Schistosomiasis

A disease in which humans are parasitized by any of four species of blood flukes: *Schistosoma mansoni*, *S. haematobium*, *S. japonicum*, and *S. mekongi*. In contrast to other trematodes, the sexes are separate; that is, male and female reproductive systems occur in individual worms. The disease is also known as bilharziasis. See also: **Digenea** (/content/digenea/194400)

The approximate dimensions of the egg and male and female adult in each of the four species are shown in the **table**.

<table>
<thead>
<tr>
<th>Species</th>
<th>Egg, μm</th>
<th>Adult</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Length, cm</td>
</tr>
<tr>
<td><em>S. mansoni</em></td>
<td>150 × 65</td>
<td>Female 1–1.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male 2</td>
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<tr>
<td><em>S. haematobium</em></td>
<td>150 × 60</td>
<td>Female 1–1.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male 2</td>
</tr>
<tr>
<td><em>S. japonicum</em></td>
<td>80 × 65</td>
<td>Female 1–2</td>
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<tr>
<td></td>
<td></td>
<td>Male 1–2.5</td>
</tr>
<tr>
<td><em>S. mekongi</em></td>
<td>45 × 40</td>
<td>Female 1.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male 1.5</td>
</tr>
</tbody>
</table>
**Distribution**

*Schistosoma mansoni* is found in Africa, Brazil, Venezuela, Surinam, the Lesser Antilles, Puerto Rico, and the Dominican Republic. *Schistosoma haematobium*, originally found in Africa, the Near East, and the Mediterranean basin, was introduced into India during World War II. *Schistosoma japonicum* is widely spread in eastern Asia and the southwestern Pacific; however, in Taiwan, it infects only animals, not humans. *Schistosoma mekongi* is reported from Laos and Cambodia.

**Biology**

An embryonated egg passed in feces or urine hatches in freshwater, liberating a miracidium. The ciliated miracidium penetrates into specific gastropod snails. There the miracidium is transformed into a mother sporocyst that gives rise by pedogenesis, or reproduction by larval stages, to several hundred daughter sporocysts. These move away to settle elsewhere in the snail and produce several thousand cercariae. The larval cycle lasts for about 1 month. The cercaria emerges from the mollusk, swims for up to 48 h, and penetrates the skin of the final host upon coming in contact with it. After a phase of growth in the lungs, the schistosomule moves to the intrahepatic veins for further development. Then it moves to its final habitat.

*Schistosoma mansoni* prefers to live in the inferior mesenteric vein of the lower bowel, particularly the branches of the sigmoid and rectum; *S. haematobium*, in the veins of the urinary bladder; *S. japonicum* and *S. mekongi*, in both the superior and inferior mesenteric veins. *Schistosoma mekongi* is related to *S. japonicum* but differs in that it has smaller eggs, a different intermediate host, and a longer prepatent period in the mammalian host.

For all schistosomes of humans, eggs start to appear within 2 months after exposure. The adult may live for many years. The generalized life cycle is shown in the [illustration](http://www.accessscience.com/content/schistosomiasis/605800/10/14/2015).
**Epidemiology**

As an intermediate host, *S. mansoni* uses snails of the genus *Biomphalaria*; *S. haematobium*, the genera *Bulinus* and *Physopsis*; *S. japonicum*, the genus *Onchomelania*; and *S. mekongi*, the genus *Tricula*. *Schistosoma mansoni* seems incapable of infecting *Oncomelania* ssp. *Schistosoma mansoni* is essentially a human parasite. Monkeys may act as natural reservoirs in Africa, and rodents in Brazil and Guadeloupe. *Schistosoma haematobium* has no reservoirs, while *S. japonicum* and *S. mekongi* possess many. Various animals may be infected in the laboratory with the four species.

Schistosomiasis is an agricultural hazard for humans of all ages in irrigated lands or swamps. Elsewhere fluvial waters are the main source of infection, in which case incidence is marked in human beings who are less than 15 years old, and is higher among boys than among girls. Since human activity is what causes the spread of the disease, it is epidemiologically sensible to say that schistosomiasis is caused by humans, not by snails.

Schistosomiasis is endemic in 74 developing countries, infects 200 million persons, and daily threatens 600 million. It persists as one of the most important parasitic diseases of humans.

**Pathology**

The disease changes in schistosomiasis may be described as follows.

**Prepatent period**

The penetration of the cercariae may or may not produce skin irritation. Heavy initial exposures result in inflammatory disease of the skin (urticaria), toxic symptoms, an increase in the size of the liver and spleen, and eosinophilia before egg laying starts.

**Patent period**

*Schistosoma mansoni* may lay 350 eggs daily; *S. japonicum*, 3000. About 10% reach the feces; the rest remain imprisoned in tissues, particularly the liver and intestine or urinary bladder, where they provoke fibrotic reaction (scars). Egg extrusion may result in bloody diarrhea or urine over a protracted period. The liver and spleen enlarge, and the lungs and spinal cord may become involved.

**Postpatent period**

The fibrotic changes may result eventually even when eggs are absent in the feces. The changes interfere with intestinal, hepatic, and bladder functions with serious consequences. Liver fibrosis leads to splenomegaly and esophageal varices. Death may occur from profuse hematemesis. Lung fibrosis may cause cardiac failure. Spinal cord lesions may result in paralysis.

**Diagnosis**
Rectal biopsy is the best definitive method to show the presence of eggs in the intestinal schistosomiasis. Bladder biopsy, or cystoscopy, is indicated in the urinary type. Fecal examination is of value in the patent period. Serological methods are of great complementary value; the complement-fixation test is the most sensitive, while the circumoval-precipitin one is highly specific. The method consists in incubating live eggs with blood serum of the suspect and searching for a hyaline, earlike precipitate protruding from the shell. Enzyme immunoassays have been developed that may prove superior to other methods as purified antigens become available. See also: Complement-fixation test (content/complement-fixation-test/152600); Immunoassay (content/immunoassay/338200)

**Prevention**

Measures to avoid contact with the infective stage are the only means of preventing infection. In agricultural societies, this is virtually impossible. Latrines, rubber boots, skin repellants, education, and snail control have been tried, but with limited success. In more advanced industrialized countries, controlled urbanization has reduced exposure sites, with a consequent decrease in new infections.

**Treatment**

Chemotherapy has been difficult and dangerous, particularly in severe infections, but drugs have become available that promise effective control. Praziquantel, for example, with a 1-day oral administration is well tolerated and reportedly attains 95% cure of all schistosomes of humans at any stage of development. See also: Epidemiology (content/epidemiology/237700); Medical parasitology (content/medical-parasitology/413000)

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**Bibliography**


**Additional Readings**


R. L. Kradin, *Diagnostic Pathology of Infectious Disease*, Elsevier Health Sciences, Philadelphia, PA, 2010
