr. Eaton, by whom it was obtained during a recent yacht voyage to that region. Among the new species from the Copenhagen Museum, one of the most interesting is a Hydractinia, from Spitzbergen. It is distinguished from *H. echinata* of our own shores by its nearly smooth spines, but more especially by the peculiar condition of its gonosome, the blastostyles being destitute of the capitulum which forms so characteristic a feature in *H. echinata*, while each carries only a single spherical sporosac of comparatively enormous size. He proposes for it the name of *H. monocarpa*. The same collection contains a new Cladocoryne, the second species as yet discovered of this remarkable genus. It was found attached to Gulf-weed, and is especially interesting in being provided with its reproductive zooids, structures hitherto unknown in the genus. These are developed among the tentacles, and are almost without doubt medusiform, though this point could not be determined with absolute certainty. For the new species the name of *C. pelagica* was proposed. Another hydroid from the same collection was a beautiful Amalthæa, a genus nearly allied to Corymorpha. It was obtained from Iceland. One of its most striking features consists in the great length of its proximal tentacles; these are nearly as long as the entire stem round which, in the living animal, they must have hung down in the form of a graceful inverted tassel of flexile filaments subject to the impulse of every passing current of the surrounding water. The name of *A. islandica* was proposed for it. The Japan collection contained, among other interesting species, a Campanularia, remarkable for the comparatively enormous size of its cups, which exceeded by about five times the dimensions of those of the largest British species. It was named *C. grandis*. This collection contained also a beautiful Thuiaria, for which the name of *T. coronata* was proposed, and in which the female gonangium or receptacle for the ova was crowned by about nine very long bifurcating hollow spines, which formed a cage-like chamber into which the ova subsequently passed. An extension of the cœnosarc is continued from the enlarged summit of the blastostyle or fleshy columnar axis of the gonangium through the whole length of the spines; and as the blastostyle must be homologically regarded as a hydranth arrested and adapted to functions connected with reproduction instead of nutrition, the author looked upon the spines as representing the tentacles of a hydranth which had lost their prehensile functions, become clothed with chitine, and adapted to the protection of the ova during an early period of their development. Mr. Busk's collection contained many beautiful new species of calyptoblastic hydroids. Among these was a Sertularella, whose tubular hydrothecæ, free from the stem in nearly their entire length, were deeply cleft at their distal ends, in the manner of a mitre. For this curious species the name of *S. episcopus* was proposed. A new genus, under the name of *Gemminella*, was constituted for a sertularia-like form, in which the hydrothecæ, instead of being situated on the opposite sides of the stem, were all brought to the front of the stem, and there became adnate to one another in pairs. A beautiful Thuiaria, with a remarkable dicholomous ramification of the main stem, and with the gonangia situated in the axils of the branches, presented a striking resemblance to the inflorescence of certain common caryophyllaceous plants, and was named *T. Cerastium*. Mr. Holdsworth's collection, made on the coast of Ceylon, contains some very remarkable species. Among these is a magnificent Plumularian of the Aglaophenian type, rendered striking by the great length of its mesial nematophores, and by the presence of two very long divergent teeth which project from the margin of the remarkably patulous hydrothecæ. The species grows in the form of crowded tufts of beautifully graceful plumes. It would seem to belong to the group which Kirchenpauer places in his sub-genus Makrorynchia, and the name of *Makrorynchia insignis* is now proposed for it; but as no gonosome has as yet been found in any of the specimens, the generic name is only provisionally assigned to it. For another beautiful form from the same collection the author has constituted a new genus under the name of *Taxella*. Its hydrothecæ and nematophores are formed on the type of those of the genus Aglaophenia, but its gonophores are not protected by corbulæ, and its ramification presents the peculiarity of being doubly pinnate, so that it represents in the Aglaophenia section of the Plumularidæ a form which in the Plumularian section is represented by the genus Diplopteron, a genus recently constituted by the author for one of the deep-sea hydroids of the *Porcupine* Exploring Expedition. The name of *Taxella eximia* is assigned to the present species, which grows in dense tufts to the height of about a foot. In Mr. Eaton's collection, from Spitzbergen, the only well-preserved hydroid is a little Sertularia with regularly pinnate ramification, elongated hydrothecæ, and a long ovate gonangium curiously constricted near its middle. The author gives it the name of *S. arctica*.

Geologists' Association, Dec. 4.—Henry Woodward, F.R.S., president, in the chair.—Dr. W. B. Carpenter, F.R.S., On the conditions which determine the presence or absence of animal life on the deep-sea bottom.

EDINBURGH

Royal Society, Dec. 21.—Prof. Kelland, vice-president, in the chair.—The following communications were read:—Remarks on the great logarithmic table computed at the Bureau du Cadastre under the direction of M. Prony, by Mr. Edward Sang.—On the elimination of α, β, γ, from the conditions of integrability of S. $U\alpha\delta\rho$, S. $U\beta\delta\rho$, S. $U\gamma\delta\rho$, by M. G. Plarr. Communicated by Prof. Tait.—The development of the ova and structure of the ovary in the Mammalia, by James Foulis, M.D. Communicated by Prof. Turner.—Mathematical Notes, by Prof Tait:—(1), On a singular theorem given by Abel; (2), On the equipotential surfaces for a straight wire; (3), On a fundamental principle in Statics.

MANCHESTER

Literary and Philosophical Society, Dec. 1.—Rev. Wm. Gaskell, M.A., vice-president, in the chair.—Some doubts in regard to the law of the diffusion of gases, by Mr. H. H. Howorth.

Dec. 15.—Mr. Edward Shunck, F.R.S., president, in the chair.—Rev. Wm. Gaskell, M.A., read an interesting account of Horrocks' and Crabtree's observations of the Transit of Venus in 1639, published in the *Annual Register* for 1769.—Some particulars respecting the negro of the neighbourhood of the Congo, West Africa, by Mr. Watson Smith, F.C.S.—Analysis of one of the Trefriw mineral waters, by Mr. Thomas Carnelley, B.Sc. Communicated by Prof. H. E. Roscoe, F.R.S.

GLASGOW

Geological Society, Dec. 15.—Mr. John Young, F.G.S., vice-president, in the chair.—Mr. James Neilson, jun., exhibited a selection of fossils from the Irish and Scotch limestone beds, and read a paper on the Armagh limestones, and their equivalents in Scotch strata.—Mr. James Dairon read a paper on the graptolites of the Upper Llandeilo rocks of the south of Scotland. Mr. Dairon described more particularly the following forms: *Climacograpsus teretiusculus*, *Didymograpsus*, *Dicranograpsus*, and *Pleurograpsus*, pointing out the characteristic features of each, and indicating their range in the rocks of the formation, and the beds in which they severally occur most abundantly. The paper was illustrated by drawings and by a beautiful collection of specimens.

BOSTON, U.S.

Society of Natural History, March 18.—The president in the chair.—Dr. Samuel Kneeland read a paper illustrated by diagrams and specimens, on the evidence for and against the so-called sea-serpent. He thought a careful weighing of the evidence showed that such an animal is not a zoological absurdity, and that from palæontology (if we discard the testimony of many credible witnesses) we may even conclude that it is a possibility—and, he believed, a probability—that some form, intermediate between the marine saurians of the Secondary and the elongated cetaceans of the Tertiary has come down to the present epoch, and will eventually come under the notice of naturalists, and prove, in this as in many other cases, that widely spread popular beliefs in natural history, especially when professing to rest upon credible testimony, have generally for their foundation some portion of scientific truth. He believed there were at least two species of the creature (which he styled Eremotherium), one in the northern and another in the southern ocean.—Notes on Ophidiidæ and Fierasferidæ, with descriptions of new species from America and the Mediterranean, by F. W. Putnam.

PARIS

Academy of Sciences, Dec. 21.—M. Frémy in the chair.—The following papers were read:—New theory of the motion of the planet Neptune: remarks on the *ensemble* of the theories of the eight principal planets, Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, and Neptune; by M. Le Verrier. The paper presented completes a work commenced on September 16th, 1839.—New theorems on series of similar triangles, by M. Chasles.—On the limited oxidation of the hydro-carbons: amylene; by M. Berthelot. The author employs a solution of chromic acid as the oxidizing agent. Hydride of amylene yields valerianic acid. Amylene when mixed with water and treated with the mixture yields a mixture of all the fatty acids from formic to valerianic—the latter and acetic acid being formed in the greatest proportions.—New documents on the flora of New Caledonia, by M. Ad. Brongniart.—On the carpellary theory according to the Liliaceæ, by M. A. Frécul.—The Laboratory of Experimental Zoology at Roscoff, by M. H. de Lacaze-Duthiers. The author gives a detailed account of this valuable establishment.—Micrometric measurements of the triple star ζ Cancri, by M. Otto Struve.—Report on a memoir by M. Sarrau, entitled, "Theoretical researches on the effects of gunpowder and explosive substances," by the Commissioners, MM. Morin, Tresca, Berthelot, and Résal.—On an apparatus for measuring gases in industrial analyses or *gas-hydrometer*, by M. E. J. Maumené.—Observations concerning a recent communication by M. A. Cornu on the degree of precision of Foucault's method for measuring the velocity of l ght; a letter from M. Lissajous to the perpetual secretary. The writer gave the following extract from Foucault in contradiction to M. Cornu's statement that the former had obtained results having an indeterminate approximation: "Increasing thus the length of the luminous path and applying greater accuracy to the measurement of the time, I obtained determinations of which the extreme variations do not exceed $\frac{1}{100}$ and which combined by the method of means rapidly give series which ageee nearly to $\frac{1}{500}$."—On the pyruvic ureides: synthesis of parabanic acid; by M. E. Grimaux. This acid has been obtained by the action of bromine and water on mononitropyruvic ureide:—

$$C_4H_3(NO_2)O_2 + 6Br + H_2O = CBr_3NO_2 + C_3H_2N_2O_3 + 3HBr.$$

On a fragment of cranium seeming to indicate that trepanning might have been employed among the Celtic people, by M. E. Robert.—M. Dumas read a telegram from M. Fleuriais relating to the transit of Venus.—Installation in Campbell's Isle of the expedition sent to observe the transit of Venus; a letter from M. A. Boquet de la Grye to M. Dumas.—Letter to the perpetual secretary on the subject of the obelisk raised at Montmartre in 1736 for the fixing of the meridian of Paris, by M. F. Lock.—On the first method given by Jacobi for the integration of equations to the partial derivatives of the first order, by M. G. Darboux.—On the changes of brilliancy of Jupiter's satellites, by M. C. Flammarion.—On the molecular equilibrium of solutions of chrome alum, by M. Lecoq de Boisbaudran.—Preparation of pure nickel salts from the nickel of commerce, by M. A. Terreil.—Action of chlorine on perbromide of acetylene, by M. E. Bourgoin.—Toxicological search for potassium cyanide in presence of non-toxic double cyanides, by M. E. Jacquemin. Researches on the pathological albumens, method of estimating albumens, &c., by J. Birot.—Analysis of a meteorite which fell in the province of Huesca, in Spain, by M. F. Pisani.—Observations relating to the Roda meteorite, by M. Daubrée.—Researches on the modifications which the blood undergoes in its passage through the spleen, from the double point of view of its richness in red globules and its respiratory capacity, by MM. L. Malassez and P. Picard.—Observations made at Bordeaux of two lunar halos of remarkable intensity on the 15th and 19th of December; a letter from M. G. Lespiault to the president.—During the meeting M. Du Moncel was elected a free member in place of the late M. Roulin.

BOOKS AND PAMPHLETS RECEIVED

BRITISH.—A Sketch of Philosophy. Part 4. Biology and Theodicy; a Prelude to the Biology of the Future: John C. Macvicar, M.A., LL.D., D.D. (Williams and Norgate)—Gardener's Year-Book for 1875: Robert Hogg, LL.D., F.L.S. ("Journal of Horticulture").—Heredity; From the French of Th. Ribot (Hy. S. King and Co.)—Geology of the Clyde Valley: John Young, M.D. (James Maclehose, Glasgow).—List of the Palæozoic Fishes. Extracted from the Geological Magazine (Trübner and Co.)—Seventh Annual Report of the Executive Committee of the Manchester Nat. Soc. for Woman's Suffrage (Alexander Ireland, Manchester)—Notes on t Till or Border Clay with broken Shells in the Lower Valley of the River Endrick: Robt. L. Jack, F.G.S (Geological Society, Glasgow).—Astronomy; J. Norman Lockyer (Macmillan and Co.)—The Physics and Philosophy of the Senses: R. S. Wyld, F.R.S.E. (Henry S. King and Co.)—Cholera: How to Prevent and Resist it: T. Whiteside Hime, A.B., M.B., &c. (Baillière, Tindall, and Cox).—Studies on Biogenesis: Wm. Roberts, M.D. (Royal Society).—On the Connection between Colliery Explosions and the Weather in 1872: Robert H. Scott and Wm. Galloway (Quarterly Journal of the Meteorological Society).—British Wild Flowers. Parts 7 and 8: John E. Sowerby (John Van Voorst).—History of British Birds. Parts 6, 7, and 8: A. Newton, M.A., F.R.S. (John Van Voorst).—Micrographic Dictionary. Parts 18, 19, 20, and 21: J. W. Griffith, M.D., and A. Henfrey, F.R.S., F.L.S. (John Van Voorst).—Anthropologia. Vol. i. Part 3 (Baillière, Tindall, and Cox).

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