notions that have been suggested, but refer only to the one recently advocated by certain authorities, namely, that the so-called chicken sarcoma agent may be an enzyme-like substance.

The well-known fact that the "agent" is completely destroyed by an exposure to the temperature of 55° C. for 15 minutes (Rous) seems to have been entirely forgotten by the advocators of the "enzyme theory." In addition we previously showed that a potent desiccate of the sarcoma tissue can be inactivated mechanically by grinding it up in a mortar into extremely fine powder, indicating that the transmitting agent may be a formed body, not a chemical substance. In this paper we report another evidence, which may well be final. It is based on the freezing and thawing method of extracting endocellular enzymes.

Mashed Rous sarcoma tissue was divided into two portions, one of which was subjected to the process of repeated freezing and thawing. The freezing was done in a test-tube by means of the freezing mixture of ice and salt (temperature of −18° C. for 20 minutes) or with the aid of dry ice (−75° C. for 10 minutes), and thawing was accomplished by dipping the test-tube in water bath at the temperature of 37° C. for from 5 to 10 minutes. After repeating this process of freezing and thawing seven to ten times, the sarcoma material was extracted with 20 times its volume of physiological saline solution for 10 minutes with constant shaking, and then centrifuged. Simultaneously the control portion, which had remained in the ice-box, was similarly extracted and centrifuged under identical conditions.

The supernatant fluid (extract) of the two materials were then separately inoculated into normal chickens, the treated extract into the left, and the same amount of the control extract into the right pectoral muscle. It was noted that extracts from the treated material contained a far smaller number of sarcoma cells than the control extracts. Sediments of the treated and control materials were also similarly tested as to their comparative tumor-producing actions.

The result of such inoculations into 30 chickens demonstrated conclusively that the process of repeated freezing and thawing very strikingly reduces the tumor-transmitting action of the sarcoma materials, both extract and sediment. With untreated materials, large tumors, often replacing the entire "breast," were produced in 7 to 10 days, while tumors resulting from treated materials were always decidedly smaller. Moreover, treated materials failed to produce tumors in 5 out of 30 cases, but untreated materials gave rise to a tumor in every case.

The point which we consider most significant in these results is the very feeble tumor-producing action of the extract from the sarcoma tissue subjected to repeated freezing and thawing. This process disrupts many sarcoma cells and should facilitate the liberation of any enzyme-like substance contained in the cells. Therefore, if an enzyme-like tumor-producing agent were contained in the sarcoma cells, extracts obtained from disrupted cells should be much more potent than extracts obtained from untreated, intact cells. Our results radically contradict this expectation and show that the extracts obtained from disrupted sarcoma cells are much less active than those prepared from intact cells. On the basis of this fact we conclude that the Rous chicken sarcoma does not contain any enzyme-like agent capable of sarcoma transmission.

WARO NAKAHARA
HIDETAKE YAOI

GOVERNMENT INSTITUTE FOR INFECTIOUS DISEASES, TOKYO

BOOKS RECEIVED

BRAMBELL, F. W. ROGERS. *The Development of Sex in Vertebrates.* Pp. xvi + 261. 24 plates. Macmillan. $4.00.

CRAWFORD, RUSSELL T. *Determination of Orbits of Comets and Asteroids.* Pp. xi + 233. McGraw-Hill. $4.00.

CREW, HENRY, and KEITH K. SMITH. *Mechanics for Students of Physics and Engineering.* Pp. xvi + 371. 215 figures. Macmillan. $4.00.

CROSS, CHARLES N. *Heat Engines.* Pp. x + 607. Macmillan. $6.00.

ELTON, CHARLES. *Animal Ecology and Evolution.* Pp. 96. Oxford University Press. $1.50.

FITZPATRICK, HARRY M. *The Lower Fungi: Phycomycetes.* Pp. xi + 331. McGraw-Hill. $4.00.

GOODRICH, EDWIN S. *Studies on the Structure and Development of Vertebrates.* Pp. xxx + 837. 754 figures. Macmillan. $10.00.

GREGORY, THOMAS C., Editor. *The Condensed Chemical Dictionary.* Second edition, revised. Pp. 551. Thumb indexed. Chemical Catalog Company. $10.00.

HALDANE, J. S. *The Theory of Heat-Engines, Including the Action of Muscles.* Pp. xv + 120. Oliver & Boyd, London. 6/-.

HEGNER, ROBERT, and JUSTIN ANDREWS, Editors. *Problems and Methods of Research in Protozoology.* Pp. ix + 532. 32 figures. Macmillan. $5.00.

HENDERSON, ARCHIBALD. *Contemporary Immortals.* Pp. xiii + 209. Illustrated. Appleton. $2.50.

HOLMYARD, ERIC J. *An Introduction to Organic Chemistry.* Pp. xi + 280. Illustrated. Longmans, Green. $1.75.

MAXIMOW, ALEXANDER A. Completed and edited by WILLIAM BLOOM. *A Text-Book of Histology.* Pp. xiii + 833. 604 illustrations. Saunders. $9.00.

SHETRONE, HENRY C. *The Mound-Builders.* Pp. xx + 508. 299 figures. Appleton. $7.50.

Tables Annuelles Constantes et Données Numériques de Chimie, de Physique, de Biologie et de Technologie. Volume VII, Années 1925–1926. Pp. xv + 947—1896. McGraw-Hill. $25.00.

THOMSON, G. P. *The Wave Mechanics of Free Electrons.* The George Fisher Baker Non-Resident Lectureship in Chemistry at Cornell University. Pp. 173. 53 figures. McGraw-Hill. $2.50.