

by the measures discussed in this paper is not known. Aconitine, according to our results, causes auricular fibrillation by rapid stimulus formation in *one* center while in the other types of auricular fibrillation investigated by us more than one center is active.

Summary. Auricular fibrillation caused by electrical stimulation of the auricles or by the application of acetyl choline to the area of the sinus node is not stopped by cooling the area of stimulation or cooling of the site of application of the drug. In 24 of 27 experi-

ments, however, the simultaneous cooling of sinus and A-V nodes terminated the auricular fibrillation. Interruption of the cooling caused the auricular fibrillation to recur.

The experiments are evidence which tends to support the theory that in some forms of auricular fibrillation more than one center of rapid stimulus formation is active. They speak against the presence of a circus movement.

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Gonadectomy and Ovarian (Spleen) Grafts and Growth of Normal Male and Female Mice.* (17776)

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The more obvious end results of castration have long since been recognized as the complete failure of humans or the lower animals to undergo the body changes of normal puberty. Although individuals in the condition of acute gonad deficiency will continue to grow to or beyond adult proportions, the resulting state represents the persistence of a neutral or asexual form. It is in effect an expression of the growth impulse of the body in the absence of functioning gonads and their physiology. The effects of castration on body vigor lend themselves to objective experimental investigation. There is some degree of controversy among investigators concerning the effect which gonadectomy has on the growth of laboratory rodents. Slonaker(1) observed greater body weight in castrated

male rats although Stotsenburg(2), and Hatai (3,4) working with albino rats, reported that castration did not make any material difference in the body. Masui and Tamura (5) reported that castration did not affect growth of mice. Tang(6), Evans and Simpson(7), van Wagenen(8), Korenchevsky and Dennison(9), and Lawless(10), all of whom worked with rats, found that castrated male rats were lighter than their controls. Mice bearing active androgenic ovarian grafts do not assume a growth pattern comparable to that of normal males(Hill)(11).

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TABLE I.

Groups	"t"	Groups	"t"
1 + 2	9.93	2 + 4	2.42
1 + 3	4.98	2 + 5	5.01
1 + 4	6.64	3 + 4	1.00
1 + 5	5.06	3 + 5	1.04
2 + 3	3.01	4 + 5	2.32

Groups: 1. Control females. 2. Control males. 3. Castrate females. 4. Castrate males. 5. Castrate females—ovary grafts. "t"—Value of statistical significance.

Experimental. The present study was undertaken to consider the effect of castration on the body weights of laboratory mice and to determine to what extent the condition of ovarian and testicular deficiency would influence sex differences in growth. It likewise seemed of interest to compare any weight differences with the weights obtained from female mice bearing a graft of ovary in the spleen. The animals were all of the Swiss Albino strain and averaged between 75 and 85 days of age at the onset of the study. The mice were subdivided into 5 groups as follows, each group consisting of 20 mice: Group I, control females; Group II, control males; Group III, castrate females; Group IV, castrate males; and Group V, castrate females bearing an ovary graft in the spleen. Castration of Groups III and IV was completed when the animals were between 75 and 82 days of age. The ovary graftings of Group V were performed when the animals were from 85 to 95 days old. All animals were kept at normal room temperature and fed *ad libitum* with a standard diet.

The weights, recorded twice weekly, and reported in this experiment extend through a period of 40 weeks and are plotted graphically as indicated in Fig. 1. Computations of the "T" value of statistical significance (Snedecor)(12) were determined between the final average weekly weights of each of the 5 groups. The results obtained are summarized in Table I. The average body weight increase is summarized as follows: Group I, control females, showed an increase of 7.6 g; Group II, control males, an increase of 11.3 g; Group III, castrate females, 13.0 g; Group

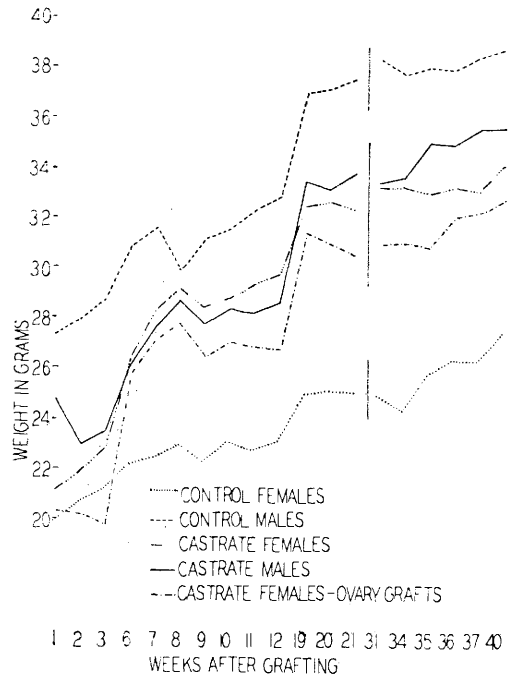


Fig. 1.

IV, castrate males, 11.0 g; and Group V, castrate females bearing ovary grafts, 12.5 g. Thus it is shown that castration of male mice has curtailed their gain in weight, while in females, the spayed animals as well as the animals bearing spleen grafts of ovaries are heavier than their normal controls. The "T" value is significant at 1% (Table I).

Tang(6), in a study of the sex difference in growth in gonadectomized albino rats found that castration of male rats did inhibit gain in body weight irrespective of the age of the animal at the time of castration. As judged by increase in weight, early castration and spaying had been no more effective in reducing the sex difference in growth than the later gonadectomy. Those animals which were gonadectomized at birth showed no apparent difference from the rest of the group. Growth in both castrated and normal males exceeded the growth rate of spayed and control females and the female mice bearing ovarian grafts. The removal of the ovaries in each of the 2 groups of experimental females affected an over-all percentage weight increase of approximately 61%, in comparison to an approximate 44% increase as a result of castra-

12. Snedecor, George W., Statistical Methods, The Iowa State Press, Ames, Iowa, 4th ed., 1946.

tion of the males. Sex difference (Fig. 1) cannot be entirely eliminated although it has been reduced by gonadectomy. Both groups of males still exceed in growth rate each of the 3 groups of females. This difference in growth rate may be due presumably to an inherent genetic factor. The body weight increase in the females bearing ovarian grafts was highly significant at the 1% level, when compared to the growth of the control and spayed females.

It has been demonstrated that no significant difference is obtained between the weights of normal females and those from grafted females bearing active androgenic grafts of ovaries in their ears (Hill)(11). The animals in this experiment had one ovary autografted into the spleen and the second ovary removed and discarded. Thus, any hormone that may have been produced by the ovary in its altered location would be transported directly to the liver via the hepatic portal system. Biskind(13), has conclusively demonstrated that natural and modified estrogens and androgens are inactivated in the liver. The estrogenic and androgenic hormones produced by the transplanted gonad, therefore, would presumably be inactivated, and the sex hormone in the systemic blood would approximate that of a nonimplanted castrate. Thus, it would appear that the significant difference in weight obtained from the females bearing ovarian (spleen) grafts and their normal controls could be attributed to the inactivation of the ovarian hormone. The growth of the normal males exceeded in every instance the growth of those females carrying ovary grafts in their spleen. These results are in agreement with the findings of Hill(11). Statistical evaluations of the comparisons indicated that the difference in weight between the grafted female mice and the control males was at least $2\frac{1}{2}$ times as great as that for the grafted animals and the castrated males.

Castrated male mice were found to be lighter than their controls, the difference being sig-

nificant at the 1% level. Freudenberger and Clausen(14) have postulated that it is oestrin that has the inhibitive effect on body growth in the female rat. The difference between the male and female controls in this experiment was significant, while the difference between the male and female test animals—*i.e.*, the gonadectomized animals, was barely significant at the 1% point.

A comparison of the grafted animals with the female controls, the male controls, and the castrate males, indicates a difference highly significant at the 1% level. Just as an intermediate type of growth curve was established for gonadectomized male and female rats against their controls (Tang)(6), so too, it would appear that a similar type of curve also results between the control and spayed female mice as compared to those animals bearing autograft ovaries in their spleen.

Summary. Castrated male mice grew at a slower rate than their normal controls, while the spayed females grew faster than their normal controls. The removal of the gonads reduced the sex difference in body weight. Those animals bearing grafts of ovaries also grew at a faster rate than their normal controls, the difference being significant at the 1% point. Although their growth curve approximated that of the spayed animals, at no time did it exceed it. The growth curve assumed by the weights of the grafted female mice did not parallel that of either the normal males or the castrated males. The differences in the body weight of the grafted females compared with the normal males and the castrated males were significant at the 1% level, the males being heavier in both cases.

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