wisest men, disregarding at this juncture mere scientific claims. The council should select for presidents at this time not representatives of science as merely to do honor but men of large experience and sympathy with the association affairs. It is of less consequence what the public thinks about the association than what we shall do for ourselves.

Realizing the gravity of the condition at this critical time the council will make wise decisions only after full discussions in a generous spirit; and the membership should in patience trust the collective wisdom of the council.

HERMAN L. FAIRCHILD.

ROCHESTER, N. Y.,
December, 1904.

'THE PROBLEMS OF EXPERIMENTAL PSYCHOLOGY.'

TO THE EDITOR OF SCIENCE: On p. 788 of your issue of December 9 (second column, line 8), I am made to speak of 'classification *a posteriori*.' What I wrote, what the sense requires, what I saw in proof, and what I left in proof, was 'classification *a potiori*.' On p. 794 (bottom of first and top of second columns), I am made to say: 'we analyze and trace to their conditions total consciousness.' What I wrote, what grammar requires, what I saw in proof, and what I left in proof, was 'consciousnesses.' A little knowledge, even in a proof-reader, is a dangerous thing.

E. B. TITCHENER.

CORNELL UNIVERSITY,
December 10, 1904.

[The errors probably would not have occurred if Professor Titchener had returned his proof to the editor in accordance with the instructions accompanying it. It was sent directly to the printers.—ED.]

SPECIAL ARTICLES.

A SUGGESTION LOOKING TOWARDS ULTRA-MICROSCOPY.

THE visibility of an object both to ordinary vision and when helped by telescope or microscope depends upon a favorable combination of several physical conditions. (1) The object must send us ethereal waves whose lengths lie between the limits of 0.38 and 0.76 microns or the violet and red ends of the spectrum respectively. (2) The difference between the intensity or color of these waves and those coming from the adjacent background must be appreciable to our nervous system. (3) The focus on the retina must be sharp. (4) The duration of the image on the retina, or, as the photographer would say, the length of the exposure, must be long enough to enable the brain to appreciate the details of the image.

By means of photography we are able to make long exposures and the fourth condition can be satisfied to such extent that fleeting pictures are caught by instantaneous exposures, while the faintest nebulæ and stars are caught by exposures that last many hours. Becquerel's first photograph by the rays that are called after his name was by an accidental exposure of many days.

By means of the schleier method, originally due to Foucault, we can overcome the difficulties of the second condition and photograph moving air waves when properly illuminated, and this method can be applied to microscopic objects and liquid substances as well as to the larger motions of the air that have been photographed by Mach, DuBois and others.

The ultimate limit of visibility is also defined by the second condition or the wave-length and intensity of the illuminating light that can affect the retina, or the sensitized photographic plate. An object that is visible by monochromatic violet light may not be visible by monochromatic red light or *vice versa*, just as a body that can vibrate to a given high pitch is often too small to send out a low note. An ear that is too dull to hear the low notes may hear a high pitch. Our retina is so constructed as to be insensible to ultra-violet light, but we can by fluorescence make short waves become visible, *i. e.*, an object illuminated by ultra-violet light whose wave-lengths may be anywhere from zero to 0.38 microns may be too small to be directly affected by long waves, but will, by fluorescence convert the short waves into longer ones whose lengths may be any given multiple of the ultra-violet wave, and will,