terpreted as measuring only the L isomer. Further study of this problem using *Lactobacillus fermenti* 36, which responds to both isomers, is in progress.

It will be noted that a fixed test dose of methionine was employed throughout all these experiments, regardless of variation in body size, and this probably accounts in part for the variation in absolute values here reported. However, expressing the observed rate of disappearance in terms of milligrams per hour yields values which are quite comparable. Experiments with other test dosages may further clarify this point.

The rapid initial fall in plasma methionine after intravenous injection is interpreted as due mainly to diffusion into the blood cells and extravascular spaces and, to a very slight extent, to excretion. The more gradual and regular rate of disappearance apparent in the later stages would seem to be a reflection of metabolic phenomena, and hence this has been considered more significant in the interpretation of the response of various subjects to the test dose of methionine.

References

1. DUNN, M. S., CAMIEN, M. N., SHANKMAN, S., and BLOCK, H. *J. biol. Chem.*, 1946, **163**, 577.
2. LYMAN, C. M., MOSELEY, P., BUTLER, B., WOOD, S., and HALE, F. *J. biol. Chem.*, 1946, **166**, 161.
3. WRIGHT, L. D., RUSSO, H. F., SKEGG, H. R., PATCH, E. A., and BEYER, K. H. *Amer. J. Physiol.*, 1947, **149**, 130.

Activation of Eggs by Oxidation-Reduction Indicators

MATILDA MOLDENHAUER BROOKS

University of California, Berkeley

In a previous paper (*1*) the writer suggested that the mechanism of fertilization of eggs was dependent upon the production of the appropriate redox potential of the enzymes controlling oxidations in the egg.

In order to test this hypothesis further, eggs were placed in sea water containing redox dyes whose E_0' values at pH 7.0 ranged from +.195 to −.258, giving an rH from 20.5 to 5.2. These dyes included o-cresol indophenol, methylene blue, brilliant cresyl blue, indigo tetra-, tri-, di-, and monosulfonate, Janus green, and neutral red. The concentration of the dye varied from .002 to .0001 per cent. The marine eggs used were those of *Urechis caupo* and *Strongylocentrotus purpuratus*. Since the end of the season for these eggs prevented further experimentation, this preliminary report is made.

The freshly obtained eggs were placed in solutions of dye in sea water for various periods of time from 1 minute to 24 hours and then replaced in sea water. Crowding was avoided. Samples were taken out at intervals. Activation was observed chiefly when eggs had been exposed from 1 minute to 20 minutes in the dye solution. Activation depended at different times on temperature, time in the dye solution, and concentration of dye. By activation is meant here either the formation of a fertilization membrane or cleavage with or without the membrane. In the case of *S. purpuratus*, development progressed to the pluteus stage in from 1 to 2 per cent of the eggs, in *U. caupo*, to the trochophore stage in about 50 per cent of the eggs. In other cases only the fertilization membrane appeared, the 2-, 4-, 8- or more cell stage developed, or irregular division occurred. The maximum percentage of activation varied from 70 per cent in *Urechis* to 10 per cent in *S. purpuratus*. Toward the end of the season no activation was obtained. In all cases unfertilized controls were completely free from activated eggs, while fertilized controls showed from 90 to 100 per cent activation.

In the case of *S. purpuratus*, the best results were obtained with indigo monosulfonate, which has an rH of 8.7. The rH of the sperm of this sea urchin was found to be from 9.0 to 9.5. In the case of *Urechis*, methylene blue and indigo tetrasulfonate gave the best results. The rH values of these dyes are 14.4 and 12.1, respectively, while that of the sperm of *Urechis* was found to be between 13 and 14. These results show a remarkable agreement between the rH values of the activating dyes and the respective sperms. Neutral red produced some fertilization membranes in a few cases. O-cresol and Janus green showed no results. A few cases of activation were produced by some of the dyes in the middle range of rH values. Development in all cases was slower than that of eggs fertilized by sperm, and a smaller proportion developed. These facts were also found by J. Loeb (*2*) in his experiments on artificial parthenogenesis with salt solutions. In some cases unorganized division takes place, resembling that of growth in neoplasms.

It should be pointed out that the sulfonate dyes have long been considered not to penetrate living eggs. However, since they have an activating effect on eggs in these experiments, one must conclude that either they penetrate at least far enough to produce parthenogenesis or the process of fertilization is initiated as a surface effect.

This preliminary report shows definitely that there is a direct relation between the redox potential and the fertilization of eggs. Other factors which may be involved will be discussed elsewhere.

References

1. BROOKS, M. M. *Growth*, 1946, **10**, 391–410.
2. LOEB, J. *The dynamics of living matter.* (Columbia Univ. Biol. Ser. VIII.) New York: Columbia Univ. Press, 1906. P. 168.

Irreversible Differentiation in Certain Plant Cell Lineages

ROBERT BLOCH

Osborn Botanical Laboratory, Yale University, New Haven, Connecticut

One fundamental problem in the morphogenesis of multicellular plants and animals is the mechanism which produces cellular diversity, and various theories as to the principal causes of histological differentiation have been proposed. Weismann's original idea of a progressive sorting out of nuclear determinants cannot be accepted. Nuclear changes of mutational character apparently play only a minor role, and at present there is general agreement that the locus of differentiation must be the cytoplasm itself. There is some difference of opinion among biologists as to just how this is brought about. It is characteristic of multicellular plants that they respond more directly than animals to influences from the outside; their cells, both in normal and regenerative ontogeny, preserve a high degree of totipotency, and, unless they have become