tero-vesical valve) and complete excision of it leads to hydro-ureter and hydronephrosis. With an infected urine pyoureter and pyonephrosis are possible.

[1] Sampson, *Johns Hopkins Hospital Bull.*, 1903, xiv, 334.

[2] Delbet, Poirier and Charpy, *Traité D'Anatomie Humain*, 1907, v. i, 108.

[3] Satani, *J. Urol.*, 1919, iii, 247; *Am. J. Physiol.*, 1919, xlix, 474; *Ibid.*, 1919, 1920, l, 342.

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Anatomy of Fear.

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In the study of pigeons after the ablation of various amounts of brain tissue, it appeared that when a sufficiently large amount of brain was removed, there was a corresponding amount of fear removed; the larger the portion of brain removed, the greater the portion of fear removed. This fact, that fear can be removed in stages by removing increasing portions of brain, seems to indicate that there is no definitely localized center for fear. It seems that the fear network spreads throughout the brain, and even after the removal of all of the cerebral hemispheres, there still remains in the residual brain, a functional portion of the fear network.

I give some findings from 4 pigeons of a series now under study. In all pigeons there appeared to be a gradual recovery of ability to show fear signs.

Of the 4, No. 1, had most brain left, and while showing, in nearly 12 months study, very much less fear than the normal pigeon, it showed considerably more than any of the other 3. On the 40th day, after being fed artificially, he flew from my knee onto the table, showing marked semblance of fear. On the 58th day, after being put down from the platform balance, he showed evidence of fear and flew 15 cm. up onto the other platform, as if trying to escape. On the 168th day to avoid being taken up, he ran and flew with such vigor and persistence that it required quite a chase to catch him. On the 251st day, when we tried to take him up, he ran under the table and out on the other side, flew up into the air, circled around, passed over the revolving book case and down on the other side (height of flight 2±M.; length 4±M.). Flying increased as time went on.

Nos. 3 and 4 had less brain left than No. 1, but owing to the influence of the nutritive condition, which cannot be easily evaluated, it is difficult to decide from the evidence, whether No. 3 or No. 4 was capable of showing the more marked fear signs. The evidence collected thus far leaves in my mind the impression that No. 3 was the more capable. I cite, here, 2 sets of facts: On the 11th day No. 3, when grasped gently, struggled considerably to get out of my hands; while, in the case of No. 4, this did not happen until the 24th day, in spite of the fact that the test had been made every day after the operation. (No. 1 escaped from my grasp on the 9th day.) Simple pursuit caused No. 3 to run away with the semblance of fear and the utterance of fear sounds, on the 41st day; while repeated trials failed to produce this reaction in No. 4 in 77 days.

No. 2 had the least amount of functional brain left and showed the least evidence of capacity for fear signs. She showed some slight fear reactions, for example: The sound of snapping the fingers caused opening of eyes and slight turning of the head toward the sound; the rapid approach of the hands on the 6th day caused only a slight dodge, and the same on the 141st day. On the 130th day she jumped off the balance platform onto a nearby box with some semblance of fear. On the 139th and 141st days the presence of a cat had no effect, even when the cat moved and struck at her. On the 141st day there were escape movements of legs and wings when she was in my grasp. On the 142nd day, the sudden appearance of the cat, once caused a sudden slight start back with no semblance of fear. Other trials caused only a slight halt in her walk, or nothing at all. On the 145th day, she looked at the slowly approaching hand; once she arched her neck; once she took 1 or 2 steps back, with an expression that might have been taken for very slight semblance of fear, or could easily have been taken for curiosity. In nearly 5 months she showed only the barest semblance of fear, and those, on very few occasions. All attempts to scare her failed to produce any flying, any fear sound, any running or any marked semblance of fear, unless the jumping from the platform of the balance or the escape movements in the grasp may be so regarded.

The Residual Brain of No. 1 was lost after it had been measured, photographed, and sent to the technician for microscopic preparation. Gross inspection, measurement, and examination of the photographs gave the following impressions: Irregular basal portions of the cerebral hemispheres remained. All the parts below the cerebral hemispheres were intact. The residue of the cerebral hemispheres showed the olfactory lobes and bulbs intact; a marginal roll on the

left side extending from the olfactory lobes to the vermis and varying in thickness from 1.5 mm. in front to 0.5 mm. in the occipital region. On the right side there was less tissue left. There remained a rounded mass near the center, more on the left of the base than on the right, about 4 mm. long and 2 mm. broad, with its transverse axis about over the centers of the optic lobes.

The residual brain of No. 3 has already been described.[1]

No. 4 is still living. Judging from the appearances and technique at the operation and succeeding symptoms, it is thought safe to assume that all cerebral tissue and a small portion of brain stem tissue in the right dorsal region, were removed.

The residual brain of No. 2 showed a retention of approximately the same median cerebral tissue at No. 3 but a loss of the lateral cerebral nucleus and of central and dorsal portions of the anterior region of the brain stem retained by No. 3.

[1] Shaklee, A. O., PROC. SOC. EXP. BIOL. AND MED., 1927, XXV, 186.