

identity with that of the earth's rotation, solar tidal friction will further reduce the earth's angular velocity, the tidal reaction on the moon will be reversed, and the moon's orbital velocity will increase, and her distance from the earth will diminish. But since the moon's mass is very large, the moon must recede to an enormous distance from the earth, before this reversal will take place. Now the satellites of Mars are very small, and therefore they need only to recede a short distance from the planet before the reversal of tidal friction."

No one can have any datum for saying that the Martian satellite must have fallen into the planet "long ere this," but Mr. Nolan shows that the satellite is now near the end of its history.

I do not think that Sir William Thomson made any allowance for solar tidal friction in estimating the ultimate distance of the moon. Both he and I only cared to obtain the result in round numbers.

I should be very much obliged to Mr. Nolan if he would give a reference to the proof of the theorem, that two heavenly bodies cannot revolve about their centre of inertia, as parts of a rigid body with their surfaces nearly in contact, unless one is smaller and denser than the other by a certain amount.

July 15

G. H. DARWIN

#### Peripatus in Demerara

CONSIDERING the great antiquity and importance of *Peripatus* it seems desirable to make a public notification of the fact that I have found a species, apparently *Peripatus Edwardsi*, in the Demerara division of British Guiana. Four specimens were obtained by me, but three of them, owing to some unknown cause, became considerably damaged and practically useless. The fourth specimen, which was found by me nearly a month ago, is still alive and evidently in good health. It is, when in progression, about  $3\frac{1}{2}$  inches in length, but it often elongates itself considerably more and at other times becomes nearly coiled into a thick lump. It possesses thirty-one pairs of feet, the last three of which it rarely puts to the ground except when it goes backwards for short distances. Several other pairs at intervals along the body are carried off the ground in the same manner. It seems distinctly restless under the influence of light, appearing comfortable only when it retreats into some moist and darkened corner. When handled, it frequently discharges its viscid secretion, but as frequently neglects to do it when handled for the first time after a long interval, but more especially when touched or taken up for three or four times in rapid succession. It has been kept in an old sardine tin with small pieces of decayed wood, which were taken from the stump in which it was found, and the wood is kept in a moist condition. The locality from which it was obtained was the Hoorubea Creek, about twenty miles from Georgetown, on the east coast of the Demerara River, close to the meeting-point of an extensive forest and a water savannah. The four specimens were obtained in the same locality; and, though I have sought for them continually in other places, up to the present I have been unable to find others. From the long period of time during which this specimen has survived in confinement, I think there will be no difficulty, when I have obtained a large number of specimens, in sending them alive to England to Prof. Moseley and others. Unfortunately I have no possible access here to any literature on the group. I do not think it is generally known, but Mr. Im Thurn has once previously found specimens of *Peripatus* in the Essequibo division of British Guiana. His specimens were, however, very small ones.

British Guiana Museum

JOHN J. QUELCH

#### Upper Wind-Currents over the Bay of Bengal in March, and Malaysia in April and May

IN my last letter to NATURE, vol. xxxiii. p. 460, on the subject of upper winds, I described the circulation of the Indian Ocean from the equator, where the north-west wind changes into the north-east monsoon, as far north as Ceylon, in the month of February. From there, about the beginning of March, I took a section of the weather, as nearly straight as practicable, from Colombo, through Calcutta, and 400 miles due north to Darjeeling.

The general weather system at that season is very simple. A belt of high pressure lies across the Bay of Bengal, from about Madras, to the southern limits of Burmah. The north-east monsoon blows to the south of this, towards the low pressure

below the equator; the belt, of course, covers a calm area; while to the north a south-west wind blows towards a low pressure somewhere beyond the Himalayas.

The upper currents over the north-east monsoon always blew from some more easterly point than the surface-wind; the cloudless sky over Madras prevented any observations; north of this the higher clouds always came from some point more northerly than the south-west wind below. The lofty range of the Himalayas seemed to make no difference; at Sendukphu I succeeded in getting a photograph of a cumulo-form cloud trailing from the summit of Kanching Junga (29,000 feet) well from the west-north-west, while a south-west wind was driving up mist from the plains. The existence of cumulus at so high a level has, I think, been denied by some meteorologists.

All these observations are in complete accordance with the normal circulation of the northern hemisphere; but the character of south-west monsoons deserves notice. The term south-west monsoon is unfortunately used for two different stages of the same weather sequence, and much confusion comes thereby. Maury and others think only of the direction of the wind; common parlance all over the East talks of the monsoon as of a rainy season which sets in suddenly, long after south-west winds have been blowing for weeks or months previously.

The facts of the case are these:—As early as January a light south-west wind commences in the north of the Bay of Bengal, first only as a sea breeze; later, when we encountered it, as a light continuous wind. Nothing can be more lovely than the weather then; bright blue sky, scarcely a light cloud, with a warm gentle wind; the monsoon, unlike March, begins like a lamb and goes out like a lion. As the season goes on an area of low pressure, which has been gradually forming over Northern Bengal, becomes more pronounced, and the south-west wind gradually works further and further to the southwards below Ceylon. Then, sometimes in June, a sudden total change comes over the weather, while the only alteration the isobars show is a slight motion of the lowest pressure towards the North-west Provinces of India. A sudden burst of rain and thunder breaks over Ceylon, and then the bad weather works slowly northwards. This is the commencement of the south-west monsoon in common talk. Everyone will tell you how many days it takes to work up to Bombay on one side and to Calcutta, by way of Burmah and Assam, on the other. Madras escapes for the present, only to be deluged in November by the north-east monsoon. So we get the curious sequence that the wind works downwards, the rain upwards; and also the fact that the greatest and most sudden change in the year is associated with no striking change in the distribution of pressure. The Indian meteorologists are of opinion that this sudden change in the character of the same wind is due to a sudden irruption of air, highly charged with vapour from the neighbourhood of the equatorial doldrums, but that the south-east trade is not linked with the south-west monsoon in a continuous current, except occasionally and temporarily. Would it not be of the highest interest and importance to discover whether this sudden change of weather is associated with any change in the relation of the upper and lower winds? In my letter to NATURE (vol. xxxiii. p. 460) I showed that over the south-west monsoon of the Gulf of Guinea the upper currents were those of the southern hemisphere, and that the south-east trade there seemed to grow gradually into a south-west wind as it crossed the line. If in Ceylon and India the higher clouds continue to come, as we found them, from west or north-west after the burst of the south-west monsoon, there must be a doldrum between it and the south-east trade; but if the upper currents turn towards south or south-east after the burst, then undoubtedly the south-east trade has invaded the northern hemisphere. The latter is of course the old theory of the monsoon; and perhaps another test may be applied to the solution of these alternatives. If the south-east trade blows into a doldrum, there must be a belt of high pressure between Ceylon and the equator to give gradients for south-west winds. Has this ever been found? I do not think that calm alone is sufficient to be called a "doldrum." During the north-west monsoon, which is unquestionably the north-east monsoon drawn across the line, the direction of the wind changes gradually, but the velocity is often less just on the equator than on either side. I made some special inquiries on this point.

In the Philippines, China, and Japan the upper winds over the south-west monsoon follow the normal course of the northern hemisphere; but there is no burst of the monsoon in those countries.