

accommodate which the order Palæodictyoptera has been formed. It is not for me to here enter into an examination of the materials included in this so-called order. It will suffice to say that not one of them could be suspected of being lepidopterous.

The point at issue is, did anthophilous insects (and therefore flowers also) exist during the carboniferous epoch? According to my views we are without evidence of their existence.

I decline any further discussion on this subject until Mr. Wallace has examined the fossil, or has obtained evidence of its peculiarities from some one in whose judgment he has more confidence than he apparently has in mine.

Lewisham, April 25

R. MCLACHLAN

Captain Cook's Accuracy

IN NATURE, vol. xix. p. 408, there is an article entitled "Captain Cook's Accuracy," which I think reflects unjustly upon the late Admiral Wilkes, U.S.N. As a specimen of Wilkes's inaccuracy the writer of the article cites first the discrepancy in the position of Turtle Island, the south-easternmost of the Fiji group, Cook and Wilkes differing more than 30' of longitude. The narrative of the U.S. Exploring Expedition was written on board ship during the progress of the work, and was placed by Wilkes in the hands of the printer immediately upon his return, in order that the general results might be known without delay. The astronomical positions were given as they were recorded at the time, and were not corrected for final chronometric errors and rates, which were carefully ascertained while the charts were being prepared for publication. A comparison of the narrative with the atlas, published subsequently, will exhibit differences of longitude almost throughout.

On the general chart of the Pacific, sheet III., which is on a very small scale, so that a slight inaccuracy of the draughtsman or engraver will cause a difference of several minutes, Turtle Island will be found to be in about 178° 22' W. long., but the special plan of the island (vol. 2, p. 94, of the Atlas) places it in lat. 19° 47' S., and long. 178° 16' 18" W., while Capt. Denham, R.N., in 1856, places it in 19° 49' 11" S., and 178° 14' 42" W., where it is at present shown on the British Admiralty Charts. The difference of latitude is about 1' 45"; that of longitude, 1' 36"; differences which might readily be accounted for by different points of observation having been used. The difference in the outline is not very material.

As Cook placed the Island in 178° W., he was fifteen minutes in error; while Wilkes differs from the latest surveys about a minute and a half. Capt. Worth, of H.M.S. *Calypsa*, in 1848, placed the island in 178° 8' W., differing seven miles from the subsequent survey by Capt. Denham, the position by the latter being now borne on the British Admiralty chart, yet the former authority is quoted to prove the inaccuracy of Wilkes's work.

Findlay, judging from what he says upon this subject, consulted Wilkes's book, instead of his chart, which was published subsequently. The second example of Wilkes's inaccuracy, cited by the writer, is that he found from a position which he occupied at Savaii, a trend of coast differing from that as shown by Wilkes's chart, but it is a question whether he was not mistaken in the identity of the point occupied by him. The waters of the Samoan group are, so far as we know, navigated safely and almost exclusively with Wilkes's charts.

The third and last example is concerning Quiros Island (Swain's Island). The facts in this case are that the boats of the exploring expedition did not effect a landing on the island at all; efforts were made to do so, but were unavailing on account of the surf, so that it is quite impossible that they could report the existence of a lagoon hid from their view by a wooded strip of land even if only a quarter of a mile in width.

In criticising the work of such explorers as Cook, Vancouver, and Wilkes, it should be borne in mind that the expeditions which they commanded were for exploring rather than surveying purposes, and it is rather a matter of surprise that they should have come so near the truth when we consider the crude materials with which they had to work.

Hydrographic Office, U.S. Navy,
Washington, D.C., April 11

S. R. FRANKLIN
Captain U.S.N. and
Hydrographer

Sense of Force and Sense of Temperature

"J. T. B.'s" "discovery" of the distinction between muscular sensations—or, as he styles them, the "sense of force," whatever

that may mean—and the sensation of temperature, has been long anticipated by Alexander Bain in his work on "The Senses and the Intellect."

Again, your correspondent's illustrations of the distinction he draws between absolute and relative muscular sensations and sensations of temperature are wholly illusory. How can it be said that a letter-sorter enjoys and improves absolute sensations of weight? Surely his sensations enable him to determine not "absolute weight" (whatever that may be), but the weights of particular letters relative to certain standards, according to which relation the postage is charged. These sensations enable him to say that certain letters are over, and others under, an ounce in weight, and thus they are in fact relative, not absolute, as "J. T. B." seems to suppose.

The same remarks apply to "J. T. B.'s" assertion that "the sense of temperature may also be rendered absolute to a certain extent," and to his illustration of the plumber who judges whether the heat of the soldering-bolt is adequate for his purpose. Here again the sensations are, in truth, purely relative, any inference drawn from them being based upon a comparison of present and previous sensations and present and previous experience of their results.

Mark Lane, April 23

Mr. Preston on General Temperature-Equilibrium

MY attention has been arrested by Mr. S. Tolver Preston's paper on general temperature-equilibrium in NATURE, vol. xix. p. 460, and by a letter from him in a later number (p. 555), pointing out a trifling literary ambiguity in it. As this implies that the paper is otherwise correct, you will perhaps allow me to protest, and to state that it is full of confusion of reasoning and of unsoundness.

I do not know how many sins against dynamics could be discovered by careful examination, but at least two pervade it throughout, viz. (1), the assumption that the simple relationship which exists between the movements and the temperatures of molecules of matter exists also between the movements and the temperatures of masses of matter; (2) the assumption that gaseous molecules (simple or compound) whose bond is chemical affinity differ mechanically from masses of matter (stellar or otherwise) in size and weight only, whereas they really differ in a multitude of other ways, and notably in elasticity; and from this difference alone it would be easy to show that the analogy in the paper is fanciful, and its reasonings and conclusions invalid, but I respect your space.

In conclusion I would say that I am not writing against the hypothesis of temperature-equilibrium itself. It may or may not be true. All I assert is, that this paper gives no real information about it.

WM. MUIR

133, Upper Thames Street, E.C., April 26

The Migration of Birds

IT was because Prof. Newton mentioned such distances as six, seven, and ten miles (*vide* NATURE, vol. xix. p. 434), in connection with the flight of migratory birds, that I brought forward the matter of temperature, and the latter still appears to me to have as much bearing on the question, as has the density of the atmosphere.

The intense frost on Christmas eve, 1861, was said to have killed a large number of thrushes, blackbirds, &c., in Scotland. Near Edinburgh, where the thermometer registered about -4° F. during the night, many dead birds were found. These deaths resulted from cold, not from starvation, for the weather was open until within a few days of Christmas day. Now, if a frost of this severity has such an effect on bird-life, surely it must be conceded that temperatures from -25° to -100° F.—those that would reign between six and ten miles' elevation, with surface temperature of +80° F.—would slay the hardest migrant.

There is a great difference between the elevation required to view a distant sea horizon, and an equally distant mountain-top. For instance, to obtain a sea-horizon of 300 miles, you must mount nearly twelve miles; but from an altitude of four miles, the summit of a mountain 20,000 feet high (less than 4 miles) would be visible, though its base lay 300 miles off. Similarly, if an elevation of 5,000 feet only be granted to the haze that constitutes the loom of land, birds flying two miles high will have a circle of vision, for the land indication, of over 200 miles radius. Under such circumstances, if the journey is 1,000 miles in length, a deviation of some 12° on either side of the true direction of flight