

Influence of Breeding on the Incidence and Onset of Carcinoma of the Mammary Gland in Marsh-Buffalo Mice

Fritz Bischoff, Ph.D.

(From the Chemical Laboratory, Santa Barbara Cottage Hospital Research Institute, Santa Barbara, California)

(Received for publication May 25, 1945)

The Marsh-Buffalo strain of mice has been used rather extensively in this laboratory in studying the influence of estrogens and gonadotropins upon the development of adenocarcinoma of the breast (1). Interest in this strain has centered upon its unique resistance to the carcinogenic activity of estrogens and its failure to respond as a high cancer strain in the laboratories of Loeb (5). Our experiments in general have been performed upon virgin mice in which the incidence of breast tumors was identical with that originally reported by Marsh (3). Because of the rather paradoxical results reported for this strain, we were prompted to study the influence of breeding upon tumor incidence under the environmental conditions existing in our laboratories.

Forty-eight mice were bred at the age of 4 months, groups of 3 females being housed with 1 male. All the females became pregnant and delivered their young in the fifth and sixth months of age. The young were weaned at 21 days of age and the mothers were again bred 15 days later. Forty-two mice became pregnant and delivered their young from the seventh to the tenth months of age. Two mice developed lymphoid tumors and 2 died of pneumonia (Table I).

The standard deviation of the mean for each tumor incidence in Table I was calculated by the formula

$$\sqrt{\frac{P \times Q}{N}}$$

in which P is the incidence of tumors in per cent, Q denotes the mice without tumors in per cent and N is the number of animals observed. The standard error of the difference between any two incidences was taken as the square root of the sum of the squares of their respective standard deviations of the mean. A comparison of the Marsh series of virgin females and the Santa Barbara series of virgin and breeding mice reveals that the greatest difference between any of the values for a given time is 1.4 times the standard error. The probability value P of .16 for this statistic is not usually considered of significance. A comparison of the Marsh series of breeding females with the other three series of mice reveals that from the ninth to the 13th month of age, the least difference between any

of the values for a given time is from 3.4 to 5.0 times the standard error. The probability value, which exceeds .001, is highly significant. From the 14th to the 18th month of age the significance of the increase in tumor incidence for the breeding mice observed by Marsh decreases, but the probability value is never below .05.

The results indicate that breeding was without influence in the mice observed in our laboratories. This was in contrast to the definite influence that the

TABLE I: CUMULATIVE INCIDENCE * OF ADENOCARCINOMA OF THE BREAST IN MARSH-BUFFALO VIRGIN AND BREEDING MICE AS FOUND ORIGINALLY BY MARSH AND AS OBSERVED IN THE SANTA BARBARA LABORATORIES

Age, months	In Marsh's Laboratory		In Santa Barbara	
	70 Virgin	190 Breeding †	297 Virgin	48 Breeding
9	7 ± 3	36 ± 4	8 ± 2	12 ± 5
10	16 ± 4	46 ± 4	16 ± 2	15 ± 5
11	24 ± 5	58 ± 4	23 ± 2	21 ± 6
12	33 ± 6	66 ± 3	32 ± 3	31 ± 7
13	40 ± 6	72 ± 3	40 ± 3	46 ± 7
14	50 ± 6	76 ± 3	45 ± 3	54 ± 7
15	61 ± 6	80 ± 3	52 ± 3	63 ± 7
16	66 ± 6	82 ± 3	56 ± 3	65 ± 7
17	66 ± 6	86 ± 3	58 ± 3	67 ± 7
18	69 ± 6	86 ± 3	67 ± 3	70 ± 7

* In per cent ± standard deviation of the mean.

† Data reconstructed from the graph of Marsh.

factors associated with breeding had in lowering the cancer age of the mice observed by Marsh. The observation is the more striking in view of the excellent agreement for cumulative incidence of breast tumors in virgins as observed in the two laboratories.

It would appear that the changes in the endocrine balance associated with breeding cannot be held directly responsible for the lowering of the cancer age when it occurs. In earlier studies from this laboratory (2) it was found that appropriate dosage of gonadotropins, which produced morphological changes in the mammary gland corresponding to those produced by pregnancy, was without influence upon tumor development. These changes, initiated in the case of

the gonadotropins at the seventh month of age, occurred somewhat later than the corresponding changes in the pregnant mice. Similar results (1) were obtained with chorionic gonadotropin when dosage was begun as early as the 21st day of life.

Miller and Pybus (4) have recently published data on the influence of breeding upon tumor incidence in the Marsh-Buffalo strain. The figures they report, 68.8 per cent versus 70.4 per cent in comparing breeders with virgins, are in perfect agreement with the data from the Santa Barbara laboratories.

SUMMARY

In 48 mice of the Marsh-Buffalo strain, breeding was without influence upon the onset and cumulative incidence of cancer of the breast. This observation is in contrast to the experience of Marsh. The observations of Marsh in regard to tumor incidence in virgins have been confirmed.

Acknowledgment is made to Arthur Blanchard for the care and maintenance of the mouse colony.

REFERENCES

1. BISCHOFF, F., LONG, M. LOUISA, RUPP, J. J., and CLARKE, GEORGENA J. Endocrine Factors Influencing Tumor Development. The Effect of the Gonadotropins and Theelin upon the Marsh-Buffalo Adenocarcinoma and Lymphosarcoma. *Endocrinology*, **28**:769-779. 1941.
2. BISCHOFF, F., RUPP, J. J., and CLARKE, GEORGENA J. Endocrine Factors Influencing Tumor Development. Administration of Gonadotropins at the Early Cancer Age to Marsh-Buffalo Mice. *Endocrinology*, **31**:329-333. 1942.
3. MARSH, M. C. Spontaneous Mammary Cancer in Mice. *J. Cancer Research*, **13**:313-339. 1929.
4. MILLER, F. W., and PYBUS, F. C. The Inheritance of Cancer in Mice. With Special Reference to Mammary Carcinoma. *Cancer Research*, **5**:84-93. 1945.
5. SUNTZEFF, V., BURNS, E. L., MOSKOP, M., and LOEB, L. The Effect of Injections of Estrin on the Incidence of Mammary Cancer in Various Strains of Mice. *Am. J. Cancer*, **27**:229-245. 1936.

Cancer Research

The Journal of Cancer Research (1916–1930) | The American Journal of Cancer (1931–1940)

Influence of Breeding on the Incidence and Onset of Carcinoma of the Mammary Gland in Marsh-Buffalo Mice

Fritz Bischoff

Cancer Res 1945;5:582-583.

Updated version Access the most recent version of this article at:
<http://cancerres.aacrjournals.org/content/5/10/582.citation>

E-mail alerts [Sign up to receive free email-alerts](#) related to this article or journal.

Reprints and Subscriptions To order reprints of this article or to subscribe to the journal, contact the AACR Publications Department at pubs@aacr.org.

Permissions To request permission to re-use all or part of this article, use this link
<http://cancerres.aacrjournals.org/content/5/10/582.citation>.
Click on "Request Permissions" which will take you to the Copyright Clearance Center's (CCC) Rightslink site.