In the Laboratory

The Lifwynn Eye-movement Camera

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In connection with the investigation of behavior disorders carried on by the Lifwynn Laboratory, accurate photographic recordings of eye movements were a specific requisite. After surveying the field and experimenting with eye-movement cameras constructed by other laboratories, it was found desirable to develop an apparatus which would meet our special needs, namely, the simultaneous recording of the horizontal and vertical components, the velocity and exact course

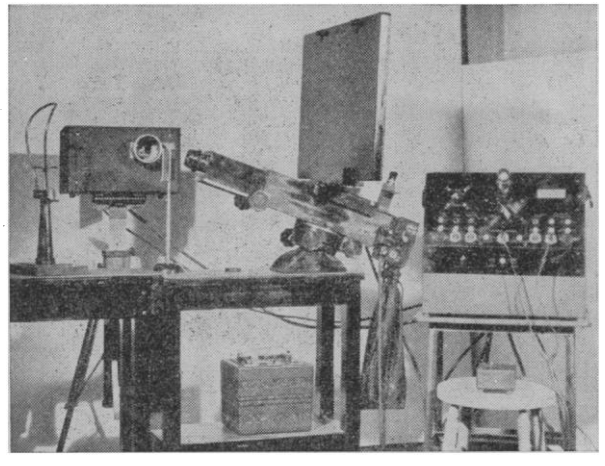

FIG. 1

of motion, and the position and duration of the fixations. It was important not only that these features be recorded simultaneously but also that they be recordable on a single frame and that a quick and easy analysis of each experiment be possible without calculation or other complicated procedures.

The Lifwynn Eye-movement Camera, as shown in Fig. 1, was devised and built by Dr. Henry Roger in his laboratory at Sandy Hook, Connecticut. Mr. Charles Robinson assisted in the development and construction of the electrical features, to be reported in detail in a future communication. The writer participated regularly in the discussion of the distinctive features required to be incorporated in the camera and in progressive experimentation with it.

The apparatus consists of three major parts: a camera with film magazine and frame-changing device, a light source, and an electrical control unit. All parts of the apparatus are interconnected by electrical cables. These are operated and controlled from a central electrical control panel.

The camera incorporates the principle of a still camera and uses 35-mm. motion-picture film. The frame size is 18×24 mm.—that is, the same as is used in regular silent motion-picture cameras. The frame change is activated by a pulldown, operated by a solenoid which is an integral part of the mechanism itself. The frame change is timed to take effect automatically once every second, but by manual control a longer exposure may be obtained.

The frequency of exposures varies from 5 to 30 per second. These frequencies were chosen arbitrarily following a number of experiments which showed that these rates were most likely to permit an adequate analysis of the photographic impressions. However, the number of exposures may be increased to 60 per second and even more if this should seem desirable.

The accuracy of the time intervals between the exposures is quite reliable. It is achieved by an electrically controlled stroboscopic device which lights up a flash lamp at intervals as set by a dial on the control panel.

In order to register the sequence of the eye movements and the duration of the fixations, a rotating dial is employed through which the flashes are projected on the cornea and from there reflected into the camera. The dial, moving clockwise, shows the changing positions of its bar, which can be analyzed readily on the photogram.

In order to secure sharp photographic impressions of this dial on highly sensitized photographic emulsions a very short exposure is required. The powerful light source needed for this purpose was secured by employing a flash tube controlled by a thyratron tube. Disturbing effects of the light flashes are obviated by means of an ultraviolet filter placed in front of the light source.

With regard to its duration, the experiment can be accurately timed within seconds or minutes by a synchronous timer which not only controls the experimental period but also actuates the shutter in the camera, the frame-changing device, and the dial that rotates in front of the light source. It was found advisable that a single turn of the dial, adjusted to one revolution per second, be registered on a single frame to avoid crowding the photogram and making analysis difficult. If, however, one desires to obtain an over-all picture of a subject's eye movements, it is possible to register a longer period on a single frame.

A projection device permits one to superimpose

several frames and also to superimpose the track of the eye movements upon the picture which the subject may be asked to observe during the experiment.

The registration and analysis of eye movements were undertaken as part of the study of the physiological modifications occurring in two forms of attention or adaptation investigated by Burrow and his co-workers. The investigation was undertaken especially with regard to disturbances in attention, as we found that a primary deflection in the process of attention was an invariable accompaniment of disorders of behavior, both individual and social. We had previously found specific alterations of the respiratory function (*1*) and of the electroencephalic potentials (*2, 3*) to be concomitant with these modifications in attention and behavior. These instrumentally measurable and verifiable aspects confirm the distinction made between the two types of attention: (a) *ditention,* as seen in "normal" as well as in neurotic behavior, and (b) *cotention,* which represents the organism's primary phylobiology or its healthy basis of orientation.

References

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Inactivation of Penicillin by Zinc Salts

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The Oxford investigators and others have reported that penicillin is inactivated by contact with various heavy metals.

In connection with experiments to determine quantitatively the influence of certain pure metals and their salts, we found that the time needed to inactivate the penicillin is quite different for the various metals and salts. The inactivating process depends on different factors and generally takes several days to complete. Zinc salts (*i.e.* sulfate, acetate, chloride, oxide), however, showed an exceptional behavior in our experiments and inactivated penicillin in a short time. That this particular action of the zinc salts, even in such a low concentration as that used under the conditions of our experiments (1/300–1/60 M) has no perceptible bacteriostatic effects calls for special attention. The inactivation with a well-defined, inorganic, easily sterilizable, and stable substance, such as zinc salts, seems to us to be preferable in some cases to procedures with enzymes or other organic compounds; at least, this method may be of interest as a complement or control of another base. The zinc inactivation method is quite useful to us in determining the effects on penicillin of metals and their salts, particularly because in the presence of these substances the use of enzymes sometimes offers serious difficulties. This preliminary report of the "Zn-inactivation method" may be valuable in cases where usual inactivators have thus far been employed.

Experimental Technique

Penicillin: We employed commercial penicillin-sodium of several manufacturers.

Test organism: The H strain of the Oxford investigators or another coagulase positive strain of *Staphylococcus aureus* sensitive to penicillin was used.

Inoculum: Culture media were inoculated with 3 drops (3/50 ml.) of a 12- to 18-hour broth culture.

Culture media: For the serial broth dilution method we used infusion broth (meat infusion and peptone), adjusted to a reaction of about pH 6.5±, distributed as a routine in small test tubes, 2 cc. for each tube. For the Oxford cup method we have employed ordinary nutrient agar (the same infusion broth solidified with 2½ per cent agar).

Zinc sulfate: Sterile solutions in water of $ZnSO_4 \cdot 7H_2O$, 5, 10, 25, and 50 per cent, were employed.

Procedures: The inactivation of penicillin by zinc sulfate can be studied by various simple and satisfactory routine procedures.

In the *Oxford cup method,* to each cubic centimeter of nutrient agar, melted and seeded with *Staph. aureus,* 1/50 ml. of one of the zinc sulfate solutions is added according to the desired concentration. We use for this purpose a capillary pipette, standardized to 1 drop = 1.50/ml. The agar is poured into plates, and the glass cups are placed on the agar and filled with the penicillin solution to be studied. Incubation is at 37°. The inactivation of penicillin is recognized by bacterial growth throughout the whole plate.

An *inverted* cup assay is as follows: To nutrient agar melted and seeded with *Staph. aureus,* as already described, the desired amount of penicillin solution is added. The mixture is poured into plates; glass cups are placed in the agar and filled with the corresponding zinc sulfate solution. Penicillin inactivation is judged by observing a zone of *Staph. aureus* growing around each cup. On the rest of the plate there is no bacterial growth.

The broth dilution method consists of adding 1/50 ml./cc. of one of the zinc sulfate solutions to a single tube with penicillin solution in normal saline or pure water, alone or with body fluids. Incubation is at 37°. After adequate time (12–24 hours or more), serial