Technical Papers

The Stereoptometer—A Simple Haploscopic Instrument for the Study of Binocular Space Perception

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In planning a series of basic studies of the functions operant in binocular stereoscopic range finding, the need for a relatively simple laboratory instrument was manifested. The requirements appeared to be that the instrument (*a*) approximate the visual tasks of the operator of a binocular stereoscopic range finder; (*b*) be as psychologically simple as possible (e.g., be without the complexities introduced by optical and/or base magnification or minification); (*c*) be adaptable to use both in controlled laboratory situations and in actual field situations.

Of the three types of classical instruments available (haploscopic, stereoscopic, and Howard-Dolman rods), a haploscopic-type instrument was considered most appropriate because of the similarity in the visual tasks presented by such an instrument and by a binocular stereoscopic range finder. Specifically, in both tasks the observer is presented with a "simulated" reticle field for comparison with an actual field of view.

In the instrument developed, the reticle field is provided by two USAF reflex gun sights. The reflex sight (see the schematic presentation in Fig. 1) consists of a source of illumination (A), a diffusion glass (B), a reticle disk (C) placed at the focal point of a Mangin mirror (D), and a half-reflecting surface (E). The Mangin mirror transforms the divergent light rays from the pattern cut in the reticle disk into parallel beams of light. The half-reflecting surface reflects these parallel beams to the eye, while at the same time allowing transmission to the eye of light (F) from the field of view. To an observer looking through the reflex gun sight, the reticle image appears to be located at some indefinite distance in the "real" field.

In a pilot model stereoptometer (Fig. 2) constructed at the Psychology Department of the Army Medical Research Laboratory, two reflex sights (S) are used. One (S-1) is mounted rigidly to a base; the other (S-2) is mounted on a bearing which allows rotation in a horizontal arc. The tangent of the angle of rotation of the one sight with respect to the other is found by use of a thousandth-inch dial gage measuring from a point calibrated as being 9.060 in. from the center of the point of rotation. As the movable sight is rotated through a given angle (e.g., the angle represented by a change in the tangent from A-1 to A-2), the point of intersection of the extensions of the two

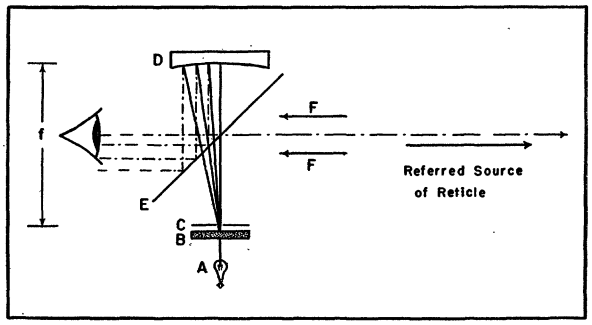

FIG. 1. Schematic diagram of a reflex sight.

reticle beams from the reflex sights is changed accordingly (e.g., from R-1 to R-2). A range, the distance from the fixed sight (S-1) to the point of intersection, is determined by appropriate trigonometric calculations. These calculations follow the formula: Range = (9.060) (IBE)/(gage reading), where the IBE is an interpupillary base estimate for the observer. With the gage reading expressed in inches, the range will be expressed in the same units as the IBE.

The instrument provides for two types of ranging tasks through the use of fused and unfused reticle fields. When the reticle patterns used are similar to the extent of allowing fusion by the observer into a single reticle image, and when the left and right reticle beams are adjusted to yield no vertical displacement, the ranging task becomes one of true stereoptic acuity (i.e., vergence of the right reticle beam results in phenomenal movement of the single fused reticle image in depth). In this case, the on-target condition occurs with the phenomenal alignment of the reticle image with the target in the depth dimension. When, however, the reticle patterns used in the reflex

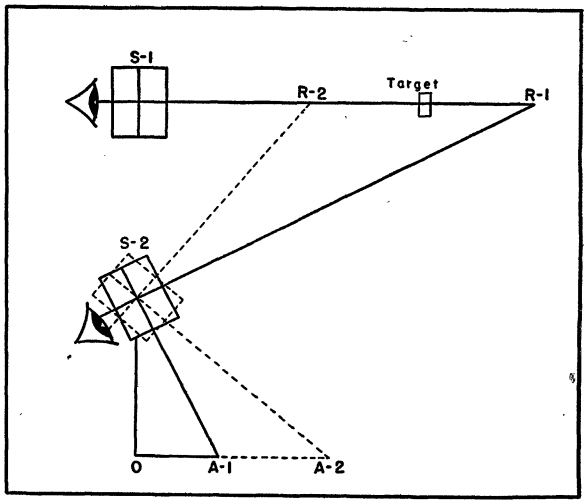

FIG. 2. Schematic diagram of a stereoptometer.

sights are dissimilar to the extent of preventing fusion, or when the left or right reticle beam is adjusted to yield a vertical displacement between the two reticle images, the ranging task may become one of either binocular summation or interocular vernier acuity (i.e., vergence of the right reticle beam results in phenomenal movement of the right reticle image in the right-left dimension only). The on-target condition in this case occurs while fixating the target with the phenomenal achievement of the particular geometric configuration used (e.g., the vertical alignment of the two reticle images of the two vertically displaced reticle beams).

It may have been noted that the instrument described above provides for vergence of the right reticle beam only. With such asymmetrical vergence, the fused reticle image in the stereoptic task appears to move obliquely from far-right to near-left, and vice versa. Were the left reticle beam the verging system, this apparent motion would be on a near-right to far-left oblique, whereas with symmetrical vergence the fused reticle image would appear to move radially in depth. It would seem desirable to have an instrument which would provide symmetrical vergence of both reticle beams as well as asymmetrical vergence of either. Such an instrument is under construction at this laboratory.

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Studies on the Uricase Activity of Rats Fed *p*-Dimethylaminoazobenzene

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An attempt was made in this paper to investigate the uricase activity of rats in the course of liver-cancer production by *p*-dimethylaminoazobenzene (butter yellow) feeding. The rats were fed *p*-dimethylaminoazobenzene for 120 days by the method of Kinoshita (*1*). This was continued for an additional 2–3 weeks with the basal diet free from the dye. After this both sexes of 14 albino rats were killed by exsanguination within a week. The livers were classified macroscopically according to the suggestion of Nakahara *et al.* (*2*) into four groups: macroscopically normal, uneven surface, cirrhotic, and liver cancer. As a control group, both sexes of 10 albino rats were fed with basal rice diet. Water intake was ad libitum and green vegetables were supplied twice a week.

To estimate the uric acid consumed, Benedict's direct method was adopted. Enzyme solution was prepared as follows. A piece of liver tissue, weighing exactly 1 g, was ground in a mortar and thoroughly extracted with 10 ml of borate buffer solution (pH 8.5), and centrifuged at 3000 rpm for 5 min. To 0.5 ml of this extract, 2 ml of borate buffer containing 0.4 mg of uric acid and 20 ml of borate buffer was added. After adding 0.5 ml of toluene, each test tube was stoppered tightly and incubated at 37° C for 6 hr. After the incubation, to 5 ml of this solution was added 4 ml of 1/12 *N* sulfuric acid, and 0.5 ml of 10% sodium tungstate solution (Folin-Wu's precipitation method), in succession, after which the solution was filtered. To 5 ml of the filtrate, 4 ml of sodium cyanide solution and 1 ml of arsenophosphotungstic acid was added, the test tube was placed in a boiling water bath for 3 min, and it was then left at room temperature for about 2 min and finally subjected to photocolorimetry.

TABLE 1

URICASE ACTIVITY OF THE LIVER OF RATS IN THE COURSE OF LIVER CANCER PRODUCTION (37° C, 6 HR).

Liver findings	No. of examples	Uric acid consumed (mg %)*	Uricase activity†
Normal liver (controls)	10	0.312 (0.276–0.369)	100
Experimental group macroscopically normal liver	10	0.390 (0.356–0.432)	125
Uneven surface liver	4	0.357 (0.285–0.414)	114
Cirrhotic liver	6	0.294 (0.227–0.359)	94
Liver cancer	6	0.072 (0.041–0.098)	23

* Figures given as averages and ranges.
† Value for normal taken as 100.

All data are summarized in Table 1. It is clearly seen in the table that the degrees of uricase activity of the livers which showed macroscopically normal and uneven surfaces were 125 and 114 respectively, whereas the activity of the normal liver reached just 100. The uricase activity of the cirrhotic liver was 94, and that of the liver cancer was only 23. This indicated that the uricase activity of rat liver was evidently increased when the pathological change in the liver was not recognized or not remarked. But, when the liver tissue became cirrhotic, the uricase activity became less remarkable than the above and almost the same as normal. It is noteworthy that when the liver tissue became cancerous, the uricase activity dropped to only a quarter of normal.

Conclusions. It was demonstrated that the uricase activity of rat liver increased once at the early stage of liver change and then decreased at the cancerous stage in the course of liver-cancer production. Uricase contains iron in the molecule as catalase does. Drastic decreases in the activity of catalase of mice and rats by tumor implantation were demonstrated by several workers (*3*), especially Greenstein (*4, 5*). And the significance of this enzyme has become more prominent in cancer research since the discovery of toxohormone by Nakahara and Fukuoka, who have shown that the extraction of a fraction with low molecular weight from tumors which, when injected intraperitoneally, lowered liver catalase activity of normal mice (*6, 7*).