pressure. A small-sized rubber bag is then attached to the horizontal portion of the tracheal cannula. The bag is thoroughly exhausted. The cocks of the pleural cannulæ are now opened. *At the end of an expiration*, the upright portion of the tracheal cannula is quickly clamped, the air pressure is turned on and the bag opened. A mercury valve is provided so that the desired pressure cannot be exceeded. The lungs collapse. Their contents are forced into the trachea and rubber bag. A portion of the air remains in the bronchi and trachea. The sample therefore approximates the *total air*.

It has been found that when no precaution is observed to maintain the body temperature, very uniform percentages of carbon dioxid may be obtained. Five experiments have been made thus far. In each experiment the carbon dioxid exhibited uniformity, either immediately or after a preliminary period of fluctuation. The periods of constancy ranged from one and a half to three and a half hours. In three experiments in each of which 8 determinations were made, the maximum deviation from the average was ± 3.0–3.5 per cent.; in one experiment, in which 7 determinations were made, the maximum deviation from the average was ± 2.4 per cent.; in another experiment, in which 5 determinations were made, the maximum minus deviation was 0.5 per cent. and the maximum plus deviation 1.4 per cent.

80 (1258)

On the compensation of the ocular and equilibrium disturbances which follow unilateral removal of the otic labyrinth.

By **A. L. PRINCE** (by invitation).

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It has been shown[1] that the disturbances of function which follow unilateral destruction of the otic labyrinth are of short duration in higher mammals, the torsion of the head being the only persistent symptom. In very young animals, the conditions

[1] Wilson and Pike, *Phil. Trans. Royal Society*, London, 1912, Series B, CCIII, p. 127.

may be somewhat different.[1] The symptoms in lower forms persist for a longer time. The question arises as to the mechanism of the compensation for the injury in higher mammals.

The experiments reported in this paper show that the mechanism for compensation involves the cerebral hemispheres.

The experiments were conducted with young cats except in one case in which a fully grown animal was used. The otic labyrinth was removed under asepsis according to the method described by Wilson and Pike.[2] At various periods following the labyrinthine operation, at a time when all ocular and equilibrium disturbances had disappeared, the animals were decerebrated by section of the brain stem just anterior to the corpora quadrigemina.

In view of their uniformity a general description of the results will suffice.

I. *The effect of complete decerebration on the position of the eyes in animals which have fully recovered from the ocular symptoms resulting from unilateral removal of the labyrinth.*

In all experiments the ocular movements were absolutely normal at the end of three days following removal of the labyrinth. At the end of 3, 11, 12, 16, and 24 days after the labyrinthine operation the animals were decerebrated. This operation was followed by an intense deviation of the eyes to the side of the labyrinthine lesion. The degree of deviation of the eye on the side of the intact labyrinth was somewhat less marked. The deviation of the eyes, as far as could be determined from the nature of the experiments, is permanent. That pure deviation and not nystagmus recurs on decerebration is readily explained by the observations of Wilson and Pike.[2] These author found that the quick return phase is dependent on the integrity of nervous paths in the region of the cerebrum.

II. *The recurrence of disturbances of equilibrium following complete decerebration in animals which have fully recovered from the symptoms resulting from unilateral removal of the labyrinth.*

The animals were untied and observed for several hours after

[1] Prince, *American Journal of Physiology*, 1917, XLII, p. 308.

[2] Wilson and Pike, XVIIth International Congress of Medicine, London, 1913, Section XVI, Otology, p. 563; *Arch. Int. Med.*, 1915, XV, 31; PROC. SOC. EXP. BIOL. AND MED., 1917, XIV, p. 75.

decerebration. Before decerebration the animals presented no disturbances of equilibrium. For several hours after this operation the animals presented all the bodily reactions which appear on the first day following unilateral removal of the labyrinth. The protocols of one of these experiments follow:

Kitten, weight 1450 g.

Feb. 15, 1917. Right otic labyrinth removed under asepsis. Operation followed by nystagmus and typical disturbances of equilibrium, violent in character.

March 3 (16 days following labyrinthine operation).

2.40 P. M. Decerebration under ether. Section just anterior to corpora quadrigemina.

2.55 to 6.30 P. M. Marked and permanent deviation of eyes to right (side of labyrinthine lesion). Animal tied to turntable with the head fixed in the vertex upward position. When the direction of rotation is toward the side of the labyrinthine lesion, the deviation of the eyes is intensified on cessation of rotation. The eyes then return slowly to the initial position of deviation. When the direction of rotation is toward the intact labyrinth, deviation entirely disappears on cessation of rotation; the eyes then return slowly to the initial position of deviation. Animal removed from rotation board. When removed from the board, the animal lay on its right side with fore limbs extended. The neck was bent to the side of the labyrinthine lesion. Marked increase in torsion of the head, occiput pointing to the right. When disturbed by pinching the tail, the animal made violent attempts to turn on its dorso-ventral axis toward the side of the labyrinthine lesion. The forelimbs participated actively in the attempts to turn to the right. When the animal was placed on its back or on its left side, it immediately rolled to the right and came to rest in the position described.

6.30 P. M. Observations made at frequent intervals since last note without noticeable changes in the reactions.

CONCLUSIONS.

The disappearance of the ocular and the equilibrium disturbances following unilateral removal of the labyrinth is attributed to the activity of a compensatory mechanism.

As the labyrinthine symptoms recur after complete decerebration, the nervous paths concerned in the process of compensation may be roughly localized in the cerebrum above the level of the corpora quadrigemina.

81 (1259)

Diuretic effects of the caffeine group.

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The knowledge concerning the diuretic action of caffeine and theobromin has been obtained almost entirely through work on rabbits. It is from this work that the many explanations of how these drugs act in producing diuresis have arisen. The dog was early recognized as being somewhat refractory or uncertain in his response, and consequently but little work has been done on this animal. It has seemed to us however that the dog's urinary function is much more comparable to that of man than is the rabbits, and we have accordingly carried out a series of diuretic experiments using dogs as the experimental animals.

The dogs used were placed on a fixed diet, with a fixed daily intake of water. We have collected and analyzed the urine in twenty-four periods in order to avoid the frequent and unexplained variations which occur in shorter periods. Drugs were withheld until a comparatively constant daily output of urine both in quantity and composition was obtained. Caffeine, theobromin or theobromin sodio-salicylate was then given in dosage varying from 0.05 to 0.2 g. three times a day, for periods of from one to five or more days. They were given with the food and in capsules.

The results may be summarized as follows: With none of these drugs, in the dosage employed have we seen any appreciable increase in the urine output. On the contrary there has been almost invariably a decrease. When the drug is given for one day only, the decrease may occur on that day or the one following. When given for several days the decrease usually continues during the entire period, although in some instances the urine output