to the medium, however actually reduces the activity of the enzyme and at a higher concentration stops it completely. It thus appears possible that the cations Mg, Na, K, Ca, Ba, Sr, and Fe play a certain role in the enzyme systems of *B. dermatitidis* which may be bound by the addition of trimeton maleate and can be overcome by a certain concentration of the above-mentioned cations.

From a pharmacological point of view it was deemed of interest to determine whether added histamine and/or histidine could neutralize the growth inhibition by trimeton maleate in a way similar to the neutralization of the histamine effect by this agent in human and animal experiments. Histamine and histidine, singly and combined, were added to trimeton-treated culture medium in amounts ranging from one half to three times the molar equivalent of the combined trimeton. Results of the trials revealed that addition of histamine and/or histidine failed to overcome the growth inhibition of *B. dermatitidis* by trimeton maleate under the conditions of the experiments.

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Visual Acuity and the Normal Tremor of the Eyes[1]

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Recent measurements have demonstrated that the "grain," or mosaic structure, of the retina does not set a limit to the resolution of fine detail. For example, it has been shown that a dark line is visible against a bright field if its width subtends a minimum angle of 0.5″ at the eye of the observer (*1, 2*). Vernier displacements of slightly under 2″ are now reliably reported (*3, 4*). Stereoscopic and real depth thresholds of about 2″ have consistently been obtained (*4–9*). Since the subtense of a single cone receptor is not less than 15″–30″ at the center of the human fovea (*10, 11*), it appears that human visual resolution is 10–20 times better than one might anticipate on the basis of "local signs" from individual receptor cells.

The various hypotheses that have been suggested to account for resolution share the central idea that discreteness in the spatial arrangement of the receptor cells is somehow compensated for by continuity in time. That is, the relatively large receptor cells may "scan" the image and convey to the brain a temporal and spatial pattern of nerve impulses which signal the presence and relative position of the corresponding objects in space. In short, the most sensitive local signs from the retina are "mean local signs" (*6*) and not "cone receptor local signs." A mean local sign is derived from a temporal summation of graded responses of a number of receptor cells, so that its spatial position is not restricted to the discrete position of any one cone receptor.

[1] These experiments were done under Contract N7onr-358, Task Order II, Project NR-140-359, between Brown University and the Office of Naval Research.

It is not our purpose to summarize or evaluate here the "dynamic" theories of visual acuity. The reviews by Walls (*9*) and Senders (*12*) may be consulted in this connection. Rather, we wish to describe some experiments that appear to demonstrate the role of mean local signs in binocular vision. Our conclusion from these experiments is that the "corresponding points" of binocular vision represent corresponding mean locations on the retina, rather than a one-to-one correspondence between cone receptors in the two eyes.

The basic system of recording eye movements by the use of a contact lens has been described elsewhere (*13*). The diagram in Fig. 1 shows the manner in which this system has been modified for binocular measurements. Plane, first-surface mirrors at M_1 and M_2 are mounted on plastic contact lenses that have been fitted to the eyes of the subject. Any rotation of the eyes in the horizontal plane will displace the images at I_1 and I_2, formed by lens L of a vertical ribbon filament R. A cylindrical lens C serves to concentrate the vertical line images as points on the recording film F. The film, moving at a constant speed, registers the horizontal component of the movements of each eye during attempted steady fixation on a point P.

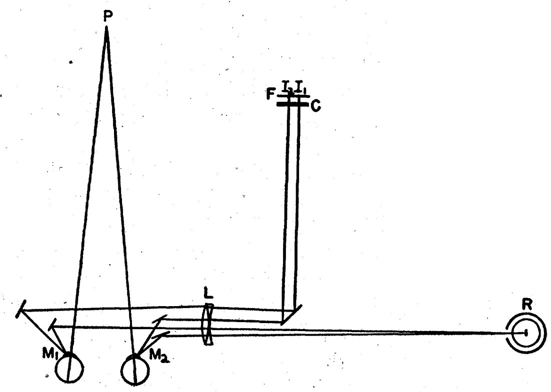

FIG. 1. Diagram of apparatus for recording the horizontal component of binocular eye movements (not drawn to scale).

Binocular records have been obtained for two of the five subjects who took part in the original investigations (*13*). Fig. 2 contains samples of records from one subject. The relatively large involuntary drifts and jerky motions, described in earlier investigations (*13–15*) are in general rather closely synchronized. They appear to be coordinated in the achievement of convergence and lateral fixation on the target point. Note, however, that the relatively small involuntary tremor movements are independent for the two eyes.

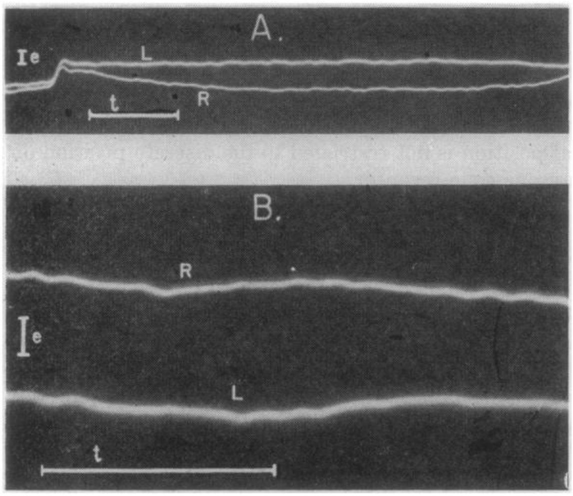

FIG. 2. Sample records of eye movements for one subject. *A*, records showing sudden jerky movement, slow drifts, and minute tremor; *B*, enlarged view of the tremor movements. In each record *L* is the trace for the left eye and *R* for the right eye, *t* represents $^1/_{10}$ sec of time, and *e* represents 100 sec of angular rotation of the eye.

These movements, occurring at frequencies up to 90/sec, amount to approximately 15 sec rotation of the eye in their median extent from crest to trough.[2] They are perhaps a natural result of the fact that the eyeball is balanced between pairs of antagonistic muscles.

Our conclusion from the above-described results is that the eyes are never similarly stimulated by a single point in the visual field. Over brief intervals, when no movement is present except for minute tremor, the mean position of a retinal point for the right eye may be identified rather closely with the mean position of a corresponding point for the left eye. The instantaneous separations of the two "corresponding" retinal points, however, must deviate rather widely (i.e., to a median extent of 10–20 sec of arc) from the mean separation. It therefore appears that the notion of anatomical corresponding points on the retina must be modified to include a rather broad range of correspondence.

The above conclusion is seemingly at variance with the data on stereoscopic acuity which reveal that disparities of about 2 sec of arc between the images for the two eyes can be used as cues for the perception of depth. In other words, the correspondence of image points for the two eyes is much closer than the correspondence of points on the retina. We may perhaps resolve this apparent contradiction by assuming that in stereoscopic vision we somehow integrate in time so that the mean retinal location rather than instantaneous retinal location is the basis for stereoscopic acuity. Existing data on the subject of exposure time (*7*) do reveal very much lower acuity for brief flashes than for longer exposures, as would be expected from the above hypothesis.

Finally, it appears that we must qualify the traditional concept of "corresponding points" in binocular vision. We must go beyond the assumption of an exact pairing of cone receptors in the two eyes. Although it may exist, such pairing is not in itself sufficient as a mechanism for the detection of such minute displacements of the image as are perceived stereoscopically. We do not wish to speculate further at this time, except to point out that both spatial and temporal patterns of impulses from the two eyes must somehow be combined centrally. The discreteness of retinal elements is therefore shown to be no more significant in relation to stereoscopic acuity than to the resolution of vernier displacements of fine black lines.

[2] This particular subject has the steadiest eyes of five subjects used in an earlier investigation (*13*). Hence the figure of 15 sec may be taken as a conservative estimate of the extent of such tremor. The measurements of the angle θ of rotation of the eye were obtained by use of the relation $\tan \theta = \frac{d}{2f}$, where *d* is the deflection of the photographic trace and *f* is the (focal) length of the optical path from the lens *L* to the film *F* in Fig. 1.

Control experiments, some of which were reported in the earlier paper (*13*), reveal that contact lenses which are individually fitted to the eyes adhere tightly and follow the tremor without appreciable slippage.

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