far towards solving many of our chief difficulties. It is perhaps somewhat revolutionary, but, whether we like it or not, even the scientific times move forward, and we can no longer maintain—most of us cannot afford to maintain—our pre-war usages. One would like opinions on this matter, for action of some kind will need to be taken in the not distant future.

WILLIAM B. BRIERLEY.
Rothamsted Experimental Station,
Harpenden, August 29.

Whispering-Gallery Phenomena at St. Paul's Cathedral.

THE very curious and interesting acoustical effects observed in the Whispering Gallery under the dome of St. Paul's Cathedral have, as is well known, been explained by the late Lord Rayleigh as due to the curvilinear propagation of sound, the waves which proceed from a source placed close to the wall of the gallery clinging to its surface and creeping tangentially along it. This view was developed mathematically by Lord Rayleigh ("Scientific Papers," vol. 5, p. 617), the theoretical conclusions arrived at being (*a*) that the sound-waves travel in a comparatively narrow belt skirting the wall, the thickness of this belt decreasing with the wave-length of the sound; (*b*) that in this belt the intensity is a maximum near the wall and decreases rapidly and continuously as we proceed radially away from it; and (*c*) that the intensity does not fluctuate markedly as we proceed circumferentially parallel to the wall.

We were much interested in the subject, and by the courtesy of the authorities of the cathedral have been enabled to carry out an extended series of observations in the gallery with the view of making a precise test of Lord Rayleigh's theory. Our experiments show conclusively that while the indication of theory as expressed in (*a*) is substantially accurate, neither of the conclusions (*b*) and (*c*) is in accordance with actual facts. Using a steady source of sound placed close to the wall at one point, we found that elsewhere the intensity of the sound showed pronounced oscillations in proceeding inwards radially from the wall, the ear of the observer passing several times through alternate zones of great intensity and of comparative silence. In the latter some of the overtones of the source could be heard clearly, while the fundamental was practically inaudible. These alternations of intensity could be demonstrated in the gallery, using a fairly high-pitched source and a sensitive flame as indicator. The distance between the successive zones of silence was about the same as the half-wave-length of the source. There were also distinct periodic fluctuations of intensity in proceeding circumferentially—that is, parallel to the wall. The latter were not equally distinct in all parts of the gallery, being most marked at the other end of the diameter containing the source.

The circumferential fluctuations of intensity might be interpreted as being, at least in part, due to the stationary interferences of waves which meet after passing in opposite directions round the gallery. But the radial fluctuations are less easily explained, and must be regarded as fundamental in any satisfactory theory of the Whispering Gallery. We find that effects similar to those we observed at St. Paul's may be demonstrated in the laboratory with any large circular reflecting surface, using a bird-call with a sensitive flame as sound-detector.

The experiments thus show that, while the explanation put forward by Lord Rayleigh is at least on the right lines, it is far from being a completely satisfactory theory of the Whispering Gallery. We propose at an early opportunity to go more fully elsewhere into the question of the revision necessary in the theory.

C. V. RAMAN.
G. A. SUTHERLAND.
22 Oxford Road, Putney, S.W.15, August 26.

Ceratium furca and Pedalion mirum.

IN describing the specific characteristics of *Ceratium furca*, one of the Peridiniæ or Dinoflagellates, Saville Kent in his "Manual of the Infusoria" gives the habitat as salt-water, and he appends a note to the effect that, "although usually regarded as entirely marine, M. Werneck has reported the occurrence of an apparently identical species in fresh-water in the vicinity of Salzburg."

It may be of interest to students of the Protozoa to state that on August 19 and 27 I discovered this species in two separate bodies of fresh-water in this district. It may be the case that other workers have found the form at other points in Great Britain, and that, by reason of my not having access to the scattered literature on Protozoa, I am only reporting an already well-established fact; but it will be most interesting to know whether *Ceratium furca* has been found elsewhere in this country, and I shall be glad to have the views of those who have given attention to this matter.

Kent gives the entire length of *C. furca* as 1/120th of an inch, say 212 microns. I find that very few of my specimens are so small as this, and I have measured several up to 256 microns, which is 21 per cent. larger than the recorded length.

The remarkable and interesting Rotifer, *Pedalion mirum*, discovered by Dr. Hudson in 1871 is described in Hudson and Gosse's classical work, "The Rotifera," as being very rare, and up to the date of the publication of that work, twelve years later, it had been recorded only from three places. Others have doubtless since been added, but Pedalion may probably still be regarded as a rare species. I have found it in both the waters in which *Ceratium furca* occurred, and in the first gathering on August 19 it was fairly numerous. A list of the known habitats of this Rotifer would be most interesting.

ALFRED E. HARRIS.
44 Partridge Road, Roath, Cardiff, August 29.

Illumination of Plankton.

IN avoiding compressed-air illness by the excellent method which we owe to Dr. J. S. Haldane, divers ascending from deep water often have to spend periods of half an hour or so in idleness suspended on a rope in mid-water 20–30 ft. below the surface. The blank tedium of such occasions can be relieved by watching the ebb and flow of plankton past the face-glass of the helmet and musing on the remarkable variation in its apparent quality and quantity from day to day.

As the diver looks upwards and inwards towards the black, shadowy keel of the salvage vessel he sees the individuals of the plankton standing out vividly by a sort of dark-ground illumination. Turning his head outwards and looking into unrelieved water space, again using a simile from microscopy, the field is overflooded with light, contrast is absent, and the teeming multitudes blend into granular haziness. In August, after our salvage ship has been moored for an hour or two in the open sea, mackerel find her out, and daily a compact shoal of them con-