

exclude the possibility that renin plays a rôle in the maintenance of normal blood pressure.

Conclusions. 1. Bilateral nephrectomy under the above conditions increases the sensitivity of the dog to the pressor action of renin administered intravenously. 2. The renin content of the kidneys of dogs bears no relation to the blood pressure level of the animals. 3. Differences in the renin concentration of the kidneys of dogs and even between the 2 kidneys of the same dog, occur. 4. Stimulation of the splanchnic nerve produces no significant change in the renin content of the dog's kidney. 5. Hypotension as induced above does not alter significantly the renin concentration of the kidney of the dog. 6. There is no evidence at present for the possible rôle of renin in the maintenance of normal blood pressure.

10403

Effect of Protein Alimentation on the Secondary Sex Ratio of Offspring of Rats.

F. HOELZEL, ESTHER DA COSTA AND A. J. CARLSON.

From the Department of Physiology, University of Chicago.

The sex-determining theory which Geddes and Thompson¹ and others attribute to Girou, namely, that the better nourished parent tends to determine the same sex in the offspring, was tested by mating rats fed diets adequate or high in protein (containing 30% to 50% casein) with rats fed diets low in protein (containing 7.5% to 12% casein, but otherwise similar to the high protein diets). Albino, hooded and hybrid (hooded-albino) rats were used. When increases in weight suggested pregnancy, the females were isolated and placed on a stock diet. The sex of the offspring was determined within 24 hours after birth. A preliminary study which lasted 8 months during which 49 litters were obtained yielded some data supporting Girou's theory but needing further confirmation. Accordingly a further study was undertaken which thus far involved 15 months during which 652 litters were obtained.

In our main study, only one male was used for mating with the females in each of 7 groups including from 10 to 17 individuals. Thus we obtained from 52 to 126 litters from each male within a year. Genetic variables were also reduced to a minimum by using

¹ Geddes and Thompson, *The Evolution of Sex*, Revised Ed., London, 1904.

the same females repeatedly for mating when possible but rotating them in random order between the different groups, excepting that albinos were mated only with albinos and hooded with hooded rats. Between Nov. 10, 1937, (the beginning of our main study) and Feb. 8, 1938, we obtained, from matings of low protein males with normal and high protein females, 51 litters (av. 8.2 young per litter) including 217 males and 203 females and yielding a sex ratio of 107 (males):100 (females). During the same period, we obtained, from matings of normal and high protein males with low protein females, 64 litters (av. 8.6 per litter) including 327 males and 226 females and yielding a sex ratio of 145:100. After this the diet of the latter groups was reversed. During periods of 67 to 71 days, respectively, we then obtained, from the same males, 56 litters (av. 8.1 per litter) including 218 males and 237 females and yielding a sex ratio of 92:100. This is a striking decrease in the male ratio as the normal seasonal (spring) effect is an increase in the male ratio. Further confirmation of the theory of Girou was obtained, in some cases, when the diet was again reversed later in the study but, in other cases, no changes were produced or the results became complicated by increased age, physical deterioration or sterility of the animals as a result of the prolonged use of inadequate diets.

We believe that divergent secondary sex ratios such as we obtained in rats are mainly due to a sex-differential resorption of embryos. The state of protein metabolism induced in the parent evidently also affects the germ cells and tends to determine the survival value of the same sex among the embryos. The survival of a larger percentage representing the better nourished sex might be due to the expected transmission of sex-linked characteristics. The results would also be explained if mammalian reproduction is a modification of parthenogenesis in which each sex tends to reproduce itself with survival of the fittest.