

THE ANNUAL RHYTHM OF FAT DEPOSITION IN WOODCHUCKS (*MARMOTA MONAX*)¹

DAVID E. DAVIS

Department of Zoölogy, North Carolina State University, Raleigh, North Carolina 27607

FOR many years it has been known that in the summer and fall various hibernating mammals store internally large quantities of fat which they slowly use during hibernation. The present report is part of a study originally designed to determine whether external factors, such as photoperiod or low temperature, control the deposition of fat in woodchucks (*Marmota monax*), a classic hibernator. In the course of these experiments, an annual rhythm of deposition has been recognized that continues even under constant environmental circumstances.

Detailed studies of woodchucks (Snyder, Davis, and Christian, 1961) have described the seasonal changes in weight according to age and sex. The percentage gain during the summer in young animals is, of course, larger than that in older animals. The gain for males and females is comparable although females are smaller, in general, than males. Other studies (Bailey, 1965; Bailey and Davis, 1965) show that a distinct seasonal change in metabolic activity occurs from a high level in April and May to a low level in the winter in a ratio of about three to one. Torpid animals have an even lower metabolic rate. Social interactions, if sufficiently severe, may also affect the weight gain. Analysis of the fatty acids (Davis and McCarthy, 1965) revealed no seasonal change in kinds. It

has been assumed that some external factor, such as photoperiod, low temperature, food supply, etc., was directly responsible for the seasonal change in weight.

A comprehensive study (Pengelley and Fisher, 1963) of a closely related species, the thirteen-lined ground squirrel, *Citellus tridecemlineatus*, reported an annual rhythm of food consumption, change in weight, and hibernation and/or estivation lasting for 2 years. However, the data do not demonstrate that the rhythm of gain in weight is independent of external (concurrent) factors because most of the ground squirrels hibernated or estivated, thus allowing the interpretation that the loss (and subsequent gain) in weight resulted from a period of torpor. A few squirrels kept at high temperatures did not hibernate during the first year, but they could well have received a signal from changes in photoperiod before they were brought into captivity in August. (In their second year they were placed in cold, and hibernated.) Because alternative explanations involving concurrent external factors remained, experiments were designed to keep woodchucks under constant conditions (insofar as known).

The woodchucks were captured in the wild at the Letterkenny Army Ordnance Depot near Chambersburg, Pennsylvania, and kept in single cages in various rooms. Two coolers were available: one at the ordnance depot was used for short-day experiments; the other at Pennsylvania State University was used for long-

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