there in small traces masked by oestrin incompletely removed in the extraction procedure. The progestin fractions were not assayed for oestrin. Fig. 3 illustrates the degree of uterine proliferation produced with 18.9 mg. (11.7 gm. of fresh tissue) of crude progestin from the secondary corpora of a mare with a 10 cm. fetus. It will be noted that the surface epithelium has proliferated and formed villi quite similar to those produced in the mare's endometrium as the maternal contribution to the equine placenta (Fig. 2). The endometrial glands of the mare appear to be shut off from the uterine lumen, and late in pregnancy when the oestrin titre is still high they become greatly enlarged and dilated (Fig. 4).

As far as we are aware, no one has previously reported on the progestin content of an individual corpus luteum or "crop" of corpora in the case of any animal. Our results show that as little as 1.1 gm. of a pregnant mare's corpus luteum contains an amount of progestin detectable by the immature rabbit test. The assays reported herein, as well as further data obtained from a study of mixed lots of pregnant mare's secondary corpora, indicate that these structures constitute the best "natural" source of progestin yet discovered.

9597

First Estrus in Rats in Relation to Age, Weight, and Length.*

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The experiments here reported represent an attempt to determine whether a relation exists between the growth rate and first estrus in the rat.

It has been common knowledge for a decade that rats and mice may be retarded in growth rate and in size at weaning by the amount of available nourishment. Many breeders have found that optimal conditions of growth and size in an animal colony may be attained by limiting the size of the nursing litter to 5 or 6 animals.

Litters of rats were selected for this study over a period of more

* Aided by a grant from the Committee for Research in Problems of Sex, the National Research Council.

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TABLE I.

Group	No. of rats per litter	No. of litters	No. of rats	Weaning Measures, 22d day		No. of rats	Vaginal Orifice—1st Estrus		
				Weight gm. Mean, S.D.	Body Length mm. Mean, S.D.		Age in Days Mean, S.D.	Weight gm. Mean, S.D.	Body Length mm. Mean, S.D.
A	2-3	23	61	41.8±4.8	117.8±8.2	61	46.54±5.6	109.9±27.1	162.0±12.8
B	4-5	15	68*	39.8±6.4	116.7±6.4	75	52.9±12.5	114.8±22.0	166.7±8.88
C	10-11	10	103	22.6±5.19	100.4±8.8	91	77.9±11.8	115.1±19.0	168.8±9.27
D	3-4 yeast fed	15	54	52.5±5	119.0±3	54	41.1±5	127.0±14	166.0±7

*Due to an oversight, weaning measurements were not taken for 7 animals of this group.

than a year. They were taken from every month in the year, but few were studied during July and August. Records were obtained on 286 rats which lived to first estrus. These represented 63 litters. To indicate the random selection of litters for study, the serial numbers of the animals reported range from 13,992, born Sept. 27, 1935, to 16,721, born Oct. 4, 1936. Those of Group D were studied between January and May of 1937.

The sex of the young was noted at birth, and females only were left in each litter. The rats were originally divided into 3 categories; those with 2 or 3 in a litter (Group A), those with 4 or 5 (Group B), and those with 10 or 11 (Group C). The latter represent in each instance 2 litters born the same night, and reared by the mother of one of the litters. Thus half of this group were foster rats. Because of the high mortality of infantile rats under such conditions of crowding, there were in Group C only 7 litters with 10 each alive at weaning and 3 litters with 11 alive at weaning. Subsequent losses reduced this number to 91 at first estrus.

The treatment accorded Group D is detailed below.

All animals were maintained on an adequate diet, used in the laboratory for 8 years. In addition, the nursing females all received special diet (McCollum's). The young were kept together in the same cages after weaning. They were given the usual colony diet adequate for growth, and each was given access to ample food supply after weaning. However, those in larger groups continued to grow at a slower rate than those in the smaller.

Body lengths were taken under deep anesthesia. The measurements include the straight line distance between the nose and the anus. The lengths of the tails were also taken, but were more variable within the group than body lengths.

The establishment of the vaginal orifice was adopted as an endpoint instead of first estrus, as determined by the vaginal smear. Both occurred on the same day in 75% of the rats (Group A 75.4%, Group B 75.0%, Group C 74.7%). With a single examination daily, this might be from one hour to 24 or 30 hours after v. o. In some instances it was felt that the estrous smear was missed entirely, because the animals were given a single daily examination.

A more intensive study was made of the first 111 rats in this series. The animals were autopsied at first estrus and organs were weighed. Nothing of significance was learned from the weights of pituitary, ovary or uterus, and these measurements were discontinued.

It is obvious that in these 3 groups of rats, the only experimental modification was regulation of litter size, in order to affect the

amount of available nourishment. Crowding may have exerted some effect, in addition to the nutrition.

All animals were weaned on the 22d day of life. The data from these observations are summarized in Table I, and graphically presented in Fig. 1. There is nothing new in the observations that litters with 5 or less gave higher average weights at weaning than those with 10 or 11 in a litter. There is no significant difference in size, weight or length, between Groups A and B. Group C is significantly lighter and shorter at this age.

The animals were examined daily from the 30th day of life to the establishment of the vaginal orifice. The earliest age at v. o. was 33 days in several animals in both A and B Groups. The earliest age at v. o. in Group C was 50 days in a single animal, the next at 58 days in a single animal.

The average ages of estrus in Groups A and B, 46.5±5.6 and 52.9±12.5 days, respectively, are not significantly different. In Group C, however, the average age of 77.9±11.8 days is distinctly different.

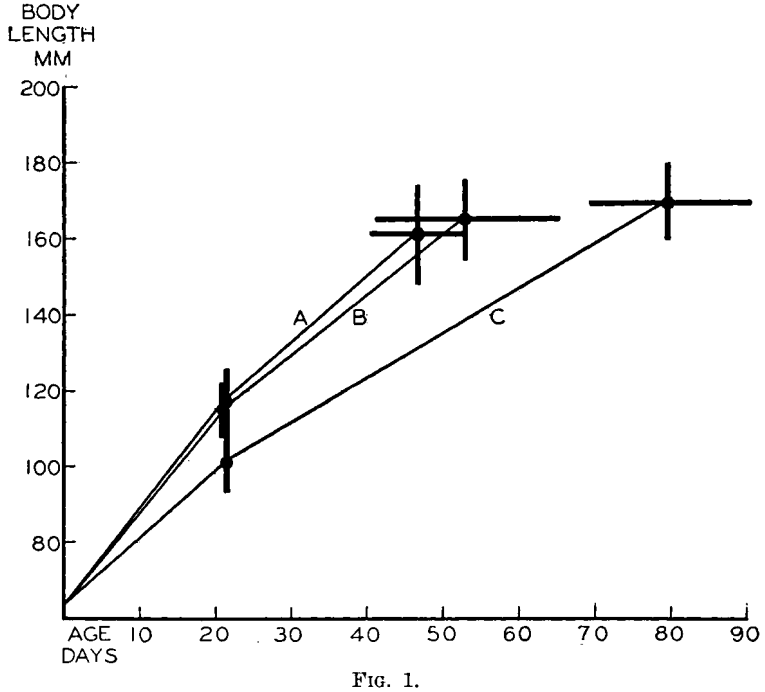

FIG. 1.

Chart showing average body length at weaning, 22 days, of 3 groups of rats, and the body lengths of the same groups at the establishment of the vaginal orifice. Circles indicate average of each group. Horizontal bars are the standard deviations of the ages at vaginal orifice; vertical bars are the standard deviations of body lengths, at weaning, and at v.o. Numerical data from Table I.

Since a slight depression of the growth rate causes a marked delay in the time at first estrus (Group C), it was thought desirable to attempt to accelerate the growth rate beyond that normal for our colony. An experiment employing one type of accelerated growth was conducted by one of us (C.E.Z.) by adding yeast to the diet.

The mother rats (Group D) were fed 2 to 3 gm. of yeast daily during pregnancy and lactation. The females, usually 4, occasionally 3 to the litter, were then fed by medicine dropper 1 to 2 gm. of yeast daily from weaning to the opening of the vaginal orifice.

As is seen from Table I the animals of Group D were heavier (52.5±5 gm.) and longer (119±3 mm.) at weaning than the A Group. They also had the earliest average first estrus, (41.1±5 days). The body weights were greater (129±14 gm.) and highly variable. The body lengths, however, were approximately the same as in the other groups, namely 166±7 mm.

Thus the rats of Group D, in which the growth rate was accelerated by addition of yeast to the diet, grew faster, were heavier, and experienced an earlier first estrus, but they were uniform with the other 3 groups in body length at first estrus.

The significant point brought out by these data is that while estrus occurred at average ages of 41, 46, 53, or 80 days in the 4 groups, ranging from 33 to 105 days, it occurred when the body length reached 160-170 mm., irrespective of the age. It can be believed from these data that age is related only in a secondary degree, within certain limits, to the time of onset of first estrus. At least the only close agreement in this study is between first estrus and body length. Body weights taken as averages for the 3 groups are close together, but the standard deviations show this to be a more variable factor than length. The coefficient of correlation for body weight and length is high for 2 groups: Group A = 0.934; B = 0.909; for Group C = 0.688.

The number of animals in this report is small. For this group, however, it is believed that the conclusions are valid. The body lengths at estrus for the first 111 rats gave results very close to those reported for each group of the completed series. The observations recorded above are not in agreement with those of Asdell and Crowell,[1] although the data are dissimilar. Asdell and Crowell had 2 groups of experimental rats, 21 of which were kept at a greatly reduced body weight by reduction of total caloric intake. The age at first estrus in their rats with most severely depressed growth rates was 357 days. It is difficult to compare our data with that

[1] Asdell, S. A., and Crowell, Mary F., *Nutrition*, 1935, **10**, 13.

which Asdell and Crowell present; but from their data we are unable to discover the basis for their statement that "age is a more important consideration than weight in determining the time at which vaginal opening occurs."

Summary. By varying the number of rats in a litter, animals of a slightly retarded growth rate were obtained. Rats raised to the time of vaginal opening, with 2 or 3, 4 or 5, and 10 or 11 in each litter showed vaginal opening at 46.5±5.6, 52.9±12.5 and 77.9±11.8 days, respectively.

While the range of ages at vaginal opening was considerable in the 3 groups, 33 to 105 days, the body lengths showed close agreement. The body lengths in the 3 groups at vaginal opening were 162.0±12.8 mm., 166.7±8.88 mm., and 168.8±9.27 mm., respectively. The body weights were similar in trend, but showed a greater variability than the body lengths.

A small group of 54 rats was maintained at an accelerated growth rate by administration of yeast. First estrus occurred at 41.1 days, but the average body length, like that of the other groups, was 166±7 mm.

9598 P

A Thermostromuhr with Direct Current Heater.*

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From an analysis of the method of measuring blood flow by the Rein[2, 3] thermostromuhr it became evident that the passage of the high frequency current through the intact blood vessel, on which a diathermy thermo-element is placed, results essentially in a localized heating of the wall of the blood vessel. Hence it was of interest to construct a thermostromuhr unit similar to the modified type introduced by Baldes, Herrick and Essex[1] in which a direct current

* Submitted for publication July 3, 1937.

1 Baldes, E. J., Herrick, J. F., and Essex, H. E., PROC. SOC. EXP. BIOL. AND MED., 1933, **30**, 1109.

2 Rein, Hermann, *Z. f. Biol.*, 1928, **87**, 394.

3 Rein, Hermann, in Abderhalden, Emil, *Handbuch der biologischen Arbeitsmethoden*, Berlin, Urban and Schwarzenberg, Abt. 5, Teil 8, 1928-1935, pp. 693-716.