were exercised for 0.5 hr. twice daily the first day, and 0.75 hr. twice daily the second day; the mice 0.5 hr. twice daily on two consecutive days. Forty-eight hours after the initiation of the experiment, marked neutrophilic leucocytosis was observed. Our findings are summarized in Table I.

Summary. We conclude that the total white cell count increases mainly as a result of neutrophilic leucocytosis during the alarm reaction. At the same time, there is relative lymphopenia. Following exposure to very severe alarming stimuli, a period of leucopenia precedes this characteristic reaction. Leucopenia is observed throughout the whole experiment in those cases in which the animal was unable to resist the alarming stimulus so that death ensued.

9148

Effects of Ovariectomy on Body Growth and Organ Weights of the Young Albino Rat.

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Freudenberger and Billeter[1] studied the effect of spaying on body growth and the organ weights of the albino rat. In their series the ovaries were removed from the experimental animals at an average age of 26 days. All animals were completely autopsied at 6 months of age. Differences in body growth between experimental and control rats as well as many differences in organ weights were noted. Lawless[2] has recently called attention to the fact that observations published regarding the effects of castration usually concern only that characteristic which it is sought to influence, so that the published reports do not furnish a complete picture of all the changes in a castrated animal. He stated that a study of all the observable changes resulting from castration in one species would therefore seem desirable. These two statements apply equally well to the studies concerning the effects of bilateral ovariectomy. We are, therefore, carrying our studies further on this problem. We wish to present here the results of bilateral ovariectomy on young albino rats as noted when the animals were about 3 months of age. Only brief mention will be made of the literature, since the more important articles have been referred to by recent writers.[1, 3]

[1] Freudenberger, C. B., and Billeter, O. A., *Endocrinology*, 1935, **19**, 347.
[2] Lawless, J. J., *Anat. Rec.*, 1936, **66**, 455.
[3] Holt, H., Keeton, R. W., and Vennesland, B., *Am. J. Physiol.*, 1936, **114**, 515.

The rats used in our work were of the Wistar strain. At the time of operation the average age of both test and control animals was 26 days with a range of from 23 to 29 days. Twenty-four test animals and 24 controls were used. In most cases the animals used for tests and controls were litter mates. The average weight at the time of operation of both the test and control animals was 47 gm. Excellent care was given all animals, the diet being the same as that used by Freudenberger and Billeter.[1] The ovaries were removed through a midline abdominal incision. In the animals used as controls the incision was made but the ovaries were only slightly disturbed, thus assuring approximately the same operative conditions. No infections occurred in any of the animals. All animals were weighed at weekly intervals. At an average age of 93.3 days (ranging from 91 to 96 days), both the ovariectomized and control animals were killed in a gas chamber. Each animal was autopsied immediately after it was killed, and the organs were then weighed. The method of autopsy was essentially the same as that used by Jackson.[4] All conditions were very similar to those that prevailed at the time the previous experiment concerning spaying was done in this laboratory, so we feel that the results should be comparable. Modern biometrical methods were again used in interpreting the results.

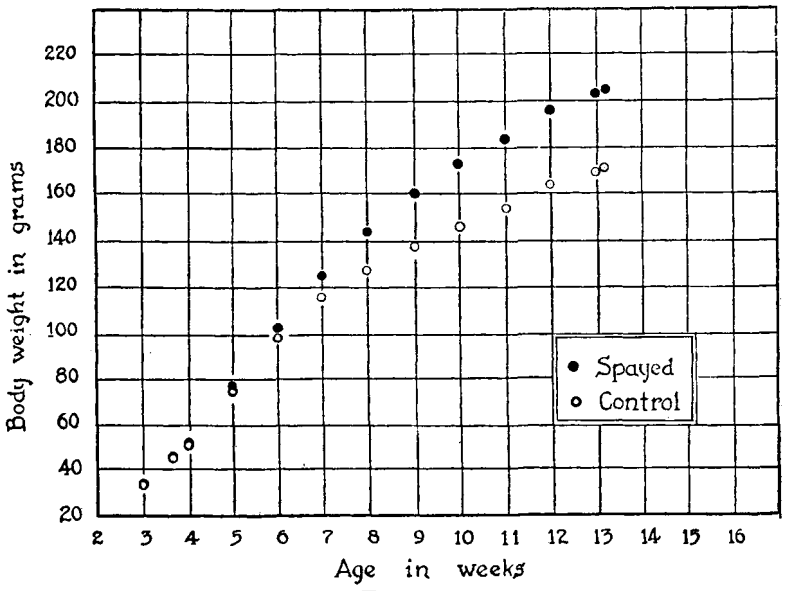

FIG. 1.
Average body weight in grams according to age in weeks.

[4] Jackson, C. M., *J. Nutrition*, 1930, **3**, 61.

As stated recently by Holt, Keeton, and Vennesland,[3] most workers have reported that ovariectomized animals gain more weight than controls. This was found to be true in our series (Fig. 1). At 5 weeks of age the test animals had an average weight which was 3% greater than that of the controls. At 6 weeks of age this difference in average weights amounted to 4%. The difference at 7 weeks was 8.8%, and this difference was found to be significant. The percentage difference in body weight between the tests and controls constantly increased until 13 weeks of age when the difference was 20.5%. At the time of autopsy the ovariectomized animals had an average weight of 205.4 gm. (range: 171-242 gm.) and the controls had an average weight of 170.9 gm. (range: 155-195 gm.). Thus, the average weight of the tests was 20.2% greater than that of the controls.

It was noted that the test animals became significantly heavier than the controls shortly after the latter became sexually mature. The vagina opened in the control rats at an average age of 42 days, and the difference in body weight between the 2 groups was found to have become significant at an average age of 49 days. However, as stated above, the test rats weighed more than the controls at 35 days of age.

TABLE I.
Organ Weights, Differences and Significance Ratios
(Measurements in grams and centimeters).

	Mean Tests	Mean Controls	Difference	% Difference	Significance Ratio
Body weight	250.4	170.9	+34.5	20.2	11.5
Body length	19.40	18.83	+ 0.57	3.1	7.0
Tail length	18.77	17.91	+ 0.86	4.8	6.5
Head	17.78	15.79	+ 1.99	12.6	10.3
Hypophysis	0.0104	0.0088	+ 0.0016	18.2	6.4
Thyroid	0.0200	0.0181	+ 0.0019	10.5	3.3
Suprarenal glands	0.0376	0.0416	— 0.0040	10.6	3.6
Thymus	0.794	0.450	+ 0.344	76.5	10.1
Heart	0.809	0.714	+ 0.095	13.3	6.9
Lungs	1.505	1.283	+ 0.222	17.3	4.5
Alimentary group	17.0	14.5	+ 2.5	17.3	6.3
Stomach	0.897	0.758	+ 0.139	18.4	10.2
Liver	7.607	6.763	+ 0.845	12.5	4.9
Spleen	0.516	0.418	+ 0.095	22.6	18.6
Kidneys	1.561	1.442	+ 0.119	8.2	3.8

Our findings are shown in Table I. The ovariectomized rats had a greater body length, tail length and head weight than the controls. The average weights of all the organs studied were also greater in the tests than in the controls with the one exception of the suprarenal glands. All of these differences were significant as indicated by the

significance ratios which varied from 3.3 for the thyroid to 18.6 for the spleen. The average weight of the suprarenal glands of the test animals was less than that of the controls. However, the difference in the weights of the suprarenal glands was not nearly so great as that found at 6 months of age. Although the percentage differences between the body weights of the test and control animals were only slightly greater at 3 months than at 6, the differences in organ weights were much greater. This would indicate that the body length and the organs of the ovariectomized rats underwent their growth changes more rapidly than those of the controls even though their final values were in many cases no greater than in normal rats. Holt, Keeton, and Vennesland[3] found that the percentage of dry matter, nitrogen, ash, and fat in gonadectomized, eviscerated female carcasses, to which the visceral fat had been added, fell within the normal ranges. They, therefore, concluded that the increase in body weight in spayed animals was due to a general increase in size rather than to any increase in the deposition of fat. They stated that the conclusion seemed warranted that ovariectomy influenced also the growth-promoting properties of the pituitary. Our results concerning body lengths and organ weights of ovariectomized rats also tended to confirm this theory. However, we had no proof that this was the true explanation of the results. It was interesting to find that R. G. Hoskins[5] in 1911 in commenting on the hypertrophy of the hypophysis occurring in both sexes of the rat following gonadectomy made the following statement: "These observations suggest that the pituitary may normally be held in check by secretions of the gonads, and that when this inhibition is removed, the pituitary manifests increased activity, leading to altered metabolisms and thus to overgrowth of different parts of the body, such as occurs both in acromegaly, and after castration."

Although we did not attempt to measure the amount of fat in our rats we felt that part of the difference in weight between spayed and normal rats was due to a greater deposition of fat in the spayed animals. While this was our impression in rats at both 3 and 6 months of age, it was more marked in the 6 months rats in which the organ weight differences were not so great but the difference in body weight was still present.

Summary. The ovaries were removed from 24 Wistar albino rats which averaged 26 days of age. An equal number of litter mate controls were used. All rats were kept under similar conditions and were killed and autopsied at 3 months of age. The endocrine glands

[5] Hoskins, R. G., *Am. J. Med. Sci.*, 1911, **141**, 535.

were studied as well as certain other organs which showed some tendency to be changed in a 6-month group of spayed rats which were studied earlier in this laboratory. The vagina opened in the control rats at an average age of 42 days. The body weight of the spayed rats became significantly greater than that of the controls when they were between 6 and 7 weeks of age. In this group of rats the percentage difference in body weight between the spayed and controls constantly increased until 13 weeks of age when the difference was 20.5%. The spayed rats at 3 months of age had a significantly greater body length and tail length than the controls. The following parts were significantly heavier in the spayed rats: head, hypophysis, thyroid, thymus, lungs, heart, alimentary group, stomach, liver, spleen, and kidneys. These differences were all greater than those found at 6 months, which seemed to indicate that ovariectomized rats go through their growth changes more rapidly than controls. The suprarenals were significantly smaller in the spayed rats, but the difference was less than at 6 months.

9149 P

Action of P-Aminobenzenesulfonamide on Type III Pneumococcus Infections in Mice.

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The discovery of prontosil by Domagk[1] has resulted in a new and very effective means of treating certain infections caused by hemolytic streptococci. Hörlein,[2] in reviewing Domagk's work, claimed that this compound was also effective against Type III pneumococcal infections, but failed to publish in detail the experimental results which led either to this conclusion, or to his grouping the Type III pneumococci with the streptococci on chemotherapeutic grounds.

The work of Tréfouël and his associates,[3] confirmed by Buttle, Gray, and Stephenson,[4] indicated that *p*-aminobenzenesulfonamide, a part of the prontosil molecule, was as effective against hemolytic streptococcal infections as the more complicated compounds. Cole-

[1] Domagk, G., *Deutsche med. Wchnschr.*, 1935, **61**, 829.

[2] Hörlein, H., *Proc. Royal Soc. Med.*, 1936, **29**, 321.

[3] Tréfouël, J., and Tréfouël, J. Mme., Nitti, F., Bovet, D., *Compt. Rend. d. Soc. de Biol.*, 1935, **120**, 756.

[4] Buttle, G. A. H., Gray, W. H., and Stephenson, D., *Lancet*, 1936, **1**, 1206.