Since v. Kries' results agree with those of König as regards the two elements of the comparison, they naturally agree with them as regards the conclusion. According to the ideas of Hering, two lights which are equivalent at an ordinary intensity must have an equal white valence, or, since that is the same thing as their twilight-values, these also must coincide. But that is very far from being the case; the mixture from the two ends of the spectrum, which is for the dichromate absolutely indistinguishable from an homogeneous light in the yellow green at an ordinary intensity, needs to be made more than a hundred times brighter to match it in a faint light. And what Hering has considered to be possible sources of error in the experiment have here been entirely done away with. It follows that it is an absurdity, upon practical as well as theoretical grounds, to speak of a brightness of a color as being due to the brightness of its colorless component.

Ueber die Wirkung kurzdauernder Lichtreize auf das Sehorgan.

J. VON KRIES. Ztsch. für Psychologie u. Physiologie der Sinnesorgane, XII., 81-101. 1896.

A large number of observations have been made lately on the subject of the secondary image which follows a brief excitation of the eye by a rather strong light. The phenomenon was noticed by Purkinje, who noticed everything; it was rediscovered by Professor C. A. Young, and the most detailed experiments upon it have been made by Hess, and especially by Bidwell, by whom it has been called the recurrent image. The observations upon it have been of a very conflicting nature; it is usually stated to occur one-fifth of a second later than the primary image, but Exner found no interval at all. In color it has been described as complementary, except by Hess, who found it to be of the same color. Bidwell and v. Kries discovered at about the same time that it fails to occur after excitation by red light, and v. Kries has now observed that it is also altogether wanting in the fovea; these two circumstances point strongly to the influence of the now commonly accepted difference of function of the rods and the cones of the retina, and consequently a study of the effect upon it of adaptation—a change of condition which takes place chiefly in the rods and which is without doubt a function of the visual purple—was very desirable. This v. Kries has now carried out; his method was similar to that of Bidwell, and consisted in allowing a spot of spectral light to fall upon a mirror which rotated upon an axis not perpendicular to its surface, and from that to be reflected to the eyes of the observer, who perceived a bright spot moving about a central point of fixation. Under

these circumstances the ghost was very distinct, of complementary color to the primary image, and at a distance from it which translated into time was equal to one-fifth of a second, so long as the eye of the observer had not been adapted for darkness; the constant darkness adaptation of the eye was maintained, since the walls of the room were black, by frequently looking out of the window. The first image is sharply defined, not quite circular, but rather cylindrical, with a concave edge behind; the second gradually fades off in a faint trail, and its head is surrounded by a circle of more than ordinary blackness. But if the light is very intense, so much so, for instance, that the trail stretches out through the entire circle, then the first image is also much longer (this is, no doubt, the ordinary positive after image), and becomes joined on to the secondary image; this is the form in which Exner saw the phenomenon—without any interval.

If the eye has first suffered complete darkness adaptation (that is, has been kept in the dark for two hours, at least), the appearance presented is very different; the secondary image is of a brilliant white, and it appears almost immediately after the first image, which is consequently in shape more like a slender crescent. The secondary image, in one or the other of its two forms, Professor v. Kries very properly takes to be at least the principal cause of the phenomenon of the fluttering heart. Both forms alike vanish when the real image goes through the central part of the retina. One observer said that it seemed as if they slipped into a tunnel. The area of this ineffective space was about 35 by 38 mm. at a distance of 1 m. from the eye, which corresponds very exactly with the size of the space which is practically free from rods.

From various attendant circumstances, Professor v. Kries is forced to assume that there are two distinct reactions of the rods, not simply one reaction which takes place after adaptation both with greater force and with greater promptness. He suggests that one may be due to visual purple in the rods, and the other to that outside of the rods, assuming in both cases that the visual purple is a true visual substance, whose product of decomposition excites the nerve end.

C. LADD FRANKLIN.

BALTIMORE, MD.

Theorie des Talbotschen Gesetzes. Von KARL MARBE. Wundt's Studien, XII., Heft 2, pp. 279-296.

The general statement of Talbot's Law is as follows: If two light stimuli successively and periodically excite the same point on