highest feasible solute concentration (*16*), whereas for glycine the yield is still rising when the solubility limit is reached.

Stein and Weiss (*17*) found slightly lower yields for the deamination of glycine and, because of the unchanged yields in the presence of hydrogen or oxygen, considered that the radicals H, OH, and HO_2 were equally efficient in the deamination reaction. Such experiments are always open to the alternative interpretation that the substrate reacts so rapidly with the initially formed free radicals that the latter are not converted to other species by reaction with the added gas.

The fact that glycine is a poor protector for alloxazinadenine dinucleotide (*18*) suggests that these two solutes react with different entities arising from the irradiation of water. This lends support to the view that glycine reacts with H or OH but not with both.

A further phenomenon observed by Dale *et al.* (*13, 19*) in the study of protection phenomena is that of the "changing quotient." It was found that the efficiency of the protecting agent decreased as its concentration was increased. This was explained as being due to the inactivation of an enzyme (C.P.) molecule by a protector molecule previously "activated" by reaction with a radical. It is significant that all the substances for which the phenomenon was observed, namely, glucose, thiourea, sodium formate, dimethyl urea, and dimethyl thiourea, are known from protection experiments to react very efficiently with the radicals that deactivate C.P. (*13, 19*). If the concept of the formation of two groups of radicals in irradiated water is accepted, the explanation of the changing quotient must be modified to take into account the greater number of activated protector molecules present in the solution as the concentration of the protector is increased and it reacts with an ever-increasing proportion of the initially formed free radicals.

The validity or otherwise of the hypothesis here presented may be tested experimentally by measurements of the *G* values for the destruction of simple molecules over the greatest possible concentration range. Using radioactive isotopes, it is possible to make such experiments, measuring the disappearance of the substrate and not merely the appearance of a particular product.

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Three-Dimensional Movies without Special Equipment

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There follows a method for putting a binocular feeling of depth into the viewing of an ordinary single-strip moving picture without the use of any complicated or special equipment. Some related observations on a relevant class of physiological phenomena are also included.

A well-known technique for obtaining two pictures of an object from slightly different directions is to rotate slightly the object between exposures (for example, tilt a microscope slide by placing a hair under one side); a stereo pair is thus obtained. This idea has been extended to moving pictures by placing the object on a rotating table (*1*) and taking movies as it rotates through two complete revolutions. This long film is cut in half, and the two resulting filmstrips are shifted in phase between corresponding views by a few frames before simultaneous projection through two projectors. For x-ray movies, the system has been modified (*2*) by a projector that simultaneously projects frames No. 1 and 3, then 2 and 4, and so forth, of a single movie of the rotating subject. (The images in both of the foregoing cases are channeled to the proper eye, for example, with polaroid.) There is another method based upon a physiological effect that allows a person, during ordinary single projection, to see a delayed or previous image in one eye while the other eye sees the present image; this can be used to see depth in any ordinary moving picture that contains sufficient motion.

The time delay between the viewing of a scene and the arrival of the impression in the brain depends on the brightness of the scene, the time being a decreasing function of brightness. Thus, if a person views a pendulum from a direction perpendicular to the plane of swing and places a neutral filter before one eye, the bob will appear to swing in an ellipse, since that eye is supplying an image of a previous position which fuses with the other image to give a resultant position in front of or behind the plane of swing. Such effects are often associated with the name Pulfrich (*3*). A monocular demonstration can be given in a darkened room, using a cigarette with a glowing tip (brighter

than the body of the cigarette). If the cigarette is shaken up and down, the tip will appear to separate itself from the body and dance up and down separately, being 180° out of phase at certain frequencies. Shaking the cigarette longitudinally will cause an apparent periodic change in length. The existence of the effect apparently indicates a threshold in the visual process that is more quickly reached by a large amplitude transient than by a small one.

Thus, to introduce an apparent retinal disparity in a movie of a rotating object, a person need only cover one eye with a neutral filter. Translation will also bring objects out from the background and shift one's angle of view to give depth. Owing to the color-sensitive transient build-up of retinal response, it might be possible to equalize approximately intensities with different colored filters before the two eyes and still have the effect (cf. Fechner Colors, for example, the Benham Top) while viewing monochrome movies. A red filter might be considered to dark adapt one eye (*4, 5*) alone. If the wrong eye is covered, for the existing direction of motion, an unfamiliar scene can appear turned inside out (pseudoscopy). In terms of the filter density, one can calculate the proper angular velocity that the body must have in order to give a normal effective interocular separation (realistic depth). For example, if the difference in time delay from the two eyes is 0.025 sec and the object is 12 ft away from the camera, it should be turned at about 1 rev in 8 sec. Objects in the scene that are turning faster will have their structure magnified in deepness, and vice versa. Circling by the camera can also augment or produce this effect. Apparent depth is inversely proportional to camera distance if the latter is not constant. A darker filter would be appropriate with slower turning, or with slow-motion projection.

It might be noted that the time difference over a given scene is probably not exactly constant, because of a lack of linearity in the dependence of time delay on apparent brightness, but this does not noticeably distort depth. In fact, if the ambient illumination in the swinging-pendulum experiment is altered, the path seems relatively unchanged, thus indicating a reasonable degree of linearity over the range. The fact that the system works indicates that this dependence applies "point by point" within one field of view. Probably these time delays are too short to be effective for movies in general, but in experimental situations the method is convenient. To transmit a 3D television image by this means, it might be better to follow the receiver by a separate cathode-ray tube for each eye and have one tube receive its signal via a delay line. Unlike other systems, band width need not be doubled (just as the previous did not require twice as much film).

A variable density goggle would allow the performance of inexpensive experiments in continuously variable effective ocular separation. It can be observed that whenever a person places a filter before one eye while watching a rotating real object directly, he varies his effective interocular distance. An easy way to demonstrate the movie effect is to watch, with one eye filtered, a ground-glass camera image of an object on a low-speed phonograph turntable. Three-dimensional or depthy shadows can be cast on a flat wall by rotating an object before a point source of light and viewing the shadow in this manner. (In the case of the aforementioned pendulum, it is obvious that the shadow will jump through and off the wall—that is, travel along the path that the pendulum itself would appear to follow). An interchange of filter position will alter the apparent sense of rotation. Without a filter (the density range 0.3 to 1.0 is suitable), a rotating shadow is completely ambiguous. The foregoing method not only is a way to put true binocular "3D" into many single movies (colored or monochrome) by a simple subsequent process, but it exemplifies quite a general method for coding and decoding two channels of certain types of information into one by a form of repetitious time-modulation.

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Incorporation of C^{14} into Various Carbohydrates of Tobacco Leaves after Different Periods of Photosynthesis in $C^{14}O_2$*

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In the numerous recent studies on the path of carbon during photosynthesis, attention has been paid mainly to various soluble compounds, while the role of starch has been neglected. Moreover, in an attempt to find the first compound into which carbon is incorporated, the tendency has been to cut down the time of photosynthesis to as short a period as possible. It appeared desirable, therefore, to follow incorporation of carbon from CO_2 in a starch-producing plant and to extend the observed duration of photosynthesis to several hours. The present experiments were performed with this object in mind.

Nicotiana tabacum plants (variety Connecticut seed leaf) were placed in darkness for 8 hr to deplete their starch content. Then after 2 hr of illumination a large number of 1-in. leaf disks were punched and strung on 10 nylon strings, 10 disks per string. The disks were placed on wet blotting paper at the botton of an 8-liter desiccator, where according to preliminary tests each disk received a constant supply of water.

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