SCIENCE

VOL. 87 FRIDAY, MARCH 11, 1938 No. 2254

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal

Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

THE APPLICATION OF ISOTOPES TO THE STUDY OF INTERMEDIARY METABOLISM[1]

By RUDOLF SCHOENHEIMER and D. RITTENBERG

DEPARTMENT OF BIOLOGICAL CHEMISTRY, COLUMBIA UNIVERSITY

THE number of organic compounds involved simultaneously in the multitude of diverse chemical reactions in the living organism is exceedingly large. Substances are continually being degraded, while their split products are linked together again to form new compounds, and all these reactions and their reaction products are held in equilibrium so that the composition of the cell and the organism stays constantly within narrow limits.

By adding to this complicated system an excess of one of the components, it is in many cases possible to follow its conversions, provided one has some general idea as to its fate. Herein lies the principle of the classical balance experiments. In order to determine the fate of one of the constituents of the organism, the substance is given in large quantities and the tissues or excreta are investigated for the presence of related compounds in abnormal amounts. This method has proved to be extremely valuable, and most of our knowledge of intermediary metabolism is based on experimentation of this kind. Unfortunately this method has theoretical limitations. Many body constituents, especially the more active ones, are never produced in excess of the animal's requirements, even if the building material is available in large quantities. Another obstacle which sometimes makes the interpretation of such balance studies extremely difficult is the known fact that one substance may induce the formation of others without itself being involved in the synthesis. Thus, for instance, insulin induces glycogen formation, and fat induces an increased for-

[1] This article contains the material presented in two papers at the meeting of the American Chemical Society at Rochester, N. Y., September, 1937.

slides over the barrel of the microscope and holds the cell flat against the ocular lens or the end of the lens barrel if the ocular lens is not used. All the light passing through the optical system of the microscope is intercepted by the cell. The camera speed is adjusted to fit the light intensity, or the light intensity is regulated by rheostat or diaphragm to conform with a desired film velocity. The cell is then removed and the camera lowered into place and the apparatus is ready for use.

The unit is subject to the same limitations as the usual exposure meter. The deflection represents the average of all the light intensities present and is satisfactory when calibrated for the kind of work in question by photographic test.

The use of a photoelectric device for the measurement of light values in photography is well established. The principles have been adapted to cinephotomicrography in the unit above described. The total cost of such a unit is less than $30.00 and soon pays for itself in the saving of film and time.

FRANCIS W. BISHOP

DIVISION OF RADIOLOGY,
DEPARTMENT OF MEDICINE,
SCHOOL OF MEDICINE AND DENTISTRY
AND STRONG MEMORIAL HOSPITAL,
UNIVERSITY OF ROCHESTER

LONGEVITY OF PLANT CELLS IN TISSUE CULTURES

THAT certain cells in plants may live for long periods is well known, and Bailey[1] has shown that the cells in a section of cambium mounted in lactose or in liquid petrolatum may continue active cyclosis for weeks. In the course of recent work I have observed numerous examples of a surprising length of survival of plant tissues. Various parts of flowers were detached and placed in sterile culture on nutrient agar. Some of these parts have undergone no regeneration and have shown no significant growth but have lived many times as long as similar structures on normal plants. Examples of this are shown in the following Table 1.

TABLE 1
LENGTH OF LIFE OF PLANT STRUCTURES IN CULTURE

Species	Structure	Time of survival in days
Tulipa Gesneriana	Petal	206
Jasminium fruticosa	"	186
"	Ovary	236
Erythronium americanum	Ovule	273
Freesia refracta	Sepal	190
Reinwardtia indica	Petal	255
Caltha palustris	"	255
Calendula officinalis	Corolla	277
Scirpus americanus	Section of culm	191
Tradescantia paludosa	Petal	365
" "	Sepal	365
" "	Stamen	365

[1] I. W. Bailey, *Zeitschr. Zellforsch.*, 10: 651–682, 1930.

Most of the structures listed in Table 1 were still vital at the end of the recorded period and might have lived longer.

The cells of *Tradescantia paludosa* were most remarkable. The petals and sepals of this plant are ephemeral and usually live only a day or two after flowering, but in culture they remained alive for an entire year. Cells of these petals and of stamen hairs were plasmolyzed with a sucrose solution. When the sucrose solution was replaced by water many of the cells recovered promptly, although others did not. Active cyclosis was not seen in any of the cells. Pieces of Tradescantia petal 0.5 mm × 1 mm were still alive.

The cultures were made in ½ ounce bottles with bakelite caps which were tightly closed. It is doubtful whether reduced respiration resulted because the amount of inclosed air has been shown to be sufficient for growth and regeneration of masses of tissue much larger than any of these.

CARL D. LARUE

DEPARTMENT OF BOTANY
UNIVERSITY OF MICHIGAN

BOOKS RECEIVED

BATESON, R. G. *Timber Drying and the Behaviour of Seasoned Timber in Use.* Pp. xvi + 138. 28 figures. Crosby Lockwood and Son, London. 10/6.

BROUWER, G. A. *The Organization of Nature Protection in the Various Countries.* Special Publication No. 9. Pp. 112. American Committee for Wild Life Protection, Cambridge, Mass.

GRANT, VERNON W. *Psychological Optics.* Pp. 240. 63 figures. The Professional Press, Chicago.

HALDANE, J. B. S. *Heredity and Politics.* Pp. 202. 15 figures. Norton. $2.50.

HOAG, J. BARTON. *Electron and Nuclear Physics.* Second edition. Pp. ix + 502. Illustrated. Van Nostrand. $4.00.

JOHANNSEN, ALBERT. *A Descriptive Petrography of the Igneous Rocks; Volume IV, Part I, The Feldspathoid Rocks; Part II, The Peridotites.* Pp. xvii + 523. 180 figures. The University of Chicago Press. $4.50.

KOLLER, GOTTFRIED. *Hormone Bei Wirbellosen Tieren.* Probleme der Biologie, Band 1. Pp. 143. Abb. 27. Akademische Verlagsgesellschaft m.b.H., Leipzig. RM. 9,20.

MATTA, DAWOOD. *A Critical Investigation of the Blood Groups and their Medico-Legal Application.* Publication No. 11 of the Faculty of Medicine. Pp. xiv + 231. 4 figures. The Egyptian University, Cairo.

MIEHLNICKEL, ERWIN. *Höhenstrahlung (Ultrastrahlung).* Band 44. Pp. xv + 319. 69 Abbildungen. Theodor Steinkopff, Dresden. RM. 25.

Palao Tropical Biological Station Studies, No. 2, 1937. Pp. 155–324. 42 figures. Japan Society for the Promotion of Scientific Research, Tokyo. Y2.00 ($1.00).

REICHENBACH, HANS. *Experience and Prediction; An Analysis of the Foundations and the Structure of Knowledge.* Pp. x + 410. The University of Chicago Press. $4.00.

Science Reports of the Tôhoku Imperial University. First Series (Mathematics, Physics, Chemistry.) Vol. XXVI, No. 3. Pp. 261–413. 10 figures. 1 plate. Maruzen, Tokyo.