written narrative of Australian discovery interesting. Mr. Eden has told the story attractively, and the reader will not only be greatly interested, but will have a fair idea of what has been done to extend our knowledge of the "fifth continent" from its first discovery down to the trans-continental journeys of Warburton and Forrest—the latter, however, being referred to in a sentence or two.

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.*]

Dr. Bastian and Prof. Tyndall on Spontaneous Generation

I BEG you to allow me a few lines to protest, as Prof. Tyndall has done elsewhere, against Dr. Bastian's proceeding, in citing a number of observers *in support* of his views (NATURE, vol. xiii. p. 284), whose researches taken in each case—as a whole—furnish conclusive arguments *against* his views.

It is only by an inadequate statement that the observations of Dr. Pode and myself—which appear in Dr. Bastian's list—can have this signification attached to them. Where we obtained the result which Dr. Bastian obtained, we were able to trace it to a vitiation of the experimental conditions. Our results conclusively and categorically contradicted the particular assertions contained in Dr. Bastian's book, the "Beginnings of Life," into the truth of which we set ourselves to inquire.

Feb. 16 E. RAY LANKESTER

Radiometers and Radiometers

I HAVE recently been trying some experiments with a radiometer, obtained from Mr. Browning, and as some of my results are different from what I was led to anticipate, I should like to know whether there is anything special in my particular instrument, or whether other people have noticed the same things.

In Mr. Crookes' paper on "The Mechanical Action of Light," *Quarterly Journal of Science*, No. xlvii. p. 348, he states that "when only dark heat is allowed to fall on the arms [of the radiometer], as from a vessel of boiling water, *no rotation whatever is produced.*" (The italics are mine.)

Now I find that my radiometer is particularly sensitive to dark heat, the presence of a heated copper wire, or still more that of an iron poker when only slightly warmed, instantly accelerating the number of revolutions.

But more than this: when exposed in a room to diffused daylight, the velocity of rotation is greatly influenced by the temperature of the room, and is by no means an indicator of the amount of light only.

One morning this week during the frost, upon looking at my radiometer, it appeared to be motionless, although standing not far from my study window. When placed nearer to the light it revolved, but so slowly that I thought the instrument must have received an injury. The room at the time was very cold, as the fire had not been lighted. After the fire had been lighted and the temperature of the room raised, the velocity of rotation increased, and upon observing the instrument just before dark, when the room was very warm, the rotation was considerably greater than it had been in the window in the middle of the day, although at the time there was only just enough light in the room to enable me to see the instrument at all. When I brought the radiometer near to the fire, which consisted only of dull hardly glowing coals, the rotation of the arms became so rapid as to render them almost invisible.

Upon taking the instrument out of doors between five and six o'clock in the afternoon, the thermometer a few degrees below freezing-point, the arms revolved slowly from right to left as usual, but upon bringing it near to a mass of snow, and shading the light off by some pieces of wood, I could see that the arms revolved slowly in the opposite direction, that is, in the same direction as the hands of a watch. Later in the evening I held the instrument in the open air in bright moonlight, the thermometer being at 24° F., and the rotation was again in the same direction as the hands of a watch. The next morning, when the temperature was nearly the same, but the air foggy with only feeble light, the arms revolved at about the same rate but in the usual direction, from right to left. In the evening I again held the radiometer in the moonlight in the cold frosty air; the rotation was as before, from left to right. Carrying the instrument in my hand I approached the house, the hall door of which stood open. As I came within reach of the light and heat the rotation diminished, and at length ceased, but upon entering the hall it commenced again, only in the opposite direction. In fact, I could stand in such a position that upon moving a few feet either way, I reversed the direction of rotation, while between the two there was no motion at all.

I afterwards repeated the experiment in a different form. I placed the instrument in a cupboard in a very cold room, with a considerable quantity of ice. Upon just opening the cupboard door and peeping in, I could see that the arms were revolving very slowly, but distinctly, from left to right. Upon opening the door a little wider the motion ceased, and when still more light was admitted the motion was reversed. I then removed the ice and nearly closed the door—the rotation ceased entirely; but upon introducing a piece of heated iron the arms spun round as fast as they usually do in full sunlight, and this, be it remembered, when the cupboard was almost dark, the door being only just sufficiently open for me to see the instrument, certainly not more than a quarter of an inch. T. N. HUTCHINSON

Rugby, Feb. 12

Since writing the above, I have been favoured with a note from Mr. Crookes, in which he points out to me that his results have been obtained by means of radiometers constructed with *pith* discs, and having no metal at all in the moving parts. In the little instrument that I have used the discs are of mica, blackened, of course, on the alternate faces, but mounted upon four metallic arms, apparently aluminium foil. Mr. Crookes observes: "I long ago gave up metallic instruments owing to their erratic movements while radiating or absorbing heat. I have mentioned this peculiarity of metallic radiometers in my papers for the Royal Society."

As this difference between the instruments used accounted, to some extent, for my obtaining results so different from those described by Mr. Crookes in the paper referred to, I felt at first that there was no further need to trouble you with these remarks, and that they had better be consigned to the waste paper basket. Upon second thoughts, however, it seems to me that there is still something that requires explanation, or, at all events, that I do not understand, in the different action of dark heat on pith only, and on mica mounted on thin metallic arms. The four arms are very fine, equally bright, and similar in all respects, hence it is difficult to see how rotation should be produced by the action of heat on the metallic parts of the apparatus. The vacuum, no doubt, is not so perfect as that obtained by Mr. Crookes with his exquisite Sprengel pump, but even this would hardly account for the "erratic movements" that I have observed.

I may add that since performing my experiments I have learnt that one of my pupils in Rugby School, Mr. H. F. Newall, has observed very similar results with a radiometer in his possession. T. N. H.

The Sailing Flight of Birds

HAVING had during several long voyages in the Pacific considerable opportunities for observing closely the flight of sailing birds, and especially of *Diomedea Melanophrys*, or "Mutton Bird," as I believe it is called by the Australians, a few suggestions on the subject may perhaps not be uninteresting to your readers.

This bird differs considerably in size from the albatross of the Cape, but as the principles of its flight are the same, the few suggestions I wish to make will apply with equal force to both species, and indeed to all sailing birds.

The *Diomedea* of the Cape it is well known can support itself in the air for a very long time without flapping its wings, and in "The Reign of Law" it is stated that "sometimes for a whole hour together this splendid bird will sail or wheel round a ship in every possible variety of direction, without requiring a single stroke of its pinions." This *may* be accurately true, but in the case of the smaller albatross I refer to, between one and two minutes, or perhaps 1,000 or 2,000 yards in space, is more approximately the limit to which the bird's power of sailing is exercised. When the flight begins after rest the bird appears to feel very considerable difficulty in rising from the sea. It runs along the surface for some distance, flaps its wings very vigorously, and continues to do this after it has left the water, until it acquires a