

greed culture from October 8, 1914, to date, during which time it has attained 951 generations.

Bryn Mawr Race. Isolated at Bryn Mawr, Pa. In pedigreed culture from January 7, 1915, to February 8, 1916, when it was discontinued at the 650th generation.

Oxford Race. Isolated at Oxford, Ohio. Pedigreed culture started on July 16, 1915, and has to-day (May 24, 1916) attained the 779th generation.

Woods Hole Race. Isolated at Woods Hole, Mass. Pedigreed culture begun on August 11, 1915, and discontinued on January 14, 1916, at the 305th generation.

Each of the above races has shown endomixis at the regular rhythmic periods throughout its culture and therefore this additional data from races from diverse sources fully corroborates the statement of Woodruff and Erdmann¹ that "this reorganization process is a normal phenomenon and probably occurs in all races of the species *Paramaecium aurelia*."

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Further investigations on the cyclic changes in the mammalian ovary.²

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In former investigations I have described cyclic changes in the ovaries of the guinea pig which depend largely upon injurious influences exerted upon the ovaries in the period directly pre-

¹ Woodruff and Erdmann, "Complete Periodic Nuclear Reorganization without Cell Fusion in a Pedigreed Race of *Paramaecium*," PROC. SOC. FOR EXPER. BIOLOGY AND MED., Vol. 11, 1914 (preliminary paper). Erdmann and Woodruff, "Vollständige periodische Erneuerung des Kernapparates ohne Zellverschmelzung bei reinlinigen Paramaecien," Biol. Centr., Bd. 34, 1914 (preliminary paper). Woodruff and Erdmann, "A Normal Periodic Reorganization Process without Cell Fusion in *Paramaecium*," Journal of Exper. Zoology, Vol. 17, No. 4, 1914 (complete paper).

² During the summer 1915 serial sections of a number of ovaries were made for me in the department of anatomy of Washington University. I wish to express my appreciation to Dr. R. T. Terry for placing the facilities of his laboratory at my disposal.

ceding ovulation. Inasmuch as ovulation depends upon degenerative changes having previously taken place in the corpora lutea, the cyclic changes in the life of the follicles are correlated with the cyclic changes in the corpus luteum. It was our aim to determine whether the same ovarian cycle existed in all mammalian ovaries; we examined for this purpose ovaries of the rabbit and of the ferret at various periods of sexual activity.

Summarizing our observations we may state that neither in the rabbit nor in the ferret do cyclic changes in the follicular apparatus of the ovaries, comparable to those of the guinea pig, occur. In the period immediately preceding or following ovulation no marked degeneration of the follicles takes place. If any follicles degenerate at all (in consequence of the circulatory changes in the ovaries during this period?), such a degeneration can only affect a few large follicles, while in the guinea pig a sudden degeneration of all the follicles, with the exception of the smallest ones, takes place during this period. The other changes subsequent to this sudden disintegration of follicles in the guinea pig are likewise absent in the rabbit and ferret.

The ovaries of the guinea pig also differ in other respects from those of the rabbit and ferret:

1. In the guinea pig a so-called "interstitial gland" is absent, while it is present in the ovaries of the rabbit and ferret.

2. In the guinea pig during heat a spontaneous ovulation usually takes place. This ovulation in no way depends upon a preceding copulation; while in the rabbit and, as far as we could determine, also in the ferret, heat as such is not sufficient, but a copulation needs to take place in order to insure ovulation.

It would be of interest to determine whether there exists a general correspondence of these various factors in such a way that animals which, like the guinea pig, do not have an interstitial gland and ovulate "spontaneously," show a very marked cycle in the ovarian follicular apparatus, while animals that possess an interstitial gland and do not ovulate "spontaneously" do not possess such a cycle.

It shall be determined in subsequent investigations whether cyclic or other changes occur in the interstitial gland of rabbit and ferret. We may, however, state here that during the winter

period (December and first half of February) the ovaries of the ferret are small and differ from the ovaries in the period of sexual activity especially through the diminution in the number of good follicles. While the ovaries as a whole are smaller, the interstitial gland is well preserved during the winter months.

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The cyclic changes in the mammary gland of the guinea pig.

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Our interest in the character of the cyclic changes of the mammary gland and in their mechanism was twofold. (1) In former investigations Loeb has shown that an early extirpation of the ovaries reduces to a very marked extent the incidence of cancer of the breast in mice. It was therefore of interest to inquire more closely into the relations between ovaries and mammary gland, and (2) we wished to determine whether there exists a parallelism between the cyclic changes in the mammary gland on the one hand and in the ovaries and uterus on the other hand. One of us had formerly shown that in the cyclic changes of ovaries and uterus we could distinguish two phases: the first, comprising ovulation and the heat changes in the uterus, depends upon the absence of the corpus luteum. These are prevented by a substance secreted by the lutein cells. This phase is, however, dependent upon another constituent of the ovaries. The second phase, comprising the further cyclic changes in the uterus as well as the production of decidua and deciduomata, requires a substance secreted by the corpus luteum. Do corresponding phases exist in the case of the mammary gland?

Relatively little is known concerning the cyclic changes in the mammary gland. Bouin and Ancel, as well as Frank and Unger, have shown that in the rabbit, even in the absence of pregnancy, but in the presence of corpora lutea, proliferation takes place in the mammary gland. Proliferation also occurs regularly during pregnancy. Frank and Unger have furthermore demonstrated