

of epinephrin from the adrenals is still sustained after division of the cord in the cervical region at the levels mentioned, and that this liberation takes place through the splanchnic and other nerves known to be concerned when the spinal cord is still connected with the brain. The contrast between the epinephrin output when the cervical cord has been divided and when the dorsal cord has been divided at the levels mentioned is very great.

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Quantitative experiments on the liberation of epinephrin from the adrenals after section of their nerves, with special reference to the question whether epinephrin is indispensable for the organism.

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1. We showed in a previous paper¹ by the blood pressure and eye reactions that after section of the nerve supply of the adrenal no demonstrable liberation of epinephrin was present in cats as long as five weeks after the nerve section.

2. As it is easier to detect very small concentrations of epinephrin by the rabbit intestine and uterus segments, we have made a series of experiments (on 7 cats) in which these tests were used to supplement the eye reactions. In all the animals one adrenal was excised and the nerves of the other cut.

In a cat tested two weeks after the operation, it was shown that the adrenal blood serum could not have contained 1 : 300,000,000, or the blood 1 : 400,000,000, of epinephrin; and that the rate of liberation of epinephrin could not have been at most 0.000001 mgm. per minute for one adrenal. In another cat three weeks after the operation² the serum of the adrenal blood was proved to contain less than 1 : 400,000,000, and the blood less than 1 : 700,000,000 epinephrin. The output of epinephrin per

¹ *Journal of Pharmacology and Experimental Therapeutics*, 1916, VIII, 479.

² In this animal after the usual operation the left semilunar ganglion and the first ganglion of the lumbar sympathetic chain below the diaphragm were excised.

minute could not have been as much as 0.000009 mgm. per minute, for one adrenal. The segments used for the tests in these experiments were extremely sensitive, and the limits of adrenalin concentrations which could be detected with certainty were carefully determined. The eye reactions were negative. In these two cats the rate of liberation of epinephrin, if any liberation whatever was going on, must have been several hundred times less than the rate in normal animals under the same experimental conditions.

It is scarcely necessary to point out that experiments yielding completely negative results indicating the absence of epinephrin with very sensitive test objects are much more important for the questions studied than experiments in which small amounts of epinephrin can still be detected. For it is impossible to be certain that when a little epinephrin is found some of the fibers concerned in the liberation may not have escaped section.

3. Since these animals had completely recovered from the operation and behaved in every way like normal animals, it must be concluded that the liberation of epinephrin from the adrenals is not indispensable for life or health, unless indeed the necessary quantity is, even in the adrenal vein blood, below the limits of detection by the methods used. It must be remembered that the epinephrin in the adrenal blood is diluted enormously (probably at least 100 times) in the right heart; so that in these cats the concentration in the arterial blood could not at most have reached 1 : 40 billions and 1 : 70 billions, respectively.

If the liberation of epinephrin is abolished by division in the dorsal cord of the path concerned in it, as our experiments on "Relation of the Spinal Cord to the Spontaneous Liberation of Epinephrin" indicate, this corroborates the conclusion that epinephrin is not indispensable. Numerous animals and men have long survived such lesions.

4. These experiments indicate that the entire liberation of epinephrin from the adrenals is controlled by nerves.

5. In a third cat (8 days after operation) the adrenal vein blood contained epinephrin but in concentration not exceeding 1 : 125,000,000. The output of epinephrin per minute was probably not more at most than one-hundredth of what might be expected in a normal animal.

6. In a cat 15 weeks after the operation it was doubtful if any epinephrin was present in the adrenal vein blood. In two others 15 weeks after operation eye reactions and segment tests showed the presence of a small amount of epinephrin, the rate of liberation being a mere fraction of the normal. The possibility of regeneration of fibers after this interval must be considered. In the seventh cat (tested two weeks after the operation) the eye reactions were negative. The segment tests revealed a small concentration of epinephrin in the adrenal blood (less than 1 : 30,000,000) corresponding to a rate of liberation of epinephrin per minute of at most one tenth of the normal.

ABSTRACTS OF THE COMMUNICATIONS, PACIFIC COAST BRANCH,
SEVENTEENTH MEETING, SAN FRANCISCO, CALIFORNIA,
APRIL 4, 1917.

87 (1265)

**The function of the kidneys under strain in uranium nephritis
and the relationship between anatomy and function
under these conditions.**

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Rabbits were injected subcutaneously with uranium nitrate in doses which varied from those which produced marked anatomical and functional changes to those which led to no certain effect.

A strain was placed on the urea-excreting function of the kidneys by the administration of urea by stomach tube.

While the kidneys were under the influence of this strain, the volume of urine, the rate of urea excretion, and the concentration of urea in the urine and blood were determined before and after the injection of uranium.

The most marked and constant functional change produced by the uranium was found to be a depression of the ratio between the rate of urea excretion and the concentration of urea in the blood. The degree of depression in this ratio was fairly closely parallel to the degree of anatomical damage, as judged from the extent and intensity of the necrosis or of the degenerative changes found in the terminal portion of the proximal convoluted tubule.