14. ROTIFERA

By FRANK J. MYERS, *American Museum of Natural History*

1. *Correlation between hydrogen-ions and geographical distribution.*

It has been definitely established many species occur in acid (soft) water that are never found in alkaline (hard) water. Conversely, many species occur in alkaline water that are never found in acid water. There is, however, a large number of species that are tolerant to both alkaline and acid water and are found under both conditions.

While admitting that hydrogen-ions are not the only determining factors in the geographical distribution of the acid-tolerant and alkaline-tolerant groups, yet there is evidently an important connection.

Investigations on geographical distribution were continued during the summer.

2. *Field Work.*

Numerous collections at various locations were made with the object of finding additions to the faunal list of Mt. Desert Island, exclusive of the anabiotic (terrestrial, moss dwelling) rotifers. As additions to the ploimate (strictly aquatic) rotifers are constantly being found, no work has been done thus far on the anabiotic fauna.

3. *Formulation of Fixed Rules for Narcotizing.*

Illoricate (soft-bodied) rotifers must be narcotized in order that they remain extended after being killed and fixed. The species vary greatly in tolerance to different strengths of narcotic used, and to the time immersed in it. Narcotizing has always been a hit or miss affair, no standard methods for different species having ever been proposed. Experiments were conducted in narcotizing with the object of finding exact methods for as many species as possible.

15. THE INNERVATION OF THE STOMACH AND RECTUM AND THE ACTION OF ADRENALINE IN ELASMOBRANCH FISHES

By BRENTON R. LUTZ, *Boston University Medical School*

A study of the literature concerning the innervation of the stomach and intestine in mammals and the effects of adrenaline reveals much confusion and contradiction. The question is of interest because of its bearing on the digestive process, especially during abnormal nervous states and under conditions of fear, anger, and worry. While the orthodox view holds that the cranial parasympathetic nervous system (vagus nerve) stimulates activity of the muscular walls of these organs and the sympathetic division (splanchnic nerve) stops this activity, so many exceptions

have been found that it appears probable that a physiological distinction between these two parts of the visceral nervous system can not be made. Thus Morat (1893), Langley (1898), Smith (1918), Tashiro (1920), Carlson, Boyd and Pearcy (1922), and M'Crea, M'Swiney and Stopford (1925) have published data contradicting the common view.

The literature concerning the visceral innervation in the lower and possibly simpler vertebrates shows also many differences. In amphibians, Goltz (1872), Dixon (1902), and Müller and Liljestrand (1918) have found the sympathetic division to activate the stomach of the frog. In reptiles, Thorell (1927) by the use of adrenaline considered the sympathetic to inhibit, while in birds, Nolf (1925) found both the vagus and the sympathetic to be either motor or inhibitory to the gizzard and small intestine.

In elasmobranch fishes Bottazzi (1902) and Müller and Liljestrand (1918) were unable to get any inhibitory effect on the stomach by stimulating the anterior splanchnic nerves but instead, got marked activity. The visceral nervous system in these fishes has other peculiarities, namely, a lack of accelerator (sympathetic) nerves to the heart (Bottazzi 1902, Müller and Liljestrand 1918, Lutz 1930) and an inhibitory action of adrenaline on the heart (Macdonald 1925, Lutz 1930). Since adrenaline is considered to have the same effect on visceral organs as stimulation of the sympathetic nervous system, the writer believed that in elasmobranchs, where the visceral nervous system is relatively simple, some useful information might be obtained by comparing the effects of adrenaline and extract of chromaphil tissue on parts of the gut with the effects of stimulation of the visceral nerves to the same parts.

The fishes used were the dogfish, Squalus acanthias, and the skates, Raia erinacea and R. diaphanes. The following results were obtained. Adrenaline caused a rise in tone and an increase in motility of all parts of the stomach. An extract of the chromaphil bodies had a similar effect although other tissue extracts used for control were ineffective. Electrical stimulation of the gastric ganglion and the anterior splanchnic nerves caused extensive contractions of the stomach, and similar stimulation of the vagus gave moderate contractions. No inhibitory effect was obtained. Simultaneous vagus stimulation did not alter the response from the splanchnic nerves.

Adrenaline and extract of chromaphil tissue caused a marked decrease in tone and inhibition of motility of the posterior end of the intestine and the rectum. Stimulation of the posterior splanchnic nerves, however, gave an increase in motility of these parts.

The motor effect of sympathetic stimulation and adrenaline on the stomach of the elasmobranch is another exception to the common view.

If the posterior splanchnic nerves are sympathetic as Müller and Liljestrand (1918) describe them to be, the inhibitory action of adrenaline on the rectum is also an exception. Such exceptions indicate that a physiological distinction between parasympathetic and sympathetic can not be made, and that the effect of adrenaline is not always the same as that of stimulation of the sympathetic system.

16. PERISTALSIS IN MYXINE

By Cornelius Olcott, Jr., *Princeton University*

Dahlgren and Turnball have studied the intestine of Myxine histologically and found (to quote Turnbull) "little or no muscle in the intestinal wall of Myxine . . . Peristalsis is carried on by the muscles of the body wall. In order that this may be possible, the small digestive tube is padded with a layer of large-celled connective tissue, kept expanded by turgidity. These connective tissue cells increase the diameter of the intestine so that it almost fills the body cavity and so brings the intestinal walls close enough to the body wall that the peristaltic action of the latter may be transmitted to the former."

The intestine of Myxine is a straight tube of large external and small internal diameter—running from mouth to anus and lying very close to the body wall, which is heavily muscled and capable of great activity.

From this study it was concluded that the intestine in no wise aids food in its passage through the body.

Work was done by me on live material to verify the histological results. It was found to be impossible to study the movements of the intestine satisfactorily *in situ* in the living animal. These creatures are extremely active and the wriggling, squirming movements of the body wall are of course, directly transferred to the intestine, which lies in immediate contact with it. To obviate this difficulty, the intestine was studied in two ways after removal: first, by direct observation; and second, by kymograph records. In both cases the intestine had to be immersed in a fluid medium similar to the blood and for this purpose, a solution was made based on figures of the analysis of Myxine blood made by Dr. E. K. Marshall, to wit:

NaCl	.30 gm.
KCl	.075gm.
$CaCl_2$	.10 gm.
$NaHCO_3$	.10 gm.
Distilled water	1000.0 gm.

Muscle tissue immersed in it could be kept alive for long periods of time.