hastily revised. Thus, in four lines quoted from Ovid, there are two bad misprints, besides a doubtful reading.

At present the results obtained in this inquiry are the accumulation of facts and the refutation of untenable explanations. One may also, perhaps, affirm (1) that the primitive condition of man and other vertebrates was, as their early foetal condition still is, one of complete bilateral symmetry of structure, and also of functional symmetry; (2) that this primitive ambidextrous use of the limbs is occasionally superseded in animals, and constantly in all races of men of which we have any knowledge, by a preferential use of one side; and that this is a necessary step in development as soon as the more delicate operations performed by a single hand take the place of those of digging, climbing, &c., in which both take part. It is, in fact, a differentiation produced by the same causes which have led to the specialisation of the fore and hind limbs in frogs, birds, or kangaroos, compared with their uniformity of structure and function in fishes, crocodiles, and horses; (3) the prevalent choice of the right hand when differentiation was established, must have depended on some slight advantage, at present unascertained, by which dexterity at last suppressed *gaucherie*; (4) The occasional preference for the left hand, which is often partial and sometimes hereditary, does not depend on any "coarse" structural abnormality, but is an instance of atavism—of reversion to the primitive and universal ambidextrous, or to a subsequent and partial lefthanded condition.

P. H. PYE SMITH

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.]

Ocean Currents

If a free body on the earth's surface should be moved from a lower to a higher latitude without friction by a force in the direction of the meridian, it would acquire a certain amount of relative eastward velocity, which would be the same whether the body moved toward the pole with a very slow uniform velocity arising from a single impulse, or whether it moved with a continual accelerated velocity down a gradient by the force of gravity. If a particle of atmosphere or of the ocean is moved in the same way by a similar force, and does not acquire the same amount of relative eastward velocity, the difference between the velocities in the two cases is the true measure of the effect of friction. But from the amount of work done, or velocity generated or destroyed, nothing can be inferred with regard to the acting force, unless we take into account the length of time during which it acts. The velocity of the interchanging motion of the water between the equator and the pole, discovered by Dr. Carpenter, is extremely small, perhaps not as much as a mile per day, and less than tidal velocities in the open ocean. If a great amount of eastward velocity, therefore, is destroyed by friction in the case of a particle of the ocean in moving from a lower to a higher latitude, it is not because the friction is great, but because it acts during a very long time.

If the velocity in the direction of the meridian were one mile per day, the deflecting force, at the parallel of 45° , arising from the earth's rotation, would be about equal to the force of gravity along a regular gradient of 6 ft. between the equator and the pole. Both the velocities north or south and east or west, and the amount of friction belonging to any given velocity, are unknown quantities. The force down the gradient of 6 ft. between the equator and the pole, which Mr. Croll allows to be the measure of the force due to the difference of temperature or density between the equator and the pole, would soon give the particles of water without friction the velocity of one mile per day, and the question now is, whether the force would then be sufficient to overcome the friction belonging to this small velocity; for the inertia of the water being once overcome, all that would be required of the force would be to overcome the friction.

The velocity of motion between the equator and the pole being probably of the same order only as tidal velocities, we may suppose the friction in the two cases to be somewhat of the same

order. Now the friction in tidal velocities in the open sea, when not regarded as entirely insensible, has always been regarded as a quantity of a second order in comparison with the disturbing forces producing the tides, or at least as being much less. But the force producing the tides is about equal to the force of gravity along a gradient of two feet between the equator and the poles. If we therefore suppose the force necessary to overcome the friction of tidal velocities to be one-fourth of that producing the tides, then the force of gravity on a gradient of 6 in. between the equator and the poles, would be sufficient to overcome the friction belonging to the slow velocities of the motion discovered by Dr. Carpenter, if we suppose, as above, that the amount of friction in the two cases is of the same order. But this is only one-twelfth part of what Mr. Croll allows to be the available force for this purpose. According to the preceding view, therefore, the difficulty is not in finding a sufficient force for overcoming the friction of Dr. Carpenter's slow velocities, but in disposing of the abundance of force we have on hand for that purpose.

Washington, May 24

WM. FERREL

The Wanderings of the Esquimaux

I AM much obliged to Dr. Rae for his courteous letter upon a subject in which he is so deservedly an authority, while I am only a student. The question upon which he joins issue with me, namely, the southerly migration of the Esquimaux, is one upon which I ought to bow to his authority; but there are some difficulties attending the solution he offers which deserve, I think, consideration. If the Greenland Esquimaux came from the north, as both of us are agreed, it is probable that the stock from which they sprung are the so-called Arctic Highlanders of Smith's Sound, about whom Mr. C. Markham has written both in the *Ethnological Journal* and the *Journal of the Geographical Society*. They are broadly distinguished from the Esquimaux of America by the use of stone igloos instead of snow huts, and by their ignorance of boats, either kayaks or omenaks. These Arctic Highlanders are a diminishing race. M'Clintock tells us "that they have become alarmed by the rapid diminution of their numbers through famine and disease" (Travels, 137). Along the shores of Smith's Sound are the ruins of many deserted huts, moss-grown, and of considerable antiquity. The skulls of musk oxen without their lower jaws, a proof that they had been killed by Esquimaux, are also found scattered along the same coast (id. 76). These facts show that the Esquimaux were formerly abundant in very high latitudes, where they have now become very few in number. What is true of Smith's Sound is also true of the great Archipelago of the Arctic circle known as the Parry Islands. These also are dotted with the moss-grown ruins of ancient and deserted huts, the remains of a once numerous race in an area now, I believe, entirely deserted by the Esquimaux. These two places are in the highest latitudes yet reached by navigators.

Dr. Rae would make these Northern Esquimaux to be wanderers from the American Continent; but, putting aside the difference of customs, which seem to show that the American Esquimaux are not the primitive stock of the race, but have been sophisticated by contact with the Indians, I may quote the following passage from Mr. Markham, who has studied the question with some care:—"The American Esquimaux never go from their own hunting range for any distance to the inhospitable north. Except in the case of the Pond's Bay natives who followed up the whalers for a specific reason, there is no instance of their having gone north, and it is unreasonable to suppose that they would do so" (*Journal of Ethnological Society*, 4, new series, 135).

When I quoted the traditions about the migration of the Esquimaux having been southerly, I had the passage especially in my mind where Sir John Franklin describes the Chippewyan legend about the discovery of copper, beginning with the words, "The Chippewyans suppose the Esquimaux originally inhabited some land to the northward, which is separated by the sea from this country; and that in the earliest ages of the world a party of these men came over and stole a woman from their tribe, whom they carried to this distant country, and kept in a state of slavery, &c." (Franklin's Narrative, 146).

Dr. Rae, on the contrary, thinks they came from the west. Now Mackenzie, who certainly knew the country well, says:—"The progress of the Esquimaux, who possess the sea-coast from the Atlantic through Hudson's Straits and Bay, round to Mackenzie River, and, I believe, further, is known to be westward. They never quit the coast" (Mackenzie's Travels, 406).

The Asiatic origin of the Esquimaux seems to me to be a very problematical solution of the difficulty. There are Esquimaux in Asia undoubtedly. The so-called Tchuktchi of Tchuktchi Ness are Esquimaux, but they are a very small fragment, and are apparently emigrants from the opposite shores of Behring Straits. Between them and the American Esquimaux there is a considerable intercourse, which has led to the products of Russian manufacture being found along the shores of the Arctic Ocean; and the American Esquimaux constantly pass the Straits for purposes of barter. Beyond the fragment of this people found at the extreme north-eastern part of Asia, and a few of the Kamtskatkans, I know of no Asiatic race whose language, or custom, or physique, favours the opinion that they are connected with the Esquimaux. The course of migration has rather been westerly and easterly. The Tchuktchi proper and the Koriaks, who are a very different race from the Tchuktchi of Tchuktchi Ness, have been pressing to the west, and have uprooted numerous tribes, such as the Omoki, &c. These latter were portions of a widely-spread race now represented by the fast-diminishing Jukagiri, whose language, so far as I have examined it, is very different from the Esquimaux (a copious vocabulary may be seen in Billing's travels). Again, between the travels of Cooke and those of Whymper, the language of the inhabitants of Kotzebue Sound has changed considerably, and become more Esquimaux, which seems to show that the Esquimaux have quite recently been pressing in this direction also.

All these facts point to apparently only one conclusion, that the original home of the Esquimaux was in the regions near the Pole, from which they have migrated to a more temperate climate; and I can see no good cause for such migration, except the increasing rigour of the climate. The question is one of great interest, both to ethnology and physical geography, and I hope Dr. Rae will favour your readers with some more facts on the other side.

While the evidence seems to be overpowering that the climate has been gradually growing more severe in the highest latitudes, there is a good deal of evidence which points to a corresponding decrease of severity elsewhere. We cannot read the descriptions of Gaul and Germany in Roman times and reconcile them to the state of things that at present exists there, without believing that the climate has very much improved. It is rash to take isolated seasons, but we may compare with profit the accounts of the terrible winters of Roman days, during which the Rhine and Danube were frequently frozen over, with the comparative mildness of modern times. The reindeer and the elk then ranged far to south of their present habitat. Ovid's lamentations over the fearful severity of his place of exile on the coast of Thrace are matched by the accounts of white foxes, &c., which then lived there, and by the proverbial rigour of the winters on the coasts of the Black Sea; while the diminution in the energy and vigour of the races that inhabit the Mediterranean borderland can best be accounted for by the theory which makes them to have in some measure succumbed to a more enervating climate. If this be true, we have a very remarkable fact hitherto ignored, so far as I know, by scientific men, namely, that it is possible that circumpolar climate may have been very temperate when the climate of more southern latitudes was very severe. This paradox, upon which I should very much like to have the opinion of some of your correspondents, is favoured by the following fact:—"It is a common remark of those who frequent the Polar seas, that they find always the least obstruction from ice when the preceding winter has been very severe in more southern latitudes. In the year 1766, though the frost had proved most intense through the rest of Europe, the whalers reached a high latitude; and not to multiply instances, the three last seasons (*i.e.* 1815, 16, and 17), which have been reckoned very open, have succeeded to winters notoriously cold and protracted," *Edinburgh Review*, 30, 34). We have only to extend the analogy of a season to a number of seasons, and we at once get a similar result to the one above named, *i.e.*, that an increase of severity of climate in low latitudes is balanced by a diminution of severity in high ones. I need hardly point the moral in the present letter of the value of such a result in speculations on the existence of the mammoth in Siberia and Northern Russia during the Glacial epoch, &c.

Derby House, Eccles, June 4 HENRY H. HOWORTH

Origin of Cyclones

IN NATURE of August 17, 1871, Mr. J. J. Murphy calls attention to a paper by Mr. Meldrum on the origin of

storms in the Bay of Bengal, &c. This paper advocates the theory of their origin "in the meeting of the trade-winds in the northern and southern hemispheres, at some distance north or south of the equator."

Mr. Murphy says:—"Over the greater part of the Pacific cyclones do not appear to be found. The reason of this probably is that, in consequence of the temperature of the sea changing but little with the seasons, the two trade-winds over the Pacific meet each other nearly on the equator all the year round; though I do not know how far this is confirmed by observations on the winds of that ocean."

Very little is known about the meteorology of this part of the Pacific, and my object in writing is to communicate to Mr. Murphy and others who may be interested in the subject the following facts:—

1. There is rarely a year without at least one cyclone passing through, or in the neighbourhood of, one of the following groups of islands, viz., Fiji, Samoa, or Hervey.

2. The cyclone season extends over a greater part of the period during which the sun is south of the equator; consequently, when the trade-winds from the north reach farthest south. Cyclones are most prevalent about the middle of the season, or rather later than the middle. They rarely visit us earlier than December or January.

3. They are usually preceded for a few days by strong northerly winds. During such winds we watch the barometer very carefully, as a sudden fall is a sure indication of a cyclone near at hand.

I may add that a strong northerly wind is blowing in this group at the present time. It was indicated by the barometer thirty-six hours before it reached us, and was preceded by a day's calm. It then burst upon us suddenly with fury, but after a few hours moderated to about the force of the S.E. trade-wind.

S. J. WHITMEE

Leulumoega, Samoa, South Pacific, Jan. 8

P.S.—Since the date of my last note we have had two earthquakes—Nov. 13, at 5.5 P.M., vertical, with a great rumbling preceding and accompanying it; Dec. 15, at 12 noon: double shock, with an interval of thirty seconds: slight.

Rain after Fire

SOME old settlers believe that great bush fires cause rain. During this summer exceptionally dry weather has prevailed over the greater part of New Zealand, more especially along the eastern coast; in several of the towns prayers for rain have been offered up in the churches. I beg to send some notes of recent date extracted from our home diary. It should be stated that this district, adjoining Banks' Peninsula, has been suffering from extensive bush fires since the 18th of last month.

"Feb. 1. Strong N.-Wester; very hot; 92° in the shade under the back verandah. Heavy bush fire on the hill still burning; showers in the evening."

On the coast here it is very unusual to have rain with a N.W. wind, which is dry and parching.

"Feb. 3. Strong N.-Easter; showers in the evening."

The bush fire was still burning, and continued to do so till the 7th. On the 5th most of the neighbours turned out to save some property in great danger of being destroyed by the fire. N.E. is a cool dry wind from the sea.

"Feb. 16. Strong N.E. Heavy bush fire under Omauhate and about Cass Peak. Slight showers from the S.W. in the morning; wind veered round to N.E."

Our rainy quarter is S.W. with a low temperature; less frequently we experience thick weather from S.E., accompanied by fine rain. These fires have been traversing a range of hills (more or less timbered in the gullies), their heights from eleven to about four hundred feet above the level of the sea. I believe the showers noted to have been as local as the fires; the direction of the wind is given as prevalent on the dates mentioned, with some indication as to its strength, but we have no memoranda as to its force during the actual fall of rain. Opportunities of watching the gradual formation of cumulus cloud above dense volumes of smoke are by no means rare in this part of New Zealand, where the occupiers of Crown land have periodical burnings of their run, or great portions thereof, in early spring. These notes are forwarded in the hope of helping to illustrate the question of whether fires cause rain, no opinion is ventured on the subject, but this curious phenomenon should be further investigated.

THOMAS H. POTTS

Ohinitahi, New Zealand, Feb. 19]