CONCLUSIONS.

The torsion of the head after unilateral removal of the labyrinth is due to the preponderating activity of the muscles of the intact side. The afferent impulses concerned come largely from the labyrinth, the muscles, the tendons of the neck, and the articulations of the cervical vertebræ.

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Is uterine activity subject to cerebral control?

By **H. G. BARBOUR** and **N. H. COPENHAVER.** (By invitation.)

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Although morphin is known to delay the progress of labor we have hitherto been unable to detect any inhibitory influence of this drug upon the tone or activity of the uterus in animals. It causes rather an increase in tone in the isolated uterus of cat and guinea pig,[1] and often in the intact uterus of the decerebrate cat or anesthetized rabbit.[2] The only inhibition of the uterus by morphin which we have observed previous to the present work has been accounted for by circulatory collapse.

Conditions of anesthesia or decerebration under which the morphin was given in our previous work have, by exclusion, led us to the belief that morphin, in clinical doses, inhibits uterine activity by a purely cerebral action. Desiring more direct evidence on this point we were led to inquire into the nature of cerebral control of the uterus, if any exists.

To this end we have begun by the employment of a method subjecting a part of the cortex and basal ganglia to the influence of cold and heat. This is done by means of a double metal tube fixed in the skull of a rabbit, on one side, anterior to the coronal suture and passing through the anterior portion of the corpus striatum to the base of the skull. The lateral ventricle is usually entered. This procedure, which was first employed by one of us

[1] Barbour, H. G., and Copenhaver, N. H., *Journ. Pharm. and Exp. Ther.*, 1915, VII, 529.

[2] Barbour, H. G., *Journ. Pharm. and Exp. Ther.*, 1915, VII, 547.

in the study of cerebral control of body temperature,[1] is performed aseptically under light ether anesthesia. As soon as the animal is free from the narcotic certain cerebral functions may be influenced by the passage through the tube of hot or cold water.

The advantages of such a method are (1) the confinement of the effective agent entirely to the cerebrum (or a portion of it), (2) the absence of an anesthetic, and (3) the ease with which the functional activity of the brain can be quickly altered in either of two opposite directions.

The uterine activity was recorded by air conduction from a finger cot inflated within the rabbit's uterus. Most of the animals used were in early pregnancy. The results obtained by this method show that under a few minutes of cerebral cooling (10° C.) the cavity of the uterus becomes much diminished in volume and there is a tendency to an increase in the amplitude and frequency of the individual contractions; on the other hand a change to heating (45° C.) soon causes a reversion to original conditions. Although voluntary limb movements are sometimes a disturbing factor we have been able to exclude these entirely as the cause of the changes described.

There is however no doubt that the changes in volume of the uterine cavity are largely dependent upon changes in tone of the abdominal musculature. One can readily follow with the hand the contraction and relaxation of the recti, for example, which are associated respectively with cooling and heating of the cerebrum. Furthermore the uterine changes were not observed in two curarized animals, nor were they obtainable in an animal with cord completely transected between the sixth and seventh dorsal vertebræ. However, under both of the latter conditions the normal activity of the uterus was very feeble.

The method of excluding the voluntary abdominal muscles by suspending the intact uterus, surrounded by warm oil, in a cylinder has failed to give very positive evidence of a direct cerebral control of the uterus. This method has always been pursued under light anesthesia however. In one of six animals there was under cerebral cooling a marked increase in tone which was not diminished by cessation of the cooling process. In another the

[1] Barbour, H. G., *Arch. exp. Path. u. Pharm.*, 1912, 70, 1.

amplitude of the individual contractions increased markedly under cooling and diminished under heating. The other four experiments were negative.

Thus far then we have established a definite cerebral influence over the volume of the uterine cavity. The fact that this appears to be largely if not entirely a control of the voluntary musculature of the abdomen does not detract from its importance in connection with the birth process.

Returning to the morphin question, we have now given small subcutaneous doses of this substance in two animals which had responded well to cerebral cooling and heating in the manner above described. Here the morphin, given to unanesthetized animals, resulted in a depression of the uterine activity, although the dose was so small in one case (.01 gram per kilo) that the animal remained sitting upright and occasional normal limb movements continued to occur. Cerebral cooling now had no effect upon the volume of the uterine cavity of these morphinized animals, showing clearly how morphin can influence labor by a central action.

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Endomixis in diverse races of Paramaecium aurelia.

By LORANDE LOSS WOODRUFF.

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Woodruff and Erdmann in 1914[1] described a normal periodic reorganization process without cell fusion, which they termed endomixis, in *Paramaecium aurelia*. This study was based chiefly on pedigreed cells from Woodruff's 5,000-generation race of *Paramaecium aurelia*, though specimens of a race of this organism isolated by Erdmann in Germany showed the same phenomenon.

The present communication is to prove the general occurrence of endomixis in races of *Paramaecium aurelia*, since this has been questioned, on a priori grounds, by certain authors.

The following races of *Paramaecium aurelia*, in addition to those mentioned above, have now been studied:

Oberlin Race. Isolated at Oberlin, Ohio. Carried in pedi-

[1] *Loc. cit.*