Schistosoma mansoni, S. japonicum, S. haematobium

The Organisms
- More than 200 million people are infected worldwide with Schistosoma species.
- The adult worms are long and slender (males are 6–12 mm in length; females are 7–17 mm in length) and can live in copula for 10–20 years within the venous system
  - *S mansoni*: inferior mesenteric veins of large intestine
  - *S japonicum*: inferior and superior mesenteric veins of small intestine
  - *S haematobium*: veins of urinary bladder.

- Humans acquire the infection when they contact water infested with the Infectious cercariae. Cercariae are attracted to the warmth of a body and skin lipids and begin to burrow into exposed skin. Within 30 minutes, the cercariae have penetrated the epidermis and transformed into Schistosomules, which enter the peripheral circulation, where they eventually become adults in the hepatoportal system or venous plexus surrounding the bladder.
- The female schistosomes begin releasing eggs approximately 5–8 weeks after infection.
Pathology and Pathogenesis

The most significant pathology is associated with the schistosome eggs, not the adult worms.

Female schistosomes can lay hundreds or thousands of eggs per day within the venous system. When eggs are released, many are swept back into the circulation and lodge in the liver (S mansoni and S japonicum) or urinary bladder (S haematobium).

In chronic cases, blood flow to the liver is impeded, which leads to portal hypertension, accumulation of ascites in the abdominal cavity, hepatosplenomegaly, and esophageal varices.

With S haematobium infections, there is urinary tract involvement: urethral pain, increased urinary frequency, dysuria, hematuria, and bladder obstruction leading to secondary bacterial infections.

In travelers to endemic countries, clinical findings of acute schistosomiasis include an itchy rash (swimmer’s itch) that occurs within an hour after cercariae penetrate the skin, followed by headache, chills, fever, diarrhea, and eosinophilia.
Diagnosis is by O&P:
- S mansoni (lateral spine) egg in stool
- S japonicum (nubby spine) eggs in stool
- S haematobium (terminal spine) eggs in urine

Echinococcus granulosus **(hydatid cyst)**

*Echinococcus granulosus* is a small, three-segmented tapeworm found only in the intestine of dogs and other canids.
The eggs leave these hosts and infect grazing animals. The larva hatches from the egg, penetrates the gut, and migrates to various tissues, especially liver, spleen, muscle, and brain.

The larva of Echinococcus develops into a **fluid-filled cyst called a hydatid cyst**. The cyst contains germinal epithelium in which thousands of future larvae (called **protoscolices**) develop.

Inside the hydatid cyst, the protoscolices are contained within brood capsules. If the hydatid cyst ruptures, the brood capsules can spill out of the cyst, metastasize to other sites, and develop into a hydatid cyst. Thus, ingestion of a single egg can give rise to several hydatid cysts, each containing several brood capsules.

**Humans are infected only by ingesting Echinococcus eggs from dog feces. The dog, in turn, can acquire the infection only from an infected herbivore (cyst).**

Humans are only the intermediate and never the final host of this tapeworm.

### Pathology and Pathogenesis

- Hydatid cysts can grow about 1–7 cm per year, and the symptoms depend on the location of the cysts in the body. **The liver is the most common site, where compression, atrophy, portal hypertension from mechanical obstruction, and cirrhosis can occur.**

- Extreme care must be taken when removing the cyst. If the cyst ruptures, the highly immunogenic hydatid fluid can lead to anaphylactic shock and brood capsules can metastasize to form additional hydatid cysts.

**Fig. 2. Hydatid cysts removed.**
In conclusion:

- The lifecycle of *E. granulosus* involves **dogs and wild carnivores as a definitive host** for the adult tapeworm. **Definitive hosts** are where parasites reach maturity and reproduce. Wild or domesticated animals, such as sheep, and human serve as an **intermediate host**.

- The larval stage results in the formation of echinococcal **cysts** in intermediate hosts (human). Echinococcal cysts are slow growing, but can cause clinical symptoms in humans and be life-threatening. Cysts may not initially cause symptoms, in some cases for many years. Symptoms developed depend on location of the cyst, but most occur in the liver, lungs, or both