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The food factor in hibernation. (Preliminary communication.)

By **SUTHERLAND SIMPSON.**

[*From the Physiological Laboratory, Medical College, Cornell University, Ithaca, N. Y.*]

In those animals that hibernate the condition is generally believed to be brought about mainly by a low external temperature; when the winter cold sets in the animal retires to its burrow or nest and remains dormant until spring. Some, on the other hand, hold that a diminished food supply is the chief, or at any rate, an important cause of hibernation, and my experience with a colony of woodchucks (*Marmotta monax*) during the past winter would appear to support the latter view.

About the middle of September, 1911, eighteen woodchucks, which had been caught in box traps in the neighborhood of Ithaca, and were uninjured, were placed in eight artificial burrows about five feet below the surface of the ground, the object being to study, amongst other things, changes in the nervous system during hibernation. The burrows, which were packed with dry straw, opened into a central court into which food (clover, corn, apples, carrots, etc.) was placed every second day, and it was expected that when the animals began to hibernate the food would cease to be consumed.

In this locality I was told that woodchucks are rarely seen in the open fields later than the first or second week of October, and as the food still continued to disappear after that time, the burrows were opened up and the animals caught and examined to find out their condition, on the following dates.—Oct. 13, Nov. 11 and 27, Dec. 18 and 26. They were found to be quite active on all these occasions, with rectal temperatures somewhere in the neighborhood of 100° F.

The weather up till the end of December had been unusually mild for this climate, and this might possibly have had some influence in maintaining the wakeful condition, but from the beginning of January till the end of March the winter was excessively cold, the air temperature being often below zero fahrenheit,

and on two occasions 16° below. Notwithstanding this low temperature the food was still eaten by the woodchucks.

No food was supplied from Jan. 20 till Feb. 14 when the animals were again examined in the burrows. On that day their tracks in the snow were abundant. Six were found to be in a semitorpid condition, but they did not show the deep narcosis of true hibernation; the others were very active and combative, one having a rectal temperature of 99° F. Although no food had been placed in the inclosure for three weeks, it is still possible that they had some stored in their burrows, or that they ate the straw.

The six which showed some degree of torpor were removed to the laboratory, kept overnight outside the building in a large box amongst straw, and the next day, under ether anesthesia, a small lesion was made in the spinal cord of each. On the day following they were completely awake and active, and remained so until killed at various intervals after the operation. Food was supplied to these as well as to those left behind in the burrows from Feb. 14 onwards; they were inspected at short intervals from that date till the end of March and never showed any tendency to hibernate. The rectal temperature ranged from about 95° F. to 101° F.

These animals were not artificially protected from the weather in any way; the only circumstance in which their condition differed from that of their fellows in the open fields was that food was furnished them. The behavior of this colony would seem to point to the fact, therefore, that the absence of food supply is an important factor in determining the onset of hibernation.

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A rapid method of producing a hemolytic serum.

By **FREDERICK P. GAY** and **J. G. FITZGERALD.**

[*From the Department of Pathology and Bacteriology, University of California.*]

Fornet and Müller[1] were first to suggest the intensive method of immunizing animals by giving large doses of serum for pro-

[1] Fornet and Müller, *Zeitschrift für biologische Technik und Methodik*, Strassburg, 1908, vol. 1, p. 201.