The Habitat of the Snail Host of *Schistosoma japonicum* in the Philippines

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The wartime interest in schistosomiasis makes it timely to set forth some field observations on the habits and habitats of the intermediate host. In 1913 an investigator in Japan (*1*) incriminated a snail as the intermediate host of *Schistosoma japonicum*. A fresh-water form, at present designated as *Schistosomophora quadrasi* (Mollendorff), was reported by Tubangui (*2*) to be the intermediate host of the causative agent of schistosomiasis in the Philippine archipelago. With an increased amount of material available for examination, Bartsch (unpublished material) has shown *Schistosomophora hydrobiopsis,* often considered as a host in the central Philippines, to be synonymous with *S. quadrasi.*

S. quadrasi has been reported from eastern Leyte (Alangalong to Abuyog, inland to Dagami), eastern Mindoro, northeastern Mindanao, and all of Samar. There have been no reports of the species from Luzon, Panay, Negros, or Cebu. Observations reported herein were made primarily on southern Samar and around Palo, Leyte, during the early part of 1945.

Although the species is amphibious, its periods of terrestrial existence are not as prolonged as a review of the literature would indicate. The preference for an aquatic environment apparently is proportional to the temperature. These mollusks were found on the stems of emergent vegetation, particularly reeds, often as much as four inches above the water surface. However, this was true only in the early morning and in the cooler part of the evening. During the hotter part of the day they migrated beneath the water surface and were especially abundant in the shade of overhanging trees and shrubs. Collecting from emergent vegetation was not very profitable in the early afternoon. No observations were made as to their nocturnal locations. However, when placed in artificial containers indoors, the majority remained submerged and made little effort to leave the water.

Under natural conditions these snails were most frequently found in grassy ponds or slowly moving water. They do not normally live in swiftly flowing water, although floods may transport the debris to which they are attached great distances and into unnatural environments. They were abundant in the brown algal scum in the slowly flowing seepages from the banks of ponds and ditches. They seemed particularly to prefer, and were easily collected from, floating dead coconut fronds and partially submerged coconut husks. They apparently did not migrate into deep water, but could occasionally be collected from bottom debris and the surface of the mud in shallow bodies of water. No specimens were taken from wells. Contrary to expectations, rice paddies were not heavily populated by these snails.

The water in most of these habitats was found to have a pH of about 6.0 when tested with nitrazine indicator paper. The great amount of pollution and dead vegetation probably aids in maintaining this acidity. Some concept of the degree of pollution with human wastes might be obtained from the fact that in one area 36 per cent of the *S. quadrasi* examined contained developmental stages of human schistosomes.

Associated in the same habitats were *Melanoides turriculus* (Lee), *Physastra hungerfordiana* (Nevill), *Fossaria philippinensis* (Nevill), *Gyraulus quadrasi* (Mollendorff), and *Helicorbis mearnsi* (Bartsch). Determinations of all specimens were made by Dr. Paul Bartsch, of the Smithsonian Institution.

In general, it may be said that in the Philippines *S. quadrasi* occurs in shallow, quiet, or slowly flowing, polluted, acid water that contains an abundance of decayed organic matter, particularly coconut fronds. In such habitats they may be very abundant.

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[1] The opinions expressed herein are those of the author and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

Systolic Effect by Sulfhydryl Reagents[1]

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Considerable attention has been given in the past to the phenomenon of systolic standstill in the isolated frog heart which can be obtained with such diverse groups of substances as the cardiac glycosides, the veratrum alkaloids, ascorbic acid, the angelicalactones, and other oxidizing agents.

It has been demonstrated by the author (*3*) that cysteine and glutathione prevent the systolic standstill of the isolated frog heart caused by the oxidizing agents α–β and β–γ angelicalactone and *t*-butyl hydrogen peroxide. On the assumption that the –SH groups contained in cysteine and glutathione are responsible for this action, it was thought that specific

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reagents which combine with the sulfhydryl groups of the sulfhydryl-containing enzymes would also bring about systolic standstill of the isolated frog heart. This assumption has been verified by the observations outlined below.

Use has been made in this investigation of the three types of sulfhydryl reagents used by Barron and Singer (*1, 4*) in the study of the role of sulfhydryl-containing enzymes in carbohydrate, fat, and protein metabolism and by Hellerman, Chinard, and Deitz (*2*) in their study of the reversible inactivation of urease. The isolated frog heart, mounted on a Straub-Fuhner cannula, has been subjected to the action of the following sulfhydryl reagents: (1) the oxidizing agents, porphyrindin and the sodium salt of *o*-iodosobenzoic acid; (2) an alkylating reagent, iodoacetamide; (3) mercaptide-forming compounds, the sodium salt of *p*-chloromercuric benzoic acid, and phenarsine oxide hydrochloride.

Porphyrindin in a concentration of 2×10^{-3} (7.5×10^{-3}M) causes an immediate systolic effect accompanied by a decrease in heart rate. Systolic standstill is brought about in a period of approximately 30 minutes. This effect is prevented when porphyrindin is dissolved in a solution of glutathione 6.5×10^{-3}M. Glutathione does not reverse the effect of porphyrindin once the systolic standstill has been achieved. Small concentrations of porphyrindin (up to 1×10^{-4}) cause temporary increase in the amplitude of contraction.

Ortho-iodosobenzoate in a concentration of 2×10^{-4} (8.3×10^{-4}M) causes systolic standstill in approximately 20 minutes, this effect usually being preceded by an increase in heart rate. A concentration of 1×10^{-4} to 0.5×10^{-4} causes a temporary increase in the amplitude of contraction.

Iodoacetamide in a concentration of 1×10^{-3} (5.3×10^{-3}M) brings about systolic standstill in a period of approximately 10 minutes. In one experiment a concentration of 1×10^{-4} caused no appreciable effect.

The study of the mercaptide-forming compounds presented more difficulties than that of the other two groups of reagents. Preliminary experiments show that systolic standstill is obtained with *p*-chloromercuric benzoate and with phenarsine oxide hydrochloride only under certain conditions.

Para-chloromercuric benzoate in concentrations of 1×10^{-5} to 1×10^{-4} causes a depressant effect which ends in diastolic arrest of the heart. Concentrations of 2×10^{-4} (5.6×10^{-4}M) produce a depressant effect of approximately one-minute duration followed by a gradually developing systolic effect, but before complete systolic effect is obtained, the heart stops beating. Complete systolic standstill can, however, be obtained when the heart is connected with an electrical circuit consisting of a platinum wire placed in the fluid of the Straub cannula and a cotton-wrapped copper wire, the cotton wick being placed in contact with the surface of the heart. The stimulating electrodes are connected through the output potentiometer of a condenser-discharge stimulator, thus closing the circuit of a voltaic cell. The reaction is obtained even when the stimulator is not operating.

Stoppage of the heart before achieving systolic standstill is also a troublesome matter when phenarsine oxide hydrochloride 1×10^{-3} (4.2×10^{-3}M) is applied. Complete systolic effect is obtained, however, when a clean, soft, copper wire, 0.025 inch thick, is placed in the fluid of the Straub cannula for a period of 40 to 60 minutes before applying the solution of the arsenical.

The interpretation of the results obtained with the mercaptide-forming compounds requires further investigation.

The preceding results show that certain sulfhydryl reagents cause systolic standstill of the frog heart. This investigation suggests the possibility of studying certain enzymatic reactions in the isolated frog heart, a living tissue.

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Reduction of Sympathetic Synaptic Transmission as an Index of Inhibition at Adrenergic Junctions in General[1]

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Physiological quantities of epinephrine have been shown to inhibit synaptic transmission in sympathetic ganglia (*7, 9*). Furthermore, drugs like ephedrine (*2, 3, 4*), which are dependent upon the presence of adrenergic fibers for the exercise of their major and typical actions, likewise produce inhibition at the synapses of sympathetic ganglia (*7, 10*). These findings agree in indicating that the synapses at which the inhibition in question takes place must be adrenergic and opposed to the cholinergic excitatory ones already known to function in sympathetic ganglia.

The action described therefore constitutes a means of studying sympathomimetic inhibition, e.g. by the amines, which has distinct advantages and avoids some of the drawbacks of methods hitherto available.

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