

THE OXYGEN AND CARBON DIOXIDE CONTENT OF
THE BLOOD DURING HIBERNATION IN THE
WOODCHUCK (*MARMOTA MONAX*)

ANDREW T. RASMUSSEN

*From the Physiological Laboratory, Medical College, Cornell University,
Ithaca, New York*

Received for publication September 14, 1915

INTRODUCTION

Of the several theories attempting an explanation of the cause of hibernation in mammals, a most interesting one, especially in the light of renewed work on the rôle of CO_2 in the dormancy of plants (1), is the theory that so-called winter-sleep is due to the accumulation of CO_2 in the blood and tissues of the animal. This excess of CO_2 is supposed to cause a form of narcosis as seen in the torpid condition of the hibernating animal. When the CO_2 reaches a certain concentration, the respiratory center is excited, respiration accelerated and the muscles become hyper-irritable. These culminating results are responsible for the awakening from dormancy.

A suggestion of this theory is found in the work of Bert (2), who in 1873 concluded that the dormancy may be due to the accumulation of CO_2 rather than a diminished supply of oxygen, as he had earlier believed. It was, however, apparently worked out independently as the carbonic auto-narcosis theory by Dubois (3) (1895). It appears that the attention of Dubois was called to the researches of Bert by Gley (4) some time after Dubois had published his carbonic auto-narcosis theory of natural sleep.

Dubois claims (5) that he can induce typical hibernating sleep by causing the active marmot to breathe a mixture of air (43 per cent), CO_2 (45 per cent) and oxygen (12 per cent). Further, he shows that torpid marmots remain dormant if supplied with this mixture; but by increasing the amount of CO_2 such animals may double their rate of respiration in ten minutes and may be awakened apparently as they naturally awake from lethargy. The author maintains (6) that the CO_2 acts principally on a nervous center for sleep and awakening situ-