FROM THE EYE CLINIC (CHIEF: PROFESSOR G. KARPE)
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THE ELECTRORETINOGRAM ON BINOCULAR AND MONOCULAR LIGHT STIMULATION

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Wirth (1951) found the *b* potential on the electroretinogram in man to be lower on binocular light stimulation than on monocular. The difference was so large that the *b* potential on binocular stimulation was denoted as subnormal in relation to that on monocular stimulation. To explain this finding, he suggested that the bipolar centrifugal cells of the retina have a consensual action when stimulation is binocular. Their centripetally conducting, crossing fibres would run in the optic fasciculus to the optic centres in the cortex. A centrifugal inhibiting reflex would be able in this way to decrease the *b* potential of the other eye.

Wirth also envisaged the possibility of an electrochemical process, but rejected this idea on account of the inappreciable time available for such a process.

The observation in question is of great theoretical interest, and is also of considerable practical importance for clinical recording of the electroretinogram.

A prerequisite for such an examination is, however, that no change takes place in the state of accommodation of the eye during the examination. Otherwise, an experimental error is introduced that is difficult to control. It is hard to avoid this experimental error on successive recording of a binocular series, and thereafter of a monocular series from one eye. It is not apparent from Wirth's account whether this error could be eliminated in his investigation.

It is, however, possible to eliminate the error of adaptation

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by making the recording simultaneously from both eyes, with alternate covering of the right and left eye, followed by binocular recording.

The investigation reported in the following was performed in this way, in order to ascertain whether Wirth's observation could be confirmed.

Method.

The ERG recorded with the method described by Karpe in 1948, but with simultaneous registration from both eyes.

The intensity of stimulus was 20 and 800 m.c. The light stimulus was screened off from either eye as follows. The patient was provided with a pair of underwater goggles fitting tightly round both eyes. A broad ring of sponge rubber was placed round the frame of the goggles, and a pasteboard cuff, which could easily be taken on and off, was slipped over the frames (see Figs. 1 and 2).

When the head band with the leads was in place, the underwater goggles were put on. The contact glasses were attached to the leads, and the pasteboard cuff was slipped over them. The contact glasses were then inserted and filled with physiologic saline. The pasteboard cuff was attached to the frame of the goggles. The leads from the contact glasses were passed over the edge of the cuff and anchored with adhesive tape. A bakelite lid with an inner disc of sponge rubber, and a diameter large enough for the edge to fit over the cuff, was used to cover the opening.

In this way, absolute impermeability to light was obtained for one eye at a time. Using the bakelite lid, it was easy to cover each eye alternately.

A blepharostat could not be used, since it projected beyond the goggles and let in light.

After five minutes adaptation to darkness, the recording was started. Light flashes were given at 15-second intervals, with first the right and then the left eye covered. Finally, both eyes were stimulated concurrently, both being uncovered. Altogether 10 such series of recordings were made in each subject with a light stimulus af 20 m.c. and 10 with 800 m.c.

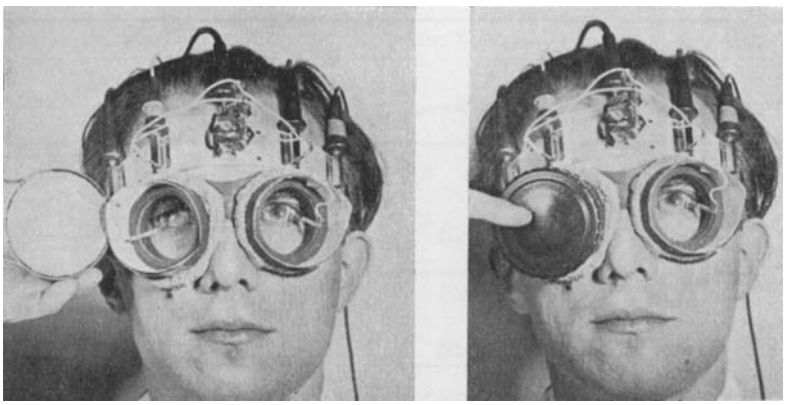

Fig. 1.
Arrangement for screening off either eye. Both eyes uncovered.
Fig. 2.
As in Fig. 1, but with the right eye covered.

Using this technique, the change in the adaptation to darkness was not introduced as a source of error in the calculation of the *b* potential. A possible slight change in the adaptation then had an equal effect in both series, and could therefore be disregarded in a comparison between them.

Case Material.

The experimental subjects consisted of 8 medical students and 2 student nurses. Ophthalmologic examination showed normal conditions in every case. The corrected visual acuity was 1.0, and the refraction tanged from — 1.5 to + 1.5.

Results.

The results of the investigation are recorded in Table 1.

It may be inferred from the table that no consistent difference (Diff) existed between the *b* potential on monocular (R/L) and binocular (R + L) light stimulation.

The largest differences are + 0.02 and — 0.03. They are present in only one case at 20 m.c. and in another at 800 m.c. Nor is there any difference in this respect between the 20 m.c. and the 800 m.c. series. In order to give a better illustration

Table 1.

Case	Eye	20 m.c.				800 m.c.			
		b pot. R.E.	Diff.	*b* pot. L.E.	Diff.	*b* pot R.E.	Diff.	*b* pot. L.E.	Diff.
1	R+L	0.42		0.45		0.28		0.29	
	R/L	0.42	0	0.45	0	0.29	+0.01	0.28	−0.01
2	R+L	0.43		0.44		0.42		0.46	
	R/L	0.42	−0.01	0.42	−0.02	0.43	+0.01	0.45	−0.01
3	R+L	0.35		0 36		0.31		0.27	
	R/L	0.34	−0.01	0.36	0	0.32	+0.01	0.27	0
4	R+L	0.29		0.31		0.19		0.16	
	R/L	0.32	+0.03	0.36	0	0.20	+0.01	0.16	0
5	R+L	0.37		0.46		0.41		0.41	
	R/L	0.35	−0.02	0.46	0	0.42	+0.01	0.41	0
6	R+L	0.41		0.42		0.34		0.35	
	R/L	0.41	0	0.43	+0.01	0.36	+0 02	0.34	0
7	R+L	0.37		0 34		0.25		0.25	
	R/L	0.36	−0.01	0.34	0	0.26	+0.01	0.26	+0.01
8	R+L	0.45		0.43		0.37		0 35	
	R/L	0.45	0	0.43	0	0.38	+0.01	0.35	0
9	R+L	0.39		0.33		0.28		0.26	
	R/L	0.39	0	0.34	+0.01	0.28	0	0.27	+0.01
10	R+L	0.55		0.53		0.39		0.39	
	R/L	0.54	−0.01	0.53	0	0.36	−0.03	0.40	+0.01

R+L = binocular light stimulation.
R/L = monocular light stimulation.
Diff. = increase or decrease in *b* pot. occuring on monocular light stimulation compared with binocular. Each *b* pot. is the mean of 10 recordings.

of the results, some ERG curves are shown; they were recorded from the same subject (Case 1 in Table 1). One curve is a recording at 20 m.c. (Fig. 3) and the other at 800 m.c. (Fig. 4) with calibration.

Summary.

The electroretinogram (ERG) with binocular leads was recorded in 10 persons with healthy eyes. The stimulus was alternately monocular right eye, monocular left eye and binocular, at 15-second intervals. Both 20 m.c. and 800 m.c. were used as the light stimulus.

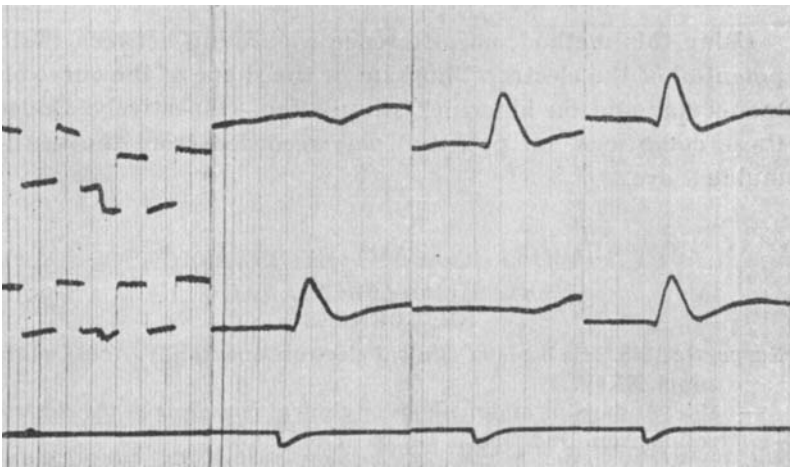

Fig. 3.

Light stimulus: 20 m.c.

Binocular stimulation:	*b* pot. R.E.	0.42 mV	
	b pot. L.E.		0.45 mV
Monocular stimulation:	*b* pot. R.E.	0.42 mV	
	b pot. L.E.		0.45 mV

(Each of the above potentials is the mean of 10 recordings).

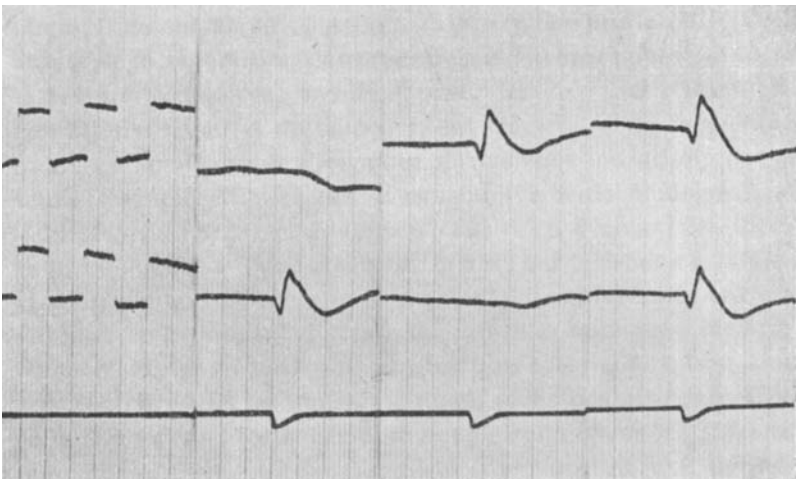

Fig. 4.

Light stimulus: 800 m.c.

Binocular stimulation:	*b* pot. R.E.	0.28 mV	
	b pot. L.E.		0.29 mV
Monocular stimulation:	*b* pot. R.E.	0.29 mV	
	b pot. L.E.		0.28 mV

(Each of the above potentials is the mean of 10 recordings).

Using this method, no difference was found between the *b* potential of the electroretinogram or the shape of the curve on monocular and on binocular stimulation, respectively. Under these conditions, no potential was recorded from the unstimulated eye.

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