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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.

GEOLOGY AND CHEMISTRY[1]

By Professor NORMAN L. BOWEN

THE UNIVERSITY OF CHICAGO

WE are here to-day with the pleasant duty of dedicating a splendid new building to the service of chemistry and geology. Some of you may have been led to wonder at the housing together under one roof of two sciences that are often placed in opposed categories, the one an experimental science, the other a natural science. But is it, after all, so strange a union?

Chemistry had a utilitarian beginning. It grew out of the attempts of man to convert natural materials to his uses. The first chemical process consciously employed was probably the process of combustion. Fire was to early man, as it is to us to-day, of outstanding importance, and one of its earliest services was that of reducing metals from their ores. A primitive hunter kindled a fire in the lee of a rusty boulder and was astounded to find in the ashes glistening pellets that he could shape at will by pounding them with a stone. From this beginning he and his fellows learned to associate the production of this lustrous, malleable material with the bringing together of fire and a certain kind of rock substance. When they wished more of that material, for which they found many uses, they learned to seek other occurrences of similar rock to be fired in a similar manner. The production of metals from natural rock substances was at first no more than a craft. But man does not long remain content with wholly utilitarian pursuits, else we should not find among primitive peoples the remarkable knowledge of such matters as the motions of heavenly bodies. Our nimrod metallurgist soon began to ponder upon the fundamental nature of his craft. In this act the science of chemistry was born, but no less also was the science of geology born, if indeed any purpose is served by attempting to classify the trains of thought instituted in those unpracticed minds. The desire to understand the real nature of the raw material, to grasp why it

[1] Address given at the dedication of the new Science Building of Bryn Mawr College, October, 22, 1938.

tubes for several days at room temperatures, but in the egg, death of the embryo may be followed very shortly by mortality of the protozoa.

No pathogenic action by these protozoa on the chick embryo has ever been noted. If left in the incubator for the full incubation period, normal chicks hatch out. Trichomonads are no longer present, since the allantoic fluid has disappeared.

It is apparently not necessary for the trichomonads to be entirely free of bacteria in order to multiply in the allantoic fluid, since the presence of saprophytic air-contaminants has been found not to prevent their development. If, however, the bacteria kill the chick embryo, the trichomonads die in a day or two.

Preliminary series of experiments indicate that eggs which have been incubated about 12 days are more satisfactory for cultivation of *Tritrichomonas foetus* than eggs incubated for shorter or longer periods. An incubation temperature of 37° C. is better than 34.5° C. or 39° C.

Tritrichomonas muris from the rat has also been cultivated in developing eggs, but no sub-cultures have been attempted to date.

Since protozoa have already been cultivated in artificial culture media and in tissue culture, the use of developing chicken eggs offers a third type of medium which may prove of value in experimental propagation studies.

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THE PRODUCTION OF GOITER IN CHICKENS[1]

ALTHOUGH goiter in poultry has been noted in iodine-deficient areas,[2] no report of its experimental production has been found. We have obtained goiter in chickens with a ration containing .145 mg per kilo of iodine, and have prevented goiter by the addition of 5 mg per kilo of iodine to the same ration.

Five hundred White Leghorn chicks were used in the two lots. The basal ration contained 71.5 per cent. yellow corn meal, 25 per cent. soybean oil meal, 1 per cent. casein, 0.5 per cent. salt, 2 per cent. bone ash, 0.001 per cent. activated animal provitamin (50,000 units of D per gram), 0.015 per cent. manganous sulfate, and 0.03 per cent. of a salt mixture. The vitamin G requirements for growth were supplied by liquid skim milk.[3]

Thyroid weights of chickens fed the basal ration were 130 per cent. of the control thyroid weights at 6 weeks, 240 per cent. at 12 weeks and 294 per cent. at 18 weeks. In extreme cases, thyroids have been found to approximate twenty times normal weight.

Histopathological examinations of the enlarged thyroids at these intervals during growth showed an absence of colloid and a hyperplasia of the living cells of the follicles. These changes were apparent at 6 weeks and increased in severity with age. Thyroid glands from the control group remained normal.

Work on the iodine requirements of poultry is being continued.

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* Assigned by the State Department of Agriculture to assist in diagnostic and research work.

[1] This work is being conducted through an investigatorship established by the Iodine Educational Bureau, Inc., New York. The Vitamin D solution was generously supplied by Dr. J. J. Waddell, Biological Laboratory, E. I. du Pont de Nemours and Company, Wilmington, Delaware.

[2] H. Welch, *Montana Agr. Exp. Station Bulletin*, 214, 1928.

[3] G. F. Heuser, H. S. Wilgus, Jr., and L. C. Norris. *Poultry Science*, 11: 105, 1938.

BOOKS RECEIVED

ADAMS, FRANK D. *The Birth and Development of the Geological Sciences.* Pp. v + 506. 78 figures. 14 plates. Williams and Wilkins. $5.00.

British Guiana Papers; Scientific Results of the Oxford University Expedition to British Guiana in 1929. Illustrated. Oxford University Press. $7.00.

DEAVER, GEORGE G. *Fundamentals of Physical Examination.* Pp. 299. 126 figures. Saunders. $2.75.

HECTOR, J. M. *Introduction to the Botany of Field Crops; Vol. I—Cereals.* South African Agricultural Series. Pp. xi + 478 + xxxiv. 190 figures. Central News Agency, Johannesburg. £3.10.0 per set.

HOOTON, EARNEST A. *Crime and the Man.* Pp. xvi + 403. Illustrated. Harvard University Press. $3.75.

MACDERMOT, H. E. *Sir Thomas Roddick; His Work in Medicine and Public Life.* Pp. xiii + 160. Illustrated. Macmillan. $2.00.

MUENSCHER, WALTER C. *Poisonous Plants of the United States.* Pp. xvii + 266. 75 figures. Macmillan. $3.50.

MUDGE, COURTLAND S. and FLOYD R. SMITH. *A Fundamental Approach to Bacteriology.* Pp. vii + 265. 17 figures. J. W. Stacey, San Francisco.

NEYMAN, J. and E. S. PEARSON, Editors. *Statistical Research Memoirs, Vol. II, December, 1938.* Pp. 149. Illustrated. Department of Statistics, University College, London. 15 s.

Papers in Physical Oceanography and Meteorology, Vol. VII, No. 1; Fluid Mechanics Applied to the Study of Atmospheric Circulations, Part I, December, 1938. Pp. 125. 24 plates. Massachusetts Institute of Technology and Woods Hole Oceanographic Institution. $1.50.

Research—A National Resource; I, Relation of the Federal Government to Research; Report of the Science Committee to the National Resources Committee, November, 1938. Pp. vii + 255. Superintendent of Documents, Washington. $0.50.

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