really an accurate portrait of the Korean envoy who visited Japan in 1877.

It is impossible to do justice to Dr. Rein's important book in the space at our command. Its construction is eminently scientific, and its thoroughness will excite the admiration of all who know the difficulty of obtaining, and especially of selecting, information upon many of the matters so exhaustively treated. The errors are few and seldom important, and will probably disappear in the next edition. One powerful recommendation is the absence of the *ego* from its pages; the author everywhere studiously keeps his own individuality concealed, and in the discussion of most points he is nearly always contented with such a statement and grouping of the principal facts as will leave the inference well within the grasp of the reader's mind. In conclusion, it is the best of the many publications upon the subject of Japan that have appeared in the last ten years, and, unlike most of the number, supplies a real want, and will be received gratefully by all who seek for solid, trustworthy information. We trust that the completion of the work will soon be issued.

OUR BOOK SHELF

Études géométriques et cinématiques. Note sur quelques Questions de Géométrie et de Cinématique, et Réponse aux Réclamations de M. l'Abbé Aoust. Par E. J. Habich. 8o pp. (Lima, 1880.)

M. L'ABBÉ AOUST, author of the "Analyse infinitésimale des Courbes planes," and our author put forward conflicting claims as to priority of discovery.

The polemics have fired off their powder in *Les Mondes* (tome iv., 1880, Aoust: tome i., 1879, Habich; see also the *Comptes rendus*, lxxxv., 1877, and lxxxix., 1879), and the object of the present pamphlet is "de réduire à leur juste valeur les assertions" of the Abbé. The matters in dispute can be inferred from the three divisions of the present work:—

"1. Développoïdes—considérations historiques, étude des enveloppes des droites par la considération du centre instantané de rotation, développoïdes des divers ordres et devellopoïdes inverses.

"2. Coordonnées tangentielles-polaires.

"3. Mouvement géométrique d'une figure plane dans son plan—considérations générales, mouvement géométrique déterminé par deux systèmes d'enveloppées et d'enveloppes, mouvement d'une droit sur un plan."

We have, of course, but one side of the quarrel presented to us, but leaving polemics on one side there is a great deal of interesting matter put before us. Time will, no doubt, settle the question of priority.

A Synopsis of Elementary Results in Pure and Applied Mathematics. By G. S. Carr, B.A. Vol. i. part viii. (C. F. Hodgson and Son, 1880.)

WE recently noticed with approval the volume containing the first seven parts. This eighth part carries on the articles from 1400 to 1868, and is concerned with the differential calculus. It contains an abstract of the usual processes, and besides gives a succinct account of the theory of operations, and an analysis of matters which are treated of in the higher algebra, as Jacobians and quantics, and closes with maxima and minima, the geometrical applications being reserved for the parts on Co-ordinate Geometry.

These fifty-six pages are very correctly printed, at least we have not detected more than three or four trivial typographical errors.

This part maintains the handy character for reference of its forerunners.

The Practical Fisherman. By T. H. Keene. (London: *The Bazaar* Office.)

THIS book deals with the natural history, the legendary lore, and the capture of British freshwater fish, together with the art of tackle-making. The author has bestowed great care on his work, and seems to have studied every book written or published on the charming subject from Oppian to the present time. Mr. Keene is besides an enthusiastic fisherman, and has thus produced a treatise of great interest to the practical angler. We may add that this work is almost the only one on angling which treats of the natural as well as the traditional history of fishes.

LETTERS TO THE EDITOR

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

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

The Movements of Leaves

FRITZ MUELLER has sent me some additional observations on the movements of leaves, when exposed to a bright light. Such movements seem to be as well developed and as diversified under the bright sun of Brazil, as are the well-known sleep or nyctitropic movements of plants in all parts of the world. This result has interested me much, as I long doubted whether paraheliotropic movements were common enough to deserve to be separately designated. It is a remarkable fact that in certain species these movements closely resemble the sleep movements of allied forms. Thus the leaflets of one of the Brazilian Cassiæ assume when exposed to sunshine nearly the same position as those of the not distantly allied Hæmatoxylon when asleep, as shown in Fig. 153 of "The Movements of Plants." Whereas the leaflets of this Cassia sleep by moving down and rotating on their axes, in the same peculiar manner as in so many other species of the genus. Again, with an unnamed species of Phyllanthus, the leaves move forwards at night, so that their midribs then stand nearly parallel to the horizontal branches from which they spring; but when they are exposed to bright sunshine they rise up vertically, and their upper surfaces come into contact, as they are opposite. Now this is the position which the leaves of another species, namely *Phyllanthus compressus*, assume when they go to sleep at night. Fritz Müller states that the paraheliotropic movements of the leaves of a Mucuna, a large twining Papilionaceous plant, are strange and inexplicable; the leaflets sleep by hanging vertically down, but under bright sunshine the petiole rises vertically up, and the terminal leaflet rotates by means of the pulvinus through an angle of 180°, and thus its upper surface stands on the same side with the lower surfaces of the lateral leaflets. Fritz Müller adds, "I do not understand the meaning of this rotation of the terminal leaflet, as even without such a movement it would be apparently equally well protected against the rays of the sun. The leaflets, also, on many of the leaves on the same plant assume various other strange positions." With one species of Desmodium, presently to be mentioned as sleeping in a remarkable manner, the leaflets rise up vertically when exposed to bright sunshine, and the upper surfaces of the lateral leaflets are thus brought into contact. The leaves of *Bauhinia grandiflora* go to sleep at an unusually early hour in the evening, and in the manner described at p. 373 of "The Movements of Plants," namely, by the two halves of the same leaf rising up and coming into close contact: now the leaves of *Bauhinia Brasiliensis* do not sleep, as far as Fritz Müller has seen, but they are very sensitive to a bright light, and when thus exposed the two halves rise up and stand at 45° or upwards above the horizon.

Fritz Müller has sent me some cases, in addition to those given in my former letter of March 3, of the leaves of closely-allied plants which assume a vertical position at night by widely different movements; and these cases are of interest as indicating that sleep-movements have been acquired for a special purpose. We have just seen that of two species of Bauhinia the leaves of one sleep conspicuously, while those of a second species appa-

rently do not sleep at all. The leaves of *Euphorbia jacquiniæflora* depend vertically at night, whereas those of a dwarfish Brazilian species rise vertically up at night. The leaves of this Euphorbia stand opposite one another—a position which is rather rare in the genus; and the rising movement may be of service to the plant, as the upper surfaces of the opposite leaves mutually protect one another by coming into contact. In the genus Sida the leaves of two species rise, while those of a third Brazilian species sink vertically down at night. Two species of Desmodium are common plants near Fritz Müller's house: in one the leaflets move simply downwards at night; but in the other not only do the three leaflets move vertically down, while the main petiole rises vertically up, as is likewise the case with *D. gyrans*, but in addition the lateral leaflets rotate so as to stand parallel with the terminal leaflet, behind which they are more or less completely hidden. This, as far as I have seen, is a new kind of nyctitropic movement; but it leads to a result common to several species, namely, that of packing the three leaflets closely together and placing them in a vertical position.

Down, Beckenham, Kent, April 14 CHARLES DARWIN

Spectrum of the Star Ll. 13412

THE spectrum of the star Ll. 13412 appears to be in some respects unique. It consists mainly of three bright lines having wave-lengths of 545, 486, and 466 millionths of a millimetre. Four other stars have hitherto been found whose spectra are of this character. Three of them are in Cygnus, and have lines whose wave-lengths are 580, 568, 536, and 467. The fourth star, Oeltzen 17681, has lines at about 582 and 470 (NATURE, vol. xxii. p. 483). The line or band at 467 appears to be common to all, and that at 580 to the last four. The line at 486 in Ll. 13412 coincides with the F line of hydrogen, but is not visible in the other stars. The line at 545 is also absent in them. This star therefore appears to resemble the others in kind, but not in the material of which it is composed. It is also much brighter than the others, so that it is not a difficult object with a small telescope. Its position for 1880 is in R.A. 6h. 49·3m. and Dec. −23° 47′. It is easily found as a seventh magnitude star about 15′ north of *o' Canis Majoris*.

Cambridge, U.S., April 14 EDWARD C. PICKERING

The Indian Winter Rains

IN NATURE, vol. xxiii. p. 400, Mr. F. Chambers very properly points out that the winter rains of Northern India, though usually heaviest in years when the *mean* pressure is above the average, are yet coincident with short periods of low rather than of high pressure. The way in which Mr. Chambers accounts for the low pressure seems, however, rather far-fetched. It is true that on one or two of the American weather charts storm tracks are shown extending from the Mediterranean to Northern India or the Bay of Bengal, but these paths are drawn with dotted lines indicating that they are doubtful, and, considering the absence of meteorological stations in the greater part of the area between the Mediterranean and India, and the nature of the intervening country—especially Afghanistan with its high mountains—I should say the evidence upon the strength of which the American chartographer laid down these storm tracks, was of the slightest possible description. The winter rains are however accompanied by a cyclonic movement of the air over Northern India, and I wish to point out that, whether the cyclonic disturbance be a European or Transatlantic visitor, as Mr. Chambers supposes, or a native of the Indian region, generated by the rainfall, as Mr. Eliot has taught in his report for 1877, the "old notion" of the connection of the rains with the upper anti-monsoon current is by no means exploded. The progress of the disturbance and of the rainfall is usually from north-west to south-east, and the rainfall is heaviest, as a rule, on the eastern side of the disturbance. The winds which bring the rainfall therefore come from some southerly quarter, and as northerly winds generally continue blowing in the extreme south of India at the time when these disturbances occur in the north, the southerly rainy winds must be derived from an upper current which descends in the anti-cyclone or region of high pressure in the centre and south of India, or in the zone between the south of India and the equator. Mr. Blanford's modification of his former views regarding the origin of these rains appears from his remarks and the accompanying charts in the Meteorological Report for 1878 to be merely that the indraught towards the region of precipitation is not confined to Northern India, but is occasionally, though rarely, felt as far south as Ceylon.

In a letter of mine that appeared in NATURE for the following week (p. 409), there was a mistaken inference from Mr. Blanford's investigation regarding the "Barometric See-saw" between India and West Siberia that I beg your permission to correct. The mean pressure at sea-level in the Indo-Malayan and West Siberian regions appears from Mr. Buchan's charts to be nearly the same both on the average of the year and in January and July. Also no wind blows directly from the one region to the other. We cannot therefore infer anything regarding the strength of the winds from Mr. Blanford's results, but we may regarding temperature. The proper inferences of this kind from the results arrived at by Mr. Blanford and Mr. Archibald appear to be these:—(1) The range of temperature in the 11-year period is greater in Siberia than in surrounding countries; (2) Siberia is coldest, compared with neighbouring countries, at times of maximum sun-spot; (3) This relation is most marked in winter; and (4) near the coasts of the Pacific (Nertchinsk, Pekin, Zi-ka-wei), the Indian (all the Indo-Malayan stations, especially those nearest the sea), and the Atlantic (London) oceans, where presumably the range of temperature is less than in the heart of the continent, the variation of the barometer in the 11-year period is opposite to that observed in Siberia.

Allahabad, March 29 S. A. HILL

Palæolithic Man

IT is desirable that further search should be made for implements made by man in the deposits of this country assumed to be older than the well-known and accepted implementiferous river-gravels.

In the gravels belonging to the Thames, in and near London, palæolithic implements are of not infrequent occurrence. In my own collection I have more than 120 examples—with few exceptions found by myself—and I know of at least another hundred specimens found chiefly by London friends who have availed themselves of hints given by me.

My object now is to direct attention to the fact that the implements are not only found in and near London in the lower and middle terraces of gravel some 25 to 70 feet above the ordnance datum, but at far greater heights. Some of these heights near London may, and others no doubt do, belong to the Thames or to its tributaries, but they all (in different degrees) appear to point to a more remote time than the period when the lower terraces of the Thames and its tributaries were formed. Some of the implements now found in the lower gravels are clearly "derived" from more ancient deposits. For instance, I have one example white in colour and highly porcellaneous:—the white colour has been brought about by the decomposition of the flint in some ancient loam or clay, and not from the gravel in which the implement was found: this is proved by several more or less highly-polished accidental fractures at the edges of a different colour from the general white surface: these coloured fractures are more recent than the white facets, and date from the last deposition of the implement in the lower terrace: the white abraded flakings belong to a highly remote time. Dr. John Evans records the finding of an implement in the Thames gravel at Highbury, at 102 feet, whilst I have found one (also near Highbury), at an elevation of 144 feet. Last summer I found an implement on the eminence at the north of, and overlooking Ealing Dean, at a height of 164 feet. This is 72 feet higher than the implementiferous beds of Ealing Dean described by General Pitt Rivers, and between 80 and 100 feet higher (in one instance 104 feet higher) than the implement-bearing gravels at Acton described by the same gentleman. The gravel at the 164-feet elevation forms an isolated patch on the extreme top of a hill. I watched the excavations here (which were shallow) for road-making, with great care, and with the implement I found several flakes. These heights agree well with the heights of some of the implementiferous gravels found capping the cliffs in the South of England, also with the Erith position at Northumberland Heath, where Mr. F. C. J. Spurrell found an implement at an elevation of 175 feet.

Most geologists know the high gravels overlooking Hertford, Ware, and Amwell; their altitude is from 130 to over 180 feet above the ordnance datum. Gravel from the two first of these places is brought to London for ballast in thousands of tons. A year or two ago great quantities of gravel from Hertford were brought to Finsbury Park by the Great Northern Railway, and in the gravel thrown down near Finsbury Park I