

14492

Influence of Breeding on Induction of Mammary Cancer with Methylcholanthrene in Strain DbA Female Mice.*

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The percutaneous administration of either 9,10-dimethyl-1,2-benzanthracene or methylcholanthrene was reported by Engelbreth-Holm and Lefèvre¹ and Engelbreth-Holm² to accelerate the development of mammary cancer in female mice of strain DbA. Morton and Mider^{3,4} had previously treated similar mice in like manner, but had not described this phenomenon. The latter authors stated specifically³ that male and female animals were segregated, whereas Engelbreth-Holm made no definite statement in this regard. This possible difference in technic suggested to the present authors that breeding might condition the response to carcinogens insofar as development of mammary cancer was concerned. Another explanation for the discrepancy in the above findings could be the use of different sub-lines of this strain of mice in the two investigations. It was therefore decided to test the effect of breeding on the carcinogenic induction of mammary cancer within a single sub-line of strain DbA.[§] It was first demonstrated that 23 out of 26 untreated breeding females of the sub-line

chosen developed mammary cancer spontaneously at an average age of 370 days (range: 300 to 460 days). Only progeny of these breeders were used for the following experiments.

Two groups of female mice 6 to 8 weeks of age were placed on similar diets and given 2 percutaneous applications weekly of a 0.5% solution of methylcholanthrene in benzene. Females of Group I, 27 in number, were allowed to breed, and all animals bore one or more litters during the course of treatment. The 31 animals of Group II were maintained as virgins. Forty-eight male mice were treated similarly with methylcholanthrene.

In Group I all animals developed mammary cancer after an average treatment period of 105 days. The average age of appearance of cancer was thus 155 days, as compared with 370 days in the untreated control breeders. In Group II only 4 out of 31 mice developed mammary cancer. The induction periods for these were 177, 178, 204, and 205 days. In contrast, the longest period of induction for any of the carcinogen-treated breeders of Group I was 153 days. Sixty-five percent of the males and virgin females treated developed leukemia; none of the untreated control breeders developed leukemia spontaneously. [Induction of leukemia with carcinogens in strain DbA mice has been reported previously.¹⁻⁵] The average induction period for leukemia was 113-122 days. Probably some of the virgin females of Group II died of leukemia before mammary cancer could have

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¹ Engelbreth-Holm, J., and Lefevre, H., *Cancer Research*, 1941, **1**, 102.

² Engelbreth-Holm, J., *Cancer Research*, 1941, **1**, 109.

³ Morton, J. J., and Mider, G. B., *Science*, 1939, **87**, 327.

⁴ Morton, J. J., and Mider, G. B., *Cancer Research*, 1941, **1**, 95.

[§] Sub-line 12 was used in these experiments.

|| The incidence of mammary cancer in virgin females of sub-line 12 has not been determined. No tumors have appeared as yet in a group of 40 virgin females 9-10 months of age of sub-lines 112 and 212.

⁵ Law, L. W., *Cancer Research*, 1941, **1**, 564.

TABLE I.
Table Summarizing Data on Induced and Spontaneous Mammary Cancer and Induced Leukemia in Strain DbA Animals of These Experiments.

Group	No. of mice	No. with mammary cancer	Induction time of mammary cancer, days	No. with leukemia	Induction time of leukemia, days
I. Breeding ♀	27	27	105	7	106
II. Virgin ♀	31	4	191	20	113
III. Untreated breeding ♀	26	23	Mammary cancer appeared spontaneously at an average age of 370 days	0	
IV. ♂	48	0		31	122

appeared. Of the 11 virgins which did not develop leukemia, however, only 4 developed mammary cancer, the induction period of these being longer than in any one of the 27 cases of mammary cancer in treated breeders. It is interesting to note that the incidence of induced leukemia appears to have been reduced in the Group I female breeders, suggesting that either the development of mammary cancer, breeding, or both, might inhibit the induction of leukemia in the same animal. These data are summarized in Table I.

Mammary cancer appeared invariably as multiple growths in the breeding carcinogen-treated animals of Group I. Each of the mammary glands was studded with macroscopic cancerous and precancerous nodules. Only one to 3 mammary cancers appeared in

each of the untreated breeding females which developed the disease spontaneously. Macroscopic nodulation did not appear in the non-cancerous glands of these mice.

Further experiments are being conducted on the relationship of the estrogenic, genetic, and milk influences to the induction of mammary cancer by chemical carcinogens in various sub-lines of the DbA strain. The nature of the nodulation in all mammary glands of breeding carcinogen-treated females is also being investigated.

Summary. Mammary cancer appeared precociously in strain DbA female mice subjected to percutaneous applications of methylcholanthrene. The latent period was markedly shorter and the total incidence higher in breeding than in virgin animals.

14493

L Type of Growth in Cultures of a Hemolytic Parainfluenza Bacillus.*†

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Colonies similar to the pleuropneumonia group of organisms were isolated and maintained in pure cultures from 2 bacterial spe-

cies, the *Streptobacillus moniliformis* and *Bacteroides funduliformis*.¹ The colonies consist of small granules which invade the agar and which swell up on the surface of the colonies to large bodies of 10 micra or more. These large bodies by disintegration again reproduce the small granules. According to the observations of the author, this L type of

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¹ Dienes, L., *J. Bact.*, 1942, **44**, 37.