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

Life History of Manson's Blood Fluke (Schistosoma mansoni). 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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water swarming with cercaria, or by placing desirable food in such water, or by spraying infected water into the animal's mouth. Evidence that cercariae were attacking the animal's skin within an hour after exposure was furnished by the extreme nervousness and later by intense pruritus of the exposed tissue of the animal. This continued for several hours after the animals were removed from the infective bath. All animals exposed became infected. The animals were sacrificed under anesthesia at intervals varying from 16 hours to 70 days, the cavities were opened, the various organs and tissues carefully inspected for gross evidence of infection and then the several organs were separated by ligation and removed from the body into isotonic citrate solution. These tissues and organs were thoroughly perfused and/or chopped up and the solution centrifuged and then examined for migrating larvae. Likewise, suitable portions of each organ were fixed in Zenker's fluid and sectioned. By these methods it was found possible to trace the route of migration and development of the young worms day by day through the prepatent period.

In general the development follows that described by various workers for *Schistosoma japonicum,* the Oriental blood fluke, but with important exceptions. The migration route is as follows. Entry of the cercariae through the skin takes place within a few hours after exposure. Within 16-20 hours after inoculation the larvae have left the skin, most usually *via* the peripheral veins, but at times passing through peripheral lymph nodes. They are carried through the right heart to the lungs, where they may be found in the pulmonary capillaries as early as 20 hours and in the peribronchial venules up to 8 days. However, some get through to the left heart as early as the 3rd day and pass into the systemic circulation. As early as the fourth day a few larvae have been recovered from the intra-hepatic portal veins, with evidence that in this location they feed on blood for the first time. But they do not remain there; rather, they pass through the portal filter and back through the right heart to the lungs, where fed larvae are found up to the 19th day. Likewise, there is no evidence that larvae in the general circulation become filtered out in the stomach wall, kidneys, lymph glands, etc. They work their way through these filters, pass again through the lungs, and eventually (about the 13th day) accumulate in the liver. The larvae migrate passively from the pulmonary venules *via* the left heart, aorta and mesenteric arteries into the portal system. In no single instance was there any indication that young larvae which had gotten out of the lungs into

the pleural cavity were capable of or ever attempted to penetrate through the diaphragm into the peritoneal cavity, and by this route enter the portal system.

The stages of development parallel those of *S. japonicum* but there is a constant "lag" of 5-10 days in *S. mansoni.* Sexual maturity in *S. mansoni* is reached between the 35th and 40th day, although even in light infections only a fraction of the worms are mature and the females laying eggs before the 40th day. *Schistosoma japonicum,* when mature, has a predilection for the upper branches of the superior mesenteric vein (*i. e.,* arising from the jejunum and upper ileum). On the other hand, *S. mansoni* migrates into the lower branches of the superior mesenteric vein and the inferior mesenteric vein, to deposit eggs in the venules of the wall of the colon. In a monkey sacrificed on the 54th day mated worms were also found in numbers in the superior and middle hemorrhoidals and even in the inferior vena cava. Furthermore, eggs-laying pairs have on several occasions been found in sections of lung tissue (rats, rabbit, monkey).

Series of adult females were examined to determine the numbers of eggs *in utero.* There is usually only one egg present but in about 8% of 355 females studied 3 or more eggs were seen. However, evidence provided by egg counts of representative samplings of the bowel mucosa indicates that each female lays several tens of eggs *per diem,* although eggs evacuated in the feces account for only a small fraction of those laid, the remainder having infiltrated into the tissues of the bowel wall.

7177 P

Life History of Manson's Blood Fluke (Schistosoma mansoni). III. The Blood Picture in Schistosomiasis Mansoni.*

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The blood picture in experimental mammals infected with *S. mansoni* shows first a leukocytosis, paralleling the migration of the larvae through the lungs. This is followed by a gradually develop-

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