BREATHING RHYTHM OF *FUNDULUS HETEROCLITUS* AS RELATED TO TEMPERATURE

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The rate of opercular breathing movements was studied at various temperatures between 0 and 29°C. This work was carried on simultaneously with the investigation of chemical stimulation as related to temperature. The experimental set-up was the same for the two experiments. At least one hour adaptation in the reaction chamber was allowed the fish before the time for ten opercular movements was measured. The data from three fish were averaged for the salt water tests, and for fresh water the data from six fish averaged. The data were analyzed in accordance with the Arrhenius equation (see previous abstract). When log opercular rate was plotted against the reciprocal of the absolute temperature for the salt water tests a linear band of points was obtained. The value of µ obtained from the slope of the parallel lines bounding the band of plotted points was found to be 8,400. A similar analysis of the fresh water data revealed a temperature characteristic of 16,400 below 9.5°C., and 11,300 above this temperature. The breathing rhythm of Fundulus in either environment reaches a limiting value above about 24°C.

The temperature characteristics for *Fundulus* breathing rhythm in salt and fresh water are typical of those which have been reported by other workers for respiratory and oxidative biological phenomena. The fact that the μ value for opercular rate changes with the environment of the fish indicates that different chemical reactions with different velocity constants are controlling the rate of breathing in the two environments. Assuming the same catenary series of reactions to control opercular rate in the two cases, then the slowest member of the series would be the master reaction controlling that rate. The different μ values obtained indicate that the controlling reaction for breathing rhythm of *Fundulus* is different in salt water from fresh water; and in fresh water the controlling reaction is different below 9.5°C., from that above this temperature.

BEHAVIOR OF THE BARNACLE, BALANUS BALANOIDES, AS CORRELATED WITH THE PLANKTONIC CONTENT OF THE SEA WATER

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In observing the barnacle, *Balanus balanoides*, during the past five years it has been found that on certain days during the summer a large percentage of animals show irregular cirral movements or remain mostly closed, even when sea water freshly pumped from the bay flows over them. Such behavior makes it impossible to use the animals for testing chemical stimulation by substances added to sea water. Previous experiments have indicated that at such times there must be already present in the sea water some naturally occurring substances which stimulate the animals to become irregular or to close. It was suspected that one cause might be volatile oils set free by decomposing dinoflagellates in the sea water. These animals at Mt. Desert Island usually occur in small numbers but occasionally during the summer their population suddenly increases enormously. During the summer of 1934 on 34 successive days of July and August the population of diatoms, dinoflagellates and a few other of the larger microscopic plants and animals were determined and correlated with the number of regularly active animals in two sets of barnacles totaling 189 individuals.

Using percent closure as a criterion of behavior, it was found that no correlation exists between behavior and the number of diatoms, or algae, or total suspended materials in sea water. A definite correlation, however, was indicated between percent closure and the number of dinoflagellates per liter of sea water. Whenever the population of these animals became unusually large a corresponding large percentage of closed barnacles was found. This result is interpreted to mean that some product of metabolism or of decomposition of dinoflagellates causes closure of the barnacle if present in sufficient quantity. Further experiments are planned to identify the responsible substances.

STIMULATION OF THE BARNACLE, *BALANUS BALANOIDES*, BY NaCl, Na,SO, NaNO₃, GLUCOSE, GLYCEROL AND UREA*

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Further studies on the responses of the barnacle, *Balanus bala-noides*, to chemical stimulation were made by testing the stimulating efficiencies of the three inorganic salts, NaCl, Na₂SO₄, NaNO₃, and of the three non-electrolytes, urea, glycerol and glucose. (Preliminary studies on the salts were done in 1932 and reported in the Bull. Mt. Desert Is. Biol. Lab., for 1933, p. 29).

The experimental procedure was identical to that described in previous reports, using a temperature of $17 \pm 0.2^{\circ}$ C., a rate of flow of 250 ± 25 cc. per minute, and a recovery period of 30 minutes between tests. Each of two populations of 75 and 114 animals respectively was tested by different observers for each solution. The average volume of the 2 containers was 625 cc. The number of animals showing normal and regular cirral movements was recorded at the beginning of each test and at each successive minute up to and including 10 minutes. From such figures the percentage of regularly active animals was calculated for each interval on the basis of those regularly active at the beginning. Since in 169 of the total of 174