

moved just as when ablation of the whole hemisphere is made, (4) the natural history of nystagmus, (5) the development of nystagmus in young animals¹ and (6) the known cerebral localization of the motor cells, stimulation of which produces ocular movements, it is probable that the quick component of nystagmus is a reflex response, a part of whose path lies through the cerebral hemispheres. The reasons for invoking shock are not clear.

It is probable also that the quick component of labyrinthine nystagmus has no necessary connection with the labyrinth, but that it is a reflex² whose afferent impulses arise from stimulation of the afferent endings in the eye muscles.³ The cortical end stations of fibers from these afferent endings are, as we now believe, in the temporal region. The quick component of nystagmus has developed along with the greater degree of mobility of the eyes, and brings about the return of the eyes to a position such that the original line of vision is restored when they are deflected too far to one side.

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The influence of certain conditions on the rate at which epinephrin is liberated from the adrenals into the blood.

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I. By means of the rabbit intestine and uterus segment tests, we have obtained further evidence that, under our experimental conditions at any rate, the rate of discharge of epinephrin into the blood of the adrenal veins is relatively steady and not easily influenced by such procedures as we have tried; for example, stimulation of the afferent fibers in large peripheral nerves (sciatic and brachial) or asphyxia. This is not because the discharge is already maximal owing to the necessary conditions of the experi-

¹ Prince, *American Journal of Physiology*, 1917, XIII, p. 308.

² Wilson and Pike, International Congress of Medicine, London, 1913, Section XLV, p. 563.

³ Tozer and Sherrington, Proceedings Royal Society, London, B, LXXXII, 1910, p. 450.

ment (trauma, anesthesia, etc.). For, by electrical stimulation of the cut splanchnic, the rate of liberation can be made decidedly greater than the rate of spontaneous liberation with intact splanchnics.

2. Unlike the rate of liberation per unit of time, the concentration of epinephrin in the adrenal vein blood can be observed to vary decidedly in the course of an experiment, increasing, in general, as the rate of blood flow decreases. This can be shown by collecting adrenal vein blood in successive samples. When the blood flow slackens, owing to hemorrhage or other circumstances, the earlier specimens will be found to contain a smaller concentration of epinephrin than the later specimens.

For example, in a dog, weighing 10 kg., the first sample from the cava pocket, into which the adrenal veins were alone discharging, flowed at the rate of 8 c.c. per minute, the second sample 7.2 c.c., third 5.8 c.c., fourth 4.4 c.c., fifth 3.2 c.c., sixth 2.4 c.c., seventh 1.5 c.c. A definite increase in the epinephrin concentration in the successive samples was clearly shown by the intestine and especially by the uterus tests. The concentration was assayed in the first sample at somewhat more than 1 : 3,300,000; in the third sample at somewhat more than 1 : 1,670,000; in the seventh sample at somewhat less than 1 : 750,000.

The increase in the concentration in the blood is far too great to be accounted for by any increase in the relative proportion of plasma to corpuscles associated with hemorrhage without change in the concentration of epinephrin in the plasma. And it has been demonstrated that the sera separated from the successive samples of blood show a progressively increasing concentration of epinephrin.

Even when the circulation through the adrenals is stopped altogether by clamping the veins, the liberation of epinephrin into the pent-up blood continues for a time at an apparently undiminished rate and the concentration of epinephrin in the blood must go on increasing.

3. For the reason mentioned in paragraph 2 it is not in general permissible to deduce changes in the rate of liberation of epinephrin from changes in its concentration in the adrenal vein blood, unless the rate of blood flow through the adrenals is known. Changes in the concentration of epinephrin in the blood of the inferior cava above the adrenals can be produced by alterations in the rate of blood flow in the cava, even where the rate of liberation of epinephrin from the adrenals has remained constant.

4. No evidence has been obtained that after section of the nerves of one adrenal, any compensatory increase in the rate of liberation of epinephrin from the other gland occurs. The fact that section of one splanchnic diminishes the discharge of epinephrin by a half, without causing any material fall of blood pressure, affords additional evidence that the epinephrin discharged by the adrenal veins is not directly a factor, or at least not an important one in maintaining the blood pressure.

50 (1228)

The proportion in which adrenalin distributes itself between corpuscles and serum in relation to the technique of testing for epinephrin in blood.

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1. When adrenalin was added to defibrinated blood, and the blood centrifuged after an hour, the serum was found by the colorimetric method of Folin, Cannon and Denis, to contain practically the whole of the added adrenalin.

3 c.c. adrenalin solution (Parke, Davis & Co.), corresponding to 2.64 mg. epinephrin when assayed colorimetrically, was added to 30 c.c. cat's defibrinated blood. Correcting for the small amount of color given by the serum itself in the test, the amount of adrenalin found in 10 c.c. of the serum separated from the adrenalin blood corresponded to 1.37 mg. epinephrin. The proportion by volume of serum in the blood was 62 per cent. The amount of serum in 30 c.c. of the adrenalin blood would, therefore contain $1.37 \times 30 \times 62/100 = 2.55$ mg. adrenalin, *i. e.*, all the adrenalin added was in the serum.

2. The same result was obtained by assaying the adrenalin in the serum by injection into a pithed cat (method of Elliott). The serum gave a rise indicating, when compared with that given by a known amount of adrenalin in control serum, that 10 c.c. of it contained 1.32 mg. adrenalin. This compares with 1.37 mg. by the colorimetric method. The adrenalin blood gave a rise of blood pressure less than that given by the serum and corresponding to the concentration of adrenalin in it. The sediment, which of