

Table I shows the M.A.D., M.L.D., and therapeutic coefficient for each of the 7 anesthetics. The 5 drugs used in summer frogs showed a marked drop in toxicity at the lower winter temperature. These diminutions in toxicity in per cent of the summer M.L.D.'s were as follows: Nupercaine 100%, procaine 31%, metycaine 50%, pantocaine 62%, and tutocaine 75%. On the other hand the M.A.D.'s were practically the same with the exception of nupercaine which was almost 50% less active at the lower temperature.

Summary. The three local anesthetics, larocaine, panthesine and tutocaine, which chemically are of the procaine type, but with branched side chains, gave the highest therapeutic coefficients. In a decreasing order of sensitivity (based on the M.A.D.) the anesthetics can be arranged as follows: pantocaine > nupercaine > panthesine > metycaine > larocaine > tutocaine > procaine. In an increasing order of toxicity (based on the M.L.D.) the anesthetics can be arranged as follows: tutocaine < procaine < larocaine < panthesine < metycaine < pantocaine < nupercaine.

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7175 P

Life History of Manson's Blood Fluke (*Schistosoma mansoni*).

I. Extramammalian Phase of the Cycle.*

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The work of which this contribution forms a part was carried on in Puerto Rico, where Manson's blood fluke infection is an important and extensive clinical entity. The lateral-spined eggs of the parasite were obtained from the feces of human and experimental animals. The stools were washed and concentrated either by centrifugation or by sedimentation. The numbers of these eggs obtained from a 24-hour specimen varied not only with the age of

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the infection in the mammalian host but also fluctuated from day to day. The majority were viable, and contained ciliated larvae (miracidia), which were studied for detailed morphological features, including the number and pattern of the epithelial plates.

Hatching was found to be due to several factors, including the maturity and vitality of the miracidium, the tonicity of the medium and mechanical agitation of the eggs. Some larvae hatch immediately after washing and concentration but the majority require from 12 to 24 hours. After swimming around for several minutes in or near the bottom sediment the miracidia rise to the top of the water level and swim energetically in the top inch of the water. Under laboratory conditions their length of free-living existence was not over 24 hours, usually considerably less. If specimens of laboratory bred snails of the species *Helisoma (Planorbina) guadeloupense*, the appropriate intermediate host in Puerto Rico, are placed in a pan containing miracidia hatched from washed viable eggs of *S. mansoni*, they are soon attacked by the miracidia, which are attracted to the soft parts of the snail, particularly the tentacles. Some of these larvae secure a permanent hold on the tissues and bore their way inward. The compatibility of this host-parasite relationship was confirmed by the high percentage of snails which usually became infected (75-100%). Exposed snails were sacrificed at suitable intervals and dissected to determine the stage of development of the intramolluscan phase and the position of the parasite in the snail's body. Primary sporocysts were first isolated and identified on the eighth day (in a circumesophageal lymph sinus). From that time on development was readily traced through the propagation of second generation sporocysts and cercariae (larvae of the third generation). Complete development, with spontaneous rupture of the cercariae, was found to require 24-28 days in spring and summer and 30-35 days in winter. Infected snails are much more likely to succumb to unfavorable conditions of the environment than are uninfected ones. Most snails become infected with only a few miracidia. The cercarial progeny arising from a single miracidium may be discharged over a period of 4 months or longer and may amount to more than one hundred thousand individuals. The greatest daily discharge occurs about 2 months after the first cercariae mature.

The free-living cercariae are phototactic and emerge from their snail hosts commonly between 9 o'clock in the morning and 1 o'clock in the afternoon, particularly when exposed to direct sunlight. At first they are usually assembled as a "halo" around the opening of

the snail's shell. Later, up to 8-10 hours, they tend to become more or less equally distributed through the water, apparently poised in a vertical position, with tails almost always upward, but actually moving very slowly in the current of water. From time to time they actively swim about, with their anchor-flukes (bifid tail) directed forward, but in a few seconds resume their passive pose. They readily become entangled in mucus discharged by the snail. This distribution through the water is maintained for 18-24 hours, after which they more commonly crawl about on the bottom of the container, but can be readily activated. They move away from moderate cold but if placed in the ice box will sink to the bottom of the container and survive for 24 hours or longer at or just above the freezing temperature. On return to normal temperature (22-30°C.) they readily become activated. Less than 5% die within the first 24 hours but by 30 hours 90% have perished.

The cercariae of *Schistosoma mansoni* are found on careful examination of immature and mature living specimens to have *two pairs of anterior secretory (penetration) glands* with large dense granular contents and *4 pairs of posterior secretory glands* with finely granular contents. In a small percentage of specimens freshly emerged from the snail evidence of a head gland has been found.

The cercaria is the infective stage for man or other mammals which wade, bathe, swim or otherwise expose their skin to the "infected water".

7176 P

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II. The Mammalian Phase of the Cycle.*

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In Puerto Rico man is the only known definitive host of *Schistosoma mansoni* infection. The experimental data included in this report are based on infections of laboratory rats and rabbits and rhesus monkeys, as well as on one accidental human infection. Twenty-three rats, 8 rabbits and 4 monkeys were submitted to inoculation, either by placing the animal for one to 2 hours in a bath of

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