

because it is based on a purely electro-magnetic effect. The limit of accuracy is determined by the characteristics of the galvanometer used.

Fig. 3 shows a typical calibration curve obtained with a carotid artery taken from a dog. The deflection difference observed on reversing the magnetic field was plotted against the rate of flow as measured with a graduate and stopwatch. It shows the linear relationship and gives an idea of the order of sensitivity of the particular arrangement.

The method was tried in living anesthetized dogs by placing the exposed but unopened carotid artery between the magnet poles. Deflections of as much as 14 cm. were obtained. The normal deflection was about 8 to 10 cm. With this sensitivity it is possible to determine changes in rate of flow of about 1% of the normal flow.*

I am indebted to K. Jochim for his valuable assistance and advice, to A. Meyer and S. Gaddas for technical assistance, and especially to Dr. L. N. Katz for his stimulating interest and guidance in developing the method.

8855 C

Effect of the Testis on the Mammary Gland.

C. S. McEuen, H. Selye and J. B. Collip.

From the Department of Biochemistry, McGill University, Montreal, Canada.

[We reported¹ that treatment with testosterone benzoate stimulates the development and secretion of the mammary gland in normal and castrate male and female rats. While following up these experiments, it became obvious that a certain degree of mammary gland development is always present even in untreated male rats after they have passed puberty.] It seemed of interest, therefore, to establish whether the male gonad would physiologically exert a specific stimulating effect on the mammary gland. The experiments which we wish to report on here prove this to be the case.

A group of 12 immature castrate males, 34 days old, and 12

* These results indicate that electrical currents are induced in the body by the earth's magnetic field. Calculations suggest that the order of magnitude of the voltage induced in an aorta is of the order of 10^{-7} volts.

¹ Selye, H., McEuen, C. S., and Collip, J. B., *Proc. Soc. Exp. Biol. and Med.*, 1936, **34**, 201.

normal controls of the same age were used in the first series. Biopsies of the mammary glands taken on the 48th day of life showed considerable glandular development and some milk secretion in the group of normals, while the castrate animals showed no secretion or development. A second biopsy, taken on the 56th day of life, showed that the development of the mammary gland in the non-castrate group had proceeded farther, while the castrates still showed no trace of development.

¶ In order to see whether removal of the testes would cause involution of an already developed mammary gland, 6 adult male rats were castrated at the age of 4½ months; that is, at a time when the mammary gland is already well developed. Biopsies 15 days later showed no secretion and marked signs of involution of the gland, which involution was still more advanced in biopsy specimens taken 30 days after operation.

In connection with this mammary gland stimulating effect, which is so similar to that of oestrin, it seemed of importance to establish whether testosterone would exert an oestrogenic effect on the vagina. This seemed all the more important since Deanesly and Parkes² state that testosterone causes cornification of the vagina, while Korenchevsky³ obtained vaginal mucifications but no cornification.

Three normal and 2 ovariectomized 21-day-old females were injected subcutaneously once daily with 200 γ of testosterone in corn oil for 7 days. The vaginal smears showed no cornification. The

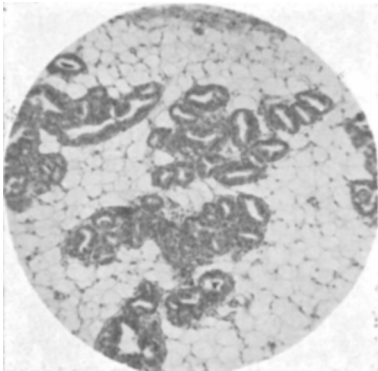


FIG. 1.
Mammary gland of a normal male rat,
48 days of age.

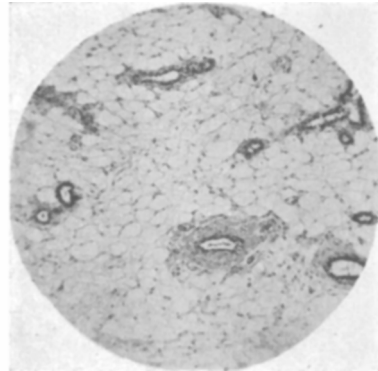


FIG. 2.
Mammary gland of a castrate male rat,
48 days of age.

² Deanesly, R., and Parkes, A. S., *Br. Med. J.*, 1936, 3918, 257.

³ Korenchevsky, V., *Nature*, 1936, **137**, 494.

dose was then raised to 400 γ per day for a period of 4 days, and even this dosage had no vaginal oestrogenic effect, while the mammary glands exhibited marked development and secretion at the end of this period.

From these experiments it seems evident that testosterone is not oestrogenic in doses sufficient to stimulate the mammary gland. It is obvious, furthermore, that the effect of the male hormone on the mammary tissue cannot be attributed to its transformation in the organism into the female sex hormone. We have to conclude that testosterone itself stimulates the mammary gland both in the male and in the female, and that such mammary stimulation is a physiological result of the activity of the male gonad. In this connection clinical observations of Jung and Shafton⁴ are of interest. These authors found that proliferation of mammary tissue is normally demonstrable in boys between 12 and 17 years of age.

Summary. Development and secretion of mammary parenchyma is normally demonstrable in male rats beginning at puberty. Castration prevents the proliferation of the mammary gland in the immature male, just as it does in the female. In adult males, in which the mammary gland is already developed, castration is followed by involution of the gland. Testosterone in doses sufficient to produce mammary gland development does not cause vaginal cornification either in the normal or the ovariectomized immature female rat.*

⁴ Jung, F. T., and Shafton, A. L., PROC. SOC. EXP. BIOL. AND MED., 1935, **33**, 455.

* The testosterone benzoate used in these experiments was kindly supplied by the Schering-Kahlbaum Co., through the courtesy of Prof. Schoeller.