VISION.

Oscillations rétiniennes consécutives à l'impression luminense. AUG. CHARPENTIER. Comptes Rendus. 13 Jan. 1891.
Nouvelle forme de réaction négative sur la rétine. id. 27 Jan.
La réaction négative et la centre de la rétine. id. 3 Fév.
Strosboscopie rétinienne. id. 10 Fév.
Irradiation ondulatoire de l'impression luminense. id. 17 Fév.

M. Charpentier pointed out, some five years ago, that the starting up of a light-process in the retina is followed at a very brief interval by a process of the opposite character, that is, by something which causes an instantaneous sensation of extreme blackness. Under favorable conditions there are several alternations, less striking than the first one, of light and dark, before the continuous sensation of a bright surface establishes itself. So marked is the first sensation of blackness that it has been named the *black band*, when it is formed just after the advancing border of a white sector upon a rotating wheel. The whole penomenon is referred to as *retinal oscillations.* In the series of papers in the *Comptes Rendus* whose titles are given above, M. Charpentier discusses both this subject and the 'recurrent image.' The latter was first noticed by C. A. Young, and has been best studied by Shelford Bidwell. According to Charpentier, it is not well named; it is not properly called an image, for it does not always reproduce the shape and size of the luminous object which it follows; if that is feeble in intensity, its ghost is smaller; if that is very bright, the ghost may be five or six times as large as its original. Moreover, what has been seen by many observers as a definite recurrent image is in fact merely a maximum phase of a sensation which, in its waxing and waning, lasts for a considerable time. But as M. Charpentier does not propose another name, we shall continue to use the one which has become somewhat familiar.

His method for producing the phenomenon consists in a rotating black disc with a window in it which constitutes the moving luminous object. This window is lighted up by a piece of ground glass which is itself illuminated by rays which have passed through a plano-convex lens and which come from a source of light the intensity of which can be regulated. Thus the rapidity of the moving object, its intensity and its size can all be varied at pleasure. When these conditions are all happily chosen (the author does not state what they should be, except that a single revolution of the disc should take place in from one to three seconds) the bright object is followed first by a very black interval and then by a re-vivescence of itself, usually of no definite color, but bluish when the preceding light is very feeble, and of a greenish-yellow color after blue. Some have seen it only after blue, in which case it is in fact always most distinct. Charpentier finds it after all colors; others have failed to find it after red, but Charpentier used red glass and Shelford Bidwell succeeded, with an ingenious arrangement, in using spectral light. Red glass, while it is red in a very different sense from that in which any other colored glass is of its color, is usually rather more yellowish than the extreme limit of the spectrum. The black interval may have a duration of one-fourth of a second if it follows a feeble and short excitation; otherwise it lasts one thirty-sixth of a second. Here also an oscillation may be seen under favorable circumstances. These oscillations in sensation at the beginning and at the end of an excitation by light are very suggestive of the oscillations in the direction of the electrical current which are the objective effect of the action of light upon the retina.

There is an additional observation upon the black band to the effect that it may still be detected when the preliminary excitation is so short that there is no white surface for it to appear upon; it may then be seen as a band of extreme blackness *upon the recurrent image.* This would seem to be equivalent to saying that the negative reaction of the shock of the impinging light is so strong as to mask the negative reaction of the shock caused by sudden darkness. To show this it is only necessary to make a very narrow window in the revolving disk; one degree is a convenient width.

Since there is a negative reaction at the beginning and at the end of an excitation, it seemed possible that a sudden change of intensity would produce the same effect, and this was found to be the case.

The black band had been found to propagate itself beyond the place on the retina which had been effected by the original excitation, in two directions and with a definite velocity, which had been calculated. With the arrangement just described it is very easy to exhibit this phenomenon; the persistent image has attached to it a larger or smaller luminous zone of diffuse light, and (after a very short preliminary excitation) two black streamers may be seen upon this, one proceeding towards the fixation point and the other in the opposite direction, the latter resembling the tail of a comet, with its convexity turned in the direction of the movement, the other being perhaps slightly concave in the same direction. They both begin to appear at the same moment with the black band, and on either side of it; they consist, therefore, of a propagation of this negative reaction in a definite direction and with a definite velocity, a velocity of about 77 mm. a second upon the retina. It is believed that these streamers also exhibit oscillations.

By a stroboscopic method, the oscillations are found to take place at the constant rate of 36 or 37 a second, for a mean intensity of the illumination; if the intensity is much greater or much less, the rate may be from 40 to 34 per second. Another circumstance brought out is that the diffuse spot surrounding the recurrent image changes its shape, becoming sometimes more circular and sometimes more elliptical, and that this change of shape has also a rhythm corresponding to that of the successive black bands. The subject is extremely interesting. It is to be hoped that these new observations will be confirmed and extended.

C. L. FRANKLIN.

BALTIMORE, MD.

Light Intensity and Depth Perception. T. R. ROBINSON. Am. Jour. of Psych., VII., 518–532. 1895.

Admit to one eye less light than is admitted to the other; then

I. a: If but little light is excluded from the second eye, to close that eye will darken the total field, to increase its light will brighten it;

b: If more light is initially excluded, an 'indifference point' (referred to below as limit A) is reached where increase or decrease of the light admitted to the second eye produces no effect on the brightness of the combined field (Robinson, in a previous article);

c: Starting with the initial proportion below the indifference point, to close the second eye produces the same effect as to increase its light; *i. e.*, a decrease of intensity of physical stimulus results in an increase of intensity of sensation (Fechner's paradox). This effect increases from the indifference point downward, until at a certain degree of obscuration of the second eye occurs the maximum darkening of the common visual field, hence a maximum brightening upon closing it or increasing its light (Aubert's minimum point; referred to below as limit B).

II. a: If the eyes are directed by lenses to separate fields, upon which are drawn figures for stereoscopic combination, complete stereoscopic combination occurs down to a certain degree of obscuration of the second eye (called limit C below);

b: With greater obscuration, the combination is only partial, or confused, down to a certain second limit (limit D);

c: Below this second limit no stereoscopic combination occurs, but only a binocular combination of the two fields, where the objects