THURSDAY, SEPTEMBER 7, 1882

ANIMAL INTELLIGENCE

Animal Intelligence. By George J. Romanes, M.A., LL.D., F.R.S., Zoological Secretary to the Linnean Society. International Scientific Series. (London: Kegan Paul, Trench, and Co., 1882.)

THE psychology of animals having hitherto been treated only in detached portions, and for the most part in an uncritical manner, Dr. Romanes has "thought it desirable that there should be something resembling a text-book of the facts of comparative psychology, to which men of science, and also metaphysicians, may turn whenever they may have occasion to acquaint themselves with the particular level of intelligence to which this or that species of animals attains." But this is only one of the objects with which he has undertaken the treatment of the psychology of animals. The second and more important object "is that of considering the facts of animal intelligence in their relation to the theory of Descent." The present volume supplies the basis for this mode of considering the facts. "While complete in itself as a statement of the facts of Comparative Psychology," it is preliminary to a second division of the work, which is to be brought out as a separate treatise under the title of "Mental Evolution."

Since the present volume is to be regarded as the first part of a scientific treatise, it is, of course, important that we should know the critical principles on which the facts have been selected. Dr. Romanes has stated these in his preface. It will not be denied that his canons of criticism are sufficiently severe; and in the book itself we do not receive that impression that the facts are being described without careful discrimination, which often makes itself felt in reading collections of anecdotes about animals. But, considering the possibilities of the subject, most readers will look for descriptions which may be scientifically accurate or not, but which, in either case, are interesting in themselves. And, notwithstanding the intention he has expressed, "as far as the nature and circumstances of the inquiry would permit, to suppress anecdote," Dr. Romanes has written a book that is very pleasant to read. Besides this, the materials are arranged in such a way that there is no difficulty in finding any fact that it is desired to refer to.

Dr. Romanes points out more than once "how slightly a psychological classification of animals depends upon zoological affinity, or even morphological organisation" (p. 241). The zoological classification is followed for the sake of its convenience, but at the same time it has, of course, been found necessary to treat some groups in much more detail than others. "Anatomically, an ant or a bee does not require more consideration than a beetle or a fly; but psychologically there is need for as great a difference of treatment as there is in the not very dissimilar case of a monkey and a man" (Preface, x.). As an example of the mode of classifying the facts relating to each group, the chapter on Ants may be referred to. First the researches are described that have been made in order to determine the exact character of the special senses of ants, and of the "sense of direction." After this, the powers of memory and recognition are considered, then the emotions. Then follow sections on the powers of communication, the habits, and the general intelligence of ants. Lastly, there is a short section on the nervous system and the sense organs; but this is not represented in the chapters dealing with other animals.

Though the complete theoretical treatment of mental phenomena in animals does not belong to the present volume, yet there is in the Introduction some discussion of theoretical questions. This was indeed necessary in order to arrive at a provisional mode of grouping the facts. For it has been objected to those who speak of the "emotions" of an ant or a bee, for example, that we are not justified in applying terms derived from human psychology to animals so remote in structure from the human type. Dr. Romanes replies to this objection by showing that the ground of all inferences as to the mental processes of animals is an argument from the analogy of their actions with our own. "Now it is, of course, perfectly true that the less the resemblance the less is the value of any analogy built upon the resemblance, and therefore that the inference of an ant or a bee feeling sympathy or rage is not so valid as the similar inference in the case of a dog or a monkey. Still it *is* an inference, and, so far as it goes, a valid one—being, in fact, the only inference available. That is to say, if we observe an ant or a bee apparently exhibiting sympathy or rage, we must either conclude that some psychological state resembling that of sympathy or rage is present, or else refuse to think about the subject at all; from the observable facts there is no other inference open" (p. 9).

Assuming that we are justified in concluding that the mental processes are similar when there are similar external appearances, we still need a criterion of mental as distinguished from reflex action; for we find both in men and animals examples of actions that are "mind-like and yet not truly mental." "Objectively considered, the only distinction between adaptive movements due to reflex action and adaptive movements due to mental perception, consists in the former depending on inherited mechanisms within the nervous system being so constructed as to effect *particular* adaptive movements in response to *particular* stimulations, while the latter are independent of any such inherited adjustment of special mechanisms to the exigencies of special circumstances" (p. 3). The criterion proposed is therefore—"Does the organism learn to make new adjustments, or to modify old ones, in accordance with the results of its own individual experience?" If it does, we have evidence that the limit of non-mental action has been passed; that is, we are able to fix, by means of this criterion, "the upper limit of non-mental action." After distinguishing reflex from mental action, it remains to distinguish "instinct" from "reason." Dr. Romanes proposes to define instinct as "reflex action into which there is imported the element of consciousness," and "reason or intelligence" as "the faculty which is concerned in the intentional adaptation of means to ends" (p. 17).

Dr. Romanes in his Introduction defends these last definitions against several objections, but the strongest argument that can be brought against them is found in the actual treatment of the phenomena of instinct and "general intelligence" in the chapters that follow. In

discussing, for example, the question of the general intelligence of ants, Dr. Romanes speaks of "the difficulty of drawing the line between purposeless instinct and purposive intelligence." He then goes on to say, "It will be remembered that our test of instinctive as distinguished from truly intelligent action is simply whether all individuals of a species perform similar adaptive movements under the stimulus supplied by similar and habitual circumstances, or whether they manifest individual and peculiar adaptive movements to meet the exigencies of novel and peculiar circumstances" (p. 123). Now this distinction between instinct and reason, when it comes to be applied, does not seem to be essentially different from the distinction between mental and reflex action. The distinction of instinct as having an element of consciousness from mere reflex action which is unconscious, seems to vanish in the actual treatment of the subject; and the way of answering the question as to instinct that suggests itself most strongly is to define it with Mr. Spencer as "compound reflex action," placing both instinct and reflex action, as merely mechanical processes, in opposition to all conscious action.

If we take this view, we must regard all animals from the lowest to the highest as having a certain measure of "general intelligence." In the higher animals this general intelligence may be as highly developed as the mechanical processes described by the term instinct. For example, Dr. Romanes says, in speaking of the beaver, "It is really impossible by the closest study of the psychology of this animal to distinguish the web of instinct from the woof of intelligence; the two principles seem here to have been so intimately woven together, that in the result, as expressed by certain particular actions, it cannot be determined how much we are to attribute to mechanical impulse, and how much to reasoned purpose" (p. 367). Now there seems to be an advantage here in confining the term instinct to the mechanical processes and calling all the rest "general intelligence." And Dr. Romanes, except in the Introduction, seems to have looked upon the facts in this way. But in considering the question how the terms should be defined, the difficulty no doubt presented itself that reflex action, instinct, and reason are usually thought of as an ascending series. This, however, is merely because the animals in which reflex, instinctive, and rational action respectively are most prominent, form an ascending series in the scale of intelligence. The difficulty disappears when we regard all animals as having some general intelligence; for we can arrange them in an ascending series (as Dr. Romanes proposes) according to the amount of consciousness possessed by them; contrasting all along the line "non-mental neuro-muscular adjustment" (simple or "reflex," and compound or "instinctive") with the mental life properly so called.

That all animals have some consciousness, some "general intelligence," is regarded as probable by Dr. Romanes; and perhaps the most interesting portions of the book are the early chapters in which he proves the presence of an element of consciousness in animals very low in the zoological scale. "Even the headless oyster," he quotes from an unpublished MS. of Mr. Darwin, "seems to profit by experience." And this power of profiting by experience, it must be remembered, is the test of rational as distinguished from instinctive action. But we find evidence of conscious purpose even below mollusca. Dr. Romanes records an observation made by himself on rotifers, and says that if we were to depend upon appearances alone, this one observation would be sufficient ground for attributing conscious determination to these microscopical organisms (p. 19). Then after quoting "some observations relating to the lowest of all animals and made by a competent person," he remarks that "although we may suppose that the adaptive movements described by Mr. Carter were non-mental, it still remains wonderful that these movements should be exhibited by such apparently unorganised creatures [*amœbæ*], seeing that as to the remoteness of the end attained, no less than the complex refinement of the stimulus to which their adaptive response was due, the movements in question rival the most elaborate of non-mental adjustments elsewhere performed by the most highly organised of nervous systems" (p. 22).

Now these phenomena, if they are ascribed to mind at all, certainly cannot be ascribed to instinct. And it is scarcely possible, consistently with the principles laid down by Dr. Romanes, to deny that they are mental. It therefore seems as if we must admit the presence of the intelligent and volitional element in Protozoa; and this view suggests itself more strongly when we consider the nature of the movements of these animals, and when at the same time we remember Mr. Spencer's description of instinct passing into intelligence by losing its perfectly unhesitating or "automatic" character.

In the higher (as regards morphological organisation) but less plastic animals Cœlenterata and Echinodermata, Dr. Romanes finds nothing that cannot be explained as reflex action. Taking this into account along with the facts already mentioned, we may infer that the opposition between intelligent and mechanical action which shows itself in the tendency of each to encroach on the region possessed at any particular time by the other, is present from the beginning of life; and thus the division of all that is included in mind into free intelligence and organised habit (instinctive or reflex) subordinate to it, is seen to be preferable to the division into reflex action, instinct, and reason.

The kind of opposition that must always exist between these two things when they have become distinct may be made clear by bringing together the general results of the chapter on Instinct in the "Origin of Species," and of those portions of Mr. Spencer's "Principles of Psychology" mentioned by Dr. Romanes in his preface. Mr. Darwin showed, in the chapter referred to, how the most complicated instincts may be formed out of purely reflex actions by natural selection: and Mr. Spencer had already shown in the first edition of the "Psychology" how instinctive processes pass into rational processes when they become too complex to be performed unhesitatingly; and how, on the other hand, rational processes when they are often repeated become habits, and may at length be fixed by heredity as secondary instincts. More recently Mr. Spencer has shown grounds for thinking that natural selection is most important in the early stages of evolution, while the formation of habits which at first are conscious, but at last pass into instincts, is most important in the later stages of evolution. But in any case

we see here both the continuity of instinct with reflex action and the constant opposition that there is between mechanical quasi-mental action and free intelligence. On the one hand the organism tends to become excessively specialised by the development of instincts under the influence of natural selection and by the formation of habits; on the other hand rational processes are constantly being applied to slightly different material, thus becoming more varied, and instincts when they become too complex are partially disorganised and contribute their share to the activity of the free intelligence. Thus, starting with a lowly organised animal having the beginnings of intelligence and reflex action, that is, having the germs of the mental and quasi-mental processes of the higher animals, we observe from this point onwards both a process of development of each kind of action along its own line and a process of transformation of each kind of action into the other.

In some ancient civilised societies of men, habits which were originally special applications of reason to particular ends have encroached to such an extent on the free intelligence that almost the whole of life has become mechanical routine. If the specialising tendency can go so far in the case of men, may we not expect to find animals rather high in the zoological scale (perhaps some species of insects) in which *all* the mental activity has passed into the form of instinctive processes? The complementary problem to that of finding evidences of intelligence in the lowest animals would be that of finding evidences of the absence of intelligence in the higher animals. In discussing ants Dr. Romanes remarks that some species do not seem to have general intelligence in proportion to the complexity of their instincts, though "other species . . . appear to be as remarkable in this respect as they are in respect of their instinctive adjustments" (p. 127). But if there is a constant struggle between instinct and intelligence, an animal in which instincts have been fixed so rapidly that all the plastic intelligence has been absorbed in forming them is quite possible, and might be found perhaps among insects. Such an organism would be a realisation of the idea of Descartes that animals are unconscious automata.

T. WHITTAKER

DALTON'S "HUMAN PHYSIOLOGY"

A Treatise on Human Physiology, designed for the Use of Students and Practitioners of Medicine. By John C. Dalton, M.D., Professor of Physiology and Hygiene in the College of Physicians and Surgeons, New York. 7th Edition. (London: J. and A. Churchill, 1882.)

THE seventh edition of this excellent work shows on almost every page that the author has submitted the previous edition to careful revision, with the result of producing a much better book in every respect. Statements are made more concisely and to the point; irrelevant or useless illustrations are suppressed; redundant sentences have been clipped and pruned till they express their meaning in the shortest form. Further, the arrangement of the book has been much improved. In the 6th edition, Dr. Dalton discussed the subject under the heads of "Nutrition," "The Nervous System," and "Reproduction," whilst in the present edition he has subdivided the first section into "Physiological Chemistry" and "Nutrition," properly so called. This arrangement has enabled him to describe more fully the chemical composition of proximate principles and to arrange the facts in a more natural order. As a matter of logical arrangement, it is doubtful how far Dr. Dalton is justified in treating of the Bile under "Digestion," and the Glycogenic Function of the Liver under "Absorption," but no doubt he has felt the difficulty experienced by those who have been obliged to deliver a systematic course of lectures on physiology as to the natural position of those important functions. At what point do they come in, if it be the object of the teacher to describe facts in natural sequence and in such a way as to help the student in grasping an idea of the entire mechanism? In the digestive process, the bile plays a comparatively unimportant part whilst the production of glycogen by the liver has little to do with absorption. Still both of these processes have a natural relation to the great functions under which Dr. Dalton has placed them, and an author may be excused for arranging them as he has done, on the ground that it is impossible for any one, with our present views of nutrition, to state precisely under what head, in any systematic treatise, these functions should be described.

In discussing the "Nervous System," Dr. Dalton has judiciously incorporated the facts brought to light by recent investigators. Thus we have a careful description of the physiological anatomy of the cerebral hemispheres and associated ganglia, and an account of the experimental evidence supplied by Fritsch and Hitzig, Ferrier, Schiff, Hermann, and Carville and Duret. In particular, prominence is given to the attempts of Ferrier and others to determine special centres for sensory perceptions, and to what may be called the "check" experiments of the New York Society of Neurology and Electrotology. Less importance is justly given to the results reached by the rough method of extirpation followed by Flourens and many others. Not a few still doubt the view that there are portions of the cerebral convolutions devoted to special motor or sensory functions, but the student will find in Dr. Dalton's pages a very clear exposition of the results of modern investigation.

The chapter on the "Senses" is clear and intelligible so far as it goes. It does not pretend to give an account of the almost innumerable phenomena of the senses, but it gives a fair representation of the more common phenomena, whilst it is suggestive and critical. The account of the mechanism of accommodation is meagre and might be much improved. No account is given of any theory of colour-perception. The account of the auditory mechanism is excellent, and the author is extremely careful in discussing the attempts made to explain the organ of Corti.

The special feature of this book, in all editions, is the prominence given to the function of *reproduction*, and we may add that no text-book of a general character gives so full and explicit an account of this department. Here, as elsewhere, the author has endeavoured to be a teacher, and has aimed not so much at giving a detailed account of all the steps of the process as at presenting the subject in a form easy of comprehension. Thus whilst it might be possible to point out statements slightly erroneous or

deficient in fulness, no one can refuse a compliment to the skill with which the learner is led on step by step through the intricacies of reproduction and development.

The popularity of the work is likely to give Dr. Dalton the opportunity of preparing another edition, and we would suggest, in particular, that further details be given as to the physiology of muscle. A student who has a fair knowledge of the structure of muscular fibre, its chemical composition at rest and in action, its relations to the nervous system, and, in short, the history of its life, has a good grounding in the fundamental principles of physiology. Again, the accounts of the ultimate changes in the respiratory process, of the functions of the kidney, and of secretion are meagre, and give an amount of knowledge not likely to satisfy the requirements of various examining boards in this country. The histology of the tissues and organs might also, with advantage, be given more fully.

When a teacher writes a text-book it may be taken as an indication of his method of teaching the subject, but often the order in which subjects are discussed is changed from a desire to give a logical and systematic exposition. To deluge a beginner with a sea of facts relating to the chemical composition of the body is likely to confuse him and to make the subject distasteful, but whilst this is a caution to the teacher, it is quite justifiable for an expositor in print to begin with such wearisome details. With Dr. Dalton's method little fault can be found. He leads a beginner, by easy stages, through many difficult problems, whilst it is clear he has thought out the matter for himself and thus can clearly indicate how much may be taken as fact and how much may be accepted as theory.

Whilst Dalton's "Physiology" is not on a level with that of Dr. Michael Foster in being a representation of the most advanced opinions in physiological science, nor with Hermann's "Physiology" (translated by Prof. Gamgee), Beaunis' "Physiologie," Landois' "Lehrbuch der Physiologie des Menschen," or Carpenter's "Human Physiology," as a repertory of facts, it is a compendium well suited, on the whole, for a student of medicine. As a rule, successive editions of a popular work become larger, but in the present instance the author has been able to sift and refine so as to save space, without injuring the quality of his work. JOHN G. MCKENDRICK

OUR BOOK SHELF

Synthèse des Minéraux et des Roches. Par F. Fouqué et M. Lévy. (Paris: G. Masson.)

THE authors of this work have earned for themselves so high a reputation by their numerous and successful experiments in the synthesis of minerals and of rocks, that we may almost take for granted the thoroughness of the work now issued. Till the appearance of this volume the results obtained since 1872 (when a similar compilation was published by Fuchs) were to be sought in scattered memoirs; all results up to the present date are here collected into a single treatise, provided with an excellent set of indices. In an interesting but brief introduction (thirty pages) the advantages accruing to mineralogy and petrology from these syntheses are pointed out and the various methods of experiment explained. The next fifty pages are devoted to the experiments having for aim the synthesis of rocks, and the remainder of the volume (300 pages) to those which have resulted in the reproduction of minerals. In each instance careful references to the original memoirs and a distinct statement of the application of the results to geology are given. The book is very well printed on good paper, and has for frontispiece a coloured plate showing the appearance in polarised light of thin sections of artificial leucotephrite and basalt. L. F.

LETTERS TO THE EDITOR

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

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

The Australian Aborigines

I OBSERVED in NATURE, vol. xxiii. p. 584, a critique from the pen of Mr. D. McLennan upon "Kamilaroi and Kurnai," the joint work of Mr. Fison and myself. On perusing it I wrote a reply to statements it contained, but owing to various causes I laid it for a time aside. Indeed I did not feel in any hurry to reply to criticisms which really did not touch my arguments. As, however, I observe that attacks are still being made elsewhere upon the conclusions at which Mr. Fison and I have arrived, and that substantially the same arguments are still being made use of which were used by Mr. McLennan, it has seemed to me that the time has arrived to meet these objections at any rate in a general manner. It is not possible in the space which I may hope that you will give me in your valuable pages, to enter upon details which would be absolutely necessary to render clear to my critics certain points which they have evidently misunderstood, perhaps from want of clearness on my part, possibly also from want of knowledge by themselves of the subject as it exists in the Australian field. I therefore now confine myself to some prominent points.

It is absolutely necessary, in order to perceive the structure of an Australian tribe with clearness, to distinguish between *clan* as a part of its local organisation, and *class* as a part of its social organisation. By this I do not mean "clan" in its ordinary acceptation, as, for instance, the "clan of the McPhersons," but a division of the local organisation which stands in relation to a division of the social organisation as *mutatis mutandis* did the Dime to the Phratria of Attica. These two organisations exist in all tribes with which I am acquainted, but in no two tribes in the same relative proportion. For the local organisation of the Kurnai tribe I have already used the word *clan;* for its social organisation I should use the word *class*. But the only two class-divisions of the Kurnai are the bird totems Yeerung and Djeetgun, which, as my critics take pleasure in pointing out, "divide the tribe into men and women." That there are, however, real totems in an abnormal form, is shown by their cinalogues occurring together with totem classes of the ordinary type in tribes of South Eastern Australia over an area extending more than 600 miles east and west. Some of these tribes have uterine, and others have agnatic descent.

In exogamous tribes having uterine descent there are no totem-clans; in tribes having agnatic descent there may be totem-clans where the *class* and the *clan* have become coterminous. The persistent use of this word "totem-clan," without regard to its application, shows in our critics a want of acquaintance with the nature of the Australian evidence.

It is not possible to argue correctly from the customs of one tribe to that of all Australian tribes, as our critics appear to do, for the customs of the tribes are very diverse. Tribes adjoining each other may be found to have each a distinctly different social organisation. It is a most misleading practice to criticise by arguing from the reported customs of one tribe to the customs of distant or of all Australian tribes. The further my inquiries extend, the clearer this comes out. The case of half-sister marriage among the Kamilaroi is an example. My inquiries have not as yet brought to light any other Kamilaroi tribe practising it than that one reported on by Mr. Lance. Yet my inquiries show that the Kamilaroi organisation in classes, sub-classes, and totem-classes extends far beyond the true Kamilaroi country northwards into Queensland, over an extent of country more than eight hundred miles north and south. The classes, sub-classes, and totem-classes can be even identified with

each other in dialectic forms. Not only do these totem-classes regulate marriage and descent, but the sub-classes, *i.e.* their well-known form as Ipai-Kumbo and Muri-Kubi, do so likewise, and moreover the two primary classes which I have now succeeded in tracing out over the area named are those in fact in considering the legality of marriages the aborigines finally look. It is, in fact, these two primary classes which, through their four subdivisions and the group of totem names, imperatively regulate marriage. They are the tw exogamous intermarrying groups into which the tribe in its social organisation is divided. The marriage of two individuals belonging to one primary class is regarded in the light of incest, and is very generally punished by death. Thus the objections which have been taken that the class-names do not influence marriage and are mere terms of address receive renewed and positive contradiction from accumulating evidence.

As to the objections taken to my statement of the practice of marriage by elopement among the Kurnai, I have little to add to the full account I have given in my work in that tribe. Mere denials of its existence, mere statements that marriage by elopement is a "product of misconception," do not alter the fact that the practice existed in Gippsland, as I have stated it. The difficulty which has been raised as to the elder men obtaining wives and second wives amounts to nothing. It may interest my critics to know as one instance that the man King Charley, whom I mentioned in "Kamilaroi and Kurnai," obtained his first wife from Maneroi by elopement; he obtained his second wife from the Wurnŭngatti division of the Kurnai also by elopement, leaving his first wife with some friends during this proceeding. In addition to these cases, in which elder men obtained wives, or second wives, in Gippsland by (1) capture; (2) inheritance from deceased brothers (own or tribal); (3) by the rare cases of gift by the woman's relatives or by exchange of a female relative, will be found by those who desire to find the evidence in "Kumilaroi and Kurnai."

It is an error on the part of our critics to suppose that in Australia it is general, or even very frequent for the elder men to monopolise all the women. The young men acquire wives in various manners in various tribes, as by arrangement by relations, by exchange of sisters, by betrothal, by elopement, or as among some of the Kamilaroi tribes, by an absolute right of selection by the "initiated youth" of any unmarried girl of the proper class-name, provided his hands are free of the blood of her kindred.

It has been asserted by more than one of our critics that "the class-names as well as the terms of relationship are names merely belonging to a system of personal addresses." Personal names are not in all Australian tribes secret names. In tribes within my knowledge personal names, class-names, totem-names, terms of relationship, are all used in addressing individuals. There is, therefore, no necessity in such tribes for individuals to have recourse to an invented system of fictitious relationships for the purpose of addressing each other, such as some of our critics believe in. The terms of relationship define groups, and the individual takes the name of his group. These groups have a real existence. For instance, in the tribe which occupied the table-land of Maneroo, it was the males of the two primary class divisions which met as two groups to mutually initiate their youths, that is, to confer upon them the privileges of manhood. It was the group "Jambi" of each intermarrying primary class-division which, under the control of the old men of the tribe initiated the youths of the other group. The youths being initiated are also "Jambi." It was one Jambi who gave a wife to the other Jambi, receiving his sister in exchange, and the relationship of Jambi included therefore "sister's husband" as well as "wife's brother"; but it was not imperative that the "sister" should be an "own sister," for she might be a "tribal sister." Jambi therefore represents a group; the individual takes the relationship of his group, and the relationship is a real one. We have here two exogamous groups of the social organisation of a tribe meeting to confer the rights of manhood on the youths of each, and each group providing the other group with wives. It is significant that in some tribes there is evidence that on such an occasion a temporary return to more or less intersexual communism between the groups takes place.

In conclusion, I may say that since the publication of "Kamilaroi and Kurnai," I have extended my inquiries over the greater part of Australia, and am still gathering information. The evidence has accumulated to a large extent, but I cannot at present foresee at what time it may be sufficiently completed for publication. I have therefore thought it well to make this statement, and also to say further that meanwhile I propose from time to time to summarise results in a series of short memoirs, the first of which I have presented to the Anthropological Institute, through the courtesy of Dr. Tylor. I must refer my critics to these memoirs, pending a final publication, for replies to their objections and for additional facts which it may be advantageous for them to consider. A. W. HOWITT

Sale, July 1

New and very Rare Fish from the Mediterranean

IN Prof. Giglioli's letter on rare Mediterranean fishes, which appeared in NATURE, vol. xxv. p. 535, he refers to specimens of *Scorpæna ustulata*, Lowe, obtained at Messina. In some "Notes on some rare and little known Fishes taken at Madeira," published between 1860 and 1870 in the *Annals and Magazine of Natural History*, I undertook to prove that the fishes on which Mr. Lowe founded that species were merely young specimens of the common *Scorpæna scrofa*, L. It might be well if Prof. Giglioli looked at the paper referred to before labelling his Sicilian fishes. With regard to the two Macruroid fishes, *Malacocephalus lævis* (Lowe), and *Coryphænoides serratus* (Lowe), which the Professor captured in the Mediterranean, I may state that they are so rare at Madeira, where they were originally detected by the late Mr. Lowe, that during thirty years I have only obtained a single specimen of the former and have never met with the latter at all. It would be curious if the "singular fish of a deep black colour, with small eyes, a naked skin, and a most abyssal physiognomy," should prove to be the rare Madeiran Gadoid, *Chiasmodon niger*, described by me in a paper read before the Zoological Society of London on November 10, 1863. The unique specimen was sent to the British Museum, but another example was afterwards taken in the West Indies, and figured by Dr. Carte in the *Proc. Z. S.* London, 1866, pl. ii. Singularly enough the stomach of the latter specimen contained a fish which exceeded the size of its swallower, and this was no other than an example of an extremely rare Madeiran species, *Neoscopelus macrolepidotus*, described by me in the *Proc. Z. S.*, January 13, 1863, pl. vii.

In enumerating the known species of precious corals in NATURE, vol. xxv. p. 552, Prof. Giglioli has not referred to the pure white species of Madeira on which Dr. J. E. Gray founded the genus *Hemi corallium*, the polyp cells being on one side of the branches, like the *Corallium secundum* of Dana. Only two specimens of this coral have fallen in my way, and one of these was presented to the British Museum. This was described with a figure by Dr. Gray in the *Proc. Z. S.* 1867, p. 394, Radiata, pl. xviii. See also his Catalogue of Lithophytes in the British Museum, 1870, p. 24. If this white coral could be found in greater abundance it would form a valuable article of commerce.

Madeira, August 26 JAMES YATE JOHNSON

Aurora

AN aurora of considerable proportions and of the radiant form was visible here on Wednesday night. At 9 p.m. the centre of energy was in the north-west, and from a large blunted cone-shaped smoke-like luminous mass in that quarter, fan-rayed streamers were projected to the zenith. The streamers were crossed at equal intervals by horizontal bars, similar in appearance, minus the motion, to the pulsating bars which sometimes form a feature of auroral activity. The day had been finer than has been the prevalent weather of late. Set of wind during the day, north-west. Drift of the clouds at high altitudes from south-west. The night calm, barometer high, thermometer 57. At 9 p.m. the western sky was covered with flocculent cirri. The north-west was obscured by the dense eruptive volume of auroral vapour. The northern sky was clear, and so was the eastern. The moon was shining brightly. The line between the auroral mass and the region of blue sky was remarkably sharp and well defined. Just after 10 p.m. a narrow streamer of great brilliancy shot from the north-west across the zenith to the north-western limb of the moon, constituting a notable feature of the display. As the night wore on, the centre of energy, together with the basal eruptive mass, travelled slowly northwards, and the northern sky became covered with bright white beams, rays, and streamers. At the same time, clouds of the cirrus type made a mackerel sky in the west, as well as in the zenith towards the south. Some of the streamers were of

extreme tenuity, others were dense and bright, hiding the stars over which they passed. The sky in the end was covered with a light haze, which condensed into a cloud canopy. No prismatic colours were visible, streamers, beams, and rays throughout being alike of a pure white light, though greatly luminous, so as to retain distinctive individuality in the face of brilliant moonlight. Thursday, early morn, sun shining through a hazy sky, wind light from the south; 9 a.m., overcast; 11 a.m., rainfall set in. Continuous all the day. Sharp fall of barometer. Thermometer mid-day, 65, wind inclined to back to the eastward. Considering that the vernal and autumnal equinoxes are the usual periods of auroral activity, and that there is yet a month to the 21st of September, an instance, now of auroral energy is somewhat out of the usual course of things. The equinoctial gales, yet earlier, set in with much rigour. Perhaps, as everything has a meaning, these phenomena presage the kind of weather which is to rule the autumn. Scarcely a summer bird remains save the swallow and martin. The swift left early. A solitary bird or a pair was observed, however, evening by evening up to the 28th to return to the nesting place of the tribe, as loth to leave the English home. To day (Friday) continuous rain, which has prevailed all the night. Mid-day, thermometer 64; barometer 29·3; set of wind southerly. X.

Worcester, September 1

Habits of Spiders

YOUR correspondent, Mr. Frank Rowbotham, in his letter on the "Habits of Spiders" (vol. xxvi. p. 386), gives it as his opinion that a spider shakes the web from a desire "to effect concealment when it feels danger is near." I am inclined to think it does so from a feeling of anger. During a long residence in the tropics, I often amused myself irritating spiders and watching their conduct. I noticed that they generally seized the web and shook it up and down in the manner described by your correspondent, but some of the spiders were of so great a size as to render concealment by such a manœuvre quite hopeless, and I attributed their behaviour to other motives. They appeared to me more to resemble angry monkeys than anything else. I have not unfrequently seen the latter when annoyed jumping up and down on all fours with their tails erect in the air, or if confined in a cage seize the bars bp their hands and feet and shake them as the spiders did their webs. W. J. C.

Torquay, August 30

THE RESPIRATORY MOVEMENTS OF INSECTS

THE respiratory movements of some of the larger insects are quite apparent, and have been described by various observers. A German naturalist, Herr Rathke, published in 1861 a memoir in which he compared those movements, observed with the naked eye and a magnifying glass, in insects of all the principal types.

According to M. Plateau (who has lately studied the subject, and has made a preliminary communication of his results to the Belgian Academy), though Rathke's memoir is very remarkable, he overlooked many details, and fell into sundry errors, owing to the difficulty of the inquiry.

Haussmann (1803) suggested a method of indicating the movements of dilatation and contraction of an insect's abdomen, by oscillations of a liquid column; but he recognised that it would apply only to articulata of large size, and it seems incapable of yielding very exact results.

M. Girard (1873) proposed encasing the insect's abdomen with a thin envelope of caoutchouc having a style attached which would inscribe the movements.

It is a form of the graphic method that M. Plateau first adopted. He confined himself to perfect insects, and directed his attention to (1) the form of the inspiration and expiration; (2) the parts of the body participating in the respiratory movements; (3) the expiratory and inspiratory muscles; (4) the influence of certain parts of the nervous system on the movements of respiration. The technical processes concerning the muscles and nervous system are a matter of mere dissection, once the form of respiratory movement is ascertained, and the latter, therefore, chiefly claims notice in a simple *résumé*.

M. Plateau used two kinds of styles to inscribe the movements on a rotating blackened cylinder. One was a narrow light strip of Bristol paste-board, fastened to the part of the body whose movement was to be ascertained, with a little Canada balsam; the other a lever of the third order, turning freely about a horizontal axis placed at one end, and resting by its own weight, at a point near the axis, on the body of the insect (the insect, in either case, being supported fixedly in any desired position).

The graphic method is, however, unsatisfactory, and sometimes quite inapplicable, and M. Plateau used another along with it, viz. the method by projection, which gave excellent results.

The insect, fixed on a small support, so that the movements in breathing are not interfered with, is introduced into a large magic lantern lit with a good petroleum lamp. A reversed silhouette is obtained on the screen, and if a certain magnification be not exceeded (say 12 diameters), a very distinct image is produced, on which one may follow all the respiratory movements sufficiently amplified to indicate real displacements of a fraction of a millimetre. With a sheet of white paper over the image one draws the contours of the silhouette, corresponding to expiration and inspiration. Further, by changing the position of the insect, and by attaching short paper styles at parts whose movements are doubtful, a complete knowledge may be acquired of all details of the respiratory movements that characterise a given insect.

With a little practice, not only may the respiratory movements of small insects, such as flies, be easily studied thus, but a number of questions are unmistakably settled, which cannot be decided by direct observation.

The following is a brief *résumé* of the author's results:—

1. There is no close relation between the form of the respiratory movements of an insect, and the insect's place in zoological classifications. The respiratory movements are similar only when the structure of the abdominal rings and the arrangement of muscles moving them are nearly the same. Among curious facts here, the movements of Phryganeidæ are unlike those of nearly related Neuroptera (such as Sialis), and like those of sting-bearing Hymenoptera.

2. *In all insects* the diameter of the abdomen diminishes in expiration by approximation of the dorsal and sternal arches of the segments; in some cases the dorsal, in others the sternal, showing the greater mobility; and in others both having nearly the same mobility.

3. The modifications in the vertical diameter *may* be accompanied by changes in the transversal diameter (*e.g.* Libellulæ).

4. Contrary to a former view, the changes of length of the abdomen, in normal respiration, by protrusion and return of the rings, are rare in insects; they are observed in an entire group only in the case of the sting-bearing Hymenoptera. Some isolated cases occur in the other zoological subdivisions (*e.g.* the caddis flies among the Neuroptera).

5. In the majority of cases, the thoracic segments do not participate in the respiratory movements of insects at rest. But the respiratory displacements of the posterior rings are less rare than Rathke supposed.

6. It has been thought that the respiratory movements in many insects were progressive, and propagated like a wave either from the base of the abdomen towards the point, or from the middle towards the two ends. This wave is, however, an exceptional phenomenon, is absent in all Coleoptera, in Acridians, in Libellulæ, in sting-bearing Hymenoptera, in Muscides, and a part of Lepidoptera, and only appears in isolated forms in certain groups.

7. When there is a pause in the respiratory phrases it always occurs in inspiration.

8. In all insects vigorous enough to furnish suitable curves (such as the large Coleoptera) one finds that the inspiration is usually slower than the expiration, and that the latter is often sudden (confirming an observation by Sorg in 1805).

9. In most insects expiration is alone active, inspiration being passive, and due to elasticity of the teguments and the tracheal walls. (This confirms previous observations.)

10. Nearly all insects possess only expiratory muscles. M. Plateau has found muscles aiding inspiration not only in Hymenoptera and Acridians (Rathke, Graber), but in Phryganeidæ.

11. The superior and inferior diaphragms of Hymenoptera have not the *rôle* Wolff attributes to them (a confirmation of objections by Graber).

12. Many insects, perhaps all, perform, with their abdomen, general movements, sometimes small, sometimes very ample, which do not coincide with respiratory movements, properly so called, and must be distinguished from them.

13. The respiratory movements of insects are purely reflex, persisting in the decapitated animal, and even in the isolated abdomen in forms whose nervous system is not condensed. In the latter case these movements are excited or retarded by the same causes which excite or retard them in the intact insect (a confirmation of previous observations).

14. The metathoracic ganglions are not, as Faivre supposed, special respiratory centres (a confirmation of the views of Barlow and Baudelot on Libellulæ).

15. The abolition of respiratory movements by destruction of the metathoracic ganglions in Dytiscidæ and other Coleoptera, results from the condensed state of their nervous system, in which a certain number of abdominal ganglions are fused with those of the metathorax.

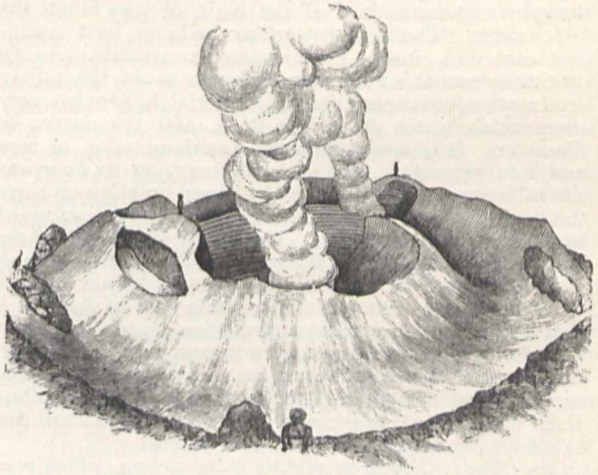
16. In insects with a condensed nervous system the excitation or partial destruction of a complex nervous mass resulting from the union of successive ganglionary centres always affects all the centres entering into the constitution of this mass.

DIARY OF VESUVIUS, JANUARY 1 TO JULY 16, 1882

IN the account given in NATURE, vol. xxv. p. 294, the eruption that has been going on in December was described up to the last day of 1881. As the height of the lava column had been diminished by the lateral outlets, the surface was consequently some considerable distance below the lip of the crater, its level on ordinary occasions being only a few metres below.

Under ordinary conditions the ejectamenta consist of masses of fluid lava blown out as the spray from an effervescing liquid. They form the so-called lava cakes, being flattened out by their fall, while still plastic. They are usually very spongy, or scoriaceous, and rapidly disintegrate. In the present instance, however, as the vapours quitted the lava at some considerable depth, these plastic masses could not reach the surface. This rapid escape of vapour through the narrow tube between the lava surface and the crater lip, was under analogous conditions to the powder gas in a fire-arm. If, for instance, we imagine a cannon, whose bore is composed of materials easily broken up, we have a rough illustration of what takes place. The lava-cakes were replaced by ejectamenta derived from the components of the sides of the chimney, such as compact lava fragments, lapilli, old scoria cakes, all more or less altered and decomposed by the hot acid vapours, to which they had been exposed for considerable periods.

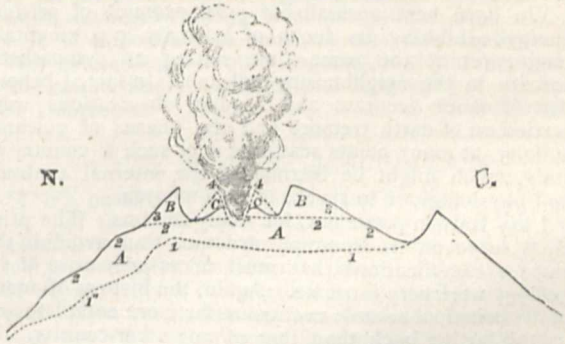
Such a condition of things naturally results in the straight-tube or chimney assuming the form of a funnel, or conical hollow whose apex will be at or near the lava level, that is to say, at the point where the gaseous products quit the fluid magma. We have, in fact, two conditions upon which the size and depth of a crater depend, namely, height of lava column, and amount and force of vapour escaping. Naturally the effect would be modified by local causes, and also the difference of com-



Sketch after Nature on July 16, 1882, 9.30 a.m. View from the north of the cones and craters of December, 1881, and January to July 16, 1882. The outer rim is broken away over the old fissure to the left or east. The smaller bocca is beneath the little figure, there is probably the remnants of another beneath the middle, or left figure.

ponent materials. The ejectamenta which in this manner were very different from that of ordinary occasions, were deposited simultaneously in a rim-like manner around the new crater.

Thus we see how a nearly perfect cone of eruption, such as existed in the beginning of December, composed as it was of alternate beds of lava and scoria cakes, with a chimney, but without a crater, may be converted into a low truncated cone, whose base is of an area considerably larger than that of the original, but whose height is much



1, Outline profile of apex of cone after eruption of 1872; 2, outline on December 31, 1881; 3, outline section on April 23, 1882 (*i.e.* the continuous line); 4, cone and crater formed between April 23 and July 16, 1882; A, materials, lava, and scoriæ since 1872; B, ditto, since December 31, 1881; C, ditto, since April 23, 1882.

less. The interior now occupied by a crater proportionally large. The whole of these changes occurring without the addition or abstraction of any materials, except an ash blown away by the wind.

On January 1, Vesuvius had become quiet, and the feeble ejections consequent thereon could no longer hoist the materials over the new crater edge, but were instead building up a new cone of eruption around the vent at the bottom of the craterial hollow.

Till January 14 no glimmer even was visible from Naples. On that evening, however, there was a slight red reflection, which continued till the 24th, when much vapour was escaping. The next day it became quiet.

February 2, slight glimmer visible again.

From February 19 to April 23, the mountain remained very quiet; only the slightest glimmer visible at night. That day I visited the crater.

The crater and its rim of December and January occupies about one-third of the plain of lava filling the 1872 crater. The former overlaps the latter in a north-east direction, and is not therefore concentric. As we cautiously mount its northern edge to avoid the falling scoria cakes, it is seen that the craterial hollow has very steep sides, about 40 metres deep, and 150 metres in diameter. It showed the usual interlamination of lava and its fragmentary products. Rising from its floor was a small cone of eruption, that had been building up since the beginning of the year, its centre, of course, occupied by the vent, but no crater. The fissure mentioned in my last report was gradually filling up by the crumbling in of its sides; there was still oozing a small stream of lava from its lower extremity. This gentle flow of fluid rock had been going on without interruption since December, and during that period had been thrown out to a considerable amount, which, however, from slow exit soon cooled and had not enough impetus to travel far, chiefly piling itself up at the toe of the cone, and spreading a short distance over the Atrio and Valle dell' Inferno.

On May 13, became slightly more active, which continued till the 17th, the day of the eclipse of the sun. On that evening the reflection was very brilliant from a much increased flow of lava on the same side. From May 18 till June 6, gradually diminishing activity, especially during the last week. During the 4th and 5th, Prof. Palmieri recorded a continued uneasiness, as shown by the Vesuvian Observatory and University seismographs. That disturbance was the forerunner of a sharp earthquake shock, which occurred at 4'47 a.m. at Isernia and Vinchiaturo in the Appenines. At 8 a.m., when I scanned the crater with a glass, there seemed to be an increased volume of vapour from the fumaroles, and the main column was much more bulky and dense. In the evening the explosions reached a considerable height, and were very brilliant. On the 7th the same, but on the 8th quieter.

We have here a small but good example of seismic energy exhibiting its focus of intensity in a mountain range, yet at the same time setting up sympathetic activity in the neighbouring volcano. In fact, I believe that if more accurate and regular observations were carried on of earth tremors and the phases of volcanic activity, at many points scattered over such a country as Italy, much might be learned of the internal anatomy and physiology, so to speak, of such an area.

I say Italy in particular, for many reasons. The principal, however, are its simple structure, thus avoiding the various complications that must necessarily arise if its geology were very intricate. Again, the history of many of its principal seismic events are far more complete and extend farther back than that of any other country. In fact, we may look forward to the time when seismology and vulcanology will be placed on much the same basis as meteorology, and probably with equally important results.

The mountain from the last date to the 29th remained tranquil, no reflection being discernible at night. That evening, however, the ejections were to be seen distinctly. The following day it was the same, but on July 1 the activity had increased, and the lava that had now been arrested for weeks burst forth again at its old exit.

The mountain now took on somewhat an intermittent phase. On the third it was quieter, 4th the same, 5th, 6th, and 7th more active, 8th, 9th and 10th quieter, 11th and 12th more active, 13th, 14th, and 15th quiet.

On July 16 I made a minute examination of the crater. Owing to a favourable wind, and with a muffle over the face, the edge of the innermost one could be reached. This, on which we were standing, was the cone of eruption that was commenced to be formed, in the bottom of the December crater, and whose growth had been going on up to June 29, when the increased activity of that and the following days, converted the top of the chimney into a small crater, at the same time scattering the materials on its outer flanks and increasing the size of the cone. The cavity, of an irregular conical form, was about 45 metres deep, and its apex could have been but little above the level of the outflow of lava that was still proceeding from the old lateral fissure. At the bottom of the crater was the bocca or mouth. Its position was slightly excentric, and irregular in form, being about 2×3 metres. It was apparently undercut by the lava that could be distinguished boiling up at a short distance from its edge, the issue of the ordinary column of vapours, carrying with each explosion a few fragments of the plastic mass, thus commencing a fourth cone within the inner crater. Part of the southern wall had crumbled away, showing well the stratification of the beds.

Between the inner cone of 1882 and that of 1881, that is to say, in the fosse-like excavation separating the two, and towards the south-west (below smallest figure in sketch), another bocca had opened. From 9 to 10 o'clock a.m., during which my examination had been carried on, only an abundant column of vapour had been emitted. When standing quite close to it, however, it suddenly started into increased activity, emitting a column of ash and lapilli, perpendicularly to some height, reminding one in form of the great geyser column of Iceland. This was due to the slipping of a part of the outer wall, which exhibited the stratification of the December cone. A continual play was maintained for about one hour and a half, when tranquility was restored. Mixed with the stones and lapilli that were being ejected were a few fragments of molten lava, demonstrating the opening to be in direct communication with the principal mass. Although one could approach the edge of the opening nothing could be seen, for the amount of vapour issuing. On that occasion the usual hydrochloric acid smell was strong but mixed with a little sulphurous, and I fancy I could detect a distinct odour of hydrofluoric acid, which is the first time. Of course it is known to exist in small quantities always.

The old lava forming the plain within the 1872 crater, and from which rise the two small cones above described, is much decomposed and covered by fumaroles, in a direction extending due south-west, that is to say, scattered along the same radius as the crateret above mentioned. It would seem from this to be the external evidence of a dyke which has extended in that direction. We might therefore infer that if any lateral opening should soon form it would be somewhere on the south-west of the cone.

H. J. JOHNSTON-LAVIS

THE HUNGARIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

BUDAPEST, *August* 28

THE twenty-second meeting of the Hungarian Association for the Advancement of Science has just been concluded. It was held at Debreczin a town of 52,000 inhabitants, and the capital of the great Hungarian Plain. Two hundred and eighty members were present, and of these 132 joined the Medical Section, while the remainder were divided pretty evenly between the Physical and Economic Sections. The Physical Section includes Chemistry, Mathematics, and Astronomy; and the Economic Section includes matters relating to Social Science and Agriculture. Unfortunately the Association does not represent Hungarian science. There is a

strong University party in Budapest opposed to its existence; and they give it no countenance either by their presence or otherwise. Nevertheless we are persuaded that the influence of the Association is good.

Debreczin is a great Calvinist centre. It has been called the "Rome of Calvinists." There is a Calvinist College which educates nearly 2,000 children, boys, and young men. Roughly there are 2,000 Calvinist parishes in Hungary, containing 2,000,000 souls, and of these 560 parishes and 800,000 souls are under the jurisdiction of the Bishop of Debreczin. The Bishop was President of the Association and the Sectional Meetings were held in the College. Great toleration exists in religious matters throughout Hungary, and the Calvinist Bishop and Roman Catholic Præpostor entered the Hall together and sat next to each other during the delivery of the Presidential Address.

On the evening of the first day of meeting, the train from Budapest which conveyed a number of members, was met at the station by the town authorities, and an address of welcome was delivered. We then went to the Town Hall, registered our names, received various publications including a fine volume giving a complete history from every point of view of the town, which has cost the municipal authorities 6000 florins. In the evening we all dined together. On the following day the Presidential Address was delivered at 10 a.m. This was followed by the reading of letters of salutation from various parts of Hungary. A paper was then read by Prof. Török one of the Vice Presidents on the Meteorites of Hungary, and specially on the Kaba meteorite which fell near Debreczin in 1857. This was the period of the Austrian domination. and many meteorites had already been taken from Hungarian museums and transferred to Vienna. A demand was at once made for the Kaba meteorite to be similarly transferred, but the Debreczin authorities answered, "It is true that you have a right to everything on and beneath the earth of Hungary, but this came from Heaven. Hence we propose to keep it here." And it remains in the Debreczin Museum. After the meteorite paper an eulogium was pronounced by Dr. Popper on Dr. Albert Kain, a recently deceased and prominent citizen. A short paper on children's diseases was then read by Prof. Bódogh, and the proceedings terminated at 1 p.m. Soon afterwards the members sat down to a public banquet of a very festive nature, which lasted till nearly 5 o'clock, and was notable for the national dishes, and profusion of native wines and mineral waters; of the latter Hungary possesses no less than *eighty* different varieties.

At 5 o'clock a lecture was given by Dr. Kiss on Hatvani, a professor of physics in the Debreczin College of the last century. He studied in Leyden and was the first to introduce experimental illustration into the college lectures. A good deal of his apparatus was exhibited and the air-pump with a huge horizontal barrel two feet in length and three inches in diameter, was particularly interesting. In principle it scarcely differed from Robert Boyle's second air-pump of the preceeding century.

At 9 a.m. on the following day the three sections were formed, and addresses delivered by the Presidents. The Physical Section was presided over by Prof Hunfalvi of Budapest, and his address was mainly devoted to the Meteorology of Hungary. He dwelt particularly on the great evils resulting from the cutting down of forests, and the climatal changes likely to result therefrom. As wood is commonly burnt for fuel in Hungary, and the winters are very severe, the destruction of forests is proceeding at a great rate. The address was considered of such importance that it was ordered to be printed separately and distributed all over Hungary. The Medical Section was presided over by Prof. Török, and the Economic Section by Prof. Kiraly. The meetings closed at noon, and recommenced again at 3 p.m. At 5 to a very crowded audience Prof. Antolik gave a lecture on the electric discharge, with some original experiments.

The Sectional Meetings were continued the next day and in the afternoon an excursion was made through the Debreczin Forest to an Agricultural College founded by the Government for the instruction of land agents and managers of large estates. The course extends over three years, and the students pay nearly £21 a year. The institution is a large model farm possessing a good deal of land, and very complete farm buildings in which fine breeds of cattle, horses, and pigs are reared. The bulls and horses are of particularly fine breed. In returning we halted at a forest hotel, dined, and afterwards danced, the national *Csárdás* being of course the most popular. Sectional meetings were continued during the following day, and on August 27 the closing meeting was held. In the afternoon there was an excursion to the salt lakes of Nyiregháza.

The invitations were written in Latin, as of course Hungarian is a language, not much known out of the country. They were worded as follows:—

"Doctores Medicinæ et naturæ scrutatores Hungariæ, hoc anno Debrecini a 20-27 Mensis Augusti, Congregationem Scientificam sunt celebraturi.

"Cum ad hoc Congregationem D. . . . M. . . . N. . . . solemniter invitaremus, simul impense, rogamus, ut nos gratissima sua præsentia honorare, vel aliis hunc honorem delegare, congregationisque medicorum et naturæ scrutatorum in cognoscendio rerum causis positum studium favore et si lubet opera prosequi non dedignetur.

"Dissertationes de naturâ rerum agentes, secundum statuta congregationis, quâcunque linguâ haberi possunt.

"Sincerissimam quam possumus salutationem exhibentes perseveramus. Debrecini, 4 Mai, 1882."

A few years ago Latin was commonly spoken by educated Hungarians, and Latin words are now frequently used in intercourse with foreigners. One morning when I was looking for my host, his little son gravely gave me a letter which he had rapidly penned, expressed with the following charming naiveté:—"Domine Professor! Meus pater est in Collegio. Si Vestra Dominatio alloqui illum vult, voco statim domo. Hora nona certe redibit." And while on the subject of colloquial Latin in this country, we are fain to remember the story of the English sailor, who was rolling a gigantic piece of tobacco in his mouth, to whom a Hungarian, unused to the custom said, pointing to the distended cheek, "Quid est hoc?" whereupon the sailor answered readily, "Hoc est quid."

It is impossible to conclude this short notice of a very interesting scientific meeting, without mention of the extraordinary cordiality and hospitality of the town of Debreczin.

G. F. RODWELL

THE BRITISH ASSOCIATION

THE number of papers in the two leading departments of the Biological Section were very few this year, as indeed they have been for some years, and therefore it was decided by the General Committee that the number of departments of that section be reduced from three to two. Next year's meeting was fixed for September 19, with the view of bringing it towards the close of the holidays rather than in the middle of them. A formal resolution was also passed authorising the Council to make the best arrangements they can for securing an equal representation of all the sections at the meeting proposed to be held at Montreal in the succeeding year. One or two speakers seemed to doubt whether the matter could be regarded as finally settled. A suggestion was made that a meeting should be held in this country as usual, and that the vice-presidents should go to Canada as delegates. It was stated on both sides that members were absent at Monday's meeting whose votes would have materially affected the decision arrived at. It is

matter of satisfaction that Southport contains numerous public meeting-places close to each other. The scattered position of the Sections at the present meeting has been a very serious obstacle to members wishing to hear papers in different Sections on the same day. This has been especially the case in Section C, which, being half a mile from most of the other Sections, seldom obtained a good audience, and indeed was only filled when the popular subject of the Channel Tunnel was brought before the Section by Messrs. Boyd Dawkins and De Rance.

REPORTS

Report of the Committee consisting of Prof. Roscoe, Mr. Lockyer, Prof. Dewar, Prof. Liveing, Prof. Schuster, Capt. Abney, and Dr. Marshall Watts, appointed at the York Meeting to prepare a New Series of Wave-lengths Tables of the Spectra of the Elements.—This Committee report that they have lately obtained an instrument for the more exact performance of the process of graphical interpolation, constructed by Messrs. Cooke and Sons of York. And since this instrument has only been received within the last few weeks they are not in a position to make a detailed report to the Association.

The Report of the Committee consisting of Prof. Balfour Stewart, Thorpe, and Rücker, appointed at the York Meeting to Report on Methods of Calibrating Mercurial Thermometers was read by Prof. Rücker. Thermometer tubes are in general of unequal bore in different parts, and the indications of the instruments will thus be erroneous, unless these irregularities are allowed for. If a short column of mercury broken off from the main mass in the bulb and tube be measured in different parts of the tube, its length will be greater in the narrower, and less in the wider parts. By means of such measurements the correction for the inequalities in the bore can be applied in two different ways distinguished as methods of calibration and correction respectively. In the first the length of the column of mercury is measured in various parts of the tube before the scale is etched on it, and the lengths of the divisions are then so adjusted as to make equal differences of scale readings correspond to equal volumes. In the second the tube is in the first instance furnished with a uniform scale, and a table of corrections is afterwards drawn up, by means of which the same end is attained as before. In either case the measurements have to be made in some systematic manner, and a number of different methods of performing the observations and calculations have from time to time been proposed. That in use at the Kew Observatory is the simplest of all, while the more elaborate methods have for the most part been proposed by German writers. The report consisted of a minute discussion of the relative merits of these various methods, the chief of which had been applied by the Committee to the same thermometer, so that the results could be readily compared. The measurements for this purpose were made in the Physical Laboratory of the Yorkshire College. The methods chiefly investigated were Gay Lussac's, Hällström's, Thiessen's, Marek's, Rudberg's, and Bessel's, both as modified by von Oettingen, and also with further modifications introduced by Professors Thorpe and Rücker. As the result of a long theoretical and experimental investigation, the Committee conclude that labour is saved and equal accuracy secured by the repetition of the simplest method of correction (Gay Lussac's), instead of the employment of more elaborate and theoretically more perfect schemes.

Report of the Committee, consisting of Professors Odling, Huntington, and Hartley, appointed for the Purpose of investigating, by means of Photography, the Ultra-Violet Spark-Spectra emitted by Metallic Elements and their Combinations under Varying Conditions.—This report was drawn up by Prof. Hartley, and communicated to the Section by Prof. Huntington. The object of this investigation was to give, first, a means of readily identifying the metals by photographs of their line spectra; secondly, a knowledge of the alterations producible in the spectra of metallic salts by the presence of various non-metallic elements; thirdly, a knowledge of the alterations caused by the dilution of metallic solutions; fourthly, a possible means of performing rapid quantitative determination of metallic substances by the aid of photography, and obtaining permanent records of the results. These objects have been more or less completely attained, and the results obtained have been the subject of two communications to the Royal Society, which contain an account of the elucidation of the following points:—(1) The solution of the practical difficulty of obtaining photographs of spark spectra of metallic salts from their solutions; (2) the comparison of spectra yielded by metallic electrodes with those obtained from saline solutions; (3) the variations in the spectra caused by dilution of saline solutions; (4) the sensitiveness of spectrum reactions under certain conditions; (5) the variation in the spectra of metals caused by alterations in the intensity of the spark employed. A comparison of the spectra of solution of salts with those of metallic electrodes show that in almost all cases the lines of the metals were produced from the solutions. The non-metallic constituents of salts do not yield any marked series of lines. The spectrum of aluminium, as obtained from pure solutions, is free from a group of short or discontinuous lines, which the author has shown to be due to iron. In estimating the relative proportions of the constituents of alloys or minerals, only those methods are to be recommended in which solutions are used, as in this way the non-homogeneity of the substance under investigation can alone be obviated. With regard to the reversal of metallic lines, it is pointed out that over-exposure suffices to produce reversal without materially influencing the rest of the spectrum; and in order to obviate this result, it is recommended that comparative exposures should be methodically employed to confirm the accuracy of observations made entirely by the aid of photographic representations and of spectra. This is especially the case where gelatine or other dry plates containing organic matter are employed.

Report of the Committee on the Lunar Disturbance of Gravity, by G. H. Darwin.—Shortly after the reading of the first report last year at York, it was found that the instrument with which he and his brother had been working, had broken down, and this together with a series of unforseen circumstances, had prevented their continuing their observations. But he still had some remarks to make on the subject. From a remark made by Signor de Rossi on an observed connection between barometric storms and the disturbance of the vertical, he had been led to make some investigations on the mechanical effects caused by variations of pressure acting on an elastic surface. When a heavy body rests on the surface of the earth in the neighbourhood of a pendulum, the direction of the pendulum, or the vertical, appears to change, a change due to two causes: first, an actual change due to the attraction of the heavy body on the bob of the pendulum; and secondly, an apparent change due to an actual change of level caused by the elastic yielding of the surface. Sir W. Thomson had pointed out to him a very remarkable relation between those two effects. If a heavy mass of any form be placed on the surface of an elastic plate of great thickness, the deflection produced on a plumb-line suspended over any point of the plate by the attraction of the mass is proportional to the slope produced in the plate at the same point by the elastic yielding to the mass. Applying this to the case of variation of barometric pressure, and supposing the earth to have a rigidity between that of glass and copper, he found that the variation of slope between two places 1500 miles apart due to a difference of 5 cm. of barometric height would be 0″·0117, whilst if the attraction of the air be included, it would amount to 0″·0146. Thus, considering two cases of high pressure to right and left, there would be a difference in the position of the plumb-line relatively to the earth's surface of 0″·0292. The amplitude of oscillation at Cambridge due to lunar disturbance of gravity, as computed on the hypothesis that the earth is rigid, was in last year's report shown to be 0″·0216, whilst the instrument was capable of detecting changes of 0″·01. As these quantities were all of the same order of magnitude, he came to the conclusion that it was hopeless to expect determinations of the lunar effect by experiment based on the pendulum method. There was another effect due to change of barometric pressure, viz. an alteration in the altitude of the surface. Under the same circumstances as above the difference in height at the two places would be 9 cms. The same reasoning applied to the tides would show that there would appear to be a greater rise and fall of tides that actually exists. This effect is in the opposite direction to that due to the elastic yielding of the earth on account of the tide-rising forces of the sun and moon. Near a coast line the apparent change of the vertical between high and low tides would be far more considerable than in the case of variation of barometric pressure. With a difference of true height of water between high and low tide of 40 cm., and with a tidal wave-length of 3900 miles, the change in slope at a distance of 1 kilometre from the water's edge would be 0″·076.—Sir W. Thomson pointed out a method by which the effect of the attraction of the

observer in Mr. Darwin's experiments might be determined independently of the deviation produced by the elastic yielding of the earth due to his weight. He also suggested that Mr. Darwin should apply the same reasoning to discuss the phenomena of seiches, such as have been observed by Forel on the Lake of Geneva.

Report of the Committee on the Present State of Spectrum Analysis (drawn up by Dr. Schuster).—The report consists of three parts. In the first part the question is discussed whether any numerical relation between the different periods of vibration of one molecule can be traced. The result of several investigations seems to be that though the different vibrations are connected according to some unknown law, they are harmonics only in exceptional cases. The second part of the report considers the question whether a connection exists between the spectrum of a compound and the spectrum of the elements which make up the compound. The investigations of Dr. Gladstone are referred to, since confirmed in many instances, in which he has shown that coloured acids, as chromic acid, when combined with different bases retain their own absorbing properties. The same applies to coloured bases. But as Dr. Gladstone himself points out, the law is by no means a general one. The curious observations of Bunsen's on the absorption-spectra of didymium salts are discussed. Bunsen has shown that their spectra are all very nearly alike, but slightly displaced either towards one or towards the other end of the spectrum. Capt. Abney and Col. Festing's observations on the absorption in the infra-red are referred to at length, and the connection between the luminous spectra of such bodies as the chlorides, bromides, and iodides of the alkaline earths is discussed. In the last part of the report the similarity of the spectra of similar bodies is pointed out, but no numerical connection has as yet been found.

Report of the Committee, consisting of Lieut.-Col. Godwin Austen, Dr. G. Hartlaub, Sir J. Hooker, Dr. Günther, Mr. Seebohm, and Mr. Sclater, appointed for the purpose of investigating the Natural History of Socotra and the adjacent Highlands of Arabia and Somali Land.—The balance in hand from 1870-1 (61. 7*s*. 10*d*.), added to the 100*l*. granted at the York meeting, together with the amount received up to the present time by the sale of the duplicate specimens of birds and land shells, viz. 171. 12*s* 4*d*., reduced by 7*s*. for postage, leaves a total balance in hand of 143*l*. 13*s*. 2*d*. for any future work on the Socotra or in the adjacent mainland.

Since the last report was presented Prof. I. Bailey Balfour has been working whenever his other duties permitted at the extensive botanical collection formed by him, to which must be added the plants collected by Schweinfurth, who has since visited the island, and who has placed the same most liberally at Mr. Balfour's disposal. Some of the preliminary diagnoses have been published, which show that the different groups are very rich, and that there is a very considerable amount of work in the collection which can only be brought out slowly. Prof. Balfour hopes to give a short report on what is completed at this meeting. Writing on June 17 he says:—"I have a lot more diagnoses in press just now, and hope in August or September to complete my work on the Botany. This *émeute* in Egypt will, however, interfere, as Schweinfurth will be unable to continue his communications, and I am waiting for a lot of notes by him on many species. I only hope his collections will not be destroyed, and as he has some of my specimens at present I am somewhat anxious regarding their fate." . . .

The rock-specimens collected by Prof. Balfour have been worked out by Prof. Bonney, whose report on the subject was read before the Royal Society at their last meeting of the present session. He states that the great limestone plateau, which forms so large a part of the upland district of the island, is found by the Foraminifera present in the rock to be of Miocene age. This is seen to rest in many places upon a floor of very ancient gneissic rock, bearing a general resemblance to the most ancient rocks of north-western Britain and other countries. The Haggier mountains, forming the highest ground in the island, consist, so far as is shown by the specimens brought, of granites poor in mica and rich in felspar, bearing often a considerable resemblance to those of Sinai. These are traversed by dykes of felsite and other igneous rocks. To the south-east of this range is a tract occupied by red felsites and rhyolites, with some agglomerates or conglomerates. The structure of some of the former rocks renders it in the highest degree probable that they are ancient lava flows. They are anterior in date to the Miocene limestones. These also are occasionally cut by basalts and perhaps trachytic rocks. In the northern part of the island, beneath the limestone, is an argillite of uncertain age, and there is probably some representative of the "Nubian sandstone." It is, however, almost certain that for a long period anterior to the Middle Tertiary, Socotra formed part of a land surface, and it is quite possible that the summits of the Haggier mountains may not have been even then submerged. If so, the flora, and perhaps the fauna, is likely to have an exceptional interest.

As to a renewal of explorations, the Committee fear that Eastern affairs make the outlook very unsatisfactory, and it would appear all through the East, in the vicinity of Aden especially, there is a very hostile spirit rampant against Europeans. It is hoped that there may soon be some definite settling of the excitement, but at present the Committee do not think that any plans for a future expedition can be made.

The results of the Socotran exploration have been so successful and so great, considering the small expenditure of money and time it entailed, that the Committee trust they may see the same kind of work extended. They trust that the opportunity will not be lost of sending properly trained naturalists into the mountainous regions of Eastern Africa, which the despatch of an expedition by the Geographical Society now presents. The scientific knowledge that would be accumulated by such explorers in such conditions as that lofty region offers would be of immense value, and not of secondary interest or importance to purely geographical information.

The Committee do not, therefore, ask for any further grant at present.

Report of the Committee, consisting of Mr. James Heywood, F.R.S., Mr. William Shaen, Mr. Stephen Bourne, Mr. Robert Wilkinson, the Rev. W. Delany, Prof. N. Story Maskelyne, M.P., F.R.S., Dr. Silvanus P. Thompson, Miss Lydia E. Becker, Sir John Lubbock, Bart., M.P., F.R.S., Prof. A. W. Williamson, F.R.S., Mrs. Augusta Webster, Rev. H. W. Crosskey, Prof. Roscoe, F.R.S., Prof. G. Carey Foster, F.R.S., and Dr. J. H. Gladstone, F.R.S. (Secretary), appointed to watch and report on the workings of the proposed revised New Code, and of other legislation affecting the teaching of Science in Elementary Schools.—When this Committee was re-appointed at York, it was with a special view to the important changes which it was expected the Government would make in the Education Code. In the postscript to their previous report, great satisfaction was expressed at the general scope of the "proposals" that had just been submitted to Parliament, but it was urged that the knowledge of nature should be more effectually encouraged as a class subject.

On assembling in the autumn, your Committee added to their number the Rev. H. W. Crosskey of Birmingham, and Prof. Roscoe of Manchester, and, subsequently, Prof. G. Carey Foster of London.

At the first meeting it was determined to enter into communication with Mr. Mundella, the Vice-President of the Committee of Council on Education, but the serious illness of that gentleman caused a delay. The Secretary, however, eventually saw him at his own house, and found him desirous of receiving the views of the Committee by deputation. As this was a step which your Committee felt themselves not justified in taking unless through the governing body of the Association itself, they drew up a series of resolutions, and submitted them to the Council, with the request that that body should appoint a deputation to urge their views.

These resolutions were passed by the Council, with the addition of that numbered VII. They were as follows:—

I. That Clauses 9 (3), 20, 26, and the Standard work in Geography (pp. 6 and 7) be approved.

II. That the arrangements involved in Clauses 18, 19, 21, 23, and 27 be subject to revision on the following grounds:—

a. That Clauses 19 and 21, read together, will practically exclude Elementary Science teaching in the Lower Division, as Geography will be almost always chosen by teachers as the second subject.

b. That placing Standard IV. in the Lower instead of the Upper Division will restrict the choice of Class-subjects to be taught in that Standard, and altogether exclude the teaching of any of the Specific subjects.

c. That, taking all these Clauses as they stand, there will practically be a cessation in the teaching of Elementary Science from the time of leaving the Infant School (Clause 9 (3)), till entering the Upper Division (Clauses 23 and 27).

It is therefore recommended that Clause 21 be left out; and that Clause 19 be so modified as to permit of the ordinary Class Grant being paid if the children pass in any one or two of the Class subjects, and an additional Grant if three be taken.

III. That the list of Specific subjects (Clause 25) should include Elementary Physics, and the fundamental facts of Chemistry; and the word "Geometry" should be used instead of "Euclid."

IV. That Clause 29 be left out, inasmuch as Domestic Economy includes the principles of alimentation, sanitation, &c.

V. That the teaching of Specific as well as Class-subjects in Night Schools should be provided for in Clause 30.

VI. That the Standard work in Elementary Science (pp. 6 and 7) needs re-arranging:—

The division (*a*) should generally include plants as well as animals.

The divisions (*b*) and (*c*) should be welded together, and more progressively arranged.

VII. That the Science programme should be regarded as a suggestion, but not necessarily as an inevitable arrangement.

VIII. That the Pupil Teachers' course (p. 11) shall provide for the study by them of Elementary Science, seeing that they will in all probability be required to give Object lessons, or to teach Elementary Science in the Schools, and to attend science classes at College.

A deputation was appointed to present the memorial, but so many other public bodies were approaching the Education Department on the subject of the New Code, that Lord Spencer was unable to find time to receive it, and the memorial was sent in the usual way. Dr. Gladstone, however, as one of a deputation from the London, Birmingham, and other School Boards had an opportunity of urging the claims of science, and mentioning the special wishes of the British Association. Nothing could be more distinct than the assurance of both Lord Spencer and Mr. Mundella as to their desire to introduce the teaching of Elementary Science as far as circumstances would permit.

Recommendations somewhat similar to those of the British Association were made, not only by the above School Boards, but also by a Conference of leading educationists on Code Reform, and by the British and Foreign School Society.

When the New Code was laid on the table of the House, on March 6, it appeared that some of these recommendations had been adopted, and that all the clauses in the "Proposals" which were approved by your committee had been retained.

The proposals thus retained are as follows:—

In infant schools the merit grant will be dependent upon the report of the Inspector, who will have to take into consideration the provision made for "simple lessons on objects, and on the phenomena of nature and of common life."

The leading facts of Physical Geography will be taught, not, as before, as an optional specific subject for the high standards, but as a part of Geography which is a class subject for the children in all the standards.

The teaching of the principles of Agriculture as a specific subject is, for the first time, recognised.

The recommendations adopted are as follows:—

"Chemistry" and "Physics" in the two branches of "sound, light, and heat," and of "electricity and magnetism," have been added to the list of sciences capable of being taken up as specific subjects by children in Standards V., VI., and VII.

The scientific specific subjects are admitted for the first time into the curriculum of evening schools.

The Department has considerably modified its scheme as to "Elementary Science" as a class subject; this "may be framed so as to lead the scholars in Standards I. to IV. up to one of the scientific specific subjects;" but a scheme is also given which "may be taken as a guide suggesting heads for a sufficient number of lessons in each standard." In the scheme, plants are recognised as fully as animals, and the inconsistencies that occurred in the original scheme are avoided.

The Department has not, however, acceded to other recommendations of your Committee. There are still retained such restrictions as will greatly hinder the introduction of this elementary science as a class subject. Domestic Economy has lost its preference as a specific subject in girls' schools. Euclid is still enforced as the handbook of geometry. There is no provision for the examination of pupil teachers by Her Majesty's Inspector in any branch of natural science, excepting that geography is made to include a good deal of physical knowledge.

Your Committee having been informed that Sir John Lubbock intended to move in parliament that it was desirable to allow children to be presented for examination in any of the recognised class subjects, passed a resolution offering him "their support in asking that the three class subjects of Schedule II. of the New Code, viz., English, Geography, and Elementary Science, should be placed on the same footing." Sir John Lubbock, in his speech, referred to the views of the British Association on this point; the debate which ensued was very favourable to the claims of elementary science, and the Vice-President promised to give the subject further consideration, and to "submit it to the Council of Her Majesty's Inspectors and the able men who assisted him in framing the Code, and, if it was possible, he should be happy to yield to the wishes which had been expressed (see *Times*, April 4, 1882).

Many of the Elementary Schools of this country are now working under the New Code, and before the month of May, 1883, they will all be in that condition. In that month also the Government inspection under this Code will commence, and it will be possible to ascertain many points of interest, such as (1) the quality of the object lessons in the infant schools; (2) how far the proposed improvements in the teaching of geography are carried out in practice; (3) to what extent elementary science is taken up as a class subject, and whether the teachers generally take it up as an introduction to the scientific specific subjects, or continue it as a class subject throughout the school; and if so, whether they have adopted some fuller scheme than that suggested in the Second Schedule; (4) whether the discontinuance of the teaching of specific subjects in Standard IV. is really a gain or a loss to science.

Your Committee, if reappointed, propose to obtain information on these points, and to draw the attention of the Council to any matters that may be necessary in connection with the working of the Code, or in respect of any future alterations.

Preliminary Report on the Flora of the Halifax Hard Bed Lower Coal-measures, by Prof. W. C. Williamson, F.R.S., and W. Cash.—The area examined is bounded by Bradford on the north, and Sheffield on the south, many of the coal-pits are now closed owing to low prices of coal, and to the iron-pyrites formerly worked being no longer used owing to the low rate at which foreign sulphur is now imported. Fossils were obtained from a bed of inferior coal 2 feet 6 inches in thickness, studded with "coal-balls," consisting of carbonate of lime and carbonate of magnesia, which are filled with fossils, which exhibit the most perfect condition of preservation, even to microscopical structure, surpassing even the well-known beds of Oldham. Much light has been thrown into the intimate structure of a large amount of vegetable forms, though some are still doubtful.

Tenth Report of the Committee, consisting of Prof. J. Prestwich, Prof. T. McK. Hughes, Prof. W. Boyd Dawkins, Prof. T. G. Bonney, the Rev. H. W. Crosskey, Dr. Deane, and Messrs. C. E. De Rance, D. Mackintosh, R. H. Tiddeman, J. E. Lee, James Plant, W. Pengelly, W. Molyneux, H. G. Fordham, and W. Terrill, appointed for the purpose of recording the position, height above the sea, lithological characters, size, and origin of the Erratic Blocks of England, Wales, and Ireland, reporting other matters of interest connected with the same, and taking measures for their preservation. Drawn up by the Rev. H. W. Crosskey, Secretary.—The Committee have received the following accounts of Erratic Blocks examined during the past year:—

Yorkshire.—Major Woodall has examined a number of boulders brought from the bottom of the North Sea north of Flamborough Head, and gives the following account of their position and character:—

North of Flamborough Head large numbers of boulders are found strewing the bottom of the North Sea; but they are arranged very much in a belt, which is generally parallel to the existing coast, at a distance of twenty to forty miles from the land. The outer or eastern edge of this belt is not well defined; but on the western side it would appear to have a sharper boundary, as the marks used by the trawlers to avoid the boulders show that the line is well marked.

While preserving a line parallel to the existing coast, it is curious to note that just opposite to the mouth of the Tees the inner edge of the "rough ground"—by which name this belt is known to the fishermen—makes a sharp bend to the eastward, coinciding almost exactly with a line drawn down the Tees Valley. I would venture to suggest that this large belt of

erratic blocks is connected with the history of the giant glacier which descended the Tees Valley, bringing, among other stones, masses of the well-known Shap Fell granite. The boulders that I have seen brought on shore—having been trawled up by the smacks—are either of Shap granite or carboniferous limestone, and of these I have examined from sixty to seventy specimens. The rough ground—as far as I am aware—extends from the coast of Northumberland to the mouth of the Humber. While the boulder clay on the coast line contains blocks of carboniferous limestone and Shap granite, the deposits of like date in the valley of the Rye and Derwent—south of the Cleveland Moor district—are composed of oolitic and liassic detritus, and are very different from those on the coast, though only a few miles distant from each other.

Warwickshire.—A remarkable group of Erratic Boulders has been exposed in some excavations made for building purposes in Icknield Street, Birmingham, between Key Hill and Hockley Hill. The section occurs on the north-west slope of the hill on which it is exposed, and consists of 7 feet or 8 feet of glacial drift (the height slightly varying at different points), which immediately rests on an irregular and broken surface of the new red sandstone of the district, and is composed of about 1 foot 6 inches of surface soil. The "drift" itself consists of erratic blocks, intermixed with numerous round and oval stones and pebbles, together with small gravel, sand and clay. In different parts of the section these various materials occur in varying proportions, a light clay gradually predominating. The erratic blocks, however, so pervade the whole bed, and so thoroughly constitute a component part of it, that they cannot have been dragged into it, either singly or by twos and threes. They must all have travelled together, for a certain distance, at any rate, and have been brought down together to the spot at which they are found.

The felsites and the felspathic ashes are the most abundant, and the Llandovery sandstones are the rarest. No block of granite has been found in this group of erratics.

Some are sub-angular; a not inconsiderable proportion are well smoothed, although they can hardly be said to be highly polished; and on a few striæ may be traced.

Prof. C. Lapworth has examined the specimens, and recognises a large number as occurring *in situ* at the Berwyn Hills; others may be found in the Arenig range.

The condition of the new red sandstone rock on which the boulders rest is most remarkable. The sandstone rock is broken up, and large fragments of it have been lifted up out of their position and thrust into the middle of the drift. At one point in the section a part of the rock has been lifted up almost like an arm, and still remains united with the basement mass, while the drift fills the L-shaped hollow. A large erratic block is seen close to the extreme end of the uplifted arm of the basement.

The evidence of violence is complete. The breaking up of the sandstone rock, the uplifting of parts of it *en masse*, and the carrying away of fragments, are facts as patent as the presence of the erratic blocks themselves.

The Rev. W. Tuckwell has called the attention of the Committee to some very interesting boulders at Stockton, near Rugby, about equi-distant from Leamington, Rugby, and Coventry. One has been moved from the roadside, where it was in great danger of being injured, placed upon a bed of concrete, and protected by railings.

Leicestershire.—Mr. W. Jerome Harrison has sent the Committee the following note on a Leicestershire boulder which has travelled northwards:—

In the construction of the sewerage for the Clarendon Park Estate, near the Victoria Park, on the east side of the town of Leicester, some interesting sections of the drift were laid bare, which I examined in June, 1880. Much of the drift exposed was of a loamy nature, containing erratics of moderately large size, and overlying, though with no well-marked line of demarcation between, the well-known great chalky boulder clay which spreads so widely in this district.

Among the travelled rocks contained in this deposit I particularly noticed one angular block identical in appearance with the syenitic rock which forms Enderby Knoll (four miles south-west of Leicester), and Croft Hill (about two miles further in the same direction). These South Leicestershire syenites are well-characterised and somewhat abnormal rocks, and their identification is easy.

The surface of the Clarendon Park Estate is about 300 feet above sea-level, while Enderby Knoll is about 350 feet, and Croft Hill 450 feet (these heights are approximations only). The block which I saw on the Clarendon Park Estate measured about $3\frac{1}{2} \times 2 \times 1\frac{1}{2}$ feet, and would weigh about three-quarters of a ton; it was irregular in shape and very angular. As it did not interfere with the direct line of the sewer, it was not removed, but was covered in. I have examined a large number of the erratic blocks which stud the surface of Leicestershire, but this is the only instance I know of a boulder which has been carried to a distance several miles due north of its parent rock.[1]

Shropshire.—The Committee have received from Mr. Luff a valuable report upon the group of erratic blocks found in the neighbourhood of Clun, Shropshire.

Prof. Lapworth has examined a series of specimens, and describes them as lower Llandovery grits and shales belonging to the Plinlimmon group of Central Wales. The hills from which they have been derived are all south of Bala, and situated almost due west from their present position.

The following are the most remarkable among a large number of boulders:—The "*Great Boundary Stone*," marking the boundary of Clun and Treverward townships. It is on Rock Hill. Its dimensions are 6 feet × 6 feet × 2·5 feet. No striations can be detected, but it is angular and polished on one face. It is a cleaved flagstone, and has travelled from a point south of Machynlleth. It rests upon a bed of clay and rubble above the Upper Ludlow rock. Height above the sea, 1152 feet.

The "*Black Hill Boulder*," 52° 24′ 40″ N. L., 2° 59′ 50″ W. L. This boulder may be calculated to contain from 8 to 10 cubic feet, and is subangular. It is a pebble grit belonging to the Plinlimmon group, and may have come, according to Prof. Lapworth, from the neighbourhood of Rhadyr. So far as can be observed, it rests upon the same limit of bed as the Great Boundary Stone. Its elevation above the sea is 1327 feet, and it is the highest of all the boulders of the group.

The "*10-Feet Boulder*" is a pebbly grit of the Plinlimmon group. It lies on the Clun Hill, near Pen-y-wern, 52° 24′ 20″ N. L., 3° 0′ 30″ W. L., at an elevation of about 1160 feet above the sea. It measures 10 feet × 3 feet × 3 feet, and weighs, I should calculate, between 6 and 7 tons. It bears every evidence of having stood upright in the ground for a very long time. The base is tolerably angular and well preserved, but the sides and apex are much weathered. About 4 feet from the base it is deeply undercut, apparently all round, exactly as we should expect such a block to be where (on the ground-line) it had been much exposed to the combined influence of moisture and frost.

Report on the Conditions under which Ordinary Sedimentary Materials may be converted into Metamorphic Rocks, by Prof. W. J. Sollas, M.A., describes experiments on quartz and other minerals which have been subjected to a heat of 300° C. in an iron tube of ½ inch diameter.

Report of the Committee for the purpose of carrying on Explorations in Caves in Carboniferous Limestone in the South of Ireland, consisting of the late Prof. A. Leith Adams, Prof. W. Boyd Dawkins, Dr. John Evans, Mr. G. H. Kinahan, and Mr. R. J. Ussher.—Within the past three months attempts have been made to effect an entrance from the face of the scarp into the series of caves discovered and reported on last year, in the rock called the Carrigmurrish, but after a careful survey had been made and levels taken from the several branches of the caves by Mr. Duffin, county surveyor, it was found that this means of access is not possible.

Eighth Report of the Committee, consisting of Prof. E. Hull, the Rev. H. W. Crosskey, Capt. Douglas Galton, Professors G. A. Lebour and J. Prestwich, and Messrs. James Glaisher, E. B. Marten, W. Molyneux, G. H. Morton, W. Pengelly, James Plant, James Parker, I. Roberts, Fox Strangways, Thos. S. Stooke, G. J. Symons, W. Topley, Tylden-Wright, E. Wethered, W. Whitaker, and C. E. De Rance, appointed for the purpose of investigating the Circulation of the Underground Waters in the Permeable Formations of England, and the Quality and Quantity of the Water supplied to various Towns

[1] It seems to the writer to show (1) that a submergence followed the retreat northwards of the great chalky boulder clay; (2) that when this submergence amounted to about 350 or 400 feet, the bosses of syenite which occur in South Leicestershire stood as little islands above the sea; (3) that "coast ice" forme on the margins of these islands, on which blocks of rock, detached by the frost, fell; and (4) that a current running northwards carried at least one of these blocks down the Soar Valley, and dropped it where it now lies, on the eastern brow of the Valley at Leicester.

and Districts from these Formations. Drawn up by C. E. De Rance, Secretary.—Eight years have elapsed since this Committee commenced to investigate the circulation of underground waters, and the quantity and character of water supplied to towns and districts so derived.

From 1874 to 1878 the Triassic and Permian formations were alone under consideration; in that year the Jurassic rocks were added to the scope of the inquiry, which at the York meeting was enlarged to include the whole of the permeable rocks in England and Wales.

The Triassic and Permian rocks of Devonshire are described in the first, fifth, and sixth reports; of Somersetshire in the first; of Leicestershire in the first, fourth, and fifth; of Warwick in the second, fourth, and seventh; of Nottingham in the second and sixth; of Cheshire in the second, fourth, and fifth; of Lancashire in the first, second, third, fourth, sixth, and seventh; of Yorkshire in the first, second, third, sixth, and seventh; of Shropshire in the sixth.[1]

Through the removal to South Africa of the member of the Committee taking charge of Staffordshire, this district is still incomplete, but some information as to the Burton-on-Trent area is given in the first report.

In Devonshire the inquiry was carried on by Mr. Pengelly, F.R.S., supplemented by details obtained by Mr. Stooke, C.E. The Triassic rocks of the district have been made the object of careful study by Mr. W. A. E. Ussher. From his investigations it would appear that the sequence exhibited has more in common with the Trias of the French side of the English Channel than with that of the midland counties. In Devonshire and Somersetshire the sandstones and conglomerates appear to have been deposited in a distinct basin to that north of the Mendips, the Keuper marls being alone common to the two districts.

The basin south of the Mendips is remarkable for having a series of marls intercalated in its sandstones, called by Mr. Ussher the "Middle Marls"; these underlie sandstones beneath the Keuper marls. The conglomerates have a distinctly local character, and when present are plentifully water-bearing, as are the sandstones, though to a somewhat less extent.

Private supplies are obtained by wells at Torquay, where the water-level is 168 feet above the sea; at Teignmouth; at Dawlish, where the water-level is 71 feet above the sea; and at Bramford Speke, near Exeter.

Near Exeter the Lyons Holt spring issues at 126 feet above sea-level, yielding towards the town supply 47,000 gallons daily of very pure water, which is extensively used for drinking-fountains.

Higher up the valley of the Exe and its tributaries private supplies are obtained at Crediton.

North is the watershed separating the streams flowing into English and Bristol Channels.

At Wellington a well 230 feet above the sea is sunk to a depth of 48½ feet; only a small quantity of water is pumped from it.

At Taunton numerous private wells give a supply of rather hard water from the New Red Sandstone.

At Somerton hard water is obtained from a well 129½ feet deep; the White Lias is said to occur in it at 90 to 99 feet.

At Wembdon a private well in triassic conglomerate yields hard water at a well 30 feet deep, at 60 feet above the sea.

At Wookey, near Wells, 70 feet above the sea, a private well, 33 feet, yields a constant supply, uninfluenced by the seasons as to quantity, but decreases 9 feet in level after dry weather.

In Bristol the wells vary in depth from 60 to 300 feet, some only penetrating peat and gravel, others passing through triassic marls, whilst a few penetrate the Coal-measures.

At Braysdown Colliery, near Bath, a shaft 500 yards deep, passing through New Red Sandstone and Coal-measures, yielded water at the bottom of the pit containing 1008 grains of common salt, or 1440 parts per 100,000.

In the Tiverton Coal-pit, near Bath, 16,800 gallons per 24 hours are yielded by plastic shale in the Blue Lias, 130 feet above the White Lias, which is 12 feet thick, resting on 23 feet of Rhætics, lying on the New Red Marl; the water contains 112 parts per 100,000 of common salt.

The Tyning Pit, Radstock, intersected a spring yielding 864,000 gallons per day at 200 feet from the surface, at the bottom of the Red Marls.

[1] Report of British Association for 1875 (Bristol) contains first report; that for 1876 (Glasgow) the second; that for 1877 (Plymouth) the third; that for 1878 (Dublin) the fourth; that for 1879 (Sheffield) the fifth; that for 1880 (Swansea) the sixth; and that for 1881 (York) the seventh.

At Kilmersdon New Coal Shaft, Writhlington, a 10 feet shaft intersected a spring at 253½ feet. On cutting through a hard base of stone the water rose 99 feet in 24 hours, and stands at this level, yielding 98,400 gallons per day of hard water. The section passed through was liassic clay, black and blue marl 78 feet; 34 feet of "red ground," with bands of blue stone; conglomerate 5 feet; red beds 4 feet; then conglomerate again; the remainder of the section is not given. The late Mr. Charles Morre considered the last, 5 feet 4 inches of the Lias, in this section to belong to the Rhætic beds.

In reference to the information furnished by Mr. Taunton as to the Thames and Severn Canal, it may be well to state that the outcrop of the oolitic rocks has an average breadth on the dip of 25 miles. The base of the Oolites resting on the Lias reaches its highest point near Chipping Campden, 1032 feet above the sea, on the watershed between the Thames and Severn basins. This, south of the Severn Wells, the source of the Churn, runs somewhat east of the base of the Oolite, causing the surface drainage of the oolitic tract around Minchinhampton, Dursley, and Wotton-under-Edge to flow into the basin of the Severn. It is probable also that a portion of the underground drainage does so also, notwithstanding the general south-easterly dip, from the basement level of the Oolites, varying in the direction of the strike, owing to the denudation of the escarpment being unequal, the Oolite to the south having been worn back much further down the dip, and consequently to a lower elevation than at Chipping Campden, descending from 1030 at the latter place, to 212 feet in the Stroud Valley, or about 800 feet in 25 miles. South of this valley the level rises slightly, so that a partial discharge of underground drainage takes place in this valley, which is immediately west of the point in the Thames and Severn watershed which is penetrated by the canal connecting the two basins.

Of the 25 miles of average outcrop of oolitic rocks measured on the dip, only about 8 consist of impermeable deposits:—viz. the Fuller's Earth, the Oxford Clay, and the Kimmeridge Clay—so that two-thirds of the area may be considered to be of a permeable character.

Warwickshire information.—The southern and western portion of the Warwickshire coalfield is overlaid by Permian rocks consisting of reddish-brown and purple sandstones, intercalated with marls in lenticular beds, rising to a height of 622 feet at Cowley Hall, which forms part of the watershed between the tributaries of the Trent to the North, and those of the Avon on the south.

Though the surface-drainage of this Permian area flows in opposite directions, that portion of the rainfall percolating into the ground has a uniform gradient to the south, the base of the Permians, where they rest on the coal-measures west of Atherstone, being 470 feet above the sea, and 170 feet under the Mithurst Tunnel of the Midland Railway, being a fall of 50 feet per mile, while at Warwick the tops of the Permians are 186 feet above the sea, and as they are not less than 800 feet thick, their base is probably about 600 feet below the sea-level, giving a furtherr fall of 786 feet in 18 miles, or a fall of 43 miles.

Examining the district more minutely, it is seen that though the Permians do not always lie conformably on the coal-measures, yet there is a general conformity, and a synclinal flexure traversing the coal-measures from north to south is shared by the overlying Permians, which have synclinal dips towards the axis of an average amount of 3°, or about 270 feet per mile from the edges of the basin towards the axis, which occurs more to the eastern than the western margin.

The fault throwing in the coal measures of Arley Wood is believed to be connected with the fault throwing back the outcrop of the main part of the coal-field at Broomfield Park; but of this there is no evidence, and as the dips in the Permian show the flexures to be present on both sides of the supposed fault, its existence is very doubtful. If it occurred, and were a water-tight barrier, the water percolating into the sandstones to the west of Atherstone and flowing south would be thrown out in a line of springs, which is not the case; and there is no doubt that the waters travelling in the porous portion of the system flow south to Leamington and Warwick, where a portion of the supply is utilised. South of this point the Permians are concealed by triassic, liassic, and oolitic rocks in the direction of Bambury. Southwards the Permians probably wedge out before the Trias, which continue into the Thames basin, the water travelling down the dip planes of the Permian, where that formation thins out, probably enters the overlying triassic sands,

and, prevented from rising higher by the Keuper marls, probably flows a considerable distance under the Thames basin, where its outlet being checked by the thinning out of the Lower Trias against the Palæozoic ridge, causes the subterranean Trias to be fully charged with water in a stationary condition, and thus limits the amounts of absorption in the area of absorption.

Between the base of the Permian and the *Spirorbis limestone* is a thickness of 150 feet, and between it and the first workable coal is a further 500 feet, of which a large portion consists of Permian sandstone fully charged with water, which was met with in sinking the Exhall Colliery.

The report also contains:—Appendix I.—Millstone Grit Wells. Appendix II.—Permian and Trias Wells, chiefly collected by Mr. E. B. Marten, C.E., Mr. S. Stooke, C.E., and Mr. H. T. Marten, C.E.. Appendix III.—Jurassic Wells.

Appendix IV., by Mr. E. Wethered, F.G.S., is on the porosity and density of rocks, and gives the results of a very elaborate investigation into the size of the grains, in decimals of an inch, making up the permeable rocks of England and Wales, of various geological ages, the specific gravity of these rocks, the specific gravity of the particles, the volume of water absorbed by 100 volumes of rock, the number of gallons of water absorbed per cubic foot of rock, and the number of gallons of water absorbed per square mile of rock three feet thick, and the relation of these volumes to the purity of the water obtained.

First Report of the Committee, consisting of Prof. Flower, Dr. Beddoe, Mr. Brabrook, Mr. F. Galton, Mr. J. Park Harrison (Secretary), Dr. Muirhead, General Pitt-Rivers, Mr. F. W. Rudler, and Mr. Charles Roberts, appointed for the purpose of obtaining Photographs of the Typical Races in the British Isles.—Owing to the accumulation of observations of height, weight, and other physical characteristics of the inhabitants of the British Isles, the discussion of which required the undivided attention of the Anthropometric Committee, the acquisition of photographs undertaken by them in 1876 was last year transferred to a Committee of the Anthropological Department.

The photographic portraits already collected have been handed over to the new Committee, and will assist materially in determining the values of crosses in different parts of the country. Some, obtained under exceptionally favourable circumstances, and especially seventeen portraits of Shetland Islanders, well illustrating the Scandinavian element in the population, and presented by Dr. Muirhead, may be safely termed typical.

The Scientific Bearing of the Subject.—A clear definition of racial features, illustrated by examples, will, the Committee believe, prove of considerable importance in connection with more than one social question.

1. First, as tending to allay national animosities springing from a belief in the preponderance of some one race, and, in connection with this, affording a safe basis for generalisation, in the place of deductions depending on doubtful traditions and insufficient historical data.

2. A correct description of the main racial types would also afford an opportunity of testing in a more complete manner than is now practicable the truth of views, believed to be extensively held, on the subject of racial tendencies and proclivities.

3. Indirectly, by indicating the way in which features, and more especially profiles, of human beings should be observed, it would lead to a more exact description of criminals and deserters, resulting, it cannot be doubted, in more frequent arrests. At present, so little attention is paid to the subject that photographs of prisoners are taken solely in full face, and the description of recruits for the military rolls is confined, so far as their features are concerned, to the colour of the hair and eyes.

Erroneous Views regarding the Possibility of a Survival of Racial Features at the Present Day.—Before proceeding further, the Committee think it will be well to notice an objection, not infrequently made, that European populations are now too much mixed to allow of racial types being recognised. This is not the belief of anthropologists generally. Prof. Rolleston—whose loss this Committee has especial reason to deplore—expressed no uncertain opinion on the subject in his address to the Anthropological Department at Bristol. "At once, upon the first inspection of a series of crania, or, indeed, of heads, from such a (mixed) race," he said it was evident that "some were referable to one, some to another, of one, two, or three typical forms;" also that intercrossing has left the originally distinct forms still in something like their original independence, "and in the possession of an overwhelming numerical representation;" and Prof. His was quoted as having arrived at a similar conclusion from an investigatfon of the ethnology of Switzerland (Brit. Assoc. Rep., 1875, p. 148).

Prof. Kollmann, too, of Bale, believes that it is quite possible to distinguish original or main racial characteristics in a mixed population, owing to a capacity in skulls and facial skeletons to preserve their pristine types long after the colour of the hair and eyes have changed by crossing. A complete fusion of component elements, the distinguished Professor is convinced, never absolutely occurs.

Reversion to Original Types.—Besides, however, these composite forms, eminent anthropologists admit a natural law, through the operation of which a complete reversion takes place, under favourable circumstances, to original types. Drs. Beddoe, Barnard Davis, Flower, Rolleston, Thurnam, and Turner, in this country, and Morton, Broca, Quatrefages, Retzius, and Virchow, abroad, have satisfied themselves, from craniological evidence, that prehistoric characteristics exist at the present day; Prof. Quatrefages, than whom the Committee believe there could not be a safer authority, even affirming that representatives of the fossil types of man are still to be found amongst us ("Crania Ethnica," p. 28).

Height and Colour of the Hair and Eyes insufficient as Evidence of Race.—Assuming the correctness of Prof. Kollmann's deductions that hair and eyes (permanent in a pure race) change by crossing more easily than skull forms; dark tints, except under conditions of intensity, joined with diminutive stature and complete dolichocephalism, such as unmistakably point to the race styled Iberian, simply indicate, according to the index of nigrescence established by Dr. Beddoe, more or less mixture in blood. Where, however, hair and eyes are light, and the stature tall, in the absence of information respecting the features generally, it would be impossible to pronounce any individual to be Celt or Saxon, Dane or Swede.

Birth of Parents and Grandparents in the same Locality no Proof of Race.—An experiment made for the purpose of ascertaining how far the birth of parents and the grandparents, on both sides, in certain districts would assist in the selection of pure local types, resulted in the conclusion that the requirement mentioned, though securing the absence, of recent foreign admixture, failed as a sufficient test, by affording no evidence that movements had not occurred in the population at an earlier date.

Photographic portraits obtained under the above-mentioned conditions do not, as a fact, assist materially in the definition of racial characteristics; the features exhibit more than one type even in districts supposed to have been peopled by a given race; though, owing to the law already alluded to, pure types may be sought for, and would more frequently be found amongst such populations than elsewhere.

This, and other considerations, led a sub-Committee, in 1880, to collect in preference, from different localities, a certain number of portraits, all of which exhibited similar features; and then an equal number distinguished by characteristics in all respects different from the first series, but equally homogeneous. They presented contrasts which appeared to be racial.

Method of Identification of Types adopted by the Committee.—Approaching the subject from the standpoint of comparative physiognomy alluded to in the last paragraph, but experimenting in the first instance on the facial skeletons of skulls obtained from ancient tumuli and cemeteries in different parts of the British Isles, it was found on superimposing tracings of the skeleton profiles of the three main types figured in the "Crania Britannica," that the brows of the Brachycephalic, round-barrow types were more prominent, and the nasal bones more angular and sharply projecting, than those of the Dolichocephalic, long-barrow type; whilst brows and nasals in the Teutonic skulls (and especially those of the Saxons proper) were respectively smooth and little prominent. The main characteristics in the profiles of the Round-barrow man and the Teuton would clearly have been the high-bridge of the nose of the former, and the entire absence of an arched nose in the Saxon.

Similar results were obtained from measurements of skulls in the Anatomical Museum at Cambridge, purchased from Dr. Thurnam by Prof. Humphry, and presented by him to that University. Also some skulls in the Museum of the Royal College of Surgeons, and the Greenwell collection at Oxford, have been measured and found to exhibit the same contrasts. Mr. Harrison, who obtained the measurements for the information of the Committee, found that the mean difference in pro-

jection of the nasal bones in skulls from the round-barrows, as measured from the basion to fixed points on the dorsum and the nasion, or root of the nasal bones, is about twice that observed in purely Teutonic crania. In the fine collection of true Saxon skulls from Wiltshire, obtained by General Pitt-Rivers, the principal characteristics are a rounded forehead and smooth brow, and but little projection in the nasals; and this in the male as well as the female skulls.

The points of contrast in the skeleton features of the two races were noticed by Dr. B. Davis; but owing to Saxons and Angles being at the time he wrote considered equally Teutonic, the differences observed in some of the examples selected by him to illustrate types, are not so strongly marked as in others. Dr. Beddoe and Mr. David Mackintosh, it should be mentioned, both consider the Anglian features to have been more prominent than the Saxon.—When proceeding to define tribal differences and crosses, the nasal forms will, with other features, be subjected by the Committee to more minute examination.[1]

The above facts having been sufficiently ascertained, it was easy to compare the skeleton features of the two main types—viz., the Round-barrow man and the Saxon—with profiles of living subjects in this and neighbouring countries presumably inhabited by similar populations. Whenever the osseous and other features were found to correspond, at the same time that they differed entirely from other equally well-marked types, it was assumed that the characteristics belonged to distinct races.

In the following definitions the main types are designated by capital letters, intended to be used as symbols when dicussing racial crosses:—

The First or Dolichocephalic Dark Type, A.—The definition of the short, narrow-headed race shown by Dr. Thurnam and Prof. B. Dawkins to have preceded the so-called Celts, and termed by them Iberian (=the Silurian of Prof. Rolleston), is at present incomplete. The forehead, however, appears to have been fairly vertical, the brows prominent, the nasal bones long and straight, the lower jaw weak (Rolleston), and the hair and eyes dark. Statistics of the colour of the hair and eyes, collected by Dr. Beddoe, show that the race exerted a much wider influence on the population than is usually supposed. A number of photographs, which, it is believed, represent varieties of the type, have been placed on cards.

The Second or Brachicephalic Fair Type, B.—The principal characteristics of this race consist in the prominence of brow and supra-nasal ridges; a slightly receding forehead; sharply projecting nasal bones, causing a high-bridged or arched nose, without undulation; a long, oval face; high cheek-bones; and a prominent fine chin. From Mr. Park Harrison's observations the lips of this type appear to be thin, and the ear pear-shaped, with no proper lobe, the fossa being continuous.

The above features are found associated with light hair and eyes, and a stature above the average.

This type includes Belgic, Cymric, and Danish varieties, which, further observation, the Committee believe, will by-and-bye enable them to differentiate; as also the Anglian, Jutish, and Frisian types. They have selected several portraits, which present common characteristics.

The definition of Type B agrees in all the main points with descriptions given some years ago by Dr. Beddoe, Mr. David Mackintosh, and Mr. Hector Maclean, as well as with Dr. Rolleston's deductions in the appendix to "British Barrows."

The Third or Sub-Dolichocephalic Fair Type, C.—The Committee believe that the following is a correct definition of true Saxon features. Brows smooth; forehead rounded and vertical; nasal bones short and straight; nose not arched, ending in more or less of a bulb; face elliptical, rounded; cheek-bones broad; chin rounded; lower part of face wide; eyes prominent, in colour blue or bluish-grey; lips moulded; ears flat, with formed lobes; face and frame well covered. Height about the average.

The definition accords with Schadow's pure German (Teutonic) type, and with the Saxon type of Beddoe and Mackintosh.

Photographs conforming in all respects to the above characteristics have been obtained from Sussex and several other English counties; and from Scotland, Sweden,[2] Germany, and France. Specimens have been arranged upon cards.

[1] Prof. Flower, speaking of the racial value of the nasal bone, when describing the cranial characters of the natives of the Fiji Islands, says: "The nose is one of the most important of the features as a characteristic of race, and its form is very accurately indicated by its bony framework" (*Jour. Anthrop. Inst.*, vol. x. p. 160) Dr. Broca defines six forms.

[2] The Dolichocephalic Swedish race of Retzius was believed by him to be closely allied to the Saxon.

No photographs have as yet been taken specially to illustrate the three types, the Committee thinking it best to proceed before doing so with the definitions of racial varieties.

New Designation of the Committee.—If re-appointed, they suggest that it should be "for the purpose of defining the facial characteristics of the races and principal crosses in the British Isles, and obtaining illustrative photographs with a view to their publication."

Constitution of the Committee.—Prof. Flower having been unable to take an active part in the proceedings of the Committee owing to pressure of other work, and having expressed a wish that another chairman should be appointed, they hope that General Pitt-Rivers will undertake the duties.

Photographs.—Mr. Barraud, who was asked to act as an Associate, has presented some cabinet photographs of well-known persons for exhibition. The Committee have also received from Dr. Beddoe a portrait in full face and profile, taken at his expense, of a native of Montgomeryshire. It is a good example of the Silurian type. Other photographs have been received in illustration of Types B and C.

The Committee ask for a renewal of the grant of 10*l.*, with an addition sufficient to procure the requisite negatives, and also photographs from different counties to illustrate crossing.

Report of the Committee, consisting of Dr. M. Foster, Dr. Pye-Smith, Prof. Huxley, Dr. Carpenter, Dr. Gwyn Jeffreys, the late Prof. F. M. Balfour, the late Sir C. Wyville Thomson, Prof. Ray Lankester, Prof. Allman, and Mr. Percy Sladen (Secretary), appointed for the purpose of aiding in the maintenance of the Scottish Zoological Station.—The Committee beg to report that, with the aid of the sum of 40*l.* voted last year, further investigations have been made by Mr. Romanes, F.R.S., and Prof. Cossar Ewart on the "Locomotor System of the Echinodermata." The work of the station was carried on at Oban, where, in addition to the ordinary forms abundant on the east coast, *Antedon* was plentifully obtained for examination. The investigators directed their attention—1. To completing their observations on (*a*) the internal nervous system of *Echinus*; (*b*) the external nervous system of *Asterias*; and (*c*) the nature of the nervous system of *Antedon*. 2. To the effects of rotation on inverted echini. 3. To the effects of poisons on echini and other invertebrates. 4. To the natural movements of *Antedon*, and to the influence on these movements of partial destruction of the nervous system. The publication of the results obtained at Oban is reserved until the further researches now in progress are completed this year. It may be added that a fine specimen of the rare compound Ascidian, *Diagona violacea*, was dredged in the Sound of Mull. During the present autumn Mr. Romanes and Professors Ewart and Schäfer are at work on the Ross-shire coast. The Committee again beg respectfully to request that a sum of 50*l.* be voted to assist in meeting the expenses of the station.

Report on the Progress of the International Geological Map of Europe, by W. Topley, F.G.S.—A committee was appointed by the Geological Congress of Bologna to prepare a map of Europe. An account of the proceedings of this Congress has already appeared in NATURE. The present Report deals chiefly with the progress since made. Arrangements have been made with Reimer and Co. of Berlin, for the engraving and publication of the map. MM. Beyrich and Hancherverne are the directors for the map. The topography of the British Isles is already engraved; a proof was exhibited to the meeting.

Report on the Earthquake Phenomena of Japan, by Prof. J. Milne, F.G.S.—This paper was illustrated by diagrams showing the effect of earthquake waves at the Palazzo Palmieri, Polla, in the Neapolitan earthquake, and in the earthquake traversing Tokio Bay on February 22, 1880, in which the centres of origin of the waves are indicated, in another the manner of interference of earthquake waves, in the ground underlying Yokohama. Earthquakes of the north-east of Japan do not spread south-west, owing to the tract of high ridges lying in their path, which form a barrier to their movement, while to the south-east, east of the central mountain axis, there is a flat district, which invariably receives the shocks. The author is preparing a seismological atlas, which shows the large number of seismic centres in which the earthquakes originate, and the relative intensity of the waves and the areas affected. Outside the island occur several seismic centres in the open sea. The waves propelled from these centres breaking against the mass of the mountain, are either reflected or absorbed by the mass. In regard to the velocity of earth-

quake waves, the author described the "time-take," which is a clock which is an automatic arrangement causing dots to be made and the time of wave-motion to be indicated without stopping the clock. He describes shocks observed by him in Japan as travelling at 10,000 feet per second, decreasing as it went on to 4500 feet, getting slower and slower as it went on. The waves last from thirty seconds to four minutes. The author describes the result of experiments carried out by himself and Mr. Gray as to artificial earthquakes, explosions of 2 lbs. to 5 lbs. of dynamite in bore-holes 10 feet in depth, fired by electricity, and the effect of letting a heavy iron ball fall on the ground to a depth of 20 to 30 feet in height. The effect of shocks is communicated along the surface, gradually decreasing as it proceeded from the point of propagation, but at a less rate as the distance increases.

SECTION A—Mathematical and Physical

On the Absolute Measurement of Electric Currents, by Prof. Lord Rayleigh.—The absolute measurement of current is more difficult than that of resistance. All the methods hitherto employed require either accurate measurements of the horizontal intensity of the earth's magnetism or of coils of small radius and many turns. This latter is difficult to evaluate, as it is impossible to measure the length of the wire wound, as the tension necessary to make the wire lie evenly, stretches it very considerably, whilst it is most important to determine the mean radius accurately, as an error therein doubles itself in the final result. The method of Kohlrausch is free from this objection, but it requires a knowledge of the moment of inertia, a quantity not easy accurately to determine. When the electromagnetic action is a simple force, it can be determined directly. In Mascart's recent determination, a large solenoid is suspended vertically in a balance, and is acted on by a flat co-axal coil of much larger radius. This is simple to think about, but not calculated to secure precise results. The appearance of accuracy is illusory, unless it can be assumed that the distribution of wire is absolutely uniform. It would appear that all the turns of the suspended coil should operate as much as possible, that is, that the suspended coil should be compact, and should be placed in the position of maximum effect. There is a further incidental advantage in this arrangement. The expression for the attraction involves as factors the product of the number of turns, the square of the current, and a function of the mean radii of the two coils, and of the distance between their mean planes. This function is of no dimensions. When the position is such that the function for two given coils is a maximum, the result is practically dependent only on the two mean radii, and the function being of no dimensions, can involve these mean radii only in the form of a ratio. This can be obtained electrically with full precision by dividing a current between them in such a way that no effect is produced on a small magnet at their common centre. In practice it will be desirable to duplicate the fixed coil, placing the suspended coil midway between two similar fixed ones, through which the current passes in opposite directions.

On the Duration of Free Electric Currents in a Conducting Cylinder, by Lord Rayleigh.—This paper was devoted to considering the rate of decay of currents of electricity circulating round a conducting cylinder. The time in which the intensity sinks from e to 1 is called the "time of subsidence." For a copper cylinder of r centimetres radius, this is equal to $r^2/800$. That this may be one second, the diameter of the cylinder must be two feet.

On the Equilibrium of Liquid-conducting Surfaces charged with Electricity, by Lord Rayleigh.—This was a mathematical paper in which was investigated the condition of stability of a sphere of fluid charged with electricity. If Q be the charge, T the surface tension of the fluid, and a the radius of the sphere, then the condition of stability is that $T > Q^2/16\pi a^3$.

Preliminary Account of Results obtained during the late Total Solar Eclipse, by Prof. Schuster and Capt. Abney.—Three photographs of the corona were obtained with different exposures. The comet Tewfik, discovered during the eclipse, appears on the photographs, and the change of its position in successive plates shows that it was moving away from the sun. The corona is seen to extend over a solar diameter away from the sun. A plate exposed in a camera which had a prism in front of the lens shows the spectra of different prominences, which are not found to be identical, but in every case the lines H and K are the strongest. A photograph obtained in a complete spectroscope shows (1) a complicated prominence spectrum; (2) a strong continuous spectrum in the lower parts of the corona; (3) a reversal of the solar line G in the upper regions; (4) a series of coronal lines, different from the prominence lines.

Some Matters relating to the Sun, by Prof. Schuster.—Observations of the shape assumed by the solar corona in successive eclipses during the last fifteen years have shown remarkable changes coincident with the sun-spot period. The corona of sun-spot minimum is characterised by a certain symmetry about an axis not far removed from the sun's axis of rotation, but very likely not quite coincident either with it or with the perpendicular to the ecliptic plane. Some apparent irregularities in the symmetry seem to be due to differences in the position of the earth in its annual orbit. Changes in the spectroscopic and polariscopic properties of the corona which are coincident and connected with the changes of form seem to point to partly meteoric origin of the corona.

On a Misprint in the Tidal Report for 1872, by Mr. G. H. Darwin.—Mr. Darwin has recently been carrying out a laborious reduction, by the Method of Least Squares, of the observations of the tides of long period at a number of stations. The results, which seem to have an important bearing on the question of the rigidity of the earth's mass, will appear as § 848 in the new edition of Thomson and Tait's Natural Philosophy, now in the press. Subsequently to the completion of the calculations, Prof. J. C. Adams discovered a misprint in the Tidal Report of 1872, which forms the basis for the method of harmonic analysis, which has been applied to the tidal observations. On inquiry of Mr. Roberts, who has superintended the original computations, Prof. Adams learnt that the erroneous formula has been used in all the reductions of the long period tides. The erroneous formula occurs near the middle of p. 471 of the Report of the British Association for 1872, in the instructions for clearing the diurnal means from the undue influence of the short period tides; in the first of the two formulæ for that purpose, the factor $\sin 12\,n/\sin \frac{1}{2}\,n$ should obviously be replaced by $\sin 24\,n/\sin n$. The tides of long period are evaluated by the following process:—A mean is taken of the twenty-four heights of the water above the datum line at each mean solar hour during the twenty-four hours. The 365 diurnal means form the results of tidal observation for the whole year, and these are to be treated by harmonic analysis; but the continuous integrals which arise in Fourier's method are of course replaced by finite integrals. This method of procedure introduces an undue influence of the short period tides on the values deduced for the long tides, and a correction to each diurnal mean is necessary to get rid of this influence. It is in the formula for the correction to be applied in the case of the semi-diurnal tides that the error occurs. This paper is an evaluation of the maximum effect which can have been exercised on the results by the error. The analysis shows that all the values assigned to the long period tides in the Tidal Reports and Tide Tables must have been more or less vitiated. The lunar fortnightly declinational tide, the semi-annual and the annual tide have suffered comparatively little. The monthly elliptic tide has suffered more, and the synodic fortnightly tide will in many years have been utterly worthless. The paper contains suggestions of a new method of procedure in the harmonic analysis of the tides of long period, and also discusses a remarkable result of the procedure by diurnal means in consequence of which there is an exaggeration of the undue influence exercised by the short-period tides on those of long period, in which either the sum or difference of the speeds is exactly 15° or 30° per mean solar hour.

On the Velocity of White and Coloured Light, by Mr. G. Forbes.—The author gave an account of experiments made by him in conjunction with Dr. James Young, F.R.S., with a view to determining the velocity of light. This research has been published in the *Transactions* of the Royal Society. The chief point of interest is that it appears that the velocity of blue light is greater than that of red, the difference being between 1 and 2 per cent. of the whole velocity.

Lord Rayleigh could give no other possible explanation of the phenomena described by Mr. Forbes, but he had great hesitation in accepting them from considerations on other sides. Michelson altogether repudiated them, and Lord Rayleigh thought that Foucault's method, that used by Michelson, was better suited to bring out results, if such existed, than Fizeau's, for it would produce a spectrum of considerable length. He would refer to some other points which he noticed in a letter to NATURE about twelve months ago, especially as to what is

meant by the velocity of propagation of a wave. In a regular train of waves this was the velocity with which any given phase of a wave moved forward; this could easily be observed in the case of waves on water, but in the case of light no wave form could be observed. The velocity determined by Fizeau's method, or by the eclipses of Jupiter's satellites, was not this, but the velocity of propagation of intermissions of light, which if the true velocity of propagation is a function of the wave-length, is not the same as the true velocity; it is only the same where, as in the case of air, the velocity of propagation is the same for all wave-lengths. Foucault's method (Michelson's) is based on determining the angular motion of a mirror between successive reflections, which again is a different quantity from the former two.

Sir W. Thomson wished to testify that the experiments were made most carefully, and felt unable to suggest any other explanation than Mr. Forbes's, but he felt trong previous objections to accepting it. He pointed out that Mr. Forbes's observations made the velocity of propagation smaller for waves of shorter period, whilst from the analogy of sound in elastic bodies we should expect the opposite.

SECTION B—CHEMICAL SCIENCE

On the Reversals of the Spectral Lines of Metals. By Professors Liveing, M.A., F.R.S., and J. Dewar, M.A., F.R.S.—The authors have a twofold object in view in the study of this subject, (1) to trace the parallel between the condition of the elements as they exist in the sun and those in which they may be placed on the earth; (2), that a knowledge of the reversible lines might aid to distinguish those due directly to the vibrations of the molecules and those produced by superposition of waves or by some strain upon the molecules, such as the electric arc might produce. They classify the reversals, as follows; (1) Reversals produced when the expanded line itself forms the background against which the absorption line is narrowed because the density is less than that of the emitted vapours. These are the ones most generally known. (2) Reversals in which there is little or no expansion of the lines, the background being either the hot walls and end of the tube, the hot pole of the arc, or such part of the spectrum which is so full of lines as to be nearly continuous. Photographs exhibiting the reversals of the lines of iron and other metals, were shown. (3) Reversals in which the background is produced by the expansion of a line of some other metal. Photographs were shown in which the lines of iron and other metals were seen reversed on the expanded lines of magnesium. (4) Reversals produced by the introduction into the crucible in which the arc was of a gentle current of hydrogen, coal gas or ammonia, by which means the metallic lines were almost swept away and the continuous spectrum increased. (5) When a carbon tube passed through a perforation in a block of lime is made the positive electrode of the arc, and a carbon rod passed into another perforation so as to meet the tube in the centre of the block, be made the negative electrode, the tube becomes gradually heated up, and in the direct line of the tube the lines are seen bright, because there is no background, but are seen reversed against the hot walls of the tube. Further the effects of the gradual increasing temperature were traced, as the tube was gradually heated. (6) A double reversal of lines is occasionally observed, and an instance was shown, in which the expansion of the magnesium lines between K and H, had taken place to such an extent as to produce the reversal of the most refrangible of the cyanogen bands; the magnesium producing a broad absorption band against which the magnesium triplet stood out bright and sharp. It is probable that this arises from the less dense but intensely heated magnesium vapour being pushed forward up the tube by the sudden burst of vapour produced when a fresh piece of metal is dropped into the arc.

On the Legal Flashing Test for Petroleum, by F. A. Abel, C.B., F.R.S.—The defects of the old legal flashing test, called the open test, and the test used in the United States, known as the fire test, led to the introduction of the close-flashing test, which was legalised by Act of Parliament in 1879. The author exhibited the apparatus required, and described the method of using this test. This test has since been adopted in Germany and the United States, and the investigations conducted in the former country by Dr. Foerster and others, showed what had already been observed by the author, that the results obtained with the apparatus were influenced by atmospheric pressure. The most recent investigations of the author and Mr. B. Redwood, have shown that a variation in the height of the barometer of one inch, was sufficient to produce a change of two degrees Fahrenheit in the flashing point of one and the same sample of oil. Further, it appears that the changes of atmospheric temperature have some influence on the flashing point of a sample of oil, and not only is it necessary to cool down the sample of oil immediately before testing it, when its temperature exceeds 65° F., but it is imperative, in cases where the oil has been stored in localities, the temperature of which is above 65° F., to maintain the oil at a low temperature for a considerable period before testing it. In consequence of this effect of changes of atmospheric temperature, some difficulties have arisen in applying this test in India, and investigations are at present being conducted, the object of which is to ascertain the conditions required for securing the attainment of trustworthy results by the application of this test in tropical climates.

On the Boiling Points and Vapour Tensions of Mercury, of Sulphur, and of some Compounds of Carbon, determined by means of the Hydrogen Thermometer, by Professor J. M. Crafts.—A description was given of the hydrogen thermometer used, the replacement of air by hydrogen was adopted because of the more rapid flow of hydrogen through a capillary tube, further, the bulb of the thermometer could be reduced from 200-500 cc. to 1-10 cc. The thermometer was one of constant volume in which an electric contact between the mercury in the manometer and a platinum point causes a current to excite a magnet and close a cock to arrest the flow of mercury into the manometer tube at the moment the gas attains a fixed volume, as determined by the surface of the mercury touching the platinum point. The boiling point of mercury has been redetermined, and found to be 357° (at the normal pressure), that of sulphur was found to be one degree lower than that assigned to it by Regnault. Naphthalene b. p. 218·08 (bar. 760 mm.), and benzophenone, b. p. 306°·1 C. (bar. 760 mm.), were also used to obtain constant temperatures near 200° and 300°. The boiling points of these two substances were determined under reduced pressures varying from 87 to 2,300 mm., giving a series of temperatures that can be easily established and maintained for any length of time, and ranging from 140° to 350°. It is probable that benzene may be easily obtained sufficiently pure to be used in a similar manner. A series of determinations of the boiling points of several carbon compounds have been made, from which it appears that successive, similar additions to the molecular weight do not cause the boiling points to rise by a constant quantity as supposed by Kopp, but that in a large number of cases the increments to the boiling temperatures diminish by a constant quantity.

The Velocity of Explosion of a Mixture of Carbonic Oxide and Oxygen, with varying quantities of Aqueous Vapour, By H. B. Dixon, M.A.—The author has compared the velocities of explosion of mixtures of carbonic oxide and oxygen with varying quantities of aqueous vapour, by observing the pressure registered in a mercurial gauge attached to the endiometer in which the gases were fired. In each experiment the same mass of carbonic oxide and oxygen was exploded at nearly constant volume and temperature. The gauge was U shaped and contained air in the closed limb. An index similar to that used in Six's thermometer was carried up and left at the highest point reached by the mercury. Near the bend of the guage two bulbs were blown to act as reservoirs, enabling the mercury to be lowered in the endiometer, without allowing air to escape from the closed limb. The endiometer was dried at 80° by drawing through it, for half an hour, air which had passed through tubes containing sulphuric acid, and a tube containing phosphoric pentoxide. It was found that in this way just sufficient aqueous vapour remained in the tube to enable the explosion to take place slowly when the sparks from a Rhumkorff coil was passed through the mixed gases. In the first experiments several sparks were passed before the gases took fire. Experiments were made in which measured quantities of aqueous vapour were added, and the vapour kept below saturation, and also with the gases saturated with moisture. The results obtained in these experiments show the pressure registered to increase with the amount of moisture present in the gases, and to be the greatest when the gases are saturated.

On the Activity of Oxygen, and the mode of formation of Hydrogen Dioxide, by C. T. Kingzett, F.I.C., F.C.S.—An account is given of the various views held regarding the formation of ozone and hydrogen peroxide by slow oxidation, in the formation of the latter by the slow oxidation of the terpenes, the author considers that an organic peroxide is first formed,

from which by contact with water hydrogen peroxide is produced as a secondary product. The views of Traube (*Chem. Soc. Journ.* 1882, 795) are criticised. The author prefers to represent peroxide of hydrogen as oxygenated water, thus, OOH_2, rather than hydrogen dioxide, a representation which is considered to explain its properties and reactions more adequately.

Metallic Compounds containing Bivalent Hydrocarbon Radicals, Part III., by Professor I. Sakurai, F.C.S., Tokio University, Japan.—By acting on monomercuric methylene iodide $Hg(CH_2)I_2$ (described in the Report of 1880) with mercuric chloride, monomercuric methylene chloriodide $HgCH_2ClI$ is obtained. This compound is acted upon by iodine, and yields mercuric iodide and methylene chloriodide CH_2ICl, which is a liquid boiling at 109° and having a specific gravity of 2·49 at 20°. The formation of this latter substance shows that monomercuric methylene chloriodide has the following constitution, $ClCH_2HgI$. Attention is drawn to the fact that the boiling point of the methylene chloriodide is approximately the mean of the boiling points of methylene chloride and iodide.

Hydrocarbons of the Formula $(C_5H_8)_n$, by Prof. W. A. Tilden, F.R.S.—An account was given of the existing knowledge of isoprene, and the author finds that it forms a tetrabromide $C_5H_8Br_4$, a liquid which cannot be distilled without decomposition. When oxidised by nitric acid isoprene yields oxalic acid, but form and acetic acids are produced when chromic acid is employed. Since isoprene can be converted into caoutchouc, experiments have been made to ascertain whether this hydrocarbon could be obtained from other sources, and inasmuch as isoprene can be converted into a true turpentine, this latter substance was studied with this object. The author found that when turpentine is passed through a red-hot tube a mixture of hydrocarbons is obtained, from which a small quantity of a volatile liquid, having the composition and properties of isoprene, has been isolated. The formulæ assignable to the eight possible compounds having the composition of C_5H_8 was discussed, as also was their relation to the terpenes.

The Ærorthometer, an Instrument for Correcting the Measure of a Gas, by A. Vernon Harcourt, M.A., F.R.S.—The object of this instrument is to simplify the method of reducing the volume of a gas to normal conditions of temperature and pressure. The instrument consists of two narrow tubes, the one open above, the other terminating in a bulb, whose capacity, including that of the stem down to the first graduation, is 1000 of the units with which the stem is divided; both tubes are connected below with a reservoir from which mercury can be driven up the tubes by the pressure of a screw. When the mercury stands at the same level in the two tubes, the air in the closed tube, which at 0° and 760 mm. occupies 1000 volumes is under existing atmospheric pressure. It has also the temperature of the surrounding air, and is therefore under the same conditions as the gas in any vessel near it. The volume read on the ærorthometer is to 1000 as the observed volume of the gas in the measuring vessel is to its normal or corrected volume. For the case of measuring gas over water, or in presence of water, the ærorthometer is charged with a drop of water. For technical purposes the graduation "1000" denotes the volume which the inclosed air occupies at 30 inches Bar. and 60° Fahr.

A Revision of the Atomic Weight of Rubidium, by Charles T. Heycock, B.A.—The object of this revision is to ascertain whether the atomic weight of rubidium can be brought into accord with Prout's hypothesis. To this end pure chloride and bromide of rubidium have been prepared, and the amount of chlorine and bromine contained in these, determined by titrating with silver nitrate in a manner identical with that employed by Stas in his classical researches. The results obtained from the chloride give an atomic weight of 85·344 for rubidium, whilst those obtained with the bromide, which the author gives with some reserve, show the atomic weight to be 85·387. These results show that, at present, rubidium cannot be regarded as conforming to Prout's hypothesis.

Method of obtaining Ammonia from Shoddy and Allied Substances, by W. Marriott, F.C.S.—A description of the method of burning shoddy moistened with soda in such a way as to collect the ammonia from the gases produced, and also utilise the combustible gases formed at the same time.

On the Application of the Diamond to Mineralogical and Chemical Analysis, by Prof. von Baumhauer.—The author after describing the various modifications of the diamond, gave an account of some methods in which the diamond might with advantage be employed in mineralogical and chemical analysis for the purpose of reducing hard substances to a fine state of division.

On the Occurrence of Tellurium and Selenium in Japan, by E. Divers, M.D., Professor, and Masachika Shimos, Student of Chemistry in the Imperial College of Engineering of Japan.—At the last meeting of the Association a communication was received from Dr. Divers in which it was shown that these elements are found in Japanese sulphuric acid. In this paper a description is given of the sulphur used in the manufacture of the acid, it differs from ordinary sulphur by being reddish-yellow in colour, and is known as *sekiriuseki*, or massive red sulphur, and is obtained from Iwoshima (sulphur island), a specimen of this red sulphur was found to contain 0·17 per cent. of tellurium and 0·06 per cent. of selenium. It is a matter of some interest that tellurium is found associated with sulphur in this state, as it is more usually associated with sulphur in a state of combination with the metals. Analysis of the mud-like deposit found in the vitriol chambers show it to contain some 10 per cent. of selenium and 1·2 per cent. of tellurium, and the sulphuric acid was found to contain 0·37 grams of tellurium and 0·15 gram selenium per liter. Attention is drawn to the fact that whilst the relative proportion between the quantities of tellurium to the selenium is as 5 to 2 in the sulphur, and as 5·5 to 2 in the liquid, it is as 1 to 9 in the deposit. This is easily explained by the fact that finely divided tellurium easily undergoes oxidation in presence of water and air whereas selenium is not so affected. Selenium and tellurium have been obtained by distilling the deposit in clay retorts.

On the Action of the Component Salts as Nuclei on Supersaturated Solutions of certain Double Salts, by John M. Thomson, F.R.S.E., F.C.S.—In a paper published in the *Journal* of the Chemical Society, May, 1879, the author has shown that if a mixture of dimorphous salts be taken, a separation may be effected by touching the solution with a crystal of one or other of the salts; a separation depending on the relative solubilities of the two salts. The investigation has been extended to supersaturated solutions of double salts, and the action upon these of the components of the double salts. Experiments have been made with solutions of double chlorides of mercury and ammonium, of mercuric chloride and ammonium bromide, of mercuric and potassium iodides, and of mercuric ammonium bromides. In these cases it has been found that the salt of the heavy metal is invariably active in producing crystallisation, whereas that of the alkali constituent is inactive. It has also been observed that the true prismatic forms of mercuric chloride and bromide produce crystallisation at once; but that if crystals of other forms are employed, as when obtained by deposition at a higher temperature, then the result is not always so defined. This is no doubt due to the fact that the first form of the heavy metallic salt is more nearly allied to that of the double salt. It appears, therefore, that these double salts of monobasic acids, although forming good supersaturated solutions, are not so firmly united together as to resist the disturbing influence of certain of their constituents, yet the disruption is not sufficient to produce a decomposition, and so a deposit of the double salt is obtained. Experiments with the double salt of mercuric cyanide and ammonium chloride, show that each constituent is active. In the case of the alums, the double phosphates and arseniates neither constituent is active. With Lefort's salts, viz. double sulphates of copper and zinc, both constituents are active, the zinc salt produces the more rapid crystallisation, but the double salt is deposited in each case. In the case of the double tartrates of sodium and potassium it was found that the potassium salt is inactive, whilst the sodium salt is active. An examination of the crystals showed them to have the composition of Rochelle salt; and since the nucleus in no wise resembled this salt in form, it would appear that rochelle salt is probably dimorphous. The activity of sodium tartrate is probably due to its being less soluble than potassium tartrate. In the case of the double citrates of these metals both constituents are active, whilst with the citrates of magnesium and sodium both constituents are inactive. These results show that the union in the double salts of monobasic acids is more of a molecular character, inasmuch as they suffer disruption more easily than do those formed of acids having a higher basicity, such as the alums and phosphates, where there is a firmer union of the constituent salts.

The Decomposition by heat of Potassium Chlorate, by Professor I. M. Crafts and A. Rilliet.—The authors have observed that the addition of metallic silver reduced from the chloride aids

this decomposition, an observation which appears to destroy the usual theories regarding the function of those metallic oxides, which have a similar effect. It was supposed that the action of the catalytic bodies might arise from a power to absorb oxygen, but experiments made by placing black oxide of manganese under conditions similar to those in which it aids the decomposition of potassium chlorate, negatived this supposition. Gas retort carbon can be completely burnt by contact with powdered potassium chlorate at 340°, the action is not attended by fusion, and it appears that in this case chemical affinity determines the decomposition. The action of heat upon potassium chlorate was studied by maintaining it at a constant temperature, and it has been observed that the chlorate begins to give off its oxygen between 330°—340°, *i.e.* at temperatures much below its fusing points. This decomposition goes on for several weeks and finally becomes imperceptibly small, but a rise of temperature or the addition of substances known to favour the decomposition, produce a fresh decomposition leading to a further limit. The authors propose a hypothesis to account for this gradual action of heat upon the chlorate.

SECTION C—GEOLOGY

On the Cause of Elevation and Subsidence of Land, by J. S. Gardner, F.G.S.—The paper claims that the evidence of the permanence of continents is inconclusive as regards eocene and pre-eocene periods, and inquires what the shallower regions of the Atlantic mean, if they do not mean a change of level at the sea-bottom. Assuming with Sir C. Lyell, that at a given depth rocks are molten, and that under further pressure they are re-converted into solids of high specific gravity, the paper demonstrates that the outer envelope is susceptible to and gives way under any increased weight, and recovers when this is removed. The evidence relied upon is that of coral isles, lava-flows, accumulations of ice, and of sediment in deltas, estuaries, and along sea-coasts. In these cases, unless there are counteracting agents, subsidence invariably follows, and littoral seas are thus areas of depression. The increasing pressure in deep oceanic basins acting on the fluid layer leads to the elevation of lines of least resistance into ridges or dry-land, these lines generally coinciding with coast-lines, and to volcanic outbursts. Geology demands pre-eocene communication between many lands. The elevation of land continuous between Europe and America in the north, during the Middle Eocene, was coincident with a cessation in the great formation of basalt, and its subsidence with a renewal of this. The conclusion is drawn that irregularities of surface have and will continue to become more and more accentuated.

Notes relating to the Drift Phenomena of Hampshire: (1) *Boulders, Hayling Island;* (2) *Chert Débris in the Gravel;* (3) *Elephant Bed, Freshwater Gate*, by Prof. J. Prestwich, MA., F.R.S., refers to the remarkable boulders of crystalline and other old rocks in Pagham, which were noticed long ago by Mr. Dixon, and more recently Mr. Codrington has described similar boulders of Portsea Island, and states that boulders of the same character occur in the gravel of Portsea Island, two boulders of granite, and three of sandstone occurring on the shore near the station, while thirty smaller specimens occurred within a mile westward of the station. Those on the shore facing South Hayling have been collected to form a rockery and local grotto work. The author considers the boulders to have been brought from the Cornwall and Devon coast by floating ice, at the time of the formation of the Brighton raised beach.

On the Sources of the Salt Supply of India, by Prof. V. Ball, F.R.S., states irrigation in some of the central districts in India has produced sterility, by raising the permanent level of the subsoil water in the ground, which becomes saline by contact with the lower strata, and through capillary attraction, salts of sodium potassium and magnesia were brought to the surface. The author states there are five distinct sources of salt in India, the most important of which are wells which have been sunk to a depth of 100 to 150 feet, and brine obtained, over a large area in the central region of India. In Assam and Burmah saline springs occur in connection with petroleum, 10,000 tons of salt are now being raised from the Sambur Lake. Rock salt occurs of Silurian age, and also in beds of Eocene Tertiary age.

On the Identification of certain Ancient Diamond Mines in India, by Prof. V. Ball, M.A., F.R.S., F.G.S.—The vague references to India as the only then known source of diamonds by the writers of 2000 years ago, give place to more definite indications of position in Sanscrit works of the sixth century, and possibly of somewhat earlier dates. In the Barhat Sanita a list of localities is given, but as the stones from some of the localities therein mentioned were copper coloured, it is possible that they were not diamonds. In the Ain-i-Akbari (1590), and also less clearly in the Ferishta's History (1425), a locality named Albeniguras is referred to, which can be identified with Wairugurh in the Central Provinces, where the remains of ancient mines are still to be seen. The following localities mentioned by Tavernier (1665), had not been identified until lately, though various attempts had been made by Colonel Rennell and others since his time. Gani or Coulour is Kollur on the Kistna; Raolconda is Ramulkota in Karnul; Soumelpour was on the Koel river in the Palamow district of Bengal. Kollur would appear from Tavernier's statement to have been the mine where the Great Mogul diamond was found. The same stone is mentioned by Garcias ab Horto, who wrote 100 years before Tavernier. Prof. Ball is of opinion that this stone, which was probably found in the middle of the sixteenth century, was the original of the Koh-i-nur. The author referred to several other early authorities, and to the mythical stories which are connected with the accounts of diamond mining, for the origin of which he proposed explanations.

On the Geology of Cardigan Town, by G. W. Keeping, M.A.—The author considers the Geological Survey in error as to the horizon, on which they place the Silurian rocks, underlying this town.

Notes on the Bure Valley Beds and Westleton Beds, by H. B. Woodward, F.G.S., considers the introduction of the term "Chillesford clay," and its supposed identification with any laminated clay that occurs on any horizon in the Norwich Crag, to have been the source of the confusion at present existing. The author finds there is no division between the Bure Valley beds and the Norwich Crag below, and that Messrs. Wood and Harmer are incorrect in referring that the former deposits are Lower Glacial.

The Iron and Lead Measures of Tynehead, Alston, by Mr. C. E. De Rance, F.G.S., of H.M.'s Geological Survey.—The Carboniferous Limestone of this area is split up into a series of limestone separated by thick beds of shale and sandstone, and traversed by an intrusive sheet of basalt, known as the Whin Sill; the section above that horizon consists only of about 200 feet of limestones, while sandstones reach 350 feet, and shales 520 feet. Beneath the Whin Sill there are 900 feet of measures, in which occur many important beds of limestone, one of which, the Melmerby Scar Limestone, reaches a thickness of 124 feet. The chief lead measures occur in the Great Limestone (70 feet), the Scar Limestone (30 feet), and the Tyne-bottom Limestone. The latter, deriving its name from its gradual inclination northward, forming the floor of the River Tyne; below this horizon but little has been done in proving the lead lodes in depth, owing to the water-charged condition of the rocks beneath. The veins in nearly every case are faults of small throw, when these traverse limestones, the veins contain lead; when they pass through sandstones they contain copper, and in both cases the sides consist of valuable deposits of brown hæmatite, which occasionally reach a thickness of 6 or 7 feet. These at present are not worked, but should a railway be carried up the Tees and into the South Tyne Valley, as is proposed to connect Alston with Middleton in Teesdale, these valuable deposits will be available for use in the Middlesboro district.

Notes on Alpine Post-Carboniferous (Dyassic) and Triassic Rocks, by the Rev. A. Irving.—This paper is merely supplementary to what has recently appeared in the *Geological Magazine*, on the Dyas and Trias of Europe. Attention is especially drawn to the three following points in connection with the Alpine Dyas ("Permian"):—(1) the occurrence of the *Verrucano*, its possible equivalence with the Rothliegende, as advocated by Gümbel, in opposition to the view of von Hauer, who prefers to regard it as belonging to the lowest horizon of the Trias; (2) the great volcanic activity manifested in the Alpine area in post-Carboniferous times, as illustrated by the great porphyry district of Bozen (in connection with which the structure of the Ritterer Horn, a "stratified cone," with interbedded "ash" beds and porphyries, is described from recent observations by the author); (3) the occurrence of certain Alpine deposits (especially the Bellerophon Limestone of the Puster Thal, and the Grödner Sandstein at Neumarkt near Bozen), which, on palæontological grounds, are regarded by Gümbel as representing a "*transition series* from the Dyas to the Trias." Attention is also drawn to the correlation of the Triassic deposits on the northern and southern sides of the great

crystalline axis of the Alpine chain, and in particular to the apparent identity of horizon occupied by the massive Schlern dolomite, with its underlying St. Cassian Beds, and the Hallstatt Limestone with its underlying marls rich in St. Cassian fossils. This point is illustrated by sectional diagrams, one through the Steinernes Meer (after Mojsisovics), the other through the valley in which St. Cassian is situated Numerous fossils recently brought from the St. Cassian district were exhibited.

On the Post-Miocene Depoits of Bovey Tracey, South Devon, by W. Pengelly, F.R.S.—Lignites with detrital gravel are of Lower Miocene or Upper Miocene age, and certain sub-tropical faults, *Betula nana* beds of later date, of post-glacial age; the so-called "head" is of somewhat older age, and is referred by some to the glacial epoch. Described clay with angular smoothed stones, considered to be Boulder Clay by Prof. Heer and other foreign geologists, but the author has failed to find any scratches upon the stones. 9 foot 6 inches below the surface is a bed of white clay with *Betula nana*. The author described the discovery of a canoe in the midst of clays, which he believes of older age than the era of *Betula nana*, and reports it to be probably of inter-glacial age if the head was of glacial age.

Problems on the Geology of the Channel Islands, by Rev. E. Hill, M.A., regards the work of the late Prof. Ansted as incomplete. The author considers that probably the Homoblendic rock overlie the groups of sark, but this requires working out. States that Prof. Ansted's conclusions as to the lithology of the rocks, are not founded on sufficient basis. He regards the work of Prof. Liveing as of considerable value in this direction, but he considers that there is much to be done in Guernsey, Sark, and Jersey. He describes basaltic dykes, dioretic dykes, and of mica-trap in Guernsey, the latter being in Sark.

The Southampton Artesian Well, by T. W. Shore and E. Westlake.—The question is, whether it is possible by an extension of the existing well, to utilise it as a source of supply to the town. The amount of water yielded by the well on the last occasion of pumping, in 1851, was 130,000 gallons per day. The quantity of water at present supplied to the town from the Itchen is from 3 to 3½ million gallons, but this is a much larger quantity per head than is found to be sufficient for towns under well regulated systems of supply. It thus appears that the well yields about 1-25th part of the quantity required. For the purpose of increasing the yield, two methods are suggested: one of them is to drive galleries or drift-ways in the chalk, the other is to continue the boring through the chalk into the Upper and Lower Greensands. The work of excavation was carried on from July, 1838 till 1851, at a total cost of 19,000*l.*, and reached a total depth of 1317 feet. The diameter of the well was 13 feet, diminishing to 7 feet; it passed through 464 feet of the Tertiary Beds, of which soil occupied 2 feet, Lower Bagshot bed 74 feet, 304 feet of London clay, the latter consisting of sandy clay with seams of water-bearing sand and pebble beds towards the top; 84 feet of Plastic Clay, with the usual bed of greensand on the bottom. The chalk was reached at a depth of 464 feet, where the masonry was terminated, but the 7-feet shaft was carried 99 feet into the chalk; a 7½ inch boring was then made with a 7½-inch augur to a further depth of 754 feet, making a total of 853 feet of chalk. The whole of the chalk contained flints, with the exception of the last 10 feet. Most of the water met with appears to have come from the chalk; previous to the boring being made, in 1842, 20,000 gallons was raised. In 1844 the quantity rose to 50,000 gallons, and finally in September, 1851, to 130,000. The chalk thus supplies 5-6ths of the whole quantity. The authors then give a description of the Brighton chalk wells, and they consider the conditions are similar at Southampton. The authors, following the advice of Dr. Buckland at the previous meeting of the British Association, have ascertained the height of the Greensand springs:—

Springs.		Height of Springs.	Height of Water in Well
Petersfield	Twyford	210	—
	Petersfield	300	150
	East Wordham	390	—
Kingsclere		—	137
Pewsey Warminster	Avon at Wivelsford	340	123
Wardour	Wiley at Boreham Bridge	337	112
Shaftesbury	Nadder at Barford	200	87

The authors are of opinion that large stores of water may be obtained by sinking into the Greensands.

On the Synclinal Structure of the Straits of Dover, by W. Topley, F.G.S.—Transverse valleys of the Weald, now dislocations or anticlinals, but, on the contrary, lie in synclinal flexures, this is observable in all the valleys of the Weald. The author considers there were six valleys on the north side of the Valley of the Weald, five of which still exist. The sixth intersected the Straits of Dover, its upper tributaries and the Rother, which now enters the Channel at Rye.

On Subsidence as the Effect of Accumulation, by Charles Ricketts, M.D., F.G.S.—There is no fact in physical geology more frequently recorded than that, whilst the deposition of sedimentary strata has been in progress, there has been simultaneously a subsidence of the earth's crust; though but little effort has been made to determine whether they are dependent on each other as cause and effect. Boring in deltas prove that depression to a great extent has occurred whilst the accumulation was being deposited. The greater amount of detritus derived from hills and valleys is carried into the sea, but, instead of filling it up, the water becomes of a great depth at a few miles from the mouths of large rivers. There was a progressive subsidence of the land during the glacial period; this may be ascribed to the weight of accumulated snow, and of the newly-formed boulder-clay; a similar depression is occurring in Greenland, under a rapid increase of snow. The carboniferous series above the limestone afford most satisfactory evidence that the amount of subsidence coincides with that of deposition; the surface of the limestone and the beds of coal furnishing sufficiently correct base-lines for determining the question. There must needs be a cause for this universal occurrence of subsidence with deposition of strata, the only efficient one being the weight of the accumulated material pressing down the crust of the earth resting upon a fluid substratum. Elevation also happens on the removal of pressure, and "those regions which have suffered the greatest amount of denudation have been elevated most."—(Capt. Dutton, U.S. Ordnance Survey). At the termination of the glacial period, the land, depressed by its load of snow, became, upon this melting away, re-elevated to a certain extent. This, and the rising of the land at the present time in Norway and Spitzbergen, may be attributed to the removal of a thick covering of snow. In elevated districts the highest parts are those in which there has been the greatest amount of denudation, and often consist of the lowest rocks in a geological series. The author thinks that these depressions and elevations cannot be ascribed to secular cooling of the mass of the earth, since by such action the accumulation cannot also be accounted for; nor could the same agency acting only in one direction cause both depression and upheaval. The concurrent pheomena of accumulation and subsidence, and their converse, demand serious and careful investigation; especially as in them may be found the great moving-power upon which depends the greater number of geological changes.

On the Origin of the Hæmatite Deposits in the Carboniferous Limestone, by Edward Wethered.—The author contended that the so called "pockets" of hæmatite which occur in the Carboniferous Limestone were caverns and fissures into which the ore had been introduced by water agency. There were two or three signs which indicated an approach to a pocket of ore:—1. Joints appeared in the rock, through which water percolated. 2. An ordinary cavern opened out, termed by the miners a Welsh "locus," the sides of which were coated with large crystals of carbonate of lime. 3. Traces of iron are found in the "locus." The fact that the first indications of ore were cracks in the rock, down which water percolated, certainly pointed to the inference that by a similar percolation the hæmatite has been brought into its present position. That it has been deposited by aqueous agency was clear from the crystalline character of some of the ore. Further, there was just what would be expected from water containing the carbonates of lime and iron in solution when not exposed to the atmosphere, namely lime has been first deposited, and subsequently hydrated peroxide of iron. The next point considered was, from whence was the iron derived. The highly ferruginous character of the Carboniferous strata was well understood, and the fire-clays indicated that large quantities of iron had been rendered soluble by the deoxidising influence of decaying vegetable matter, and removed by the percolation of water. But as to whether it was this iron which had given rise to the Carboniferous Limestone hæmatite deposits was a matter for consideration. It was doubtful whether there would have been sufficient time for the fissures and caverns to have so far developed as to form receptacles for the Coal-

measure water charged with carbonate of iron. It must, however, be remembered that after the uplifting of the Palæozoic rocks there was a vast lapse of time during the denudation by the Triassic Sea, and that much of the limestone, not now overlain by the Coal Measures and Millstone-grit, was covered by those beds for a considerable time. Further, water percolating through the Coal Measures would become highly charged with carbonic acid, given off from vegetation undergoing transition into coal, and water, so charged, would not be so long in dissolving and eroding out caverns. Mr. Etheridge had referred (*Quart. Journ. Geol. Society*, 1870, ix. 185) the origin of the Carboniferous hæmatites, in the West of England, to the infilling of faults, fissures, &c., during the denudation by the Triassic Sea; but stated that "doubtless the percolation of water through overlying strata, highly charged with oxides of iron, had been a source and mode of accumulation." Though the author was disposed to consider it possible that some of the hæmatite may have been derived from the percolation of water through the Coal Measures and Millstone-grit, yet he agreed with Mr. Etheridge that the most probable source was from the Trias rocks; not, however, during the accumulation of the strata composing that formation, but by subsequent percolation of water after consolidation of the beds. This water, on arriving at the Carboniferous Limestone, would flow down the cracks, fissures, and joints, provided there were such, but a comparatively small portion would filter through the actual rock on account of its being but slightly pervious to water. The author considered that it was owing to this fact that we generally find hæmatite where the Magnesian Conglomerate rests upon the Carboniferous Limestone. The water being unable to penetrate the rock, would naturally find an outlet at the junction of the two formations, and by the wearing away of the rock the conditions would soon be arrived at when the deposition of the iron would take place.

NOTES

THE concluding meeting of the French Association at La Rochelle was rather stormy, although not more than 203 members were present. M. Bouquet de la Grye was nominated vice-president for 1883 and president for 1884. Although very few members took part in the work of the meeting, sixteen different sections were kept in operation; this extreme division has somewhat impaired their activity. However a number of interesting papers were read and discussed. M. Debrun, Professor in the College of Pau, described a new system of central magazines for distributing electricity, a new balance for determining by mutual repulsion of currents their relative force, and a new registering electrometer. M. Marcel Deprez presented a new apparatus for determining the mechanical equivalent of heat, based mostly on Leon Foucault's experiments. He hopes to determine with a sulphurous acid calorimeter the real value of this coefficient with an approximation of $\frac{1}{1000}$th. M. Tissandier presented again his researches on light bichromate elements; he contends that he obtains regularity of action without renewing the liquid, and without insuflation. Dr. Landowsky delivered an eloquent address against the dangers of injecting morphia, as practised nowadays by so many people. He deprecated strenuously this new method of intoxication; he calls it morphiomania or morphinism. Dr. Audrat has paid special attention to the anæmia of miners, and described it in a very interesting address. Electric lighting experiments were tried in the rooms of the Hotel de Nantes by a new system invented by M. Debrun.

ADMIRAL MOUCHEZ has been visiting the Pic du Midi to ascertain whether astronomical observations could be conducted successfully there.

THE *Standard's* New York Correspondent telegraphs that Mr. Edison's system of providing an incandescent electric light for domestic use in a given district has just been put to a practical test in that city. The district selected occupies an area of nearly a square mile. Only one source of supply is provided, and that furnishes the illuminating power for sixteen thousand lamps, the electric current passing through eighteen miles of mains. The result is that the severest demands which the consumers have been able to make upon the new system have been satisfied. The *New York Herald* is using in its business premises an isolated plant on the same principle. No new obstacle has presented itself to the success in practice of Mr. Edison's theory; and scientific men, the Correspondent states, will be interested to know that this first practical experiment demonstrates the soundness of the inventor's application of the multiple arc system, pure and simple, as distinguished from the series system, or the combination of the arc and series systems. Throughout the entire district lighted as described, each lamp was independent of all the others.

THE electric illumination of the Vaudeville, on the Boulevard Montmartre, is a great success. The hall is crowded every night. An 11 horse-power gas machine with Faure accumulators is sufficient to illuminate every night about 250 Swan lamps.

CONSIDERABLE interest was expressed by many visitors to the Ordnance Survey Office during the British Association meeting at Southampton, that the old and costly process of reducing the 25-inch maps to 6-inch scale, and engraving them on copper-plates, of which moulds had to be obtained, and electrotyped replicas had to be made, from which the copies were printed off, has been superseded by a cheap and rapid process, by which maps can be at once reduced and published on the 6-inch scale, so soon as the 25-inch scale is completed; by a simple application of photography the lines are reduced to any desired scale, and at once transferred to an inexpensive zinc-plate. The new 6-inch map, produced by the photozincographic process, adopted by the Survey in their reproduction of the Doomsday Book, will in future be issued for all the counties of England and Wales, where no 6-inch maps exist engraved from copper plates, but in those counties where a portion of the area has been published, on the latter system, the old process will be continued to secure uniformity. The new 6-inch maps are smaller in size than those formerly published, and at present are not contoured, but their lines will be added in subsequent editions. Their publication will at once permit the much-required completion of the Geological Survey of our coal-fields, which is a matter of the most urgent necessity.

WE regret to learn of the death, at Dorpat, of Dr. Kreuzwald, the publisher of old Esthonian songs and poems. He was born in 1804, and studied medicine at Dorpat. When a student he began to collect songs and tales of his country-people, and in the years 1840 to 1850 he published a series of remarkable articles on Esthonian antiquities, mythology, traditions, and tales. His principal work was the publication, with annotations, of the whole of the different parts of the great Esthonian poem, "Kalewinoey," remarkable by its fine poetical feeling for nature and analysis of human feelings. It was translated into all the chief European languages. In 1877 Dr. Kreuzwald was compelled to abandon his medical practice, and died in poverty at Dorpat.

THE *Official Messenger* of St. Petersburg announces, on September 1, that "by order of the Emperor the admission of new pupils to the course of medical training for women, at the Nicholas Military Hospital, will be discontinued after the present term. The students will be allowed to conclude their course, after which the clinical instruction for women at the hospital will be abolished." The Medical Academy for Women, the courses of which were quite equal to those of the old Universities, had 367 students. Since 1877, when the first lady students passed the examinations, 281 ladies have completed the whole course of studies, and 152 had passed the examinations of M.D.; 105 of them were in service at universities and in public hospitals.

NEWS received from the Finnish Circumpolar observation party states that the members arrived at Sodankylä in the north

of Finland early in August, and that observations commenced there on the 15th ult. as intended.

M. RABOT, a member of the French Geographical Society, has sailed from Tromsoë to Spitzbergen for a private exploration. This is the first time that a French ship has been in these seas for exploring purposes since *La Siloisse* was sent during the reign of Louis Philippe, under the command of Blosseville. This ship was lost, and nothing was ever heard either of it or any of the crew.

WE notice a good book of travel in Servia, published by Franz Scherer under the title, "Bilder aus dem Serbischen Volks- und Familien-leben."

THERE has just been published an elaborate work on the present state of silk-worm culture in Southern Russia and Trans-Caucasia, giving an accurate description of the whole of the culture, and a complete bibliography of works on the subject that have appeared since 1703. It is published in connection with the Moscow Exhibition, by the Moscow Agricultural Society, with many plates of drawings.

WE have received part 3, vol. iii. of the *Transactions* of the Norfolk and Norwich Naturalists' Society. We observe from the presidential address that the strength of the Society continues to increase, the present number of members being 234 as compared with 204 in the previous year; the financial position of the Society is also satisfactory. Amongst the published papers is a biographical notice of the late Dr. S. P. Woodward, by his son, Mr. H. B. Woodward, F.G.S. This memoir forms one of a series which the Society is publishing of distinguished naturalists connected with the county of Norfolk. A paper on the extensive destruction of the Lombardy poplar, contributed by Mr. H. D. Geldack, has also more than local interest. Mr. Stephenson's paper on the plumage of the waxwing contains some valuable additions to the history of this beautiful and singular bird. Additions to the fauna of the county are made in the Mammalia by Mr. Southwell, Hymenoptera by Mr. Bridgman, the Tortricidæ by Lord Walsingham, and to the Flora by Mr. A. W. Bennett, F.L.S. There are also papers on the noteworthy springs and spas of Norfolk by Mr. H. B. Woodward, F.G.S., the herring fishery of 1881, and some interesting notes on the habits of the nightingale, extracted from a letter written to the Rev. R. Sheppard in 1819. In addition there are ornithological and entomological notes from Mr. F. D. Power, Mr. Frank Norgate, and Mr. Stevenson.

MESSRS. PIPER AND CARTER have issued a new edition (the fifth) of Capt. Abney's "Instruction in Photography." The whole of the work has been revised, sixty pages of new matter added, and the latest details as to the gelatine emulsion process given.

WE have received from Mr. Stanford other two war-maps. One of Lower Egypt, on the scale of 4 miles to the inch is extremely minute in detail, and will be found of great service in following operations. The other contains a map of the Nile Delta, a plan of Cairo and its environs, the towns and ports of Suez, Ismailia, Port Said, and a general map showing the Suez Canal and Cape routes to India.

THE English Government having sent to Egypt theee of the Woolwich balloons, we may remind our readers that balloons were taken out by the French army in 1794. But it was impossible for Buonaparte to use them, the furnace for the preparation of pure hydrogen having been lost when the French fleet was annihilated by Nelson in Aboukir Bay. Conte, the engineer of the aëronauts, was created the head of Cairo arsenal, and Coutelle, their captain, was sent on a scientific mission to Upper Egypt. The diameter of these French balloons being small (10 metres), their capacity was only 520 cubic metres; they were of silk, and always inflated with pure hydrogen, which was prepared by the action of steam on iron filings.

AN exhibition of considerable interest has been opened at the Royal Aquarium, consisting of a Javanese "Gamelon" or orchestra, of fourteen male and four female performers. There is a variety of percussion instruments and one stringed instrument stated to be a violin of the Chinese type. The females go through one of their native dances, if their peculiar postures and movement of limbs and head may be regarded as a dance. From an ethnological point of view, the exhibition is well worth a visit by those who have not had an opportunity of seeing the Javanese at home. With considerable general likeness, there is really great diversity of feature, one or two of the faces being almost European in type.

THE Swedish Government has decided not to prohibit vivisection in that country, in spite of the appeal made to them by the Diet in reference hereto last session.

ABOUT forty male pupils of the Parisian public schools who have taken honours have been sent on a visit to London. The Société Nationale Française have made arrangements for their board and guidance. The same number of laureates were sent to Central France.

TWO very large and splendid catseyes were exhibited at the *conversazione* of the British Association at Southampton by Mr. James R. Gregory. These were said to be the largest in the world; one of them measured 3 inches in length and 1¼ in. in breadth, and weighed 359 carats, or nearly 2½ ounces; the other is somewhat smaller, weighing 308 carats. They are both remarkably fine stones.

THE additions to the Zoological Society's Gardens during the past week include two Southern River Hogs (*Potamochærus africanus* ♂ ♀) from South Africa, presented by Col. J. H. Bowker and Mr. John Dunn; a Hairy-footed Jerboa (*Dipus hirtipes*) from Jeddah, presented by Mr. Lionel Adams; a Himalayan Bear (*Ursus tibetanus* ♀) from North India, presented by Mr. E. J. Coope; an Indian Chevrotain (*Tragulus meminna*) from India, presented by the Hon John Stoddart; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mrs. Crawford; two Crimson-winged Waxbills (*Pytelia phœnicoptera*) from West Africa, presented by Mr. Albert Krebl; a Four-coloured Shrike (*Laniarius quadricolor*) from South Africa, presented by Col. J. H. Bowker; a Red Brocket (*Cariacus rufus* ♀) from Brazil, a Grey Squirrel (*Sciurus cinereus* var. *nigra*) from North America, seven Madagascar Boas (*Pelophilus madagascariensis*) from Madagascar, deposited; a Yellow Baboon (*Cynocephalus babouin*) from West Africa, four White-headed Bullfinch-Larks (*Pyrrhulauda verticalis*) from South Africa, two Yellow Sparrows (*Passer luteus*) from East Africa, two Scarlet Ibis (*Endocimus ruber*) from Para, two Crested Colins (*Eupsychortyx cristatus*), eleven Variable Leaf Frogs (*Phyllomedusa dacnicolor*) from Mexico, purchased.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

UNIVERSITY College, Bristol, is making laudable efforts to provide a complete curriculum for the important district of which it is the centre. Like the similar colleges at Manchester, Leeds, Birmingham, &c., the lectures comprise all the branches of a liberal and scientific education. The erection of new buildings, which will be completed before the close of the current year, will give increased facilities for the study of science. The Chemical Department now contains accommodation for nearly fifty students, and is, we believe, equipped with the latest improvements for teaching which are in use in this country or on the Continent; lectures are delivered on pure chemistry as well

as on certain branches of applied chemistry. The physical and engineering departments are also provided with facilities for laboratory work. The instruction in experimental physics is kept abreast of the rapidly increasing requirements of the age, and arrangements are now perfected for the training of students as electric engineers—a profession for which the recent development of electric discovery opens good prospects. The Bristol Medical School, which is affiliated to the College, offers with the Royal Infirmary and General Hospital, every facility for the study of medicine. Instruction in biology is also given, and it is intended to open a biological laboratory in the course of the ensuing session. In other subjects the instruction is such as to make the curriculum practically complete.

THE Calendar of the Mason College, Birmingham, already extends to 250 pages. The list of professors is fairly complete, and the subjects cover pretty well the whole field of a liberal education. Science, of course, has a prominent place, both pure and applied, but literature, both ancient and modern, is as fully represented as could be desired. The examination papers are given, and are up to a high standard; and the College as a whole promises to fulfil the intentions of its liberal founder.

THOUGH in a less advantageous position so far as funds are concerned, the modest little Calendar of the Newcastle College of Science shows that every effort is being made to keep it up to the mark. It is a pity some of the rich coal and iron masters of the northern districts do not come forward and give the struggling institution a helping hand; they could not do the north a greater service.

AN important movement is taking place among the manufacturers and machine makers of Nottingham to promote the establishment of a first class technical school in connection with the University College in that town. A nucleus fund for this purpose has been provided by the Drapers' Company in a grant of 300*l.* per year for five years, with an additional 200*l.* in the first year for the purchase of apparatus. This grant is, however, subject to certain conditions, and is also to some extent dependent on the amount of local enterprise which is displayed. The company, after mature consideration, and upon the report of Mr. Magnus, the director of the City and Guilds' Technical Institute, who, with certain members of the Drapers' Company, visited Nottingham to make inquiries, resolved to make the grant through the Institute, and the instruction provided by it is to enable students, artisans, and others to present themselves for the Institute examination in mechanical engineering. A course of instruction in practical mechanics is to be given by a professor of physics and mechanics in the evening, and the services of a skilled fitter are to be obtained to act under the professor in the practical explanation of the tools and the machinery used in lace and hosiery manufacture. The local committee are now arranging for the setting apart of portions of the College for this special purpose.

AT a meeting of the Council of the Yorkshire College, held on September 2, Mr. N. Bodington, M.A., Fellow of Lincoln College, Oxford, and Professor of Greek and Latin in the Mason's Science College, Birmingham, was elected to the Professorship of Classics, vacant by the resignation of Prof. Marshall, and to the Principalship of the College.

A NEW University building, which has taken two years to construct, will soon be opened in Lund.

SCIENTIFIC SERIALS

Annalen der Physik und Chemie, No. 9.—Experimental contributions to a knowledge of the electric conductivity of flame-gases, by W. Giese.—On absolute systems of measurement for electric and magnetic quantities, by H. Helmholtz.—Proof of the existence of Maxwell's electromotive force Y_{me}, by R. Colley.—The electric conductivity of sulphuric acid and pyro-sulphuric acid, and the density of concentrated sulphuric acid, by W. Kohlrausch.—The specific heats of gaseous biatomic compounds of chlorine, bromine, and iodine with each other and with hydrogen, by K. Strecker.—Researches on the absorption of gases by liquids under high pressures, by S. v. Wroblewski.—On the motions of air on the surface of the earth, by A. Oberbeck.—On Newton's dust rings, by K. Exner.—On the action and piezo-electric properties of rock-crystals and their relation to the thermo-electric, by W. G. Hankel.—Note on an explosion of a glass tube filled with liquid carbonic acid, by L Pfaundler.—On an explosion of an oxygen gasometer of sheet zinc, by the same.

Rivista Scientifico-Industriale, June 15.—Elementary geometrical demonstration of the condition of minimum or maximum deviation of a homogeneous ray sent through a homogeneous prism, by Prof. Banfi.—On the reductive action of glycerine on salts of silver and application of this phenomenon to silvering of glass, by Prof. Palmieri.—On *Palæomonetes* varians and one of its varieties, by Prof. Garbini.

June 30 and July 15.—Anemoscope and anemometer with free transmission, of the Brothers Brassart, by S. E. Brassart.—On unequal heating of the two electrodes by the electric discharge, by Prof. Giovanni.—Movements, ruptures (lithoclases), and tangential pressures the direct causes of the axial elevation of the Northern Apennines, by Prof. Bombici.—Contribution to study of anthropology of the southern provinces; prehistoric objects of Molise, by Dr. Del Lupo.

Bulletins de la Société d'Anthropologie de Paris, tome v. 2 fascicule, 1882, contain: Papers by M. de Mérejkowsky, on a series of Sardinian crania, with explanatory and metric tables, and on certain American crania belonging to the Araucanian, Moxo, and other native tribes of the north-west and west districts.—A report of the discussion at the meeting of March 2, on the relative weight of the brain, with reference specially to M. le Bon's views on the invalid character of determinations based on means, and to the conclusions which he has drawn from his own methods of comparing the relative weight of the body and brain in boys and girls.—A communication from M. de Ujfalvy, on his travels in the Western Himalayas, with the results of his craniometric and other determinations among the local tribes, more especially in Kashmere, Lesser Thibet, and the Koulou country, where polyandry exists.—At a subsequent meeting of the Society, M. Beauregard gave a *resumée* of M. de Ujfalvy's observations of the ethnic and social character of these peoples, and of the records of ancient and modern travellers concerning these mountain districts, tracing the history of polyandry back to the Getæ and Massagetæ, whom he believes to be the ancestors of the Dardis, whose country is regarded by Dr. Leitner as the original seat of the Aryan race. (The discussions to which the communications of M. de Ujfalvy gave rise have led to the adoption of a resolution for the extension and more exact definition of the ethnographic observations included in the Society's Directions for travellers.)—M. F. Regnault reports the results of his recent excavations at Bordes in Ariège, where in an old moraine bed he has found two burial chambers below an erratic granite boulder. Both chambers, one of which was situated below the other, contained human bones, a cut flint, and fragments of pottery, some of which were marked with geometrical designs. In the discussion following M. Regnault's communication, M. Leguay drew attention to a similar chamber disclosed at Crécy in 1842.—M. de Mérejkowsky described an instrument designed to determine the relations of the nasal arch to other parts of the cranium with a view of establishing a new character for the better comparison of differences of race. This number of the *Bulletins* closes with the first part of M. Le Docteur D'Hercourt's Topographical Survey of the Island of Sardinia, including the geography, meteorology, and natural products of the island.

CONTENTS