fixative formula, washing in tap water and drying. It was found by trial that the D-72 concentrate had to be diluted at least fifty times to work slowly enough to stop the action before overdevelopment occurred and the time of immersion in the developer had to be cut to a matter of seconds. The film procedure finally became one of immersion only long enough for complete wetting, immediate removal and rinsing in water, then observing and quickly stopping the developing action by acid fixative. Fixation was arbitrarily set for five minutes and washing for ten minutes. Drying was by wiping with a towel and manual manipulation to reduce wrinkling. Images were present in all trials for the silver fluoride, silver chloride, silver bromide and silver iodide. The images were within the membranes and very distinct.

The extreme rapidity of development may possibly be due to a radical overexposure instead of to the fact that the developing agent can act through both surfaces of the film. Experiments are under way to determine the validity of this premise.

Examining the image under an oil immersion objective and a 15× ocular, the combination having a total magnification of 1400×, it was seen that the metallic silver particles were very small in size, were regularly shaped like balls, and arranged in what appeared to be an overlapping lattice. The silver particles seemed to be much more regular in size, shape and arrangement than in the standard photographic emulsion. The particles appeared evenly dispersed through the thickness of the membrane in more or less definite layers, each layer slightly different in position from the one above and the one below.

With the foregoing data at hand speculation as to various other membranous materials was aroused. Selecting silver chloride as an easily handled material for deposition, the procedure was tried on freshly prepared collodion, fish swim bladders, "Viscose" sausage tubing and shell membrane from eggs. The reaction proceeded in the same manner as with Cellophane, and upon exposure and development the metallic silver granules were always found in a definite arrangement. The arrangement of the silver granules varied, however, seemingly being dependent on the material utilized as a membrane. With this in mind it is desirable to try the procedure with materials such as gelatine and agar sheets with the prospect of perhaps really seeing the structure of such materials.

It was believed that the same procedure might be used wherever the product of the reaction is less soluble than the reacting substances. With this in mind a very few experiments were done with salts producing relatively insoluble products. Whenever the procedure was tried, it worked as expected, producing granules of very small size always arranged in a pattern similar to that formed with the silver salt in the same membrane.

A matter for speculation is whether a protein solution on one side with a reacting substance calculated to produce a relatively insoluble protein salt or material on the other will form the insoluble substance within the membrane or upon the surface.

It was thought that this process should be submitted for publication as it provides a tool that possibly may not have occurred to those investigating the nature of permeable or semi-permeable membranes. The process might also serve as another means of providing a support and dispersal member for catalytic agents. It might provide a means of introducing therapeutic materials where slow or controlled absorption is desired. The photographic films produced seem to offer something new, however, in the fine grain effect as no usable enlargement shows any granulation; and the rapidity of development, fixing, washing and drying produces a picture in an extremely short time.

I wish to give thanks to Dr. Lawrence Stout, professor of chemical engineering, Washington University, for the suggestion of the possible explanation of the rapidity of development of the photographic film.

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IMPROBABILITY AND IMPOSSIBILITY

IN a communication under the above caption Lecomte du Noüy[1] points out that, after replacing the word "impossible" by "highly improbable," modern physics has, through Heisenberg's principle of indeterminancy, restored the significance of the "impossible" to the microscopic field. Then he goes on to state that there is at least one impossibility in the microscopic field which is implied by the question, "What is the color of the emulsion of an unexposed film?"

It seems to me that this question, properly understood, raises no issue of possibility or impossibility. It does not satisfy Professor P. W. Bridgman's "operational" test, and consequently belongs to that category which he has characterized as meaningless questions.[2] The question, "What color will the emulsion of a particular photographic plate have after it has been exposed to light?" has a meaning, because it may have an answer on the basis of experience and knowledge of the photochemical properties of the emulsion. But du Noüy's question, with the emphasis on the word "is," has no meaning.

[1] Du Noüy, SCIENCE, 100: 334, 1944.
[2] Bridgman, "The Logic of Modern Physics," p. 30; Macmillan Co., 1927.

In a paper on "The Principle of the Unobservable," the present writer[3] formulated criteria by means of which one can determine whether or not a definition or a concept or a proposition is significant. On the basis of these criteria, the concept of the color of an unexposed film is, in the terminology of that paper, logically unobservable; because it contains a logical contradiction. Du Noüy's question asks for the specification of the color of a film, but it rules out exposure to light at any stage of the operation by means of which it may be determined. In other words it, in effect, eliminates the concept of light as an element in the concept of color. But since light is a necessary element of color, the concept of color implied by the question is self-contradictory; consequently, it is logically unobservable; and the question is meaningless.

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IN No. 2598 of SCIENCE Lecomte du Noüy in an effort to illustrate the Heisenberg's principle of indeterminancy tries to present "an observation which would be at the same time practically and theoretically impossible."

He asks a question: "What is the color of the emulsion of an unexposed photographic plate?" and asserts "that we can not know it, and that it will never be experimentally checked."

I do not think that the proposed experiment would serve the purpose, and, therefore, the argument based on this "impossibility" appears to me not convincing.

Every photographic emulsion has its threshold of sensitivity with respect to the duration of an exposure. In many emulsions the exposure of a plate to the light of 1 candle-power for 0.0001 second would produce no chemical change in the emulsion, and, therefore, no change in color of the emulsion layer.

On the other hand, the response of a photo-electric cell to the flux of light of the same intensity is faster than 0.000001 of a second, and, possibly, instantaneous. Therefore, it is possible to devise a photo-electronic colorimeter which, being placed in a camera with the experimented photographic plate, will register and read the color of the light reflected from the plate during 0.0001 of a second.

Furthermore, the belief that "the old determinism received its death blow" is not universal yet. It may be agreed that speed and position of an electron can not be observed simultaneously if a single or few sources of illumination are used. The situation is changed, however, when an infinite number of sources is used which illumine a moving electron from an infinite distance. In such case the impacts of photons (whatsoever their values of $h\nu$ may be) upon the electron produce a continuous pressure, especially when it is considered that each single photon must embrace an electron completely.[1]

Considering an electron of finite dimensions acted upon by photons of finite velocity, we have to ascribe a finite time to the action of a single photon upon the observed electron. Therefore, there is, at least, a statistical possibility to determine the speed and the position of the electron under observation. The time of a single observation must be less than

$$\frac{\text{diameter of electron}}{\text{velocity of photons}} = \frac{2.10^{-13}}{3 \times 10^{10}} = \frac{2}{3} 10^{-26} \text{ sec.}$$

This time may be considerably longer if photons have a length.

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SCIENTIFIC BOOKS

MITOSIS

Mitosis. By FRANZ SCHRADER. 110 pp. New York: Columbia University Press, 1944.

MITOSIS, like photosynthesis and certain other familiar processes, has long presented one of biology's standing riddles. And it still does. Why this is so is ably brought out in Professor Schrader's thoughtful monograph. The author has performed a valuable service in bringing together the ramifying literature in this field and subjecting it to critical analysis. As the sub-title indicates, the treatise is restricted to chromosomal phenomena and deals with cytoplasmic constituents only in so far as they are directly involved in the mitotic process. Viewing the monograph as a whole the reader will perhaps find the following four characteristics especially prominent: (1) Brevity. The size of the volume (only 86 pages in the text, and large print) precludes full treatment of the subject and whets the appetite for the type of survey which the author's 18-page bibliography shows he is prepared to give. (2) Emphasis on recent work and on the modern viewpoint of the biochemist and biophysicist. (3) Skilful treatment of the numerous aberrant types of mitotic behavior which must be considered along with the standard ones before any adequate conception of intracellular kinetic activities can be obtained. This treatment the author is, of course, uniquely fitted to give. (4) Recognition and revelation of the extraordinary complexity of the mitotic

[3] Dadourian, *Scientific Monthly*, 293, 1944.

[1] H. A. Lorenz, *Phys. Ztschr.*, 1910, s. 355.