

This agrees with the previous observations of Loeb, who under similar conditions, in which however rats with inoculated instead of spontaneous tumors were used, never observed a transmission of a sarcoma to another rat. It is however noteworthy that in strain No. 8 the large majority of cancers appeared in groups, inasmuch as several, in one case even as much as five mice, which were kept in the same box were simultaneously affected by cancer. Whether we have in this case which was not duplicated in the case of other strains to deal with an accidental occurrence we are unable to state at present.

9. From our investigations we may conclude that hereditary factors play a great part in the incidence of cancer among mice and that hereditary transmission is to a great extent responsible for the so-called endemic occurrence of cancer among animals. Certain observations especially of Borrel and Fiebiger concerning the occurrence of parasitic worms in certain kinds of cancer of animals indicate that also other factors of an infectious character may be responsible for this endemic occurrence.¹

Miss Maud Slye, of Chicago, in experiments carried on simultaneously with our own, also came to the conclusion that the incidence of cancer varies in the different strains of mice which she had under observation according to a preliminary communication she made at the last meeting of the American Association for Cancer Research in May, 1913. In the discussion to Miss Slye's paper we mentioned some of the results of our work.

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The influence of pregnancies on the incidence of cancer in mice.

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In order to analyze still further the various factors causing the spontaneous development of cancer of the breast in mice we

¹ On a previous occasion (*Centralblatt f. allg. Pathologie*, Bd. XII, N. 22, 1911, p. 994) we published already a tree of one of the families of mice under our observation in which the hereditary transmission of tumor had been apparent. Cf. also *Interstate Medical Journal*, Vol. XX, No. 5, 1913.

undertook investigations into the influence of pregnancy in various strains of mice.

Accordingly we kept a number of mice from various strains after they were weaned separated from males throughout their life. Other mice from the same strains were allowed to breed in the usual manner. A few months after we had begun our experiments we received a recent communication by Bashford, who stated that he did not notice any influence of pregnancies on the incidence of cancer in mice.

Our results are as follows:

I. *English Strain*.—Never bred mice.

Group *A* (24 non-breeding mice): 46 per cent. have tumors. The corresponding percentage in bred English mice varies in different groups between 62 per cent. and 75 per cent.

91 per cent. of the tumors in never-bred mice occurred in mice older than 12 months, 36 per cent. in mice above 17 months of age, while in breeding English mice the corresponding percentages were 32 per cent. and 4.6 per cent respectively..

Group *B* (58 non-breeding mice): Experiment not yet finished. 17 per cent. of the mice have had tumors so far, almost all of them between 10 and 12 months of age. All others, 22 of which are already more than 12 months old, have not yet had tumors. In control mice 68 per cent. had tumors at or under 12 months of age. We find therefore that even in English mice that are prevented from breeding a considerable number of tumors occur, but that the number of mice affected by cancer is distinctly decreased and that the age at which the tumors develop is higher in non-breeders than in breeders.

II. No. 8 (136 non-breeding mice). In 3.6 per cent. of the non-breeders the development of tumors was observed, in 100 per cent. of these above the age of 12 months, in 80 per cent. above the age of 20 months.

In breeding mice of the same strain 30 per cent. had tumors, 72 per cent. above 12 months of age and 36 per cent. above 17 months. We find here a great reduction in the incidence of cancer and an increase in the age at which the tumors develop in non-breeding mice.

III. No. 8½ (48 non-breeding mice). In 10 per cent. tumors

developed, in 100 per cent. of these above 12 months and in 60 per cent. above 17 months, while in breeding mice of the same strain, the tumor incidence was 14 per cent., in 69 per cent. of which the tumors occurred above 12, in 8 per cent. above 17 months of age. There is here only a slight reduction in the cancer rate in non-breeding mice and a more marked increase in the age at which cancer occurred in non-breeding mice as compared to breeding mice of this strain.

IV. Carter (44 non-breeding mice): $4\frac{1}{2}$ per cent. have tumors, 100 per cent. above 20 months of age as compared to 35 per cent. tumor incidence in breeding mice, in 63 per cent. of which the tumor developed at 12 months of age or below while in none it appeared in a mouse older than 17 months. Here we find therefore again a very marked difference in the same direction as in the previous strains.

Three further experiments the details of which do not need to be given here confirm these results. We may therefore conclude:

1. In breeding mice cancer of the breast occurs in a considerably larger number of individuals than in non-breeding mice.

2. In non-breeding mice the age at which cancer occurs is much higher than in breeding mice, and

3. The number of mammary cancers which occur in non-breeding mice varies in different strains. They are relatively more frequent in non-breeding mice from such strains in which in breeding mice the tumor incidence is greater and is relatively less frequent in non-breeding mice from strains in which also in breeding mice the tumor incidence is less.

4. In our preceding communication we stated that in some strains which are naturally poor breeders (the "creams"), the incidence of cancer is relatively low; while this factor may contribute to the low rate of tumors in such strains, it is in itself not sufficient to explain all or even the major part of the hereditary difference in the incidence in cancer in the various strains of mice.