

which show her uncertainty as to the number of small chromosomes: "Apparently 18, but number of small ones always uncertain"; "large ones all clear, small ones may be more"; "impossible to tell how many small ones."

It may be of interest that part of the notes dated September include some sketches with only 9 chromosomes, and therefore assumed that those with 18 or 20 chromosomes were spermatogonia; while sketches dated November figure the spermatocytes with 18 or 20 chromosomes. One note for November reads "looks as though these were first spermatocytes with about 18 chromosomes." Then come drawings of spermatogonia with many more than 20, such as those copied here.

It has seemed worth commenting on these notes and drawings for the scientific public, now that Painter's careful study of chromosomes in a group phylogenetically close to birds has clearly shown a similar grouping on the equatorial plate, and therefore adds significance and plausibility to Miss Stevens's observations on material evidently more difficult to handle. If she had lived, the processes of bird spermatogenesis would probably have been satisfactorily cleared up before this. But it is hoped that publishing these notes may stimulate some one to continue work on this material and try to settle the matter.

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THE PRODUCTION OF EPINEPHRIN BY THE ADRENAL CORTEX

CRAMER¹ concluded from the histological study of adrenals fixed with osmic acid that the cortex participates in the functional activity of the medulla. He found fine black granules similar to the epinephrin granules of the medulla.

We have obtained further evidence that epinephrin is produced by the cortex. The adrenal of a cat recently killed was carefully removed and then frozen with CO₂. Some of the outer portion of the cortex was sliced away with a razor. This material gave a positive test for epinephrin by the Folin, Cannon and Denis² reaction. It likewise caused inhibition of a piece of kitten's intestine contracting in Ringer's solution.

The cortex of an adrenal, the medulla of which had been completely destroyed by cautery thirty days previously, gave a positive test for epinephrin by the Folin, Cannon and Denis method. The destruction of the interior of the gland was so thorough that only a thin shell of live cortex remained. Cortex of an-

other adrenal prepared in a similar fashion gave a good inhibition of contracting intestine. By the use of the exercise test³ we have also obtained an indication of epinephrin production by the cortex. One iris had been made sensitive to epinephrin by the removal of the superior cervical ganglion on that side. One adrenal had been removed and the medulla of the other had been thoroughly destroyed by cautery. After complete recovery, exercise in the treadmill caused dilatation of the sensitive pupil.

Whenever there seemed to be a possibility of the presence of good medulla we have studied microscopically sections of the gland fixed with formaldehyde and potassium bichromate.

Finally, we have used the completely denervated pupil⁴ in order to determine whether the cortex produces epinephrin. The excitement caused by shutting off the air from the lungs for 40 seconds rarely fails to produce an increased secretion from the adrenals. Moreover, it produces perhaps the most marked effect among stimuli which are harmless. Our method has been to destroy the medulla of one adrenal by electric cautery several days before the experiment. The reaction to shutting off the air from the lungs was observed, the denervated pupil being measured by a smaller caliper square. The good adrenal was then removed. After recovery from the anesthetic the pupil response to shutting off air from the lungs was again determined. The cauterized adrenal was next removed, a final test of the denervated pupil being made after recovery from anesthesia. The cauterized adrenal was fixed and examined microscopically for the presence of medulla, the whole gland being sectioned (sections of 25 μ). Approximately every fifth and sixth sections were saved, the others being discarded.

To be more certain of medullary destruction much of the cortex was destroyed.

Experiments on fourteen cats were completed. A small portion of the medulla remained in five; medullary tissue was absent in nine; but four of these had the cortex almost completely destroyed. The five cats possessing healthy cortex and no medulla in the cauterized adrenal gave good denervated pupil reactions to shutting off the air after removal of the uncauterized adrenal. After removal of the cauterized adrenal the denervated pupil gave a much smaller reaction or no response at all to a similar test.

All of our evidence indicates that the adrenal cortex produces epinephrin.

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³ Hartman, Waite and Powell, *Am. J. Physiol.*, 1922, LXII, 225.

⁴ Hartman, McCordock and Loder, *Am. J. Physiol.*, 1923, LXIV, 1.

¹ Cramer, W., *J. Physiol.*, 1918, LII, viii-x, xiii-xv.

² Folin, O., Cannon, W. B. and Denis, W., *J. Biol. Chem.*, 1913, XIII, 477.