leaflets of the sterile leaf by the persistent formation of sectors on *both* edges of the very numerous marginal cells. This is evident from a comparison of figures 5 and 6.

## A COMPARISON OF PARALDEHYDE, CHLORAL HYDRATE AND SODIUM ISOAMYL ETHYL BARBITURATE ON THE HEART OF THE SPINY DOGFISH

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Previous studies made in this laboratory showed that the isolated sinoauricular-ventricular preparation from the spiny dogfish (*Squalus acanthias*), when suspended in a balanced saline solution, was well adapted for ascertaining the comparative effects of chemical agents (Roth 1932, 1933, 1935).

The present report deals with a study made during the summer of 1936 through use of the above-mentioned dogfish preparation, in which a comparison was made graphically of the relative toxic effects of paraldehyde,\* chloral hydrate and sodium isoamyl ethyl barbiturate.\* The details of the method are essentially similar to those previously reported (Roth 1932) except that the temperature of the saline solution was maintained 16 degrees Centigrade.

The saline solution contained 1.5 per cent of sodium chloride; 0.04 per cent of potassium chloride; 0.03 per cent of calcium chloride (anhydrous); 0.051 per cent of magnesium chloride (anhydrous); 2 per cent urea; 0.1 per cent of sodium bicarbonate and sufficient sodium acid phosphate to bring the pH to 7.55.

Comparison of the hypnotic agents was made either by using (1) the drugs alternately on the same preparation, or (2) each drug on a fresh preparation.

It was found that by the first method the order of depression was as follows: most depressant, sodium isoamyl ethyl barbiturate; least depressant, paraldehyde. Chloral hydrate was intermediate in its depressant activity, approaching paraldehyde in toxicity rather than that of the barbiturate.

The latter method attempted to determine quantitatively the relative depressant activity of the three compounds, using as a criterion the amount of drug that would stop rhythm in 30 to 50 per cent of the preparations within one hour.

By this means it was found that for the barbiturate, 10 mgm. was required; for chloral hydrate, 100-165 mgm.; and for paraldehyde, 530 mgm. On the basis of the actual amounts of each agent used, paraldehyde would, therefore, be about one-fiftieth as toxic as the barbiturate and about one-fourth as toxic as chloral hydrate.

\* Paraldehyde was generously furnished by the Niacet Chemicals Corp.; the barbiturate by Eli Lilly & Co.

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 sinoauricularventricular preparation.

Roth, George B., 1932, Bull. Mt. Desert Is. Biol. Lab., p. 22. Roth, George B., 1933, Proc. Soc. Expt. Biol. & Med., 30, 563. Roth, George B., 1935, Arch. Internat. de Pharmacodyn. et de Therap., 49, 355.

### 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