

## Cardiac Physiology of Polar Bears in Winter Dens\*

The physiology of polar bears is of particular interest because of their unusual adaptations, uncertain status as a species, and because of questions concerning their relationship to grizzly bears and black bears. By the use of implanted radio-capsules, we have determined that a conspicuous bradycardia exists in the grizzly bear and black bear when in a condition of dormancy in the winter den. In a series of black and grizzly bears studied under arctic and subarctic conditions, summer sleeping heart rates were seldom below 40 b/m, and all specimens demonstrated a gradually-acquired bradycardia during the winter until a rate as low as 8 b/m was reached.

We looked for the same phenomenon in two polar bears maintained together under winter den conditions during the winters of 1967-68 and 1968-69. This study was technically difficult to make because of the value of the specimens and lack of information on how to predict the behaviour of the animals. They were deprived of food and water, the standardized procedure for inducing dormancy in these experiments with bears. During the first summer, sleeping heart rates of one specimen seldom reached 50 b/m. During the winter, bradycardia was gradually acquired by this specimen until a rate of 35 b/m was achieved. At this point the experiment was terminated because of uncertainty as to whether one animal might attack the other. During the second summer, the other polar bear (weight 260 kg., 570 lbs.) was instrumented. This specimen showed no sleeping heart rates below 60 b/m during the months of July, August, and September. From October to the end of January the animals were observed by closed circuit television and were provided with minimal food. Their behaviour indicated the possibility of dormancy, and during the month of February rigid conditions to simulate denning in the outdoor environment were followed (complete darkness, isolation from camp noise, abundant hay in which to prepare winter dens, and removal of food). The temperature of the enclosure varied from  $-20^{\circ}\text{C}$ . to  $-50^{\circ}\text{C}$ . The instrumented animal once again initially demonstrated sleeping heart rates of 60 b/m which changed slowly week by week until rates of 27 b/m were obtained. The steady downward trend undoubtedly would have continued since both animals remained

in the position of dormancy (head under belly near tail). However, on 1 March, one month after the experiment began, the radio-capsule in the abdominal cavity of the animal failed. The results from these 2 winters is strong evidence that the polar bear has the capability of reducing its circulatory activity in dormancy in the same fashion as the grizzly and black bear. In all 3 species excellent EKG recordings by radio were made in winter and summer. The S-T interval of this measurement indicated that bears have an intermediate relationship between hibernator-mammals and non-hibernators.

G. E. Folk, Jr.  
M. D. Brewer  
D. Sanders

## Early Holocene Warm Interval in Northern Alaska

New evidence for an early Holocene warm interval has been obtained from northern Alaska. This evidence is a radiocarbon date

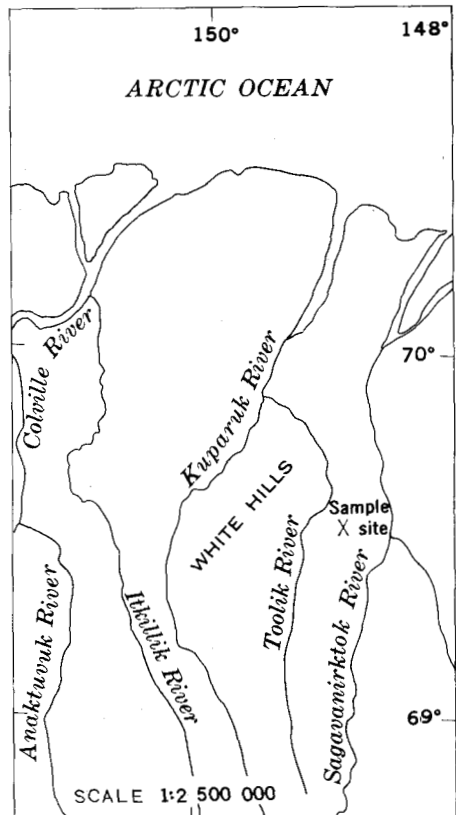


FIG. 1. White Hills section of the Arctic Coastal Plain.

\*Research supported by the Arctic Institute of North America under contract with U.S. Office of Naval Research.