THURSDAY, JULY 7, 1881

BURMEISTER'S "MAMMALS OF THE ARGENTINE REPUBLIC"

Description Physique de la République Argentine d'après des observations personnelles et étrangères. Par Le Dr. H. Burmeister. Traduite de l'Allemand avec le concours de E. Daireaux. Tome III. Animaux Vertébrés: première partie, Mammifères, vivants et éteints. Royal 8vo. (Buenos Ayres: P. E. Coni, 1879.)

THE veteran naturalist, Dr. Burmeister, has devoted the third volume of his great work on the Argentine Republic to an account of the Mammals, recent and fossil, of his adopted country. As regards the latter series it is well known how long and how laboriously the author has worked on the extinct Mammalian Fauna of Buenos Ayres, and what excellent results have followed on his investigations. The summaries of his various memoirs on this subject contained in the present volume will therefore be much appreciated by those who may not have leisure or opportunity to refer to the originals, and will be especially useful in bringing the chief results already arrived at in a convenient shape before future explorers. Although so much has already been done in this direction, there are few countries in the world that still offer such a promising field for the palæontologist as the pampas of the Argentine Republic, where in certain spots bones of *Megatherium*, *Glyptodon*, *Macrauchenia*, and other extinct monsters seem almost to strew the upturned soil!

As concerns the recent Mammals of Buenos Ayres, Dr. Burmeister has also given us a very useful work, the only previous available authority on the subject being the summary of the Mammal-Fauna contained in the same author's second volume of his well-known "Travels" in the Argentine Republic, which is neither so full nor so complete. But we fear there is also still much to be done before this branch of the subject can be deemed to be satisfactorily known, and that Dr. Burmeister has not in every case made himself acquainted with the most recent investigations published upon several points.

In the first place, as regards the general arrangement of the Mammalian series, Dr. Burmeister will forgive us if we point out that he is a little behind the age. The Cuvierian division of the class into "Unguiculata," "Ungulata," and "Pinnata" was no doubt most in vogue thirty years ago, but we cannot agree with our author that it is still adhered to by "la plupart des zoologistes modernes." It is certainly strange to zoologists of the present day to find, in a work dated 1879, the Marsupials located in the centre of the placental series, and the Seals divorced from the other Carnivores. Again, on referring to the accounts of the more obscure groups of Bats and Rodents, we find a disposition to quote from Rengger and the "Voyage of the *Beagle*" instead of giving particulars obtained from modern specimens. Surely the Museo Publico of Buenos Ayres must have a well-arranged and properly-determined series of the native Mammals, whence particulars respecting their ranges and variations might have been taken.

The recent Mammals of the Argentine Republic, according to Dr. Burmeister's enumeration, are about 112 in number. Of the Quadrumana only four species intrude into the northern provinces, where alone forests are met with, the American monkeys being exclusively arboreal in habits. Of Chiroptera Dr. Burmeister allows twenty species, but there are doubtless more to be discovered when the fauna is worked out. The Feræ are twenty-one in number, embracing the jaguar and puma, both of which extend all over the Republic, and five other smaller species of *Felis*, besides seven different dogs of peculiar types. Five opossums of varying sizes constitute the Marsupial fauna of the Argentine Republic, and are succeeded in Dr. Burmeister's classification by twenty-seven Rodents—here, as is usual, except in Australia, the most numerously represented order of Mammals. Amongst them are the two most characteristic animals of the Argentine pampas—the Patagonian cavy (*Dolichotis patachonica*) and the Vizcacha (*Lagostomus trichodactylus*), which are spread over the whole Republic. The recent Edentata are represented by seven armadillos and two ant-eaters—a feeble remnant of the huge monsters of the same group that once existed in the country. Amongst these the most remarkable is the Pichy-ciego (*Chlamydophorus truncatus*), found in sandy dunes of San Juan and Mendoza, of which, and its singular habits, Mr. E. W. White has lately given us a most interesting account.[1] This diminutive burrowing armadillo is indeed one of the marvels of the class of Mammals. Such are its fodient powers, says Mr. White, "that a man has scarcely time to dismount from his horse before the creature has buried itself to the depth of its own body."

In Ungulates, like the rest of the neotropical regions, the Argentine territory is poor. Dr. Burmeister enumerates only ten, of which one-half are deer of the American type *Cariacus*. Besides these there are only two lamas, two peccaries, and the ordinary tapir of the lowlands (*Tapirus suillus*), which occurs in Tucuman and Corrientes, and concludes the terrestrial Mammal-fauna. Amongst the marine Mammals or "Pinnata," with which Dr. Burmeister, following Cuvier, concludes his list, are included two Seals and fourteen Cetaceans. One of the former (*Otaria jubata*) is well known in this country from the living examples in the Zoological Gardens. The latter have as yet been but imperfectly studied, and several of the species mentioned appear to be rather doubtful.

An atlas, intended to accompany this volume of Dr. Burmeister's important work, is announced to appear in *livraisons* at a later date.

THE ARABIAN DESERT

Gleanings from the Desert of Arabia. By the late Major R. D. Upton. (London: C. Kegan Paul and Co., 1881.)

THE author of this volume was an enthusiastic admirer of the Arabian horse, and seems to have visited the Arab tribes in the neighbourhood of Aleppo and Damascus with the single purpose of seeing and purchasing high-bred animals and acquiring information about the breed. The narrative part of the book is not furnished with dates, but from incidental remarks it appears that Major Upton was at Aleppo in 1875 and at Damascus in 1878. On the former occasion he journeyed

[1] *Proc.* Zool. Soc. 1880, p. 8, "Notes on *Chlamyphorus truncatus*," by E. W. White, F.Z.S.

eastward as far as the Euphrates, but does not seem to have descended below Balis, or to have ever been more than two days' journey from Aleppo. On this tour the traveller was mainly among half-settled tribes, and at the season of his visit the great hordes of pure nomads who sometimes pasture their flocks in the district had withdrawn to the south. Of the author's excursion from Damascus he gives no topographical detail. It was simply a visit to an encampment of the Eastern Anazeh.

From the limited range of these journeys, and from the fact that the writer made no exact observations except on his favourite subject, it will readily be understood that the book has little merit as a record of travel. Except in the matter of horseflesh, Major Upton merely describes in the loose manner of the amateur traveller whatever happened to amuse or strike him as he moved from place to place. He is neither an archæologist nor a naturalist; and though there is no doubt a great deal still to be learned about the less public customs even of the Arabs of the Syrian desert, who have been often visited by good observers, it is not surprising that Major Upton adds nothing on this head to what has been given to us by Burckhardt, and more recently by Lady Anne Blunt and her husband. Some facts may perhaps be gleaned from the remarks upon individual tribes and families, but even here the book is inferior to Lady Anne Blunt's "Bedouin Tribes," while the proper names are printed in such an inaccurate transcription that they must be used with caution.

Of the three parts into which the volume is divided the first and a small part of the second are personal narrative. The main bulk of the second part should have been altogether cancelled, for it consists, not of gleanings from the desert, but of gleanings from Pococke's "Specimen" and the extracts from Abulfeda printed at the close of White's edition of that work. The author, whose credulity is displayed in the earlier pages of the volume by an excursus on the Great Pyramid, based on conversations with a missionary of the Pyramid religion whom he met going out to preach to the heathen, accepts the whole mythical history of Arabia as sober fact, and as he has a theory that it throws great light on the parallel history of the Arabian horse, we are treated to some eighty pages of abridgment and excerpts from Pococke (generally without acknowledgment of the source). Unhappily, Major Upton's knowledge of Latin is that of a backward schoolboy. He frequently misses the meaning of his author, and, to make matters worse, the book has been so carelessly revised for press by the friend who undertook to superintend the posthumous publication that *inquit Jalalo'ddinus* becomes *inquib Jalabó dainus*, El Makîn, El Maka, and so forth, while the words *lingua Arabica qua coelitus descendisse Alcoranus dicitur*, with the marginal note *in Alcor. Sur. XVI.* become "the Arabic language in which the heaven-born Alkoran is said to be descended in Alk." The author is not stronger in Arabic than in Latin, as may be judged from the fact that he derives Hijâz from Hajar, *a stone*, and Kheil, the generic name of the horse, from the pigment Kohl. No reliance therefore can be placed on the transcription of Arabic words, and here again errors of the press have conspired to produce results truly appalling. Of the names of the seven mares of the prophet, for example, not one is quite correct, and the errors include such monstrosities as Sekh for Sekb, Sizez for Lizâz, Haif for Lakhîq. In brief, everything that our author derives from books, and all the historical and geographical speculations which he is so fond of, are absolutely worthless. This blemish affects even the third part of the book, where Major Upton deals with his proper subject, the horse. For his actual observations on the strains of pure Arabian blood are hopelessly entangled with fabulous legend and baseless theories. It is to be observed, moreover, that he admits that his own reading of the information derived from the Anazeh did not always accord with the views of the friend who accompanied him on his journey, an inhabitant of the verge of the desert, and long familiar with the Bedaween. Yet it is clear that Major Upton's knowledge of Arabic was by no means sufficient to enable him to take up an independent position in such matters. Like most men with a hobby, he had a theory to which facts must bend. But what a theory! Nothing less than a mythical history of the Arabian horse, the purest strains of which he traces back first to the time of David, when "the horses of his ancestors were entailed on" Rabî'atu-'l-faras, and then to Salâmân, the fourth in descent from Ishmael. That all authentic notices of the horse in Arabia point to a comparatively late introduction of that quadruped is of course indifferent to our author, who presumably had never heard of the researches of Hehn, Guidi, and others in this field.

Probably no European except Mr. Blunt can speak with real authority on the complicated subject of Arabian horse-breeding. Major Upton however takes no notice of what Mr. Blunt has written so well and fully on the topic, and on points where the two accounts diverge the uninitiated will hardly fail to prefer the clear and lucid statements of one who saw far more of the desert and is not biassed by theory. Lovers of the horse will however peruse with interest Major Upton's notes on the characteristic features of the Arabian breed illustrated by descriptions of individual animals.

W. Robertson Smith

OUR BOOK SHELF

Easy Lessons in Botany, according to the Requirements of the Revised Code, 1880. By the Author of "Plant Life." (London: Marshall Japp and Co., 1881.)

Neither better nor worse than the innumerable other little books of the same kind. The morphological part consists of the usual enumeration of descriptive terms, with coarsely-executed diagrams. The histology and physiology are very weak. The cell-nucleus is defined (p. 27) to be "a portion of the protoplasm denser than the rest," which may or may not be the case, but we are further informed, which is a more doubtful statement, that "it is this part of the protoplasm which grows." The following is at any rate a dogmatic way of stating the facts:—"By the addition of nitrogen and sulphur (taken up in water by the roots) to the constituent parts of starch, protoplasm has the power of forming *albumenoids*" (*sic*). If this is in accordance with the requirements of the Revised Code it only shows what tyranny in science is compatible with free institutions. On p. 32 we learn that "carbonic acid gas . . . finds its way . . . into the *spiral* vessels, which convey it to the cells of the *fibro-vascular* bundles." Very good; the Revised Code ought to know. But surely as a matter of argument there is a screw loose about the following sentence:—"As the store of albumen

is undivided the grain of wheat is said to be *Monocotyledonous*" (p. 42). Not even the solemn name of the Revised Code can enable us to digest this without distress.

Plant-Life. Popular Papers on the Phenomena of Botany. (London: Marshall Japp and Co., 1881.)

THIS is a most attractive-looking book by the same author as the dismal little tractate just noticed. It might have been hoped that it would have made clear some of its dark sayings. But they all seem to be *ipsissimis verbis*, sugared over with copious extracts from all sorts of people, from Thoreau and Kingsley to Mr. Worthington Smith, Dr. Masters and Mr. Darwin. On p. 30 we have "The carbon absorbed from the air is combined with the cell-sap and forms a substance called starch," which is even harder doctrine than anything in the "Easy Lessons." Much is said about *Equisetaceæ* and the hygroscopic movements of the elaters of their spores. An unfortunate microscopist is quoted from *Science Gossip* of such a remote date as 1878, who is of opinion that "the ultimate cause of this movement is quite unknown . . . . most probably it takes place by the contraction and expansion of the cells of which the elaters are composed." Of course it is well known that the spores are unicellular and the elaters are simply strips of the spirally torn outer cell-wall. The book, with all its blundering accounts of *Englena* (sic), *Claydonia* (sic), the "lovely *Closterium*" which "consists of two cells," and the like, may stimulate the curiosity of those who know nothing of plants to know more and better. It is at any rate interesting to find that Prof. Schwendener's lichen-theory has found its way to popular books, even though it is introduced with the remark that "concerning" gonidia "a humorous theory was promulgated a few years ago, but met with the ridicule it deserved." The book has 148 illustrations drawn by the author, which scarcely do justice to the "specially prepared rolled paper" provided for them.

The London Catalogue of British Mosses and Hepatics. Published under the direction of the Botanical Record Club. Second Edition. (London: David Bogue, 1881.)

THIS is a handy list on the well-known model of that formerly issued by Mr. Hewett Cottrell Watson for British flowering plants. It gives the distribution through the eighteen provinces into which Mr. Watson divided Great Britain for the purpose of ascertaining the range of British plants.

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.]

Dr. W. B. Carpenter and Mr. W. I. Bishop

I AM sorry to find that Dr. Carpenter is "greatly surprised" at my allusion to the effect which has been produced by the circulation of his letter to Mr. Bishop, for in making that allusion I was under the impression that this letter had been put to a use other than that which Dr. Carpenter could have either intended or desired. If, as it now appears, I was wrong in entertaining this impression, it is needless to say that I am willing to apologise for having so far given it public expression; and in this case I can only infer that my error arose from an unfortunate difference in the estimate which we have respectively formed touching the scientific importance of the phenomena which Mr. Bishop has displayed. Such physiological and psychological interest as these phenomena present appeared to me to call for investigation in the ordinary way, *i.e.* by one or a few competent persons; it did not occur to me that they were of so much scientific value as to call for such "an assembly of gentlemen" as that which met at Bedford Square. Therefore, in writing my report, I took it for granted that Dr. Carpenter would have concurred in the "regret" which I expressed that his friendly recommendation should have been, as I thought, so far misused by Mr. Bishop as to constitute a general advertisement to scientific men; and my expression of regret was thus intended to show that I did not suppose Dr. Carpenter was to be considered intentionally responsible for the excitement which Mr. Bishop has succeeded in creating. It would no doubt have been wiser had I ascertained Dr. Carpenter's views upon this subject before assuming that they were the same as my own, and I do not yet quite understand whether he considers Mr. Bishop's manifestations worthy of all the attention which they have received. But in any case I hope that Dr. Carpenter will accept as more satisfactory an expression of further "regret," when I say I am very grieved to find that my allusion to his relations with Mr. Bishop, although intended as a friendly allusion, does not appear to have met with his approval. GEORGE J. ROMANES

Re W. I. Bishop

LET any one read carefully Dr. Carpenter's account of the card trick exhibited to him by Mr. Bishop; let him suppose that Mr. Bishop had two packs of cards, the one an ordinary pack for exhibition to the company, and the other a pack containing fifty-two cards, all alike (the backs of both packs being of the same pattern). Let Mr. Bishop now perform the trick with cards from the latter pack, and his success can be readily explained. But grant that Mr. Bishop had only one pack of ordinary cards: even then it is possible that the explanation of the trick is not hard to find.

Dr. Carpenter allows that Mr. Bishop *may* have known where the selected card was placed. Take Dr. Carpenter's diagram on p. 188, and let No. 11 be the card known to Mr. Bishop, and which is to be finally discovered by Dr. Carpenter. "Drop your left hand on any row you wish *taken away*," says Mr. Bishop to Dr. Carpenter. Suppose, *by chance*, B, D, and A successively dropped on and removed, as in the instance given by Dr. Carpenter, then the upper pair of row C, then 15, we have 11 left and the trick done.

Suppose that C is selected first. Mr. Bishop may now assure Dr. Carpenter that the card wanted is in that row, and that he has forced Dr. Carpenter to select it. The chances are equal that Dr. Carpenter will in his next selection drop on that pair in row C, which includes 11. Should Dr. Carpenter in his third choice drop on 11, a most convincing proof of Mr. Bishop's will-compelling power will have been exhibited.

Should Dr. Carpenter however drop on 15, Mr. Bishop has merely to ask him to put it aside, and turning up the remaining card to exhibit it as the chosen and identified card. By a combination of the two methods of removing and leaving, Mr. Bishop can provide for all cases, and can perform a trick well known to schoolboys.

Dr. Carpenter, as I read his letter, tells us how Mr. Bishop acted when he himself was the subject of the experiment. If Dr. Carpenter can declare that the rows of cards, pairs of cards, and single cards *dropped in* were *in all three experiments* removed, I must confess that the laws of probabilities are against me, and that there seems to be strong proof of Mr. Bishop's power of *will-compelling*, a power which, as far as I have heard, Mr. Bishop has not yet publicly claimed to possess.

If Mr. Bishop *did not* know where the selected card was placed, Dr. Carpenter must invent a name for Mr. Bishop's new power of discovering a card, the position of which neither Mr. Bishop nor "the subject of the experiment" knew.

We can all regret with Dr. Carpenter "that Mr. Bishop did not offer for like careful testing experiments," &c.

I had the pleasure of attending a *public* performance given by Mr. Bishop in Edinburgh, on which occasion Mr. Bishop, much to the entertainment of a crowded hall, exhibited the legerdemain by which he had duped the subjects of, I believe, the before-mentioned experiments.

At this entertainment Mr. Bishop also showed how spiritualists performed such feats as knocking nails into boards, putting rings on scarves, &c., while their hands were tied together behind their backs and secured to a post. Prof. Turner, of the University of Edinburgh, explained to the spectators (no doubt at Mr. Bishop's request) that Mr. Bishop *seemed* to be enabled to perform those feats by the peculiar conformation of the bones and muscles—perhaps both—of his shoulder and arm.

We are told by newspaper correspondents that to this physical gift Mr. Bishop has added the power of reading and getting pictures of his subjects' thoughts, and now Dr. Carpenter endows him with the power of controlling the wills of his subjects, or—"*may*" teste—with some unnamed power still more mysterious. To Mr. Bishop as the successor of the Westminster whale or of Master Pongo, no one can have the slightest objection. Mr. Bishop as a *great* scientific phenomenon will, I fear, require better backing than the *careful testing* of Dr. Carpenter, and letters of introduction from scientific and medical men in Edinburgh who received Mr. Bishop, and in their turn gave him letters of introduction as a clever conjuror who performed by mechanical means feats of strength and agility attributed by spiritualists to their immaterial familiars.

THOMSON WHYTE

Merchiston Castle School, Edinburgh, July 2

Mind-Reading versus Muscle-Reading

SEVERAL years ago I had the opportunity of witnessing in a private circle of friends some experiments on so-called "thought-reading," even more striking than those recently described in your columns and elsewhere. An attentive observation of these experiments led me to question the accuracy of that explanation of the phenomenon with which Dr. Carpenter has made us so familiar, namely, unconscious muscular action on the one side, and unconscious muscular discernment on the other. After making the most extravagant allowances for the existence in some persons of a muscular sense of preternatural acuteness, here still remained a large residuum of facts wholly unaccounted for on any received hypothesis. These facts pointed in the direction of the existence either of a hitherto unrecognised sensory organ, or of the direct action of mind on mind without the intervention of any sense impressions. Such startling conclusions could not be accepted without prolonged and severe examination, and it was solely in the hope of stimulating inquiry among those who had more leisure and more fitness for the pursuit than myself that I published the brief record of my experiments which, some years ago, brought derision and denunciation upon me. As no physiologist came forward to give the subject the wide and patient inquiry it demanded, I went on with the investigation, and for five years have let no opportunity slip which would add to the information I possessed. A letter addressed to the *Times*, asking for communications from those who had witnessed good illustrations of the "willing game," brought me in, at the time referred to, a flood of replies from all parts of England, and down to the present time fresh cases are continually coming under my notice. Each case that seemed worthy of inquiry was, if possible, visited and investigated either by myself during the vacation, or by a friend on whom I could rely. It is true that many long journeys have been taken and much time has been spent without a commensurate reward, but this was to be expected. Still, after casting out cases which might or might not have been due to "muscle-reading," there remained abundant evidence to confirm my belief in the insufficiency of Dr. Carpenter's explanation. Until this evidence is published, which it will shortly be, and the accessible cases are examined and reported upon by a competent and impartial committee, I simply ask the public to suspend their judgment on this question. And to show that this is not an unreasonable request on my part, I here give a few particulars of a remarkable case which reached me only a few months ago, and was carefully investigated by myself last Easter.

A clergyman in Derbyshire has five young children, four girls and one boy, aged from nine to fourteen years, all of whom are able to go through the ordinary performances of the "willing game" rapidly and successfully, *without the contact of the hands or of any communication besides the air between the person operating and the subject operated on.* More than this, letters and words, or names of places, of persons, and of cards, can be guessed with promptness and accuracy; the failures in any examination not amounting to one in ten consecutive trials. The failures, I am assured by the father—and there is no reason to doubt his veracity—form a far smaller fraction when the children are not embarrassed by the presence of strangers; for example, the parents assured me that their children, before I arrived, told correctly seventeen cards chosen at random from a pack, without a single failure, and after that correctly gave the names of a dozen English towns indiscriminately selected. I will however only ask attention to what came under my own observation, which in brief was as follows:—

One of the children, Maud, a child of twelve, was taken to an adjoining room, and both the doors between fastened. I then wrote on paper the name of some object *not in the room* (to prevent unconscious guidance by the *eyes* of those who knew the thing selected), and handed this paper round to those who were present. Not a word was allowed to be spoken. I myself then recalled the child, placed her with her back to the company, or sometimes blindfolded her before bringing her into the room, and put her in a position where no whisper or other private communication could reach her undetected. In from two to twenty seconds she either named the object I had written down (the paper, of course, being concealed) or fetched it, if she could do so without difficulty. Each child was tried in succession, and all were more or less successful, but some were singularly and almost invariably correct in their divination of what I had written down; what was more curious, the maid-servant was equally sensitive. This led me to try other experiments with those who knew the words chosen: and the father was found to be pre-eminently the best willer, and to be in fact almost as necessary for success as the sensitive "guesser"; further experiments showed that a battery of minds, all intently fixed on the same word, was far more successful than one or two alone. Apparently a *nervous induction* of the dominant idea in our minds took place on the passive mind of the child, and the experiments recalled the somewhat analogous phenomena of electric and magnetic induction. There seemed to be a veritable exoneural action of the mind.

I am quite prepared for the chorus of sceptical laughter which will greet this statement. That there should be disbelief is quite natural; a desire for further inquiry is all I ask for. To those who, with a single eye for truth, even if it be in collision with received opinions, are anxious to know if every possibility of error or deception was removed, permit me to add the following additional experiments. Instead of allowing the child to return to the drawing-room, I told it to fetch the object as soon as it "guessed" what it was, and *then* return with it to the drawing-room. Having fastened the doors I wrote down the following articles one by one with the results stated: *hair-brush*, correctly brought; *orange*, correctly brought; *wine-glass*, correctly brought; *apple*, correctly brought; *toasting-fork*, wrong on the first attempt, right on the second; *knife*, correctly brought: *smoothing-iron*, correctly brought; *tumbler*, correctly brought; *cup*, correctly brought; *saucer*, failure. On being told this object the child said, "Saucer came into my head, but I thought you would never ask for that after asking for a cup, so I wasn't sure what it was." Then names of towns were fixed on, the name to be called out by the child outside the closed door of the drawing-room, but guessed when fastened into the adjoining room. In this way Liverpool, Stockport, Lancaster, York, Manchester, Macclesfield were all correctly given; Leicester was said to be Chester; Windsor, Birmingham, and Canterbury were failures. I might give many other similar trials, for I spent three long evenings testing the children; but these results and the attempts made to answer the many questions that at once started to the mind, such as the effect of distance, &c., must be left for the present. Meanwhile, at the suggestion of Mr. Romanes, I have arranged for a small committee of scientific experts to visit the family, and verify or disprove the conclusion to which I have arrived, which is certainly opposed to that drawn by Mr. Romanes from his experiments on Mr. Bishop (NATURE, vol. xxiv. p. 172). Whether Dr. Carpenter will find in this case "a precise confirmation" of everything he has said on the subject I cannot say.

W. F. BARRETT

July 3

A Case of Slow, Sub-Tropical Discharge of Earth-Electricity, and the Sun Recognisant thereof

IN the course of yesterday afternoon, in the midst of a sky otherwise clear and exquisitely blue, a large cloud of unusual shape and character began to form in the upper regions of the atmosphere vertically over, but very far above, the southern slope and even most elevated mountain tops of Madeira, and remaining there, as it did, most fixedly more than half the day, so contrary to the locomotive habits of ordinary clouds, it soon attracted the attention, and presently the fears, of most of the inhabitants.

As seen from this place, between 1h. and 3h. p.m., there was little more than a single dense cloud of peculiarly rounded outline and somewhat elliptical figure, stretching from the western horizon to within 10° or 15° of the zenith; but as time advanced,

other and successively smaller clouds were formed directly under the first, having symmetrical and concentric outlines therewith, while the central vertical axis, which might be conceived as passing through the whole series, remained unchanged and fixed in space. This central fixity, too, of them all continued, together with the infinite smoothness of the outlines of all the smaller lower strata of cloud, although the largest and uppermost one visible to us began to put forth a variety of fringes of cirro-cumulous character; and, as tested by the spectroscope before sunset, all the lower smooth-rimmed clouds were remarkable for the large quantity of watery vapour they contained, and held fast too, for no rain fell. As sunset approached every one was gazing at the strange phenomenon of a cloud-congeries of most portentous size and absolute fixature above the trade-wind, probably also the anti-trade region; and after sunset the most gorgeous coloured illuminations through all the ranges of scarlet-red, red, crimson-red, ultra-red, and then dun-coloured and grey passed from member to member of the series, distinguishing the various heights of its strata one above the other; while the greatness of the general height was shown, even long after darkness had set in, by a faint lunar-like illumination of the northern outline of the whole. But by ten o'clock that began to fail, and the system of superposed clouds was beginning to contract on its central axis, and faded away, without leaving its place, before morning.

In so far we had been witnessing, though without any positive light of its own, a vertical series of disks of cloudy matter, extremely like the lower end of the successive, transverse, discous arrangements seen in a gas vacuum-tube of large dimensions, when the electric discharge from a powerful induction-coil is passing through it; and we were inevitably reminded thereby that the cosmical electric theory of M. Gaston Planté (of "secondary batteries or storage" fame) justifies an escape of the earth's interior electricity from time to time into planetary space, and more particularly to the sun.

Was there, however, in this case any symptom of the sun exciting, or calling for, any such discharge, and from this part of the earth?

The sun was undoubtedly in the Northern Tropic, and the highest northern declination for the year had just been reached; but for a fortnight or more past the solar spot manifestations had generally been weak, almost fading away. This I knew well, having taken a picture of the sun-spots every day (Sundays excepted) since I have been here. However, though the appearances were as poor as they well could be on June 21, 22, and 23, yet on Friday, June 24, there was a little improvement, some new, though small symptoms appearing in either solar tropic. On Saturday, June 25, these new features were confirmed and slightly increased. But what were they on Sunday, June 26, when the extraordinary cloud-arrangement was hanging so long above Madeira?

I, who am here merely as a private amateur in a different subject, know not; but on Monday morning, so early as 5h. 30m. a.m., I was astonished and delighted at the solar scene then presented. The spots first caught sight of on Friday were now well advanced and much developed; a new group with extensive double ramifications had also appeared in the same tropic nearer the equator; while finally, near the middle of the sun's disk in the south tropic, were two large spots, with connections extending over 60,000 miles in length of solar surface, and indicating more solar energy to have been thereby rapidly, if not suddenly, manifested within the last forty hours, than anything which I, at least, have witnessed for a very long time past.

PIAZZI SMYTH,
Astronomer-Royal for Scotland

Jones's Hotel, Quinka do Corvalho,
Funchal, Madeira, June 27

P.S.—The grand, and now circumpolar, comet was not neglected here on the same night.—P. S.

Carbonic Acid Gas not Free in Sea Water

IN a short paragraph in NATURE, vol. xxiv. p. 176, it is stated that Tornö, in the Norwegian Deep-Sea Expedition, had found "carbonic acid both in a gaseous and basic form."

For some time past I have doubted whether there was any free carbonic acid gas in the deep water where pressure should make its presence felt. Lately, in a paper to the Royal Microscopical Society, I have demonstrated that if there is any carbonic acid in the sea water at great depths, its dissolving action is not equal in rapidity and intensity to that exercised by a microscopic Thallophyte which bores into an bissolves sponge spicules from within. Moreover amongst deeb sea deposits I find perfect organisms which have long been pead, which have been penetrated by parasites and covered here and there by foraminifera, and yet in exposed parts, the ornamentation is perfect. There is no evidence of erosion.

Now on carefully examining into Tornö's essay I come to a different conclusion to the writer in NATURE, and I find that the able Scandinavian denies the existence of free carbonic acid in the sea.

The following notes, which I made in abstracting Tornö's "Chemi" of the Norwegian North Atlantic Expedition, Part II., may be interesting:—

The carbonic acid gas, driven off by the process of boiling sea water, when collected, varied in a most marked manner; it was always appreciable, and the quantity was sometimes large. The pressure was that of the atmosphere. Under different conditions, and when the gases were boiled out in a vacuum created by steam, and of course at a lower temperature, the quantity of carbonic acid gas was often *immeasurably small*. Moreover the quantity varied.

Jacobsen, by distillation, succeeded in expelling the whole amount of carbonic acid contained in a quarter litre of sea water, and found that North Sea water contained 100 mgr. per litre. The neutral carbonates in the residuary deposit contained about 10 mgr. per litre. Hence a very small proportion of the carbonic acid driven off by distillation, could have been present in bicarbonates. Vierthaler had asserted that the carbonic acid in sea water was got out of the bicarbonates by boiling.

If the carbonic acid is free and absorbed by the sea water in a free gaseous form, it is remarkable that it should not be more readily got. Jacobsen supposed that sea water has a peculiar property of retaining its carbonic acid, owing to the presence of the chloride of magnesia. Buchanan was led to believe that most of the salts were in some degree distinguished by the property of determining the retention of carbonic acid in the sea. He especially insisted on the importance of the sulphates, and asserted the mean amount of carbonic acid present in the waters of the Southern Seas to be 43·25 mgr. per litre.

Tornö, following Jacobsen, found the amount of carbonic acid gas present in the water of the track of the northern cruise of 1877 to be about 100 mgr. a litre, but got 12 mgr. per litre as a variation in the amount.

He was struck with the improbability that sea water should possess so remarkable a power of retaining mechanically one gas and exert no corresponding influence on others, and then he found that sea water had *an alkaline reaction*. He began to believe that some of the neutral carbonates had been decomposed during the boiling, and had evolved much of the carbonic acid gas.

He then proved by experiment that the saline mixture in sea water, on the temperature being raised to the boiling point, decomposed neutral carbonates, and that all previous experiments with the object of measuring the carbonic acid in the sea water had been faulty. He was influenced by some experiments on the determination of carbonic acid gas in mineral water, and applied the method to sea water.

He found the total amount of carbonic acid gas in a specimen to be 97 mgr. per litre, and the proportion forming neutral carbonates to average about 53 mgr. The difference, 44 mgr., cannot occur free as gas, but will unite with the carbonates to form bicarbonates. Hence Jacobsen's experiments could be explained on the assumption that sea water contains no trace of free carbonic acid, but as much as 53 mgr. per litre forming carbonates, and only 44 mgr. forming bicarbonates.

On page 35 he states: "*If we bear in mind that sea water is an alkaline fluid which does not contain the smallest trace of free carbonic acid.*"

What a comfort this must be to globigerina and coral reefs!

June 27 P. MARTIN DUNCAN

Symbolical Logic

I AM afraid I share the proverbial obtuseness of my countrymen in the matter of jokes. I really did not at first see the point of Mr. Venn's humorous suggestion that "an attitude of slight social repression" should be observed towards troublesome authors of new proposals. Now however that Mr. Venn has kindly pointed it out to me (see NATURE, vol. xxiv. p. 140), I see the joke perfectly and can laugh at it heartily.

As for the little parenthesis which offended me, I am sorry I noticed it, and hope Mr. Venn will forgive the passing irritation which it produced. What he means by the words "I knew that he was very anxious that the fact should be known," I do not quite understand; but the matter is too unimportant for further comment.

With regard to the "crowning triumph" quotation or misquotation, I can only congratulate Mr. Venn on the adroitness with which he eluded the dilemma in which I quite thought I should place him. In my simplicity I expected that he would answer *Yes* or *No* to my question; but Mr. Venn was not thus to be caught.

It is but fair to own that the critical remarks which I made on Mr. Venn's book in my last letter, though perfectly just as far as they go, are somewhat one-sided. As I only spoke of points on which he and I differ in opinion it could not well be otherwise. His book contains much other matter which I did not touch upon at all, and of which I entertain a very high opinion. His diagrammatic method especially is most ingenious, and his exposition of it is lucid and attractive. The limits of its application in actual practice are, as he himself points out, rather narrow; but within those limits, and for purposes of illustration and verification, it is undoubtedly an important contribution to the science of logic.

HUGH MCCOLL

Boulogne-sur-Mer, July 2

How to Prevent Drowning

THOSE who have followed the correspondence commenced in NATURE by Dr. MacCormac may be interested in the following extract from an essay, "Pourquoi les Bêtes nagent naturellement," which occurs oddly enough in a book entitled "Observations sur les Plantes et leur Analogie avec les Insectes," published at Strasburg in 1741 by Guido Augustin Bazin, a physician of that place:—

"Lorsqu'un homme qui n'a point appris à nager tombe dans l'eau, il n'y a point de doute que s'il pouvoit tenir son corps dans une position verticale et fixe, et porter ses jambes en avant, comme il fait lorsqu'il marche sur la terre, il ne pût nager naturellement aussi bien que, les bêtes, les habiles nageurs le font souvent pour leur plaisir. Nous connoissons un peuple entier qui ne nage pas autrement, ce sont les Hottentots; voici ce qu'en dit Mr. Kolbe, dans une bonne description qu'il nous a donnée du Cap de bonne Espérance:—"Aussi faut-il avouer qu'ils (les Hottentots) sont les meilleurs et les plus hardis nageurs que j'aye jamais vû. Leur manière de nager a même quelque chose de frappant, et je ne sçache pas qu'aucune nation s'y prenne de la même façon. Ils nagent tout droits; leur col est entièrement hors de l'eau, aussi bien que leurs bras, qu'ils étendent en haut; ils se servent des pieds pour avancer, et pour se mettre en équilibre, mais je n'ai jamais pu sçavoir comment ils les font jouer. Tout ce qu'il y'a de sûr, c'est qu'ils avancent très vite. Ils regardent en bas, et ont presque la même attitude que s'ils marchoient sur terre ferme.' Mais cette attitude est impossible à un homme qui ne s'est pas point exercé à la prendre, parce que les mouvements de l'eau, et l'incertitude de son corps, toujours vacillant dans un liquide, le tirent à tout moment de la direction verticale, et l'entraînent malgré lui en avant ou en arrière" (pp. 44, 45).

W. T. THISELTON DYER

Resonance of the Mouth Cavity

I HAVE not tried Mr. Naylor's experiment, but from the account which he gave of it I could not see that any novel fact was involved, nor do I now see that the fact of "the different rates of vibration being *already in the air*" alters materially the conditions of the case. Whether the sounds are produced by the clatter of wheels, the impact of the thumb-nail upon the teeth, or by the vibrating tongue of a jew's-harp, the part played by the mouth-cavity in selecting the notes of a tune is substantially the same.

GEORGE J. ROMANES

Storage of Energy

LIKE many others, I have given much thought to the accumulation of force, and have felt much astonished at the account of Faure's battery, if it is to be so called, although of course such a development was to be expected from the time that Planté made his.

I see that men immediately rush to waterfalls, rivers, and tides to obtain the power for accumulation when they leave coal and wood; my ideas are rather in the direction of wind; and I have often pictured our country covered, like that around Zaandam, with windmills. The wind is not constant, but more so than most of our efficient streams, and it is found at every spot. The power is quite unlimited, and we can moderate the action of the machinery whenever we obtain the requisite force. Storage has hitherto been required. I have imagined our windmills pumping up water to great reservoirs, but we have not yet learned to make reservoirs for water except at an enormous expense and in unprotected valleys; other imaginings have come into many minds, but if we have a really true and safe storage, such as described, the wind will become our fire to warm us, our steam to drive us, our gas to light us, and our universal servant. The wind will drive our mills, too (except when a fog comes, lasting so long that our stores of power fail), with sufficient storage, inconstancy will cease to trouble us, whilst every valley may have its lights and every mountain-top its beacon, and darkness will scarcely trouble mankind in this new-coming world of light. We have heard of the golden servants of Vulcan and the mechanical slaves of the great Khan. What will be the result when every man has the wind at his command and the lightning at his service by friction, like Aladdin? It seems to me that the wind is the great power that we shall next use, and that Prince—the power of the air—shall be bound to serve us for at least a thousand years.

The Dutch have long made windmills, but when over in Holland a few years ago examining a little, I was unable to find the books wanted on the subject.

The fact that coal can be carried will not affect the question if wind is used. Wind carries itself. We shall seek our power from the heavens instead of the infernal pits, and a race of healthy, ruddy faces will take the place of the blackened and degraded countenances from mines.

I wish to show that we have excess of power in the wind. Will this new accumulator, of which I know nothing from personal experience, serve us to keep it? To keep it a few hours is a great point. Coal becomes secondary if we accumulate the force of the wind, and Niagara itself will be no longer wanted. Of course we need machines to use the wind-power. At present coals are cheaper with us; not so in all parts of Holland, and not so in many other places. However, here we have problems enough to solve; do not let us throw cold water on the discoveries of others, or show, as scientific men so often do, our own opinion to be dear beyond the truth among others.

R. A. S.

Explanation of the Female Dimorphism of Paltostoma torrentium

IN his paper on "*Paltostoma torrentium*, eine Mücke mit zweigestaltigen Weibchen" (*Kosmos*, vol. viii. pp. 37–42), my brother Fritz Müller supposes that this species of Blepharoceridæ originally was blood-sucking, but in later times changed its habits and became fond of flower-nectar. In the males, who need only little food, this change of habits and the corresponding change of the mouth-parts was accomplished, my brother supposes, more rapidly and perfectly than in the females, who, maturing eggs and passing the winter, stand in need of more albuminous food than the males do. Whilst therefore in some females of *Paltostoma torrentium* the same change of habits and mouth-parts has taken place as in the males, other females have still more or less continued their original blood-sucking habits and preserved their original blood-sucking instruments.

This explanation given by my brother is not yet proved by any direct observation of *Paltostoma's* habits. He mentions, as an indirect argument for his opinion, that in several Diptera the females have been stated to be blood-sucking, whilst the males take nectar of flowers. It may therefore be worth publishing, that in *Empis punctata* really just the same takes place as my brother's explanation of the female dimorphism in *Paltostoma torrentium* requires to be supposed: males who exclusively feed on flower-nectar, besides females, both enjoying flower-honey and attacking living animals and sucking their blood. Several weeks ago (May 26) a great many males as well as females of *Empis punctata* roved on the flowers of hawthorn (*Cratægus oxyacantha*). The males were exclusively occupied with sucking nectar. Of the females some did the same, whilst others attacked, murdered, and consumed the most clever visitor of flowers among all our Syrphidæ, *Rhingia rostrata*.

HERMANN MÜLLER

ACROSS AFRICA[1]

TO cross Africa has almost ceased to be an extraordinary feat. Indeed it seems evident, the more we know of the Portuguese native traders, that even before Livingstone's memorable first journey, it was no uncommon thing for the Pombeiros to do in the ordinary way of business. Of course some routes are more dangerous than others, and that by which Stanley made his famous march was perhaps the most difficult and dangerous that could be selected. Still the journey performed by Major Serpa Pinto was in many ways remarkable, and perhaps not its least remarkable feature is the characteristic manner in which he tells his story. The Major's narrative is in every respect a contrast to the quiet and sober narrative of Dr. Holub, recently reviewed in these pages. The Major is all excitement and enthusiasm, and his frequent digression to unbosom himself of his feelings under his frequently trying circumstances, though they do not convey much information, are pleasant reading. The expedition of which he was leader was fitted out very handsomely by the Portuguese Government, its object being to cross the continent from the Portuguese settlements in the west to those on the east coast. He was accompanied by MM. Ivens and Capello, but these soon parted from him, and conducted an exploration on their own account, the full narrative of which has yet to be published. Much time was wasted at the outset before the expedition could leave Benguella, collecting carriers and making other arrangements, so that it was January, 1878, before the Major fairly started for the interior. Although much of the ground he traversed had been gone over before, coinciding partly with the route of Livingstone, still he was able to open up a considerable stretch of new country, and most of all to clear up to a great extent the complicated hydrography of the region lying between the West Coast and the Zambesi. While the Major has many interesting notes on the natural history of the country he traversed, and while he seems to have been able to bring to light some new animals and not a few new plants, the main value of his narrative lies in the full details he gives on the geography and ethnology of Western South Africa. He was unable to carry out the original programme of the expedition, having been compelled to turn southwards on reaching the Central Zambesi, reaching the East Coast at Natal. On leaving Benguella the Major proceeded in a south-easterly direction towards the Cunene, before reaching which he turned north-eastwards, proceeding by Caconda to Bihé. After staying here for some time he again turned south-eastwards across the Cuando to the Zambesi, a little below its junction with the Liba, which seems to have more right to be considered the main stream than that which comes from the east. Proceeding down the Zambesi, passing numerous cataracts, he got into trouble among the Barotse, a new king having succeeded to the deposed Sepopo, whom Dr. Holub found ruling the Marutse-Mabunda kingdom at Sesheke. Escaping with bare life, he fell in with the French missionary family Coillard, who gave him all possible succour, visited and attempted to survey the Victoria Falls, and proceeded southwards and eastwards in a leisurely way into country pretty well known, but of which and of its various native states he is able to give us some interesting details. Between the West Coast and the Zambesi the expedition must have crossed hundreds of rivers, many of which Major Pinto has laid down with approximate accuracy in his maps. For he deserves the highest praise for the persistency with which he took his observations under the most trying circumstances, so that to the cartographer his work is of the greatest value. It is no easy matter to discriminate the various watersheds here, and indeed the observations of Major Pinto, combined with those of previous travellers, shows that many of the rivers which flow north to the Congo, south-west to the Atlantic, south by Cubango to Lake Ngami, and south-east to the Zambesi, rise quite close together on what is really a table-land ; and in the rainy season it will often be difficult for them to make up their minds which direction they shall take. Major Pinto's numerous maps tend greatly to clear up the complicated hydrography of this region.

The country through which he passed to reach the Zambesi is varied in its aspect and productiveness, though most of it is luxuriantly fertile, and capable of great development. Much of it is however swampy, and even cultivated fertile districts are depopulated, mainly through wars and slave-hunting. Major Pinto tells us much that is interesting on the metal-working, which is common along the first part of his route. There seems to be really a large store of iron in this region, and the natives show considerable ingenuity in working it. There are several chief centres for these operations, and the metal is fashioned into all sorts of implements and weapons.

FIG. 1.—Cabango Man.

"During the coldest months, that is to say June and July, the Gonzellos miners leave their homes and take up their abode in extensive encampments near the iron-mines, which are abundant in the country. In order to extract the ore they dig circular holes or shafts of about ten to thirteen feet in diameter, but not more than six or seven feet deep ; this arises most probably from their want of means to raise the ore to a greater elevation. I examined several of these shafts in the neighbourhood of the Cubango, and found them all of a similar character. As soon as they have extracted sufficient ore for the work of the year they begin separating the iron. This is done in holes of no great depth, the ore being mixed with charcoal, and the temperature being raised by means of primitive bellows, consisting of two wooden cylinders about a foot in diameter, hollowed out to a depth of four inches, and covered with two tanned goat-skins, to which are fixed two handles, twenty inches long and half an inch thick. By a rapid movement of these handles a current of air is produced which plays upon the charcoal through two hollow wooden tubes attached to the

[1] "How I Crossed Africa, from the Atlantic to the Indian Ocean," &c. By Major Serpa Pinto. Translated from the Author's manuscript by Alfred Elwes. Two vols. Maps and Illustrations. (London: Sampson Low and Co., 1881.)

cylinders, and furnished with clay muzzles. By incessant labour, kept up night and day, the whole of the metal becomes transformed, by ordinary processes, into spades, axes, war-hatchets, arrow-heads, assegais, nails, knives, and bullets for fire-arms, and even occasionally fire-arms themselves, the iron being tempered with ox-grease and salt. I have seen a good many of these guns carry as well as the best pieces made of cast steel."

The book contains several illustrations of the methods adopted, and the double-bellows used for the furnace is very curious. His observations on the animals met with along his route are valuable, and he has carefully indicated on his map where the principal animals are found. Elephants seem to be abundant enough south-east of Bihé, and lions were met with in considerable numbers as the Zambesi was approached. He also met with the huge and dangerous buffaloes familiar to readers of Livingstone's First Journey. One of our illustrations gives a good idea of an antelope which was met with in the Cuchibi, which the Major thus describes :—

"At one of the turns of the river I perceived three antelopes of an unknown species, at least to me; but just as I was in the act of letting fly at them they leaped into the water and disappeared beneath its surface. The circumstance caused me immense surprise, which was increased as I went further on, as I occasionally came across several of these creatures, swimming, and then rapidly diving, keeping their heads under water, so that only the tips of their horns were visible. This strange animal, which I afterwards found an opportunity of shooting on the Cuchibi, and of whose habits I had by that time acquired some knowledge, is of sufficient interest to induce me for a moment to suspend my narrative to say a few words concerning it. It bears among the Bihenos the name of Quichôbo, and among the Ambuellas that of Buzi. Its size, when full grown, is that of a one-year-old steer. The colour of the hair is dark grey, from one quarter to half an inch long, and extremely smooth ; the hair is shorter on the head, and a white stripe crosses the top of the nostrils. The length of the horns is about two feet, the section at the base being semicircular, with an almost rectilinear chord. This section is retained up to about three-fourths of their height, after which they become almost circular to the tips. The mean axis of the horns is straight, and they form a slight angle between them. They are twisted around the axis without losing their rectilinear shape, and terminate in a broad spiral. The feet are furnished with long hoofs similar to those of a sheep, and are curved at the points. This arrangement of its feet and its sedentary habits render this remarkable ruminant unfitted for running. Its life is therefore in a great measure passed in the water, it never straying far from the river banks, on to which it crawls for pasture, and then chiefly in the night-time. It sleeps and reposes in the water. Its diving-powers are equal, if not superior, to those of the hippopotamus. During sleep it comes near to the surface of the water, so as to show half its horns above it. It is very timid by nature, and plunges to the bottom of the river at the slightest symptom of danger. It can easily be captured and killed, so that the natives hunt it successfully, turning to account its magnificent skin and feeding off its carcase, which is however but poor meat. Upon leaving the water for pasture its little skill in running allows the natives to take it alive ; and it is not dangerous, even at bay, like most of the antelope tribe. The female, as well as the male, is furnished with horns. There are many points of contact between the life of this strange ruminant and that of the hippopotamus, its near neighbour. The rivers Cubangui, Cuchibi, and the upper Cuando offer a refuge to thousands of Quichôbos, whilst they do not appear either in the lower Cuando or the Zambesi. I explain this fact by the greater ferocity of the crocodiles in the Zambesi and lower Cuando, which would make short work of so defenceless an animal if it ventured to show itself in their waters."

Major Pinto's account of the powerful kingdom of Bihé is full of interest. It is evident from his narrative and those of Dr. Holub and Mr. Joseph Thomson that these African states are in a constant state of unstable equilibrium. Not only are the chiefs and dynasties frequently changed, but an entire population may be removed or reduced to slavery, and its dominant place taken by a conquering people. The Bihenos are probably the most extensive travellers in Africa.

"Where travelling is concerned as connected with trade, nothing comes amiss to the Bihenos, who seem ready for anything. If they only had the power of telling where they had been and describing what they had seen, the geographers of Europe would not have occasion to leave blank great part of the map of South Central Africa. The Biheno quits his home with the utmost indifference, and bearing a load of sixty-six pounds of goods, will start for the interior, where he will remain two, three, and four years ; and on his return, after that lapse of time, will be received just as though he had been on a journey of as many days. Silva Porto, whilst engaged in doing business with the Zambesi, was despatching his negroes in other directions, and was trading at the same time in the Mucusso country and in the Lunda and Luapula territories. The fame of the Bihenos has travelled far and wide, and when Graça attempted his journey to the Matianvo he first proceeded to the Bihé to procure carriers. These people have a certain emulation among one another as travellers, and I met with many who prided themselves on having gone where no others had ever been, and which they called *discovering new lands*. They are brought up to wandering from their very infancy, and all caravans carry innumerable children, who, with loads proportionate to their strength, accompany their parents or relatives on the longest journeys ; hence it is no uncommon thing to find a young fellow of five-and-twenty who has travelled in the Matianvo, Niangué, Luapula, Zambesi, and Mucusso districts, having commenced his perigrinations at the age of nine years."

Major Pinto has a good deal to tell us of the various kinds of ants he met with on his journey, though the value of his observations is much decreased from his want of a knowledge of entomology. Here is his account of one terrible insect :—

"When the work of cutting down the wood for our encampment commenced I saw a sudden commotion among my blacks, who then took to their heels in every direction. Not understanding the cause of their panic, I immediately proceeded to the spot to make inquiries. On the very place which I had selected for my camp appeared issuing from the earth millions of that terrible ant called by the Bihenos *quissonde*, and it was the sight of these formidable creatures which scattered my men. The quissonde ant is one of the most redoubtable *wild beasts* of the African continent. The natives say it will even attack and kill an elephant, by swarming into his trunk and ears. It is an enemy which, from its countless numbers, it is quite vain to attack, and the only safety is to be found in flight. The length of the quissonde is about the eighth of an inch ; its colour is a light chestnut, which glistens in the sun. The mandibles of this fierce hymenopter are of great strength, and utterly disproportioned to the size of the trunk. It bites severely, and little streams of blood issue from the wounds it makes. The chiefs of these terrible warriors lead their compact phalanxes to great distances and attack any animal they find upon the way. On more than one occasion during my journey I had to flee from the presence of these dreadful insects. Occasionally upon my road I have seen hundreds of them, apparently crushed beneath the foot, get up and continue their march, at first somewhat slowly,

but after a time with their customary speed, so great is their vitality."

The author gives some valuable details concerning the Mucassequeres, who seem to be a remnant of one of the primitive African tribes.

"The Mucassequeres occupy, jointly with the Ambuellas, the territory lying between the Cubango and Cuando, the latter dwelling on the rivers and the former in the forests; in describing the two tribes, one may say that the latter are barbarians and the former downright savages. They hold but little communication with each other, but, on the other hand, they do not break out into hostilities. When pressed by hunger the Mucassequeres will come over to the Ambuellas and procure food by the barter of ivory and wax. Each tribe would seem to be independent, and not recognise any common chief. If they do not fight with their neighbours they nevertheless quarrel among themselves; and the prisoners taken in these conflicts are sold as slaves to the Ambuellas, who subsequently dispose of them to the Bihé caravans. The Mucassequeres may be styled the true savages of South Tropical Africa. They construct no dwelling-houses or anything in the likeness of them. They are born under the shadow of a forest-tree, and so they are content to die. They despise alike the rains which deluge the earth and the sun which burns it; and bear the rigours of the seasons with the same stoicism as the wild beasts. In some respects they would seem to be even below the wild denizens of the jungle, for the lion and tiger have at least a cave or den in which they seek shelter, whilst the Mucassequeres have neither. As they never cultivate the ground, implements of agriculture are entirely unknown among them; roots, honey, and the animals caught in the chase constitute their food, and each tribe devotes its entire time to hunting for roots, honey and game. They rarely sleep to-day where they lay down yesterday. The arrow is their only weapon; but so dexterous are they in its use, that an animal sighted is as good as bagged. Even the elephant not unfrequently falls a prey to these dexterous hunters, whose arrows find every vulnerable point in his otherwise impervious hide. The two races which inhabit this country are as different

FIG. 2.—The Quichôbo.

FIG. 3.—Malanca.

in personal appearance as they are in habits. The Ambuella, for instance, is a black of the type of the Caucasian race; the Mucassequere is a white of the type of the Hottentot race in all its hideousness. Many of our sailors, browned by the sun and beaten by the winds of many a storm, are darker than the Mucassequeres, whose complexion besides has so much of dirty yellow in it as to make the ugliness more repulsive. I regret exceedingly my inability to obtain more precise data concerning this curious race, which I consider to be worthy the special attention of anthropologists and ethnographers. In my opinion this branch of the Ethiopic race may be classified in the group of the Hottentot division. In form it possesses many of the characteristics of the latter, and we may observe in this peculiar race a sensible variation in the colour of the skin. The *Bushmen* to the south of the Calaári are very fair of hue, and I have noticed some who were almost white. They are low of stature and thin of body, but exhibit all the characteristics of the Hottentot type. To the north of that same desert tract, more especially about the salt-lakes, there is another nomad race, that of the Massaruas, strongly built, of lofty stature, and of a deep black, who possess the same Hottentot type, and who indubitably belong to the same group. I was told on the Cuchibi that between the Cubango and the Cuando, but a good deal to the south, there existed another race, in every respect similar to the Mucassequeres, both in type and habits, but of a deep black colour. In consideration therefore of the affinity of character, I have no hesitation in admitting that the Hottentot group of the Ethiopic race extends to the north of the Cape as far as the country lying between the Cubango and the Cuando, passing through sundry modifications of colour and stature, due probably to the conditions under which they live, to altitude, to the great difference of latitude, or even to other causes that are less apparent."

By the time Major Pinto reached the Barotse territory and fell in with the hospitable missionary family Coillard, he had got on to comparatively well-known ground, though the interest of his story is sustained to the very end; and even here he succeeds in adding something to our knowledge of the countries through which he passed. His visit to the Great Falls of the Zambesi, and his illustrations taken from various points, are a material addition to what we know of them from the narratives of Livingstone and Mohr. Some of his observations are worth quoting, especially as, under circumstances of the greatest danger, he succeeded in making a fairly accurate survey. "Mozi-oa-tunia" is a Basuto word, meaning "the smoke is rising," "so that it is very easy to suppose how a name, common among the natives and apparently so apt and appropriate, came to be given by strangers to the cataract itself.

"*Mozi-oa-tunia* is neither more nor less than a long trough, a gigantic crevasse, the sort of chasm for which was invented the word abyss—an abyss profound and monstrous into which the Zambesi precipitates itself bodily to an extent of 1978 yards. The cleft in the basaltic rocks which form the northern wall of the abyss is perfectly traceable, running east and west. Parallel thereto, another enormous wall of basalt, standing upon the same level, and 110 yards distant from it, forms the opposite side of the crevasse. The feet of these huge moles of black basalt form a channel through which the river rushes after its fall, a channel which is certainly much narrower than the upper aperture, but whose width it is impossible to measure. In the southern wall, and about three-fifth parts along it, the rock has been riven asunder, and forms another gigantic chasm, perpendicular to the first; which chasm, first taking a westerly curve and subsequently bending southwards and then eastwards, receives the river and conveys it in a capricious zigzag through a perfect maze of rocks. The great northern wall of the cataract over which the water flows is in places perfectly vertical, with few or none of those breaks or irregularities that one is accustomed to see under such circumstances. An enormous volcanic convulsion must have rent the rock asunder and produced the huge abyss into which one of the largest rivers in the world precipitates itself. Undoubtedly the powerful wearing of the waters has greatly modified the surface of the rocks, but it is not difficult for an observant eye to discover clearly that those deep scarps, now separated from each other, must at one time have been firmly united. The Zambesi, encountering upon its way the crevasse to which we have alluded, rushes into it in three grand cataracts, because a couple of islands which occupy two great spaces in the northern wall divide the stream into three separate branches. The first cataract is formed by a branch which passes to the south of the first island, an island which occupies, in the right angle assumed by the upper part of the cleft, the extreme west. This branch or arm consequently precipitates itself in the confined space open on the western side of the rectangle. It is 196 feet wide and has a perpendicular fall of 262 feet, tumbling into a basin whence the water overflows to the bottom of the abyss, there to unite itself to the rest in rapids and cascades that are almost invisible, owing to the thick cloud of vapour which envelopes the entire foot of the Falls. The island which separates that branch of the river is covered with the richest vegetation, the leafy shrubs extending to the very edge along which the water rushes, and presenting a most marvellous prospect. This is the smallest of the Falls, but it is the most beautiful, or, more correctly speaking, the only one that is really beautiful, for all else at Mozi-oa-tunia is sublimely horrible. That enormous gulf, black as is the basalt which forms it, dark and dense as is the cloud which enwraps it, would have been chosen, if known in biblical times, as an image of the infernal regions, a hell of water and darkness, more terrible perhaps than the hell of fire and light. Continuing our examination of the cataract, we find that the beginning of the northern wall, which starts from the western cascade, is occupied to an extent of some 218 yards by the island I have before alluded to, and which confines that branch of the river that constitutes the first Fall. It is the only point whence the entire wall is visible, simply because along that space of 218 yards the vapour does not completely conceal the depths. It was at that point I took my first measurements, and by means of two triangles I found the upper width of the rift to be 328 feet, and the perpendicular height of the wall 393 feet. This vertical height is even greater further to the eastward, because the trough goes on deepening to the channel through which the river escapes to the south. At that point likewise I obtained data for measuring the height. In my first measurements I had as my base the side of 328 feet, found to be the upper width of the rift; but it was necessary to see the foot of the wall, and I had to risk my life to do so. After the first island, where I made my measurements, comes the chief part of the cataract, being the portion comprised between the above island and Garden Island. In that spot the main body of the water rushes into the abyss in a compact mass, 1312 feet in length, and there, as is natural, we find the greatest depth. Then follows Garden Island, with a frontage of 132 feet to the rift, and afterwards the third Fall, composed of dozens of falls which occupy the entire space between Garden Island and the eastern extremity of the wall. This third Fall must be the most important in the rainy season, when the masses of rock which at other times divide the stream are concealed, and but one unbroken and enormous cataract meets the eye. As the water which runs from the two first falls and from part of the third near Garden Island rushes eastward, it meets the remainder of the third Fall coursing west, and the result

is a frightful seething whirlpool, whence the creamy waters rush, after the mad conflict, into the narrow rocky channel before alluded to, and go hissing away through the capricious zigzag chasm."

FIG. 4.—Mozi-Oa-Tunia (the Victoria Falls).—The West Falls.

In the appendices and throughout the work Major Pinto gives many astronomical and meteorological observations which are of real scientific value. Altogether his work is one of the most attractive and instructive of recent narratives of African travel.

ÉTIENNE HENRY SAINTE-CLAIRE DEVILLE.

WE regret to record a serious loss to French chemistry in the death of the celebrated professor, Sainte-Claire Deville, which occurred July 1, at Boulogne-sur-Seine. Étienne Henry Sainte-Claire Deville was born March 11, 1818, on the island of St. Thomas, in the Antilles, and was of Creole origin. Like most of the youth in the French colonies, he was sent to Paris to undertake a course of study. Of his two brothers who also proceeded to France to enter upon active careers, one, the late Charles Sainte-Claire Deville, devoted himself likewise to science, and we have had occasion more than once to refer to his remarkable geological investigations in these pages. While the Creole element has rarely lacked in the artistic and literary circles of the French capital, we believe that the two brothers in question furnish the only notable instance in which science has profited from the highly imaginative and versatile Creole temperament. It is related of the young Henry that on completing his collegiate studies, he hesitated for a long time in making his choice between music and science. His decision was due in a great measure to the enthusiasm awakened at the time by the brilliant lectures and no less brilliant investigations of Jean Baptiste Dumas. Guided by the counsels of the latter, he equipped a laboratory, and commenced a series of investigations so fertile of results that in a short time he was ranked among the most promising of the younger school of chemists. In 1844 he entered upon professorial duties in accepting the Chair of Chemistry in the Scientific Faculty of Besançon, where, notwithstanding his comparative youth, he was appointed dean of his faculty. In 1851 he was called upon to succeed Balard as Professor of Chemistry at the *École Normale* of Paris. Gladly exchanging the comparative obscurity of a provincial university town for the manifold advantages of a Parisian professorship, he devoted himself with such ardour to the duties of his new position that, after a short lapse of time, the laboratory of the *École Normale* became one of the central points of chemical investigation, not only in France but in all Europe. In 1854 he accepted, in addition to his usual duties, a lectureship at the Sorbonne, which, fourteen years later, was changed for a full professorship. His favourite field of activity remained, however, the *École Normale*, and it was with difficulty, some months since, that he felt himself called upon to relinquish active professorial duties in consequence of rapidly increasing feebleness.

As an investigator, Deville made his *début* in organic chemistry in 1840 with a remarkable study of turpentine oil and various derivatives of the terpenes. His carefully tabulated results form the chief basis of our present knowledge of the different isomeric states of this group. They were followed in 1842 by a research on toluene, the importance of which was only duly felt on the introduction of the aniline colours. After minor investigations of various resins, Deville abandoned organic chemistry

to devote himself almost exclusively to the inorganic branch, and announced in 1849 his first grand discovery, that of nitric oxide. By demonstrating the existence of this interesting and important compound, as resulting from the action of chlorine on silver nitrate, $2AgNO_3 + Cl_2 = 2AgCl + O + N_2O_5$, Deville did much to stimulate the theoretical speculation of the day, especially among the opponents of the school of Gerhardt, whose theories did not recognise the possibility of the existence of monobasic acid anhydrides. After a few years devoted to varied studies of metallic carbonates and new analytical processes, he commenced in 1855 the famous research on metallic aluminium, which proved to be one of the crowning features of his lifework. Furnished with ample means by the munificence of Napoleon III., he was enabled to carry out experiments on a large scale, and so rapid was his success that even in 1855 he displayed at the Exhibition of Paris massive bars of this handsome metal, which previously had scarcely been seen in a pure state. The study of this metal and its metallurgical production, as well as of the various compounds of aluminium, carried out during a series of years, forms one of the most remarkable and complete contributions made to inorganic chemistry within a recent period. Deville's perfected process for the preparation of aluminium, as carried out in the two French and the single English establishment in which alone this metal is obtained, consists essentially in heating the double salt of aluminium and sodium, $AlCl_3.NACl$, with metallic sodium, fluorspar or cryolite being added as a flux. The metal thus obtained in the form of a solid regulus is used for a large variety of objects where lightness, strength, and freedom from oxidation are demanded, and forms the essential part of numerous valuable alloys. It has failed partly to meet the extended use to which Deville looked forward, on account of its comparatively high price and the difficulty of welding the metal. Among other industrial branches which we owe to Deville's efforts to create the manufacture of aluminium, such as the production of bauxit and cryolite, mention should especially be made of the manufacture of metallic sodium, the price of which sank in ten years from 2,000 francs to 15 francs per kilogramme. Deville's researches in this direction and his various methods of manufacture are to be found *in extenso* in his classical work, *De l'aluminium, ses propriétés, &c.*, 1859. In union with Caron he applied in 1863 the method found successful in the case of aluminium to the production of magnesium, and thereby created a second branch of industry. The manufacture of this metal, although confined to an annual production of about ten tons, is fully as interesting and ingenious as that which places aluminium within the reach of the industrial and scientific world. In this connection mention should be made of his exhaustive researches, chiefly in company with Débray, on the metals of the platinum group (1859—1862), in the course of which he succeeded for the first time in fusing large quantities of platinum by means of the oxyhydrogen blowpipe. The phenomena accompanying the high temperatures so all-important in the metallurgical operations just alluded to, gradually assumed a leading place amongst the subjects of Deville's researches. After successfully devising lamps and furnaces by means of which a high degree of heat was attainable, and methods by which the temperature could be measured, he proceeded to study a variety of reactions taking place at temperatures scarcely reached before his time. First among the results obtained in this direction reference should be made to the variety of crystallised minerals prepared artificially, such as willemite, greenockite, zircon, periclase, staurolite, &c. This branch of research has been so ably followed up by scholars of Deville, that but few natural minerals exist nowadays of which artificial counterparts have not been prepared. Of much greater importance were the numerous determinations of the vapour densities of bodies which are ordinarily solid, such as the chlorides of aluminium, of iron, and of various rare metals, by means of which the molecular weights of numerous compounds have been satisfactorily obtained. By far the most important of Deville's thermal investigations, those which have rendered the grandest services to theoretical chemistry, are connected with his noted discovery of the principle of dissociation in 1857. This principle, which explains a variety of hitherto anomalous occurrences among thermal phenomena, may briefly be considered as the property of many compound bodies to undergo partial decomposition under the influence of heat in confined spaces, until the liberated gas or vapour has attained a certain tension greater or less according to the temperature. So long as this temperature remains constant, no further decomposition takes place, neither does any portion of the separated elements recombine. If the temperature be raised decomposition recommences, and continues until a higher tension of the liberated gas or vapour, definite for that particular temperature, is attained. If the temperature falls, recomposition ensues, until the tension of the residual gas is reduced to that which corresponds with the lower temperature. The enunciation of this simple, but far-reaching principle has thrown light upon a number of phenomena, such as the formation of minerals, the apparent volatilisation of solids, &c., and has been the fruitful source of countless novel discoveries.

The number of different subjects touched upon by Deville during his long career of investigation, has been so great that we are forced to simply allude in conclusion to several notable researches, such as that on boron in company with Wöhler (1857), preparation of silicium, and its compounds with copper (1863), a new calorimeter, and the changes attendant upon the mixture of liquids (1870), the examination of a large variety of minerals and natural products, &c.

In reviewing the lifework of Sainte-Claire Deville, we are struck constantly by the predominance of one quality —that of simplicity; a quality so eminently characteristic of the man in his social relations, as well as in his scientific labours, that perhaps no phrase could describe him better than that of the French Bunsen. Like his great fellow-worker across the Rhine, he has been able to find abundant material for the exercise of his genius in attacking the still unsolved problems of inorganic chemistry; like him also he has held himself aloof in a great measure from the polemics prevalent in the modern school of chemists; the same charming simplicity characterises his apparatus, his methods, the few fundamental principles he has enunciated. As a professor Deville was deeply beloved by his students, to whom he was in turn greatly devoted; responding readily to all demands on his time and thought, and making use of his vast influence to further the interests of those who evinced special merit. His proverbial tenderness towards trembling candidates in the public examinations rendered him eminently popular in student circles.

"Voyons, Monsieur, de quoi est composée l'eau? . . . d'O?"

"Xygène," repondait l'élève.

"Et encore? . . . d'hy . . .?"

"Drogène," ajoutait le candidat.

"C'est cela, Monsieur, merci!"

Sainte-Claire Deville was elected a member of the French Academy in 1861. A year before he had been elected a honorary member of the Chemical Society of London. He was the recipient of numerous other marks of recognition from foreign societies and governments. A few years since he received the commission of preparing the normal international metre measure, a task which brought upon him much labour. While holding aloof from politics, Deville was highly regarded in the business

world, and was a director in the Parisian Gas Company and the Eastern Railway of France. His family relations were singularly happy. He leaves behind him a group of five sons. In addition to the treatise on aluminium already alluded to, Deville was the author, in company with Débray, of an exhaustive work in two volumes on the "Métallurgie du Platine" (1863).

T. H. N.

CONVERSAZIONE AT KING'S COLLEGE

ON Saturday, July 2, a brilliant and successful *conversazione*, given by the Council and the Academical Staff of King's College, brought to a conclusion the celebration of the fiftieth anniversary of the opening of the College. In the afternoon H.R.H. the Prince of Wales, accompanied by H.R.H. the Princess of Wales, distributed the College prizes to successful students, and the College rooms were converted into tastefully decorated drawing-rooms and picture galleries, in which were exhibited many very choice pictures and works of art.

The library was furnished with microscopes which had been lent by members of the Microscopic Society. The large entrance hall and the front of the College were brilliantly lighted by three Crompton electric lights, which burnt with remarkable steadiness throughout the evening. In the scientific department, the museum of King George III. contains an unrivalled collection of mechanical and physical apparatus, and is especially rich in apparatus of historic interest. The nucleus of the collection was presented to the College by Her Majesty the Queen in 1843, when the museum was opened by Prince Albert, who then witnessed some of the experiments of Sir Charles Wheatstone on the electric telegraph. Important additions have been made to the collection of apparatus by the Professors of Natural Philosophy, and at his death Sir Charles Wheatstone's valuable collection was bequeathed to the museum. Among the interesting features in the museum are: calculating machines of Cavendish and others, Appoldie centrifugal pump, Newcomen's model of his steam-engine, original forms of Daniell's battery, Siberian loadstone used for his induction spark by Faraday, original Wheatstone's bridge, early forms of stereoscope, early forms of electrical machines, polar clocks and shadow clocks, De Kempelen's talking machine.

From its foundation in 1868 the Physical Laboratory, now called the Wheatstone Laboratory, has been under the direction of Prof. W. Grylls Adams. Among the interesting apparatus exhibited in this department were the Wheatstone Collection of electrical apparatus for exhibition in Paris, dynamo-electric machines, diffraction spectra, an optical bench, showing interference of light, measuring polariscopes, with universal motions for the exact measurement of crystals, and vacuum tubes in great variety, including a very beautiful coronet. The great event of the evening in the Physical Department was the exhibition for the first time in England of the Faure's secondary battery or reservoir of electricity. Two boxes of this battery, which had been previously charged from a dynamo-electric machine, and had then been brought to the College, were capable of heating and keeping heated to bright redness a platinum wire 2 metres long and 1 millimetre in diameter. Six boxes were found to be sufficient to cause Swan electric lamps to glow brilliantly. Twelve of these boxes supplied a pedestal of Lane-Fox lamps, supplied by the British Electric Light Company, and during the evening the Physical Lecture Theatre was brilliantly illuminated by twenty Swan lamps of the latest type with the current from twelve other boxes of Faure's secondary battery. It was shown that by means of these boxes of electricity the lighting of private houses by electricity was already an accomplished fact.

THE COMET

WE have received the following communications:—

AT about 11h. 0m. G.M.T. on June 29 a transit of the "following" nuclear jet of the great comet over a star of 8m. was observed by Mr. N. E. Green, of 39, Circus Road, St. John's Wood, and by me, with a 12½-inch reflector belonging to Mr. Green. Definition was very good and tranquil. As the star became involved in the jet it gradually increased in size, and when seen through the brightest part of the jet traversed resembled an ill-defined planetary disk about 3″ in diameter. At this moment the comet seemed to have two nuclei similar in aspect and brightness.

The effect of the cometary matter on the star's image resembled that of ground glass, not that of fog; the image of the star, being dilated into a patch of nearly uniform brightness, instead of presenting a sharp central point with a surrounding halo. Cirro-stratus, passing into rain-cloud, produces on the appearance of the sun an effect the counterpart of that produced by the cometary emitted matter on the star. There was not sufficient light for the use of the spectroscope, the star, afterwards identified as B.D. + 65°, 519, being fainter than 8m.

The transit of the jet occupied about 3m., and the star slowly resumed its ordinary appearance and dimensions, the image *contracting* as the centre of the jet left the star behind. A transit of this kind has not frequently been observed, at least under such favourable conditions as to brightness and definition of the objects, and it is to be hoped that others may have been as fortunate as Mr. Green and the undersigned.

If the point which obeys the Newtonian law be a solid body, the observation just recorded seems to show that its true outline would probably be rendered unrecognisable, and its aspect totally altered by the (refractive?) power of the coma and jets.

CHARLES E. BURTON

38, Barclay Road, S.W., July 1

THE following is an extended list of places obtained with the transit-circle when the comet passed *sub Polo*:—

	Date.	Greenwich Mean Time of observation.	Observed R.A.	Observed North Polar distance (uncorrected for parallax)
		h. m. s.	h. m. s	° ′ ″
(*a*)[1]	June 23	11 30 54·4	5 34 55·2	44 53 20·6
(*b*)	,, 24	11 30 42·6	5 38 39·9	40 35 33·7
(*c*)	,, 25	11 30 58·3	5 42 52·2	36 38 27·4
(*d*)	,, 27	11 33 2·8	5 52 50·2	29 46 5·8
(*e*)	,, 28	—	—	26 49 45·0
(*f*)	,, 29	11 37 39·3	6 5 20·5	24 11 37·9
(*g*)	,, 30	11 41 3·9	6 12 42·2	21 50 26·3
(*h*)	July 1	11 45 19·9	6 20 55·5	19 44 41·3
(*i*)	,, 2	11 50 31·9	6 30 4·9	17 52 59·6

Remarks.—(*a*) The nucleus distinct but nebulous. Tail bright, and estimated 15° in length. Observation good.

(*b*) Observation difficult, owing to cloud.

(*c*) Nucleus better defined than on June 23, but not so bright. Length of tail estimated at 15°. Observation good.

(*d*) Observation fair, very cloudy. Tail 12°-15° long.

(*e*) Observed through short break in clouds. Tail 10° in length.

(*f*) Observation very good. Tail 10°.

(*g*) Observation very good. Nucleus smaller and fainter than on preceding nights. Tail 10°.

(*h*) Observation very good. Tail 9°.

(*i*) Very faint, observed through haze. Tail 8°.

Radcliffe Observatory, Oxford E. J. STONE

MY chief object in writing to-day is to explain a word in my letter of June 28 (p. 200) that is quite open to misinterpretation. In examining the head of Comet *b* 1881 with a small direct-vision spectroscope and a narrow slit, I saw, on June 27, three bright lines or bands on a faint continuous spectrum. Two of the lines were strong, and

[1] The observed R.A. and G.M.T. for June 23, reported in last week's NATURE (p. 200), should be *decreased* one minute, as above.

near together, and of a bluish-green ; the third was much fainter and with very little apparent colour, but easily seen as a bright line. I called these "three green lines," as that was the general appearance in the field of view, and I had no intention of fixing the positions of the lines. The words however require explanation, as they would naturally be understood as restricting the bands to a definite part of the spectrum. On July 1, shortly before midnight, I examined the position of these lines more carefully, keeping the slit sufficiently open to secure a fairly strong continuous spectrum from the nucleus in the centre of the field, whilst the bright lines extended along the whole length of the slit. I could then see clearly that the two strong bands were in the green and blue, and that the fainter line was almost at the extremity of the more refrangible end of the spectrum visible in the small spectroscope used, and would therefore be situated in the violet or purple.

The comet on the night of July 1 was very much diminished in brilliancy, but at midnight it could still be traced by aid of a binocular through at least 7°. The nucleus shone as a 2·3 magnitude star, and under a considerable magnifying power it was found to have lost most of the interesting features of June 27. The double envelope, so well defined in outline a few days previous, had disappeared, and there now remained only the bright nucleus bounded towards the tail by two arcs, one on either side of the centre, from which those rays seemed to spring which moved slightly in the direction of the sun, and then bent round to help in forming the tail. A mass of light surrounded the head, but this faded away gradually into a nebulous outline. The light from the tail diminished very rapidly as the distance from the head increased. A *sub Polo* transit of the centre of the nucleus gave, for July 1, 11h. 50m. 7s. G.M.T., the following position uncorrected for parallax and aberration :—

R.A. 6h. 20m. 53s.·51 ; N. Decl. 70° 14′ 53″·7.

S. J. PERRY

Stonyhurst Observatory, Whalley, July 4

I INCLOSE three drawings of the comet made on

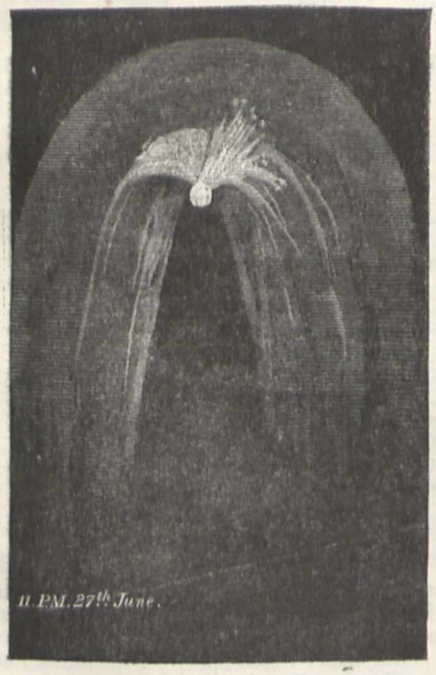


FIG. 1.

the 27th, 29th, and 30th ult. On the 27th the bright jet extending from the nucleus was very plain, and gave the hydrocarbon spectrum very distinctly. No bands were seen in the tail, but only in the immediate proximity of the nucleus. On the 29th the comet was much fainter;

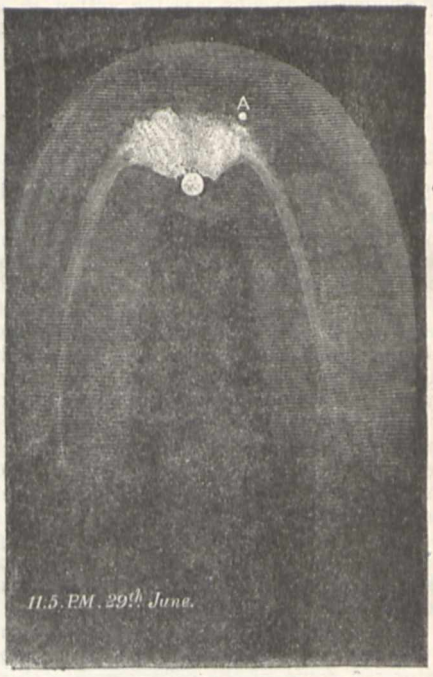


FIG. 2.—A = small star.

the bright jet had disappeared, giving place to a fan, of which the left-hand side was the brighter. A small star was seen through the coma, *a*, which the comet rapidly passed.

FIG. 3.

Last night (30th) the fan-shaped projection had narrowed considerably and apparently extended farther from the nucleus.

A. PERCY SMITH

Temple Observatory, Rugby, July 1

I HAVE made some sketches of this comet, and have taken some photographs with the 3-foot reflector. Particulars of the latter may be useful.

On the night of June 24 the comet, which was very brilliant, presented the appearance of Fig. 1 ; the nucleus very bright and some 6″ in diameter, and not in the centre of head. Photographs with two minutes' exposure gave a decided impression on the gelatine dry-plate ; with twenty-one minutes' exposure the image was very dense,

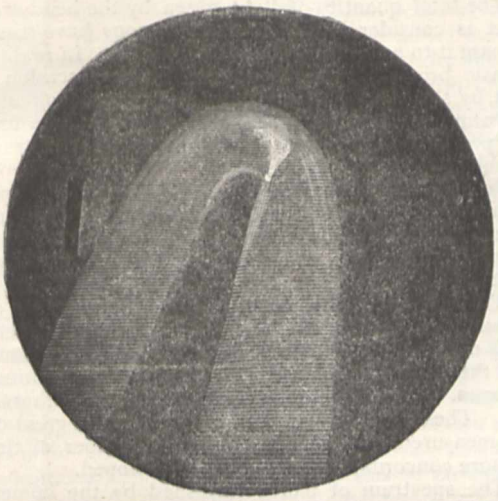


FIG. 1.—June 24, 12h. to 13h.

and the small bright tail that proceeded from the nucleus comes out well, but owing to the rapid motion in declination the image of the nucleus appears as a trail some quarter of an inch long.

On June 25 the appearance of the comet was altered, the club-footed mass of light had disappeared, and the nucleus presented a rayed appearance.

Photographs were taken with similar results to those obtained on the 24th, but a dense image of the nucleus

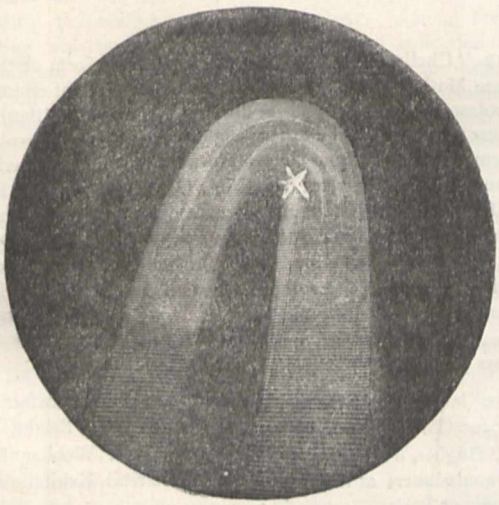


FIG. 2.—June 25, 13h. 1m.

was got with one minute's exposure. The intensity of light must quite equal that of a seventh magnitude star. The small bright tail was still very apparent, but between it and the edge of the large tail proper there was a decided dark space on the *p* side. At 13h. 35m. the *f* side was noted to be much the brightest; this change must have taken place very suddenly, as it had been specially noted just before as being the faintest side of the tail. Fig. 2 was taken before this was noticed. Cloudy nights intervened till the 29th. I had in the meantime fitted a fine screw to the plate-holder, and found that by giving this screw a certain calculated part of a turn every half minute for twenty minutes, I got a fair negative (I beg to forward this for your inspection) without any of the distortion caused by the motion in declination.

FIG. 3.—June 29, 13h. 2m.

The comet was observed to have changed to a much more symmetrical form (see Fig. 3). The conditions under which the photographs were taken were not very favourable : the mirror and flat were not at the best as regards polish, and the plates were about two years old.

A. AINSLIE COMMON

THE comet engaged the attention of the Paris Academy of Sciences at their sitting last Monday week, and we give the following extracts from the papers communicated.

Admiral Mouchez writes as follows :—"This comet, which was observed for the first time seventy-four years ago by an Italian monk on September 9, 1807, was observed by Pons eleven days afterwards at Marseilles on the 20th, and remained visible till March 27, 1808; during this long period it was possible to make a large number of observations, so that Bessel could for the first time calculate its elements; and he found that the period of its revolution must be comprised between 1404 and 2157 years, and was probably 1714 years. The calculations being revised and account taken of new perturbations, a period of 174 years was arrived at. The observations made during its second appearance will doubtless render it possible to determine the causes of perturbations or the errors of calculation and observation which have rendered its present return so unexpected.

"M. Tisserand has called my attention to a comet, not catalogued, but cited in Struyck's work, 'Vervolg van de Beschryving der Staatsterren' (Amsterdam, 1753), which appears to have been seen at the Cape of Good Hope in 1733, just seventy-four years previous to 1807 ; the want of precise observations, doubtless, did not allow of calculating the elements ; but the identity of the period and the comet's appearance in the southern hemisphere lead us to suppose that it is the same comet as we observe now, and which, from some cause difficult to conceive, seems not to have been observed in Europe after its passage through perihelion. Perhaps the Dutch, to whom the Cape of Good Hope then belonged, will find in their archives some documents which will enable us to utilise this old observation, to which I have invited the attention of M. Oudemans, the learned and able astronomer of Utrecht."

M. Bigourdan says he first perceived the comet on June 22 at 13h. 30m. The following elements are deduced from the observation at Kiel (where the comet was seen two hours earlier than at Paris) on June 22, and the two following at Paris :—

1881.	Paris Mean Time.	Apparent Right Ascension.	Apparent Declination.
	h. m. s.	h. m. s.	° ′ ″
June 24 ...	9 51 26·0 ...	5 38 21·84 ...	+49 5 31·6
26 ...	10 46 5·8 ...	5 47 22·66 ...	+56 50 2·4

Perihelion passage, 1881, June 16·52806

$$\left.\begin{array}{rl} \varpi &= 265^\circ\ 22'\ 59'' \\ \Omega &= 270\ 57\ 51 \\ i &= 63\ 26\ 57 \end{array}\right\} \text{Mean equin. } 1881\cdot0.$$

$$\log. q = \bar{1}\cdot866099$$

Representation of mean observation

In longitude ... ... $(o - C)\cos\beta = -7''\cdot7$
In latitude ... ... $o - C = -4''\cdot3$

The last elements obtained by Bessel for the great comet of 1807 are as follows :—

Perihelion passage, 1807, September 18·74537 mean Paris time.

$$\left.\begin{array}{rl} \varpi &= 270^\circ\ 54'\ 42'' \\ \Omega &= 266\ 47\ 11 \\ i &= 63\ 10\ 28 \end{array}\right\} \text{Mean equin. } 1807.$$

$$\log. q = \bar{1}\cdot810,3158$$
$$e = 0\cdot995,4878$$

With regard to the physical constitution of the comet, M. Wolf points out that while Coggia's comet (1874)—the only large comet visible on the horizon of Paris since spectrum analysis came into use—was at first telescopic, developed rapidly, and disappeared at the most interesting stage, the present comet comes to us already very much developed after its passage through perihelion. The transformations of the nucleus and its envelopes are extremely rapid (as the drawings show). In the large telescope the segmentation of the head, which Bond found in Donati's comet, was distinctly visible on June 24 ; the smallest instruments did not show it.

"The new comet represents, then, the second period of development of one of these curious stars, of which we have the first only in Coggia's comet. Its study enables us to follow the transformations of the envelopes, and to complete what information the comet of 1874 supplied.

"From the standpoint of spectrum analysis we may now correct a premature conclusion which might be deduced from our observations of Coggia's comet in 1874. That comet, from May 19, presented the continuous and nearly linear spectrum of the nucleus, traversed by the three bright bands characteristic of the light of comets (which I have found in more than a dozen of these stars). But on July 13, the evening of the last observation possible, the three bands had nearly disappeared, while the spectrum of the nucleus was become much brighter.

"Must we therefore conclude that the incandescent gas, carburetted hydrogen or other, to which these bands are due, disappear as the comet is developed, giving place to the light, proper or borrowed, of the nucleus? The observation of the new comet elucidates this. It rises rapidly from the horizon, in the same region of the sky where Coggia's comet descended to disappear, too quickly, below the horizon. Now on June 24 its spectrum, observed with the same instrument as was used in 1874, was reduced nearly to a continuous ribbon given by the nucleus ; the nebulosity only gave a broad and very pale band, well terminated on the more refrangible side, diffuse on the other ; the other bands of comets did not exist, or at least one could only suspect their existence in the neighbourhood of the nucleus. But yesterday (June 26) the comet was already far from the horizon, and when the sky was pure the three bright bands appeared with great distinctness. The green band especially was bright, longer than the two others, and distinctly limited on the less refrangible side (wave-length 516). On this side it seeemed bordered by a dark space, as in the spectrum of Coggia's camet. As in the latter the red is the only colour pretty visible in the spectrum of the nucleus, and it is slightly dilated. The ulterior observations will show whether these bands will continue to develop. We are put on our guard, in any case, against the effect resulting from difference of altitude of the comet.

"The total quantity of light given by the head of the comet is considerable, and many persons have tried to compare it to a star of the first magnitude. In reality its intrinsic brightness is very slight. I had occasion last night, by slightly displacing the telescope, to look at the spectrum of a star of fifth or sixth magnitude ; the line of light produced was at least as bright as the spectrum of the nucleus."

Admiral Mouchez having put at M. Thollon's disposal the 14-in. equatorial of the Observatory, the latter made some spectroscopic observations of the comet on the nights of June 24, 25, and 26, with the following results :—

"The nucleus of the comet gives a pretty bright continuous spectrum, on which one can distinguish neither bands nor lines. The nebulosity surrounding the nucleus gives three bands which are detached on a continuous spectrum. One of them is very visible ; the others are faint. Their position has been measured with great care. The measurements, repeated a large number of times, are more concordant than I could have hoped.

"The spectrum of bands furnished by the comet so resembles that given by the blue spirit flame that I consider them identical. This identity does not result merely from the aspect of the bands and their ratios of intensity, but also from their absolute position. The spectrum of the comet is, then, the spectrum of carbon or of one of its compounds. The sole difference I have met with is that the violet band given by alcohol is not seen in the spectrum of the comet ; the absorption of the atmosphere suffices to account for this difference." M. Thollon is making further observations.

NOTES

THE "Chelini-Memorial" volume takes the form of "Collectanea Mathematica," and is issued under the joint editorship of Professors Cremona and Beltrami (U. Hoepli, Milan). It contains thirty papers by twenty-eight sufficiently representative mathematicians, of whom sixteen are well-known Italian writers; of the remaining twelve, five (MM. Geiser, Kronecker, Reye, Schläfli, and Wolf) write in German, four (MM. Borchardt, Darboux, Hermite, and Mannheim) write in French. Of the three English contributors, Messrs. Cayley (on a differential equation), Hirst (on the complexes generated by two correlative planes) write in English, and Prof. H. J. S. Smith discourses in Latin "de fractionibus quibusdam continuis." There is a likeness of Chelini.

THE Government have appointed the Earl of Crawford and Balcarres Chief Commissioner, and Sir Charles T. Bright, Prof. D. E. Hughes, F.R.S., and Lieut.-Col. C. E. Webber, R.E., as Commissioners at the forthcoming Electrical Exhibition and Congress at Paris.

STUDENTS of Cretaceous geology will regret to hear that Griffiths, the well-known "fossil man" of Folkestone, has been disabled for many months by rheumatism, brought on by constant exposure during the past twenty-five years, in which he has daily extracted from the wet and slippery tract of Gault clay in Eastweir Bay the remarkable series of mollusca with their pearly nacre preserved, plants, corals, crustacea, and reptilian remains that ornament not only the private collection of those who make

the Gault a subject of special study, but the national museums both of this country and of the New World. In addition to collecting by far the most perfect specimens of the Gault fauna and flora hitherto obtained, Griffiths has rendered an important service to science in carefully noting the bed or horizon from which each specimen was procured, which identification has formed the groundwork of the divisions which English geologists have been able to make in the Gault, and the correlation of these zones by M. Barrois and others with deposits occurring on the Continent. In consideration of these results, carried out by a working man under the difficulties of a struggle for life with circumstances, and the rigorous weather of the English Channel coast, it has been thought advisable to appeal to English geologists to raise a small fund which should render it unnecessary for work to be carried on when dangerous to health, and to tide him over present difficulties; towards this end a committee has been formed, consisting of Mr. W. Topley, F.G.S., Mr. F. G. H. Price, F.G.S., Prof. Boyd Dawkins, M.A., F.R.S., and Mr. C. E. De Rance, F.G.S., with Mr. F. G. H. Price of Messrs. Childs' Bank, Temple Bar, as treasurer, who will gladly receive subscriptions.

ACCORDING to annual custom, the specimens added to the Museum of the College of Surgeons are now exhibited in the Council Room of the College, and will remain for inspection until the 13th inst., when they will be distributed in their proper places in the Museum. The number of additions, both to the Pathological and Physiological series, appears to be unusually large. Among the former we notice a novel feature in a collection illustrating vegetable pathology and teratology, prepared by Mr. S. S. Thattock; also a fine series showing the characteristic lesions produced by Indian dysentery, presented by Sir Joseph Fayrer. To the physiological, or rather zootomical, series the inhabitants of the Zoological Society's Gardens have yielded their usual quota of mortal remains, and almost every portion of the internal anatomy of the manatee, the external appearance of which was so familiar, during seventeen months, to the visitors of the Brighton Aquarium, can now be seen, neatly dissected and displayed in spirit. There are also some very beautiful preparations of human anatomy. Among the most striking objects shown in the osteological collection are a magnificent skull of a sea-elephant and a fine articulated skeleton of a sea-lion, both of which were obtained for the museum by the secretary to the Falkland Islands Company, Mr. F. Coleman. A series of skulls and skeletons of Veddahs, the aboriginal inhabitants of Ceylon, have been contributed by Mr. W. R. Kynsey. It is mentioned in Prof. Flower's report that the whole of the Barnard Davis collection, which numbers 1630 specimens, mostly crania, have been cleaned, arranged in the museum, and re catalogued during the year, and are now available for study. The report also refers to the appointment of an additional assistant curator, having special duties in the pathological department of the museum.

THE Anniversary Meeting of the Sanitary Institute of Great Britain will be held at the Royal Institution, Albemarle Street, on Thursday, July 14, at 3 p.m. An address will be delivered by the Chairman of Council, Prof. S. F. B. F. De Chaumont, M.D., F.R.S., entitled, "Modern Sanitary Science;" and the medals and certificates awarded to the successful exhibitors at the Exhibition at Exeter in 1880 will be presented.

AT a meeting of the joint committee of the Edinburgh Town Council, the Highland Society, and the Scotch Fisheries Improvement Association, held in Edinburgh on the 29th ult., a strong opinion was expressed in favour of the proposal to hold a Fisheries Exhibition in Edinburgh, of making it an international exhibition open to all countries, and of having it, if possible, in the Waverley Market, in April next year. An Executive Committee was appointed.

THE University College, Nottingham, was opened on Thursday last, July 30, by His Royal Highness the Duke of Albany, in a brief ceremony. At a luncheon afterwards, given in the Albert Hall, the Duke made a thoughtful speech on the nature and aims of the Institution. We hope to return to the subject.

BELGIUM (according to *L'Électricité*) will take a considerable share in the forthcoming Paris Exhibition. The number of exhibitors is over a hundred. Among other exhibits the Jaspar regulator and the *lampe-soleil* of MM. Clerc and Bureau will compete prominently with the numerous other systems of electric lighting. Of telephone-specialists M. de Locht-Labye will show his pan-telephone in action, and M. Navez's researches will doubtless receive due attention. Meteorological instruments will be specially represented by those of M. Van Ryssel-berghe, with which the indications of a meteorograph at a distance are registered directly at Brussels Observatory. Col. Leboulangé will exhibit ballistic apparatus of special type, and his ingenious dromometer and dromoscope for controlling the velocity of trains, especially at dangerous points. Various kinds of telegraph wire will be shown, and a special interest will attach to the wires of phosphor bronze from the works of M. Montefiore Lévy; these wires have a conductivity four times that of iron, and their tenacity being also much greater, lines may be made in which the wire section is greatly reduced. An official and special catalogue is being prepared for the Belgian section it will comprise an introductory notice by M. Bonneux on electrical science and industry in that country.

A PRIVATE visit was paid on Saturday last to the Channel tunnel experimental works by Sir E. Watkin, M.P. (chairman of the South-Eastern Railway Company), and a large party of scientific and other gentlemen. Very satisfactory progress was found to have been made at Abbot's Cliff since the last visit. The heading has now been advanced a total length of nearly half a mile. The tunnel is kept well free of water, and a good average rate of work is maintained. The work at the new shaft at Shakespeare's Cliff promises to be even more satisfactory. A very superior boring machine is used, and a more powerful engine is being fitted up to drive it.

THE first general meeting of the Society of Chemical Industry was held on the 28th ult. in the hall of the Institute of Civil Engineers, Prof. Roscoe presiding. After the President's address papers were read on "Recent Legislation on Noxious Gases," by Mr. E. K. Muspratt; "The Brewing of Lager Beer," by Prof. C. Graham; and "Mechanical Furnaces," by Mr. James Mactear. This promising Society already numbers 300 members.

THE Council of the University of Dublin have nominated Valentine Ball, M.A., of the Geological Survey of India, to the Professorship of Geology in the University of Dublin; this nomination however requires to be confirmed by a vote of the Board of Trinity College, Dublin. There were seven candidates.

M. W. DE FONVIELLE, editor of *L'Électricité*, and M. Lippmann, one of his contributors, made a balloon ascent on July 2, shortly after midnight. The descent took place near Rambouillet at a quarter past five, the distance traversed being 48 kilomètres. The balloonists carried with them a small Planté accumulator with a special safety electric lamp constructed by Trouvé, composed of a platinum wire inclosed in a glass tube. While the apparatus did not weigh more than 1 kilog. it gave sufficient light for reading the barometer and thermometer, and writing notes with accuracy. A special luminous compass for aëronauts will be constructed on this plan and sent to the Exhibition of Electricity.

THE number of Chinese in the United States is now proved by the census to be very much less than has been commonly sup-

posed. It is only 105,717 (California possessing 75,122). It is true that the numbers have nearly doubled within the last ten years, but even at that rate they are not of a nature to cause any alarm such as appears to have been felt in some quarters. In the Eastern States the Chinese element is quite inappreciable among the foreign elements of population; New York contains but 942, Massachusetts 256, Illinois 214, &c.

THE scheme, earnestly advocated by the late Sir Thomas Moncreiffe, for providing Perth and Perthshire with a satisfactory natural history museum is now being realised, a handsome building in the Scottish baronial style having been built in South Tay Street with the funds provided. The ground floor contains a lecture-room, library, and laboratory or work-room, and the museum occupies the upper part of the building. To the rear a piece of ground has been secured on which additions more than doubling the accommodation could be built, but meantime the ground is to be used as a garden, in which all the more notable Perthshire plants will be grown. Access from the building can be easily obtained to two much larger lecture-halls than that in the museum, if necessary. The museum is to be strictly confined to the natural history, botany, and geology of Perthshire, excepting a small type collection, and should the project be rightly carried out (by the Perthshire Society of Natural Science) one of the most interesting and valuable local collections should thus be formed. The cost of the building (which is described in the current number of the *Scottish Naturalist*) has been upwards of 1,700*l*., all of which has been subscribed. A further amount is required for furnishing, &c., and for this end a bazaar is to be held about the end of the year.

THE Literary and Antiquarian Society of Perth propose an extension of their Museum in Perth, the only one hitherto existing in the county, by building, at an estimated cost of 3000*l*., a hall behind the present museum, mainly to accommodate the zoological collection (which comprises some 800 vertebrate and 2000 invertebrate forms). It is designed to present in this room a gradational view of animal life. A bazaar in aid of the proposed extension will be held on October 5 and 7. Subscriptions and donations may be sent to Mr. D. Hepburn, solicitor, 12, Charlotte Street, Perth, or to Dr. Bower, R.N., Montreal College, Perth.

AT the concluding meeting of the session of the Geologists' Association on Friday, July 1, a costly timepiece and ornaments were presented to Mr. J. Logan Lobley with the following address:—"The accompanying timepiece and ornaments are presented by the members of the Geologists' Association of London to their treasurer, J. Logan Lobley, Esq., F.G.S., F.R.G.S., in recognition of the valuable services he has rendered to the Association as Honorary Secretary, 1871–74, and Honorary Editor, 1871-81, and of the active interest he has always taken in its welfare and progress."

A BRANCH of the Baturite railway in Brazil has a gradient, which is probably the steepest in the world worked with a locomotive acting by simple adherence. This gradient is about 10 per cent., or 90 to 100 millimetres per metre. The line (described in last week's *La Nature*) is of narrow gauge, and extends from the port of Alfandega on the Atlantic to the town of Fortaleza, about 2 kilometres distance. The locomotive is from the Baldwin works in the United States; it has an adherent weight of 20,000 kilograms, and draws three loaded goods waggons or a single passenger car of the American type at a velocity of 20 kilom. per hour. By always limiting the weight to be drawn to an amount considerably under that of the engine, the regularity of the service on this line has been ensured during the two years it has been in use.

THE first part of a fourth edition of Griffith and Henfrey's useful Micrographic Dictionary has appeared. It is expected that the issue will be completed in twenty-one of these monthly parts, which will include important additions representing recent scientific progress. This work is known to aim especially at helping the microscopic observer to discover what any object is which may be presented to him, and by the aid of the Bibliography to refer to more extensive treatises for further details. A system is also adopted by which one is guided to a general knowledge of particular departments of science. There is an introduction on the use of the microscope. Dr. Griffith is assisted in the editing by the Rev. Mr. Berkeley and Prof. Rupert Jones.

WE have received an excellent specimen number of a new French engineering journal entitled *L'Ingénieur*. The proprietors have acquired the right of reproduction, in France, of articles from our contemporary, *Engineering*, of which articles the new pager will largely consist.

M. FERDINAND DE LESSEPS has been elected president of the Société de Géographie of Paris.

THERE was recently landed at Marseilles a magnificent zebra which the King of Choa, Menelick II., has sent as a present to the President of the French Republic. This zebra, called the *Semaphore*, has been brought from Abyssinia by two Marseillais. The Société de Géographie, to which it was addressed from Aden, has intrusted it to the Marseilles Zoological Garden.

THE evening *fête* of the Royal Horticultural Society was held on the 28th ult. in the Gardens at South Kensington. Coloured lamps were disposed about the lawns, and here and there the cool plash of fountains was to be heard. The Siemens and Maxim electric lights were placed in the upper part of the Gardens, and in the lower part were two tents illuminated by the Brush electric light, and containing the plants of a flower-show, which continued next day. Brilliant effects were obtained with coloured fires behind the trees and the spray of the fountains.

THE Berwickshire Naturalists' Club commemorated the fiftieth year of its existence on the 29th ult. by a meeting at Grant's House, largely attended by members. Excursions were made to different places of interest in the locality, and before dinner Mr. James Hardy, joint secretary, was presented with a valuable microscope and 110*l*. in recognition of his long and arduous services. The Rev. Thomas Brown, Edinburgh, one of the oldest members of the club, presided.

FROM the *Colonies and India* we learn that the Meteorological Conference lately held at Sydney has agreed to a division of Australia into meteorological districts or aspects, to form the basis of weather telegrams and warnings. A cipher code has been arranged for weather telegrams to New Zealand, and the Queensland Government is to be asked to co-operate in the matter.

FROM an approximate summary of this year's census of Victoria, which has just been received from Mr. H. H. Hayter, the Government statist, it appears that the total population of the colony, including Chinese and Aborigines, is now 855,796, against 731,528 in 1871. The Chinese number 11,796, and the aborigines 768, the former showing a decrease of 6299 and the latter of 562.

THE additions to the Zoological Society's Gardens during the past week include a Purple-faced Monkey (*Semnopithecus leucoprymnus*) from India, presented by Lieut. W. V. Anson, R.N.; a Daubenton's Curassow (*Crax daubentoni*) from Venezuela, a Hawk's-billed Turtle (*Chelone imbricata*) from the East Indies, presented by Capt. King; a Rough Terrapin (*Clemmys punctularia*) from Trinidad, presented by Mr. Lachmere Guppy; ten Green Turtles (*Chelone viridis*) from Ascension presented by

Messrs. Weil Brothers; two Yellow Snakes (*Chilobothrus inornatus*) from Jamaica, presented by Mr. Chas. B. Masse; a Squirrel Monkey (*Chrysothrix sciurea*) from Demerara, a Military Macaw (*Ara militaris*) from South America, deposited; a Wapiti Deer (*Cervus canadensis*), two Hybrid Paradoxures (between *Paradoxurus leucomystax* and *P. stigmaticus*), born in the Gardens.

GEOGRAPHICAL NOTES

THE Geographical Society's *Proceedings* this month are chiefly occupied with the anniversary meeting at the end of May, and everything said and done on that occasion seems to have been carefully recorded. The only paper given is that by Mr. Minchin on Eastern Bolivia and the Gran Chaco, and it is illustrated by one of the best maps which the Society has published for some time. The geographical notes supply intelligence of matters which have not hitherto attracted notice in this country, though one at least is of considerable importance. We allude to the recent exploration of the Beni River by Dr. Heath of Wisconsin, which is a distinct addition to our knowledge of the Amazons' system. When fuller details, including Dr. Heath's observations for latitude and longitude, have come to hand, it will be for the first time possible to fix the precise position of the mouth of the magnificent river, best known as the Madre de Dios, which, until a few years ago, was believed by geographers to be a feeder of the Purus instead of the Madeira. Some information is also given as to the progress of exploration between the Rovuma and Lake Nyassa.

M. ABBÉ DESGODINS, who is well known for the excellent geographical work he has done in Eastern Tibet, contributes to *Les Missions Catholiques* the first part of some interesting notes on the marriage and other domestic customs of the Tibetans.

IT may be interesting to mention that in last week's number of the Society of Arts' *Journal* some useful notes are published on gums, resins, and waxes, which Mr. C. G. Warnford Lock has compiled from the journals of recent travellers. Especial prominence is given to india-rubber and the curious fossil resin known as gum copal.

M. ROUX has been intrusted by the Minister of Public Instruction and Fine Arts at Paris with a scientific mission to Tunis, and he has already begun the exploration of the region near the Constantine province of Algeria. He will afterwards undertake topographical and botanical investigations in the country between the Mejerba Valley and Cape Bon peninsula. Under the auspices of the same department M. Lantz is engaged in making natural history collections in some of the unknown parts of Madagascar.

M. BOULANGIER, a French Government engineer, has lately been engaged on a surveying expedition in Indo-China, in connection with the project for a railway. He went by a somewhat circuitous route from the frontier of French Cochin-China across Cambodia to Siam, made an especial study of the basin of the Tonlé-Sap, or Great Lake, which, according to his view, was formerly the head of the Gulf of Siam. The mountains south of Pursat must, therefore, have been an island, but the intervening low country becoming filled up they were joined to the mainland. As the result of his observations, M. Boulangier thinks that the Tonlé-sap will gradually silt up.

WE hear that Mr. Dorward, of the China Inland Mission, returned to Shanghai early in April from a five-months' journey in the province of Hunan. He is the only Protestant missionary who has ever traversed the route by which he returned from Hung-kiang to the neighbourhood of the Tung-ting Lake. Mr. Dorward also paid a flying visit to Kwei-yang-fu, the capital of the Kweichow province.

A PROMINENT paragraph in the *Standard* of last Saturday states that the "Geographical Society has received some interesting details of the fate of the Wybrants [*i.e.* Capt. Phipson-Wybrants] Expedition in Mozambique." We understand that there is absolutely no foundation for this statement, and the only effect of it is to inflict cruel disappointment on the relatives of the deceased members of this unfortunate expedition, regarding whose last days detailed particulars are anxiously awaited. Whether these will ever be known is, we fear, more than doubtful. The expedition was a purely private undertaking on the part of the late Capt. Phipson-Wybrants, and though he was aided with a loan of instruments, he was in no sense sent out by the Geographical Society.

THE Brazilian Section of the Lisbon Geographical Society, which was established a short time back, has commenced the publication at Rio de Janeiro of a periodical under the title of *Revista Mensal*. Dr. F. Mendes de Almeida is the editor-in-chief.

THE Bengal Asiatic Society have issued as part of their *Journal* Mr. Longworth Dawes' sketch of the Northern Balochi language, containing a grammar, vocabulary, and specimens of the language.

CIVILISATION AND BARBARISM IN SOUTH AFRICA

AT a meeting of the Anthropological Institute on the 28th ult. Sir Bartle Frere gave a lecture treating of the results of contact of civilised with uncivilised races in South Africa. The first part of the lecture dealt with the historical results of such contact in other countries, and the lecturer, after a sketch of the recent history and present condition of the various South African races, maintained that on the whole natives have increased in numbers as well as improved in physique and in intellectual status by contact with Europeans, and that there was also little real reason to doubt an improvement in moral status. The conditions required to raise and improve races like the Kaffirs were (1) a strong imperial government; (2) freedom from slavery and equality before the law. To secure these two requisites it was necessary (3) to determine whether the standard of moral and social progress shall be that of the European or that of the native races; (4) education according to English standards. The general results arrived at in the lecture were summarised in the following propositions:—(1) It is possible for the civilised to destroy by war the savage races, to expel, or repel, or turn them aside in their migrations; (2) proximity of civilised and savage races has led or is leading to the decay and probable extinction of the Bushman race. But this result is doubtful in the case of the Hottentot races, and is certainly not taking place with regard to the Bantu or Kaffir races; (3) the changes consequent on proximity of civilised and uncivilised races are an approximation to the European type of civilisation; (4) the essentials to such approximation are (*a*) a pax Romana or Anglicana, bringing with it (*b*) protection of life and property, which involves equality before the law, individual property in land, abolition of slavery, abolition of private rights of making war and of carrying arms without the authority of the supreme ruler; (*c*) power of local legislation on European principles, with a view to secure education in the arts of civilised life, taxation sufficient for state purposes, restrictions on the use of intoxicating substances, as measures essential to the full attainment of any one of the preceding objects.

INDIGO AND ITS ARTIFICIAL PRODUCTION

MORE than eleven years ago the speaker had the pleasure of bringing before this audience a discovery in synthetic chemistry of great interest and importance, viz. that of the artificial production of alizarine, the colouring substance of madder. To-day it is his privilege to point out the attainment of another equally striking case of synthesis, viz. the artificial formation of indigo. In this last instance, as in the former case, the world is indebted to German science, although to different individuals, for these interesting results, the synthesis of indigo having been achieved by Prof. Adolf Baeyer, the worthy successor of the illustrious Liebig in the University of Munich. Here then we have another proof of the fact that the study of the most intricate problems of organic chemistry, and those which appear to many to be furthest removed from any practical application, are in reality capable of yielding results having an absolute value measured by hundreds of thousands of pounds.

In proof of this assertion, it is only necessary to mention that the value of the indigo imported into this country in the year 1879 reached the enormous sum of close on two millions sterling, whilst the total production of the world is assessed at twice that amount; so that if, as is certainly not impossible, artificial indigo can be prepared at a price which will compete with the native product, a wide field is indeed open to its manufacturers.

[1] Lecture delivered at the Royal Institution, Friday, May 27, 1881, by Prof. H. E. Roscoe, LL.D., F.R.S.

Indigo, as is well known, is a colouring matter which has attracted attention from very early times. Cloth dyed with indigo has been found in the old Egyptian tombs. The method of preparing and using this colour is accurately described by both Pliny and Dioscorides, and the early inhabitants of these islands were well acquainted with indigo, which they obtained from the European indigo plant, *Isatis tinctoria*, the woad plant, or pastel. With this they dyed their garments and painted their skins. After the discovery of the passage to India by the Cape of Good Hope, the eastern indigo, derived from various species of *Indigofera*, gradually displaced woad as containing more of the colouring matter. But this was not accomplished without great opposition from the European growers of woad; and severe enactments were promulgated against the introduction of the foreign colouring matter, an edict condemning to death persons "who used that pernicious drug called devil's food," being issued by Henry the Fourth of France. The chief source of Indian indigo is the *Indigofera tinctoria*, an herbaceous plant raised from seed which is sown in either spring or autumn. The plant grows with a single stalk to a height of about three feet six inches, and about the thickness of a finger. It is usually cut for the first time in June or July, and a second or even a third cutting obtained later in the year. The value of the crop depends on the number of leaves which the plant puts forth, as it is in the leaves that the colouring principle is chiefly contained. Both the preparation of the colouring matter from the plant, and its employment as a dyeing agent, are carried on at the present day exactly as they have been for ages past. The description of the processes given by Dioscorides and Pliny tally exactly with the crude mode of manufacture carried on in Bengal at the present day.

Dioscorides says:—"Indigo used in dyeing is a purple-coloured froth formed at the top of the boiler; this is collected and dried by the manufacturer; that possessing a blue tint and being brittle is esteemed the most."

The identity of the blue colouring matter of woad and that of the Bengal plant was proved by Hellot, and by Planer and Trommsdorff at the end of the last century. These latter chemists showed that the blue colour of the woad can be sublimed, and thus obtained in the pure state, a fact which was first mentioned in the case of indigo by O'Brien in 1789, in his treatise on calico printing. Indigo thus purified is termed indigotin. It has been analysed by various chemists, who ascertained that its composition may be most simply expressed by the formula C_8H_5NO.

Concerning the origin of indigo in the leaves of the *Indigofera*, various and contradictory views have been held. Some have supposed that blue indigo exists ready formed in the plant; others, that white indigo is present, which on exposure to air is converted into indigo-blue. Schunck has, however, proved beyond doubt that the woad plant (*Isatis tinctoria*), the *Indigofera tinctoria* of India, and the Chinese and Japanese indigo plant (*Polygonum tinctorium*) contain neither indigo-blue nor white indigo ready formed. By careful treatment the leaves of all these indigo-yielding plants can be shown to contain a colourless principle termed indican, and that this easily decomposes, yielding a sugar-like body and indigo-blue. That white indigo is not present in the leaves is proved by the fact that this compound requires an alkali to be present in order to bring it into solution, whereas the sap of plants is always acid. The decomposition is represented by Schunck as follows:—

$$\underset{\text{Indican.}}{C_{26}H_{31}NO_{17}} + 2H_2O = \underset{\text{Indigotin.}}{C_8H_5NO} + \underset{\text{Indiglucin.}}{3C_6H_{10}O_6}.$$

So readily does this change from indican to indigo take place, that bruising the leaf or exposing it to great cold is sufficient to produce a blue stain. Even after mere immersion in cold alcohol or ether, when the chlorophyll has been removed the leaves appear blue, and this has been taken to show the pre-existence of indigo in the plant. But these appearances are deceptive, for Schunck has proved that if boiling alcohol or ether be used, the whole of the colour-producing body as well as the chlorophyll is removed, the leaves retaining only a faint yellow tinge, whilst the alcoholic extract contains no indigo blue, but on adding an acid to this liquid the indican is decomposed and indigo-blue is formed.

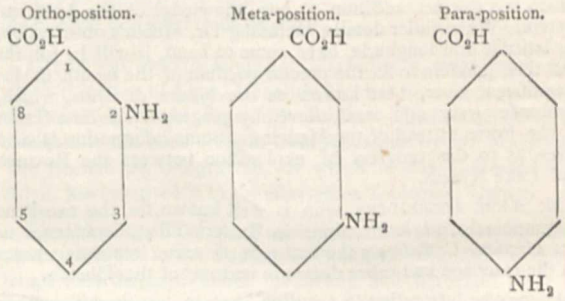
What now was the first step gained in our knowledge concerning the constitution of indigo, of which the simplest formula is C_8H_5NO?

Step No 1.—This was made so long ago as 1840, when Fritsche proved that aniline, $C_6H_5NH_2$, can be obtained from indigo. The name for this now well known substance is indeed derived from the Portuguese "anil," a word used to designate the blue colour from indigo. This result of Fritsche's is of great importance, as showing that indigo is built up from the well-known benzene ring C_6H_6, the skeleton of all the aromatic compounds, and moreover that it contains an amido group.

Step No. 2 was also made by Fritsche in the following year, when, by boiling indigo with soda and maganese dioxide, he obtained ortho-amido-benzoic acid, or, as he then termed it, anthranilic acid. The following is the reaction which here occurs:—

$$\underset{\text{Indigo.}}{C_8H_5NO} + O + 2H_2O = \underset{\text{Ortho-amido-benzoic acid.}}{C_7H_5NH_2O_2} + CH_2O_2.^1$$

What light does this fact shed upon the constitution of indigo? It shows (1) that one of the eight atoms of carbon in indigo can be readily separated from the rest; (2) that the carboxyl and the amido-group are in neighbouring positions in the benzene ring, viz. 1 and 2. For we have three isomeric acids of the above composition.



Step No. 3.—The next advance of importance in this somewhat complicated matter is the discovery by Erdmann and Laurent independently, that indigo on oxidation yields a crystalline body, which, however, possesses no colouring power, to which they gave the name of isatin.

$$\underset{\text{Indigo.}}{C_8H_5NO} + O = \underset{\text{Isatin.}}{C_8H_5NO_2}.$$

Step No. 4.—The reverse of this action, viz. the reduction of isatin to indigo, was accomplished by Baeyer and Emmerling in 1870 and 1878, by acting with phosphorus pentachloride on isatin, and by the reducing action of ammonium sulphide on the chloride thus formed.

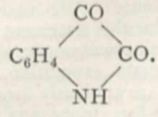
Understanding now something of the structure and of the relationships of the body which we wish to build up, let us see how this edifice has, in fact, been reared. Three processes have been successfully employed for carrying out this object. But of these three only one is of practical importance.

For the sake of completeness, let us, however, consider all three processes, although Nos. 1 and 2 are at present beyond the pale of practical schemes.

These three processes have certain points in common. (1) They all proceed from some compound containing the benzene nucleus. (2) They all start from compounds containing a nitrogen atom. (3) They all commence with an ortho-compound.

They differ from one another; inasmuch as process No. 1 starts from a compound containing seven atoms of carbon (instead of eight), and to this, therefore one more atom must be added; process No. 2, on the other hand, starts from a body which contains exactly the right number (eight) of carbon atoms; whilst No. 3 commences with a compound in which nine atoms of carbon are contained, and from which, therefore, one atom has to be abstracted before indigo can be reached.

Process No. 1 (Kekulé—Claissen and Shadwell).—So long ago as 1869 Kekulé predicted the constitution of isatin, and gave to it the formula which we now know that it possesses, viz.



Following up this view, Claissen and Shadwell, two of Kekulé's

[1] Bottinger, *Deut. Chem. Ges.* 1877, i. 269.

pupils, succeeded in preparing isatin, and, therefore, now indigo, from ortho-nitro-benzoic acid.

The following are the steps in the ascent :

1. Ortho-nitro-benzoic acid acted on by phosphorus pentachloride yields the chloride $C_6H_4(NO_2)COCl$.
2. This latter heated with silver cyanide yields the nitril $C_6H_4(NO_2)CO.CN$.
3. On heating this with caustic potash it yields ortho-nitrophenylglyoxylic acid, $C_6H_4(NO_2)CO.CO_2H$.
4. This is converted by nascent hydrogen into the amido-compound $C_6H_4(NH_2)CO.CO_2H$.
5. And this loses water and yields isatin, $C_6H_4NH.CO.CO$.

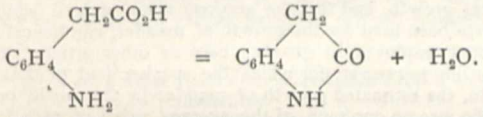
(Q. E. D.)

The reasons why this process will not work on a large scale are patent to all those who have had even bowing acquaintance with such unpleasant and costly bodies as phosphorus pentachloride or cyanogen.

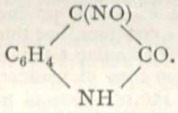
Process No. 2.—Baeyer's (1878) synthesis from ortho-nitrophenylacetic acid.

This acid can be obtained synthetically from toluol, and it is first converted into the amido-acid, which, like several ortho compounds, loses water, and is converted into a body called oxindol, from which isatin, and therefore indigo, can be obtained. The precise steps to be followed are :—

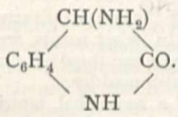
1. Ortho-amido-phenylacetic acid yields oxindol :



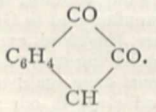
2. This on treatment with nitrous acid yields nitrosoxindol :



3. This again with nascent hydrogen gives amidoxindol :



4. Which on oxidation gives isatin,



(Q.E.D.)

This process, the feasibility of which had also been foreseen by Kekulé, is however not available as a practical scheme for various reasons.

Process No. 3.—This may be called the manufacturing process, and was also proposed by Baeyer. It starts from cinnamic acid, a substance contained in gum benzoin, balsam of Peru, and some few other aromatic bodies. These sources are, however, far too expensive to render this acid thus obtained available for manufacturing purposes. But Bertagnini, in 1856, had obtained cinnamic acid artificially from oil of bitter almonds, and other processes for the same purpose have since been carried out. Of these, that most likely to be widely adopted is the following practical modification by Dr. Caro of Mr. Perkin's beautiful synthesis of cinnamic acid :—

1. $C_6H_5CH_3 + 4Cl = C_6H_5CHCl_2 + 2HCl$.
   Toluene. Benzylene dichloride.
2. $C_6H_5CHCl_2 + 2CH_3.CO.O.Na =$
   Benzylene dichloride. Sodium acetate.

$$C_6H_5CH{=}CH.CO.OH + 2NaCl.$$
Cinnamic acid.

But why did Baeyer select this nine carbon acid from which to prepare indigo? For this he had several reasons. In the first place, it had long been known that all indigo compounds when heated with zinc dust yield indol, C_8H_7N, a body which stands therefore to indigo in the same relation as anthracene to alizarin, and Baeyer and Emmerling had so long ago as 1869 prepared this indol from ortho-nitro-cinnamic acid thus :

$$C_8H_6(NO_2)CO_2H = C_8H_7N + O_2 + CO_2.$$

Secondly, the ortho-nitro-cinnamic acid required (for we must remember that indigo is an ortho-compound and also contains nitrogen) can be readily prepared from cinnamic acid, and this itself again can be obtained on a large scale. Thirdly, this acid readily parts with one atom of carbon, and thus renders possible its conversion into eight-carbon indigo.

The next steps in the process are (3) the formation of ortho-nitro-cinnamic acid, (4) the conversion of this into its dibromide, (5) the separation from this of the two molecules of hydrobromic acid, giving rise to ortho-nitro-phenyl-propiolic acid, and (6), and lastly, the conversion of this latter into indigo by heating its alkaline solution with grape sugar, xanthate of soda, or other reducing agent. These reactions are thus represented :—

3. $C_6H_5CH{=}CHCOOH$ $C_6H_4(NO_2)CH{=}CH.COOH$.
   Cinnamic acid yields Ortho-nitro-cinnamic acid.

In this process the para acid is also obtained, and as this is useless for the manufacture of indigo, it has to be removed. This is effected by converting the acids into their ethyl ethers, which, possessing different degrees of solubility, can be readily separated from one another :—

4. This is next converted into the dibromide

$$C_6H_4(NO_2)CHBr.CHBrCOOH.$$

5. And by careful treatment with caustic soda this yields ortho-nitro-phenyl-propiolic acid, thus :—

$$C_6H_4(NO_2)CHBrCHBrCOOH + 2NaOH = C_6H_4(NO_2)C_2.COOH + 2NaBr + 2H_2O.$$

6. $n[C_6H_4(NO_2)C_2.COOH + H_2 = C_8H_5NO + CO_2 + H_2O]$.
   Ortho-nitro-phenyl-propiolic acic. Indigotin.

(Q. E. D.)

The last of these reactions is in reality not so simple as the equation indicates. For only about 40 per cent. of indigo is obtained, whereas according to theory 68 per cent. should result. Indeed although, as we have seen, indigo can be prepared by these three methods, chemists are as yet in doubt as to its molecular weight, the probability being that the molecule of indigo contains twice 16 atoms of carbon, or has the formula $4(C_8H_5NO)$ or $C_{32}H_{20}N_4O_4$. Still it must be remembered that according to Sommaruga the vapour density of indigo is 9·45, a number corresponding to the simpler formula $C_{16}H_{10}N_2O_2$.

The artificial production of indigo may even now be said to be within measurable distance of commercial success, for the ortho-nitro-phenyl-propiolic acid, the colourless substance which on treatment with a reducing agent yields indigo-blue, is already in the hands of the Manchester calico printers, and is furnished by the Baden Company for alkali and aniline colours at the price of 6*s*. per lb. for a paste containing 25 per cent. of the dry acid.

With regard to the nature of the competition between the artificial and the natural colouring matters it is necessary to say a few words. In the first place, the present price at which the manufacturers are able to sell their propiolic acid is 50*s*. per kilo. But 100 parts of this can only yield, according to theory, 68·58 parts of indigo-blue, so that the price of the artificial (being 73*s*. per kilo.) is more than twice that of the pure natural colour. Hence competition with the natural dye-stuff is not to be thought of until the makers can reduce the price of dry propiolic acid to 20*s*. per kilo., and also obtain a theoretical yield from their acid. This may, or it may not, be some day accomplished, but at present it will not pay to produce indigo from nitro-phenyl-propiolic acid. Nevertheless a large field lies open in the immediate future for turning Baeyer's discovery to practical account. It is well known that a great loss of colouring matter occurs in all the processes now in use for either dyeing or printing with indigo. It has already been stated that a large percentage of indigo is lost in the "cold vats" in the sediment. Another portion is washed off and wasted after the numerous dippings, whilst in order to produce a pattern much indigo must be destroyed before it has entered into the fibre of the cloth. Moreover, the back of the piece is uselessly loaded with colour. In the processes of printing with indigo the losses are as great, or even greater, and, in addition, such considerable difficulties are met with, that only a few firms (Potter, Grafton in Manchester, and Schlieper in Elberfeld) have been successful in this

process. But a still more important fact remains, that no printing process exists in which indigo can be used in combination with other colours in the ordinary way, or without requiring some special mode of fixing after printing. Hence it is clear that the weak points of natural indigo lie in the absence of any good process for utilising the whole of its colouring matter, and in the impossibility, or at any rate great difficulty, of employing it in the ordinary madder styles of calico printing. Such were the reasons which induced the patentees to believe that although the artificial dye cannot be made at a price to compete with natural indigo for use in the ordinary dye-beck, it can even now be very largely used for styles to which the ordinary dye-stuff is inapplicable.

To begin with, Baeyer employed (Patent 1117) grape sugar as a reducing agent. The reduction in this case does not take place in the cold, and even on long standing only small traces of indigo are formed, but if heated to 70° or upwards the change takes place. Unfortunately this production of indigo-blue is rapidly followed by its reduction to indigo-white, and it is somewhat difficult in practice to stop the reaction at the right moment. But Dr. Caro of Mannheim found that sodium xanthate is free from many of the objections inherent to the glucose reduction process, inasmuch as the reaction then goes on in the cold. Moreover, he finds that the red isomeride of indigo-blue, Indirubin, which possesses a splendid red colour, but has little or no tinctorial power, is produced in less quantity in this case than when glucose is employed. On this cloth, alumina and iron mordants may be printed, and this afterwards dyed in alizarine, &c., or this colouring matter may also be printed on the cloth and the colour fixed by moderate steaming without damage to the indigo-blue. This process is now in actual use by printers both in England and on the Continent, so that, thanks especially to the talent and energy of Dr. Caro, Bayer's discovery has been practically applied within the short space of twelve months of its conception. Operations on a manufacturing scale have been successfully carried on in the Baden Soda and Aniline Works at Ludwigshafen for the last two months, and the directors see no reason why they should not be able to supply any demand, however great, which may be made for ortho-nitrophenyl-propiolic acid.

The proper way of looking at this question at present is, therefore, to consider ortho-nitro-phenyl-propiolic acid and indigo as two distinct products not comparable with each other, inasmuch as the one can be put to uses for which the other is unfitted, and there is surely scope enough for both. Still, looking at the improvements which will every day be made in the manufacturing details, he must be a bold man who would assert the impossibility of competition with indigo in all its applications. For we must remember that we are only at the beginning of these researches in the indigo field. Baeyer and other workers will not stay their hands, and possibly other colouring matters of equal intensity and of equal stability to indigo may be obtained from other as yet unknown or unrecognised sources, and it is not improbable that these may turn out to be more formidable competitors in the race with natural indigo than ortho-nitrophenyl-propiolic acid.

Looking at this question of the possible competition of artificial with the natural indigo from another point of view, it must, on the other hand, be borne in mind that the present mode of manufacturing indigo from the plant is extremely rude and imperfect, and that by an improved and more careful carrying out of the process, great saving in colouring matter may be effected, so that it may prove possible to produce a purer article at a lower price, and thus to counterbalance the production of the artificial material.

The potential importance, from a purely commercial point of view, of the manufacture, may be judged of by reference to the following statistics, showing that the annual value of the world's growth of indigo is no less than four millions sterling.

How far the artificial will drive out the natural colouring matter from the market cannot, as has been said, be foreseen. It is interesting, as the only instance of the kind on record, to cast a glance at the history of the production of the first of the artificial vegetable colouring matters, alizarin. In this case the increase in the quantity produced since its discovery in 1869 has been enormous, such indeed that the artificial colour has now entirely superseded the natural one, to the almost complete annihilation of the growth of madder-root. It appears that whilst for the ten years immediately preceding 1869 the average value of the annual imports of madder-root was over one million sterling,

Estimated Yearly Average of the Production of Indigo in the World, taken from the Total Crop for a Period of Ten Years.

	Pounds Weight.	Pounds Sterling.
Bengal, Tirhoot, Benares, and N. W. India	8,000,000	2,000,000
Madras and Kurpah	2,200,000	400,000
Manilla, Java, Bombay, &c.	...	500,000
Central America	2,250,000	600,000
China and elsewhere, consumed in the country ...	...	Say 500,000
		4,000,000

the imports of the same material during last year (1880) amounted only to 24,000*l.*, the whole difference being made up by the introduction of artificial alizarin. In 1868, no less a quantity than 60,000 tons of madder-root were sent into the market, this containing 600,000 kilos of pure natural alizarin. But in ten years later a quantity of artificial alizarin more than equal to the above amount was sent out from the various chemical factories. So that in ten years the artificial production had overtaken the natural growth, and the 3 or 400,000 acres of land which had hitherto been used for the growth of madder, can henceforward be better employed in growing corn or other articles of food. According to returns, for which the speaker had to thank Mr. Perkin, the estimated growth of madder in the world previous to 1869 was 90,000 tons, of the average value of 45*l.* per ton, representing a total of 4,050,000*l.*

Last year (1880) the estimated production of the artificial colouring matter was 14,000 tons, but this contains only 10 per cent. of pure alizarin. Reckoning 1 ton of the artificial colouring matter as equal to 9 tons of madder, the whole artificial product is equivalent to 126,000 tons of madder. The present value of these 14,000 tons of alizarin paste, at 122*l.* per ton, is 1,568,000*l.* That of 126,000 tons of madder at 45*l.* is 5,670,000*l.*, or a saving is effected by the use of alizarin of considerably over four millions sterling. In other words, we get our alizarin dyeing done now for less than one-third of the price which we had to pay to have it done with madder.

To Englishmen it is a somewhat mortifying reflection, that whilst the raw materials from which all these coal-tar colours are made are produced in our country, the finished and valuable colours are nearly all manufactured in Germany. The crude and inexpensive materials are, therefore, exported by us abroad, to be converted into colours having many hundred times the value, and these expensive colours have again to be bought by English dyers and calico-printers for use in our staple industries. The total annual value of manufactured coal-tar colours amounts to about three and a half millions; and as England, though furnishing all the raw material, makes herself only a small fraction of this quantity, but uses a large fraction, it is clear that she loses the profit on the manufacture. The causes of this fact, which we must acknowledge, viz., that Germany has driven England out of the field in this important branch of chemical manufacture, are probably various. In the first place, there is no doubt that much of the German success is due to the long-continued attention which their numerous universities have paid to the cultivation of Organic Chemistry as a pure science. For this is carried out with a degree of completeness, and to an extent, to which we in England are as yet strangers. Secondly, much again is to be attributed to the far more general recognition amongst German than amongst English men of business of the value, from a merely mercantile point of view, of high scientific training. In proof of this it may be mentioned that each of two of the largest German colour-works employs no less a number than from twenty-five to thirty highly-educated scientific chemists, at salaries varying from 250*l.* to 5 or 600*l.* per annum. A third cause which doubtless exerts a great influence in this matter is the English law of patents. This, in the special case of colouring matters at least, offers no protection to English patentees against foreign infringement, for when these colours are once on the goods they cannot be identified. Foreign infringers can thus lower the price so that only the patentee, if skilful, can compete against them, and no English licencees of the patent

can exist. This may to some extent account for the reluctance which English capitalists feel in embarking in the manufacture of artificial colouring matters. That England possesses both in the scientific and in the practical direction ability equal to the occasion none can doubt. But be that as it may, the whole honour of the discovery of artificial indigo belongs to Germany and to the distinguished chemist Prof. Adolf Baeyer, whilst towards the solution of the difficult problem of its economic manufacture, the first successful steps have been taken by Dr. Caro and the Baden Aniline and Soda Works at Mannheim.

H. E. R.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

THE Linacre Chair of Physiology and Anatomy, lately held by Dr. Rolleston, and practically a chair of comparative zoology, will now be split into two, being succeeded by chairs of anatomy proper and physiology proper, with a more direct relation to the teaching of those subjects as part of a preliminary medical education, as was intended by Dr Linacre.

DR. OLIVER J. LODGE has been appointed to the Lyon Jones Professorship of Experimental Physics and Mathematics in University College, Liverpool, by the Councils of that College and of the Liverpool Royal Infirmary School of Medicine. Prof. Lodge has been some time Assistant-Professor of Physics at University College, London, and is the author of a work on elementary mechanics and various papers of original research.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, June 16.—"On the Stresses caused in the Interior of the Earth by the Weight of Continents and Mountains," by G. H. Darwin, F.R.S.

The existence of dry land proves that the earth's surface is not a figure of equilibrium appropriate for the diurnal rotation. Hence the interior of the earth must be in a state of stress, and as the land does not sink in, nor the sea-bed rise up, the materials of which the earth is made must be strong enough to bear this stress.

We are thus led to inquire how the stresses are distributed in the earth's mass, and what are magnitudes of the stresses.

In this paper a problem of the kind indicated is solved, by the use of certain results obtained by Sir William Thomson, for the case of a homogeneous incompressible elastic sphere, and the results are applied to the case of the earth.

If the earth be formed of a crust with a semi-fluid interior the stresses in that crust must be greater than if the whole mass be solid, far greater if the crust be thin.

The strength of an elastic solid is estimated by the difference between the greatest and least principal stresses, when it is on the point of breaking, or, according to the phraseology adopted, by the breaking stress-difference. The most familiar examples of breaking stress-difference are when a wire or rod is stretched or crushed until it breaks; then the breaking load divided by the area of the section of the wire or rod is the measure of the strength of the material. Stress-difference is thus to be measured by tons per square inch.

The problem is only solved for the class of inequalities called zonal harmonics; these consist of a number of waves running round the globes in parallels of latitude. The number of waves is determined by the order of the harmonic. In application to the earth the equator referred to may be any great circle, and is not necessarily the terrestrial equator. The second harmonic has only a single wave, and consists of an elevation at an equator and depression at the pole; this constitutes ellipticity of the spheroid. An harmonic of a high order may be described as a series of mountain chains, with intervening valleys, running round the globe in parallels of latitude, estimated with reference to the chosen equator.

In the case of the second harmonic it appears that the stress-difference rises to a maximum at the centre of the globe, and is constant all over the surface. The central stress-difference is eight times as great as the superficial.

Amongst other examples it is shown that if the homogeneous earth, with ellipticity $\frac{1}{230}$, were to stop rotating, the central stress-difference would be thirty-three tons per square inch, and it would rupture if made of any material excepting the finest steel.

The stresses produced by harmonic inequalities of high orders are next considered. This is in effect the case of a series of parallel mountains and valleys, corrugating a mean level surface with an infinite series of parallel ridges and furrows.

Numerical calculation shows that if we take a series of mountains, whose crests are 4000 meters, or about 13,000 feet above the intermediate valley-bottoms, formed of rock of specific gravity 2·8, then the maximum stress-difference is 2·6 tons per square inch (about the tenacity of cast tin); also if the mountain chains are 314 miles apart, the maximum stress-difference is reached at 50 miles below the mean surface. It appears that there is no stress at the surface, but the solution is only approximate, for it does not give the stress actually within the mountain masses, but gives correct results at some three or four miles below the mean surface.

The cases of the harmonics of the 4th and higher orders are also considered; and it is shown that, if we suppose them to exist on a sphere of the mean density and dimensions of the earth, and that the height of the elevation at the equator is in each case 1500 meters above the mean level of the sphere, then in each case the maximum stress-difference is about four tons per square inch. This maximum is reached in the case of the 4th harmonic at 1150 miles, and for the 12th at 350 miles, from the earth's surface.

It is then shown that the great terrestrial inequalities, such as Africa, the Atlantic Ocean, and America, are represented by an harmonic of the 4th order; and that, having regard to the mean density of the earth being about twice that of superficial rocks, the height of the elevation is to be taken as about 1500 meters.

Four tons per square inch is the crushing stress-difference of average granite. From these results it may be concluded that either the materials of the earth have about the strength of granite at 1000 miles from the surface, or they have a much greater strength nearer to the surface.

This investigation must be regarded as confirmatory of Sir William Thomson's view, that the earth is solid nearly throughout its whole mass. According to this view the lava which issues from volcanoes arises from the melting of solid rock, which exists at high temperature at points where the pressure is diminished, or else from comparatively small vesicles of rock in a molten condition.

Zoological Society, June 21.—Prof. W. H. Flower, F.R.S., president, in the chair.—The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of May, 1881, amongst which special attention was called to an African Wild Ass (*Equus tæniopus*) from Upper Nubia, and a White-marked Duck (*Anas specularis*) from Antarctic America, both new to the collection.—Mr. R. Bowdler Sharpe exhibited a specimen of *Podilymbus podiceps*, stated to have been killed at Radipole, near Weymouth, in the winter of 1880–81.—Mr. W. A. Forbes read a paper on the Petrel called *Thallassidroma nereis*, by Gould. This, he showed, was not a true *Procellaria*, but must form the type of a new genus, to be called *Garrodia*, most closely allied to *Oceanites*, *Fregetta*, and *Pelagodroma*, and constituting with them a distinct family of "Tubinares," proposed to be called "Oceanitidæ."—Mr. W. A. Forbes read a paper on the conformation of the thoracic extremity of the trachea in the "Ratite" birds, noting specially a highly-developed syrinx in the genus *Rhea*, in which respect it differed from all the other genera comprised in that group.—A communication was read from Mr. George F. Bennett, C.M.Z.S., containing an account from personal observation of the habits of the *Echidna hystrix* of Australia.—Mr. G. A. Boulenger read a paper on the Lizards of the genera *Lacerta* and *Acanthodactylus*, prepared after a study of specimens in the British Museum.—Mr. F. C. Selous read a paper on the Antelopes that had come under his observation in Central South Africa. He exhibited a series of skins of the Bush-Buck (*Tragelaphus sylvaticus*), and pointed out their variations in different locallities; also specimens of the Poku (*Cobus vardoni*), and the Speke's Antelope (*Tragelaphus Spekii*).—A communication was read from the Rev. O. P. Cambridge, describing some new genera and species of Araneidea.—Mr. Sclater pointed out the generic divisions of the Bucconidæ which he proposed to adopt in his monograph of the group now approaching completion, and characterised a new species of the family under the name *Nonnula cineracea*.—Mr. R. Bowdler Sharpe communicated some notes on new or rare species of Flycatchers lately added to the British Museum, principally from the Gould collection, and which it was proposed to call *Malurus cyanochlamys*, *Siphia obscura*, and *Rhipidura Macgillivrayi*.—A second paper by Mr. Sharpe contained an account of several collections of birds formed by Mr. W. B.

Pryer in the district of Sandakan, in North-Eastern Borneo. Two new species were described as *Lanius Schalowi* and *Dicæum Pryeri*.—Lieut.-Col. H. H. Godwin-Austen read the second portion of his paper on the land shells collected by Prof. J. Bayley Balfour during his recent expedition to the Island of Socotra. It referred to the family *Helicaceæ*.—Mr. G. E. Dobson communicated some notes on certain points in the muscular anatomy of the Green Monkey *Cercopithecus callithrix*.—Dr. A. Günther exhibited and read a description of a specimen of *Schedophilus medusophagus*, a Mediterranean fish new to the British fauna, lately captured off the coast of Ireland.

Anthropological Institute, June 14.—Major-General A. Pitt-Rivers, F.R.S., president, in the chair.—General Pitt-Rivers read a paper on the discovery of flint implements in the gravel of the Nile Valley, near Thebes. The worked flints were found embedded two or three metres deep in stratified gravel. Much interest has always been attached by anthropologists to this subject on account of its bearing on the antiquity of man. While in Europe we know that the use of stone for implements preceded the employment of metals, and was coeval with many animals that are now extinct, we have hitherto had no certain evidence that this period in northern regions, remote as it undoubtedly was, may not have been contemporaneous with the very earliest phase of Egyptian civilisation, traced backward as it is by the now accepted chronology of Manetho to an antiquity of 7000 years from the present time. Now, however, the evidence of human workmanship has been found in gravel deposits which had become so indurated that the ancient Egyptians were able to cut flat-topped tombs in it, supported by square pillars of gravel, which have retained their form uninjured to the present day, proving an enormously greater age for the flints embedded in the gravel, some of which were chiselled out of the sides of the tombs.—Mr. Alfred Tylor read a paper on the human fossil at Nice discovered by M. Ischa in December, 1880.—Mr. F. E. im Thurn read a paper on some stone implements from British Guiana.—Mr. J. Park Harrison exhibited a collection of Danish and French photographs.—The following papers were taken as read:—Mr. Gerard A. Kinahan, on sepulchral remains at Rathdown, co. Wicklow.—Mr. J. H. Madge, notes on some excavations made in Tumuli, near Copiapo, Chili, in June, 1880.—A number of specimens collected by Mr. Madge were exhibited, among which were two skulls, a quantity of pottery, and a cervical vertebra, in which was embedded a stone arrow-head.

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Academy of Sciences, June 27.—M. Wurtz in the chair.—The following papers were read:—Observations of Comet *b* 1881 (comet of 1807) at the Paris Observatory, by MM. Bigourdan, Wolf, and Thollon; note by M. Mouchez (see p. 223).—On the prolegomena of a new treatise on meteorology, published in Italy by M. Diamilla-Müller, by M. Faye. The first part is entitled "The Laws of Tempests (according to Faye's theory)," and M. Faye expresses satisfaction that his views seem to be gaining ground. In a letter to the author he suggests that in thunder-storms the source of electricity is not merely charged air (and icy particles) whirling downwards from upper regions, but electricity is developed in the act of gyration (reminding us of a Holtz machine working up a weak charge).—M. Janssen presented a photograph of the comet.—On Fuchsian functions, by M. Poincaré.—On the injuries to vegetation produced in treatment of phylloxerised vines, by M. Catta.—Influence of variations of atmospheric pressure on the duration of oscillations of the pendulum, by M. Saint-Loup. He found an advance of 0·077s. to occur in the day for a lowering of mercury pressure 10 mm. The experiment was of a preliminary nature.—Observations on the comet, and principally on the physical aspect of the nucleus and the tail, by M. Flammarion. He inclines to the view that comets' tails are not material—perhaps an excitation, electric or other, of ether. Their transparence favours this view. He also calculates that the tail of the comet of 1843, at the distance of the earth from the sun, must have swept space with a velocity of 64,000,000 of metres per second. Any molecule of matter flying at such a rate would not remain a single instant dependent on solar attraction, and would not go in a closed orbit.—On the surface with sixteen singular points, by M. Darboux.—On the surfaces for which the co-ordinates of any point are expressed by Abelian functions of two parameters, by M. Picard.—On a general means of determining the relations between the constants contained in a particular solution and those contained by the rational co-efficients of the corresponding differential equation, by M. Dillner.—On the vibratory forms of circular liquid surfaces, by M. Decharme. The internodal distances are inversely proportional to the corresponding numbers of vibrations; and this result is independent of the nature of the liquid. There is the greatest similarity between the vibratory forms in question and those of soapy pellicles of the same diameter.—On the employment of liquid prisms in the direct vision-spectroscope, by M. Zenger. On the anterior plane of a liquid prism he fixes a quartz prism of the same refringent angle, but placed in an opposite direction; the posterior face has, as usual, a plane parallel plate. The loss of light by reflection at the anterior and posterior surfaces is thus reduced to a minimum; the spectra are very intense, and the lines are well defined.—Photography of colours, by coloration of layers of coagulated albumen, by MM. Cros and Carpentier. M. Edm. Becquerel pointed out that it was not an immediate photographic reproduction of images with the natural colours of bodies, but a polychrome working by way of photographic impression, in which the tints of images are varied at will with the shades of the colouring matters used, and are not connected in any necessary manner with the colours of the active rays.—Pneumatic apparatus; pneole, spirelle, by M. de Romilly. In the pneole a jet of water sent upwards (say) by a turbine immediately enters an orifice (larger than that it comes from) of a vertical conical pipe, in which some of the water accumulates; and through this water numerous bubbles of air ascend, but cannot return. The water returns to the turbine by a lateral pipe. The spirelle (also for producing an air current) is entirely immersed in the circulating liquid (say in a turbine). It consists in one case simply of a slit of special position and nature in a tube which rises from the liquid, one edge of the slit is higher than the other.—On silicium, by MM. Schutzenberger and Colson.—On a cyanic ether of borneol, by M. Haller.—On the *rôle* of phosphoric acid in volcanic soils, by M. Ricciardi. This is a reply to M. de Gasparin.—On the volcanic soil of Catania, by M. Tedeschi di Ercole.—Unilateral phenomena, inhibitory and dynamogenic, due to an irritation of the cutaneous nerves by chloroform, by M. Brown-Séquard.—New mode of electric excitation of nerves and muscles, by M. d'Arsonval. In the apparatus described he aims at giving the induction current a mathematically definite value, easy to reproduce, rendering the electric excitation purely mechanical (not chemical), and at having an induced current of neutral direction (no positive or negative pole).—On the etiology and pathogeny of variola in the pigeon, and development of infectious microbes in lymph, by M. Jolyet.—Influence of nature of food on the development of the frog, by M. Yung. The substances tried stand in the following decreasingly favourable order:—Beef, fish, coagulated albumen of hens' eggs, albuminoid substance of frog's egg, vegetable substances (algæ). The two latter do not suffice to transform the tadpole into a frog. A purely albuminous substance suffices.—Metamorphosis of the Pedicellata, by M. Barrois.—On the formation of the cyst in muscular trichinosis, by M. Chatin.

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