However, readjusting these comparative figures on the basis of their molecular weights, namely, 132 for paraldehyde, 248 for the barbiturate, and 165 for chloral hydrate, the real comparative toxicity of paraldehyde to the barbiturate would be about 1/100 to one, and of paraldehyde to chloral hydrate, about 1/4 to one.

In order to ascertain whether the high toxicity of sodium isoamyl ethyl barbiturate was a specific effect or one due to its high alkalinity, comparative experiments were made to determine the effect of alkali by the use of (1) sodium bicarbonate (up to 200 mgm.), and (2) sodium barbital (up to 20 mgm.), a relative non-toxic barbiturate of about equal alkalinity.

In both instances the rhythm, rate and amplitude were but little decreased after one hour, thus showing that the effect of the sodium isoamyl ethyl barbiturate was a specific one on the sinoauricular-ventricular preparation.

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## THE RATE OF HEART BEAT IN CLAMS

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Mollusks are known to have two heart-beat rates: one for the expanded state and one for the contracted state. Baker in 1897 studied this condition for several mollusks, noting the characteristic number of beats for each species in the expanded and contracted states. His figures for these rates are:

| | | | | | | |
|---|---|---|---|---|---|---|
| *Selenites concavus* | contracted | 50 | per min.; | extended | 82 | per min. |
| *Vitrea arborea* | " | 100 | " " ; | " | 160 | " " |
| *Vitrea electrina* | " | 95 | " " ; | " | 130 | " " |
| *Pyramidula alternata* | " | 50 | " " ; | " | 82 | " " |
| *Polygyra thyroides* | " | 70 | " " ; | " | 82 | " " |

Baker also found that during hibernation there was no heart beat.

In unpublished studies the author has recorded heart rates in oyster spat, transparent *Anomia,* and adult oysters. When oyster spat and *Anomia* close their valves there is sudden cessation of heart beat and no subsequent beat as long as the valves remain closed; nor is there any ciliary action.

In adult oysters the heart may be exposed by sawing a window in the upper valve over the heart region and cutting the edge of the mantle over the pericardium. Oysters treated in this manner and kept in running water live and feed, apparently very nearly normally, for many weeks. At all times when the valves are closed there

is no heart beat. When the valves are open the heart rate averages somewhat over 20 beats per minute at 20° C.

When the entire upper valve of the oyster is removed the same stoppage of heart beat occurs at intervals. Oysters with the upper valves carefully removed will live for several weeks in running water, feeding and building extensive plates of new shell along the edges of the mantle. During feeding, when the mantle is expanded and the gills and cilia are active, the heart beats at the same rate as in oysters with windows in the upper valve. For periods of several hours a day each oyster is inactive; the mantle is contracted, the gills are contracted, carmine suspension placed upon the gills is not moved, no feces are extruded, and the organism appears to be in a state comparable to a closed valve condition. There is no heart beat during these periods.

Studies were continued at the Mount Desert Island Biological Laboratory in July 1936 with observations on the soft shelled clam, *Mya arenaria*. The right valve was removed with as little injury to tissues as could be effected. The mantle over the pericardium was cut so as to expose the heart in its uninjured chamber. The organisms were kept in running water overnight before observations were begun. (Shock keeps them contracted and inactive for a long time after removal of the valve.)

The same heart conditions occur in the clam as in the half-shell oyster. When the siphons are extended with expanded tentacles and the incurrent and excurrent water exchange is taking place, the heart beats. When, during frequent periods in each day, the siphons are retracted, the tentacles inactive, and there is no perceptible water current, there is no heart beat.

The heart rate in the feeding clam with the valve removed is from 14-20 beats per minute at 13-14° C.

These observations may prove to be of considerable importance in a more extensive study of conditions in closed bivalves.

REFERENCE

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## THE EFFECT OF TEMPERATURE ON THE ADAPTATION OF *FUNDULUS* TO BLACK AND TO WHITE BACKGROUNDS

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The rapid darkening of *Fundulus* when transferred from a light background to a dark one, and blanching when the reverse transfer is made, are well known reactions. It has been proved by many workers that the epidermal melanophores are chiefly concerned in the color change, that they are innervated through the central nerv-