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THE OCCURRENCE OF CARBON DIOXIDE¹ WITH NOTES ON THE ORIGIN AND RELATIVE IMPORTANCE OF SUBTERRANEAN CARBON DIOXIDE

By Dr. FRANK E. E. GERMANN

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OCCURRENCE

THE earliest scientific record of carbon dioxide seems to be that of Pliny,² who in his "Naturalis Historiae" says, "But, by Hercules! the history of the heavens themselves would not be more difficult to relate: the abundance of metals . . . the virtues of medicinal springs . . . the exhalation of deadly vapors (spiritus lethales) either emitted from caverns or from certain unhealthy districts; some of them fatal to birds alone as at Socrate, a district near the city; others to all animals, except to man, while others are so to man also." These openings were generally called vents and, by some persons, Charon's sewers, from their exhaling a deadly vapor. The account continues by telling of a place, in Asia, where no one can enter in

¹ Address of the president of the Southwestern Division of the American Association for the Advancement of Science, Albuquerque, N. Mex., April 27, 1938.

² Pliny the Elder, 2, 95 (A.D. 77).

safety, except the "priest of the great Mother of the Gods," and of prophetic caves, where those who enter are intoxicated with the rising vapor so that they can predict future events, as at Delphi.

There is to-day no doubt about the fact that Pliny was referring to the various carbonated water springs and carbon dioxide gas vents, such as the Grotta del Cane at Pouzzoles near Naples and the many similar grottos in various parts of the world. The Grotta del Cane is particularly interesting because it has been known since very early times. It is reported to yield a gas consisting of about 70 per cent. carbon dioxide, 24 per cent. nitrogen and 6 per cent. oxygen. Inasmuch as the ratio of the nitrogen to oxygen is exactly the ratio of these gases in the air, it seems reasonable to assume that there has been an unavoidable contamination with it either at the exit or somewhere deeper under ground.

INFLUENCE OF BILE ACIDS ON EROSIONS OF THE CHICK GIZZARD LINING

EXPERIMENTAL results indicating the necessity of an organic dietary factor for the maintenance of a normal gizzard lining in the chick, and the prevention of erosions or lesions of the lining have been given in a number of papers.^{1, 2, 3, 4} A series of experiments on the rôle of the bile acids in this deficiency disease may now be reported.

The feeding of whole bile by oral administration or by mixing with diet or as commercial dried bile tablets has been found to prevent the development of the roughened and eroded gizzard lining characteristically found in chicks fed the basal diet without supplement. In other experiments, vacuum concentrated whole beef bile, cholic acid, deoxycholic acid, sodium glycocholate and sodium taurocholate were used as supplements to the basal diet. All these showed a marked protective action against the development of gizzard lesions. In all these experiments vitamin K in the form of an extract of alfalfa was added in a constant amount just sufficient to maintain an approximately normal blood-clotting time. In one case this vitamin K supplement was added at a level about twenty times that required. Typical results may be illustrated by the data given in Table I.

TABLE I

Supplement to basal diet	Number of chicks	Average weight at four weeks, grams	Average blood clotting time, minutes	Average gizzard erosion score ^{1, 2}
None	10	290	4.9	0.90
Cholic acid, pure, 0.5 per cent. of diet	10	281	4.6	0.05
Vitamin K supplement 20 times adequate level..	10	283	2.7	0.96

It is apparent that certain components of bile, when added to the diet, protect against erosion and lesions of the gizzard lining. It seems probable that bile may play a definite rôle in the maintenance of a normal gizzard lining.

The separation of gizzard erosions from the vitamin K deficiency syndrome is given further support in the facts that bile is a very poor source of vitamin K⁵ and that large doses of vitamin K can be fed without diminishing the incidence of gizzard erosions.

The identity of the chick gizzard factor with any

of the components of bile and the mechanism of the action of these components on the gizzard lining will require further research.

H. J. ALMQUIST

DIVISION OF POULTRY HUSBANDRY,
UNIVERSITY OF CALIFORNIA

BOOKS RECEIVED

- BEST, CHARLES H. and NORMAN B. TAYLOR. *The Living Body; A Text in Human Physiology*. Pp. xxii + 563. 283 figures. Holt. \$3.60.
- BRINKLEY, STUART R. *Introductory General Chemistry*. Revised edition. Pp. x + 731. 176 figures. Macmillan. \$3.50.
- BRUCE, GEORGE H. *High School Chemistry*. Second revised edition. Pp. 10 + 550. World Book Company. \$1.68.
- CLARK, JOHN A., FREDERICK R. GORTON and FRANCIS W. SEARS. *Physics of Today*. Pp. v + 632 + x. 750 figures. Houghton-Mifflin. \$1.80.
- DILL, DAVID B. *Life, Heat and Altitude; Physiological Effects of Hot Climates and Great Heights*. Pp. xiv + 211. 25 figures. Harvard University Press. \$2.50.
- FREDERICK, ROBERT W., CLARENCE E. RAGSDALE and RACHEL SALISBURY. *Directing Learning*. Pp. xvi + 527. Appleton-Century. \$2.75.
- HARLOW, WILLIAM M. and ELLWOOD S. HARRAR. *Textbook of Dendrology*. Pp. xiii + 527. 224 figures. McGraw-Hill. \$4.50.
- HERSKOVITS, MELVILLE J. *Acculturation; The Study of Culture Contact*. Pp. 155. J. J. Augustin, New York. \$2.00.
- Industrial Arts Index*. Vol. 25, No. 10, September, 1937. Pp. xviii + 436. H. W. Wilson, New York.
- JACOBS, MORRIS B. *Chemical Analysis of Foods and Food Products*. Pp. xxii + 537. 56 figures. Van Nostrand. \$6.00.
- ROSENBLATT, LOUISE M. *Literature as Exploration*. Pp. xiii + 340. Appleton-Century. \$2.25.
- SCHORLING, RALEIGH, JOHN R. CLARK and ROLLAND R. SMITH. *Modern-School Geometry*. Pp. xiv + 450. Illustrated. World Book Company. \$1.36.
- SEARLES, ADA W. *Alaska Wild Flowers*. Pp. vii + 156. Illustrated. Stanford University Press. \$3.00.
- SMITH, DONNAL V. and ROBERT W. FREDERICK. *Live and Learn; Social Education in the Elementary School*. Pp. viii + 220. Illustrated. Scribner.
- SPEMANN, HANS. *Embryonic Development and Induction*. Pp. xii + 401. 192 figures. Yale University Press. \$5.00.
- STRAUSBAUGH, PERRY D. and BERNAL R. WEIMER. *General Biology; A Textbook for College Students*. Pp. xi + 555. 284 figures. Wiley. \$3.75.
- TOOPS, HERBERT A. and S. EDSON HAVEN. *Psychology and the Motorist*. Pp. vi + 265. Adams, Columbus, Ohio. \$2.00.
- Woods Hole Oceanographic Institution. *Collected Reprints, 1937, Part I*. Illustrated. The Institution.
- Woods Hole Oceanographic Institution. *Collected Reprints, 1937, Part II. The Marion and General Greene Expeditions to Davis Strait and Labrador Sea under the Direction of the U. S. Coast Guard, 1923-1935*. Pp. vi + 259. 155 figures. Superintendent of Documents, Washington. \$0.75.

¹ H. J. Almquist and E. L. R. Stokstad, *Nature*, 137: 581, 1936; *Jour. Nutrition*, 13: 339, 1937.

² H. J. Almquist, *Jour. Nutrition*, 14: 241, 1937.

³ H. R. Bird, C. A. Elvehjem and E. B. Hart, *Jour. Biol. Chem.*, 114: p. x, 1936.

⁴ H. R. Bird, O. L. Kline, C. A. Elvehjem and E. B. Hart, *Jour. Nutrition*, 12: 571, 1936.

⁵ Unpublished data of the writer.

Recent Statement by the Judges of the MEAD JOHNSON VITAMIN A AWARD

"The Vitamin A Award offered by Mead Johnson & Company was supposed to be made on the basis of papers published or accepted for publication by December 31, 1936. The judges of this award, meeting in New York, June 4, 1937, feel that its presentation at this time is not warranted since no clinical investigation on vitamin A has yet been published which completely answers any of the objectives of the original proposal. The judges, therefore, agree to defer further consideration of the granting of this award until December 31, 1939. This action was taken because of the existence of pronounced differences of opinion among investigators as to the reliability of any method yet proposed for determining the actual vitamin A requirements."

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*Johns Hopkins
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ROBERT A. STRONG
*Tulane University,
New Orleans*

Statement by Mead Johnson & Company

In view of this action by the judges of the Mead Johnson Vitamin A Award, and as an earnest of our good faith in the matter, we have segregated from our corporate funds on deposit with the Continental Illinois National Bank & Trust Company of Chicago, the sum of \$15,000. This cash deposit has been placed in escrow and will be paid promptly when the board of judges decides on the recipient of the Main or Clinical Award. The Laboratory Award of \$5,000 was made on April 10th, 1935.

References: J.A.M.A. 98:14-15; 100:14-15; 104:50

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