are actively dividing. The former seems more likely at present, for the biotin content of rat liver vigorously regenerating after partial hepatectomy,[9] or of the pregnant human uterus, was found not to differ from that of the same tissues in a non-hyperplastic state.

We are indebted to the following gentlemen for a generous supply of material: Drs. Robert P. Hill, James W. Jobling, Homer D. Kesten, John G. Kidd, Richard E. Shope, Charles M. Steer, Fred Stewart, Arthur Purdy Stout and Benjamin P. Watson.

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THE PRESERVATION BY FREEZING AND DRYING IN VACUO OF THE MILK-INFLUENCE FOR THE DEVELOPMENT OF BREAST CANCER IN MICE[1]

THERE is an active influence in the milk of lactating females of strains of mice having a high incidence of carcinoma of the mammary glands which promotes the development of this type of cancer.[2] This influence is usually obtained by nursing but may also be transferred by the transplantation of splenic tissue[3] and by the feeding of milk secured from females of cancerous strains. The milk was given to animals after they had been weaned.[4] The amount of milk given may have influenced the incidence and the average age at the time of the appearance of the tumors. Macerated liver from mice of cancerous strains failed to affect the incidence of breast tumors.

This report considers the feeding of lyophilized tissue of spontaneous mammary carcinoma. The tissue was prepared by Dr. G. Burroughs Mider, research fellow, National Cancer Institute, while at the University of Rochester, as follows: The spontaneous tumors were removed under aseptic conditions, finely minced with a knife and placed in tubes. The tissue was frozen immediately at −72° C. and dried *in vacuo*. At the completion of the process the tubes were sealed with a blow torch.

Thirty cc of water was added to 10 cc of the lyophilized tumor-tissue and filtered (filter paper). The filtrate was placed before the mice in small dishes: 10 cc for each 5 mice or 2 cc per mouse. The animals had been without water for about 18 hours.

The mice which received the filtrate were representatives of the Ax strain[2, 5, 6] and were from 4 to 5 weeks of age. The mice of this line are descended from a female (No. 38432) of the A strain which had been fostered from birth by a female of the CBA or X stock (low breast cancerous strain). The incidence of breast cancer in breeding females of the Ax strain has been 3.1 per cent. (292 mice), average tumor age 13.9 months and average non-tumor age 17.2 months. Over 90 per cent. of the breeding females of the A stock develop mammary cancer,[5, 6] whereas few (4.9 per cent.) of the females of the A strain kept as virgins became cancerous.[7]

Six of the 10 mice of the Ax strain which consumed the filtrate of the lyophilized tumor-tissue have developed breast tumors (12.4 months), one was missing at 12 months of age and three are living at 17.5 months. These mice were used as breeders.

DISCUSSION

As has been reported the females of the Ax strain are genetically of a constitution in which breast tumors may be expected to develop if they are nursed by females which have the active influence in their milk and are used as breeders.[8]

The ten experimental animals were the progeny of three females. Two of the three mothers have had other progeny which have been continued as breeders, and they and their descendants number 24 mice. As none of these mice has developed breast tumors it is improbable that the mice which received the filtrate of the lyophilized tissue were subjected to an active influence in the milk of their maternal parent or that the influence developed *de novo*.[5]

The voluntary method of feeding the material did not insure that each mouse consumed the same amount, as some might have taken very little. Whether or not the age of the animals at the time they developed tumors may indicate the amount taken is problematical, as great age differences in the time of tumor development are also common among the controls, even for mice of the same litter.

The technique used in the preparation of the lyophilized tumor-tissue was similar to that described by others to preserve the viruses of other diseases.[9] Thus, the results obtained in the present experiment with a small number of animals suggest that the active influence in the milk of females of strains of mice having a high incidence of breast cancer may be a virus.

SUMMARY

The development of spontaneous breast cancer in

[9] George M. Higgins and Reuben M. Anderson, *Arch. Path.*, 12: 186, 1931.

[1] Preliminary report.

[2] J. J. Bittner, SCIENCE, 84: 162, 1936. Reviewed in footnote 8.

[3] *Idem, Pub. Health Rept.*, 54: 1827, 1939.

[4] *Idem, Proc. Soc. Exper. Biol. and Med.*, 45: 805, 1940.

[5] *Idem, Cancer Research*, 1: 113, 1941.

[6] *Ibid.*, 1: 115, 1941.

[7] J. J. Bittner, *Pub. Health Rept.*, 54: 1113, 1939.

[8] *Idem, Jour. Nat. Cancer Inst.*, 1: 155, 1940.

[9] J. G. Wooley, *Pub. Health Rept.*, 54: 1077, 1939.

mice following the feeding of lyophilized tissue prepared from breast tumors suggests that the active influence usually transferred in the milk by nursing may be a virus.

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A PROBABLE AGENT FOR THE TRANSMISSION OF FOWL PARALYSIS

FOWL paralysis, sometimes called "range paralysis," is a disease that is widespread in this country. In many instances the toll is heavy. The disease made its appearance at this college in 1937, causing 61 deaths in a flock of 225 chickens. In 1938 a flock of 345 birds had 92 fatalities. In 1939 three flocks with a total of 439 birds had 403 fatalities.

The fatalities in 1939 occurred from May 10 to September 28. An old barn infested with "blue bugs," *Argas persicus* (Oken) (*A. miniatus* Koch), stood near the pens, and the chickens were practically all infested when the large number of fatalities occurred. This led one of the authors (Brown) to suspect the "blue bugs," or fowl ticks, as being associated with the disease. Immediately experiments were started to see if the suspicion was justifiable. The barn was torn down and the hen houses were disinfected with carbolineum.

On September 2, 1939, twelve pens heavily infested with "blue bugs" were divided into two groups of six pens each. In group I six birds with paralysis were placed in each pen on September 4. On September 9 twelve birds without paralysis were placed in the six pens with the thirty-six paralyzed birds. The paralyzed birds were removed from the pens on September 21. Twenty-one days after being placed in the pens the well birds began to show paralysis. On the thirty-first day all were down with paralysis.

The six pens of group II were thoroughly disinfected with carbolineum on September 5. Six pullets were placed in each of the six disinfected pens on September 9. These pens were disinfected again on September 12. These pens were used as controls, and no paralysis occurred after they had been occupied for 31 days.

Similar experiments to the one outlined above were repeated five times over a period of one year, with the exception that no paralyzed birds were introduced. Some were kept in pens infested with "blue bugs," while others were kept as controls in pens free from these parasites. In the pens infested with the "blue bugs" 111 birds out of 120 developed paralysis. In the control pens 1 bird out of 126 developed paralysis.

[10] Assisted by a grant from the National Cancer Institute.

On September 1, 1940, five hens were placed in one of the infested pens. When paralysis had appeared (September 27), one of the hens was taken to the laboratory where the young "blue bugs" were removed from the hen, treated with 50 per cent. ethyl alcohol, removed to a sterile physiological salt solution, and ground until a suspension was made of their body contents. This suspension was injected into three young birds—two cockerels and one pullet. These birds were placed in a clean pen free from "blue bugs." Between the twenty-first and the twenty-fifth day the cockerels broke down with paralysis; the pullet broke down on the twenty-ninth day. On November 1 a two-year-old hen and a pullet were injected with some of the same suspension (34 days after making it). On November 29 the pullet was prostrate. The hen was paralyzed in one leg. In the main breeding yards of the college only five chickens with paralysis have been found since September, 1939, following intensive work to prevent the recurrence of "blue bugs."

The results given here indicate that the "blue bugs," *Argas persicus,* are agents for transmitting fowl paralysis. Other parasites may be agents also, but in this preliminary report the authors have data for only the one. Further experimentation on an extensive scale is now being planned.

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BOOKS RECEIVED

ARENSON, SAUL B. *Chemical Arithmetic.* Second edition. Pp. 130. Wiley. $1.50.

CHANEY, RALPH W. and HSEN HSU HU. Carnegie Institution of Washington, *Publication No. 507; A Miocene Flora from Shantung Province, China.* Pp. 147. 57 plates. The Institution. $3.25.

CHILD, C. M. *Patterns and Problems of Development.* Pp. ix + 811. 224 figures. University of Chicago Press. $8.00.

FIESER, LOUIS F. *Experiments in Organic Chemistry.* Second edition. Pp. x + 487. 80 figures. Heath. $2.80.

GRAY, GEORGE W. *Education on an International Scale; A History of the International Education Board, 1923–1938.* Pp. xiii + 114. Illustrated. Harcourt, Brace. $2.00.

HODGE, W. V. D. *The Theory and Applications of Harmonic Integrals.* Pp. ix + 281. Cambridge University Press, Macmillan. $4.50.

HURLBURT, CORNELIUS S., JR., Editor. *Dana's Manual of Mineralogy.* Fifteenth edition, revised. Pp. x + 480. 436 figures. Wiley. $4.00.

MILLER, FREDERIC H. *Partial Differential Equations.* Pp. ix + 259. 15 figures. Wiley. $3.00.

PAVLOV, IVAN P. *Conditioned Reflexes and Psychiatry.* Translated and edited by W. HORSLEY GANTT. Pp. 199. International Publishers, New York. $4.00.

WOODRUFF, LORANDE L. *Foundations of Biology.* Sixth edition, revised. Pp. xvii + 773. 469 figures. Macmillan. $3.75.

WORTHEN, EDMUND L. *Farm Soils; Their Management and Fertilization.* Third edition, revised. Pp. xiii + 515. 226 figures. Wiley. $2.75.