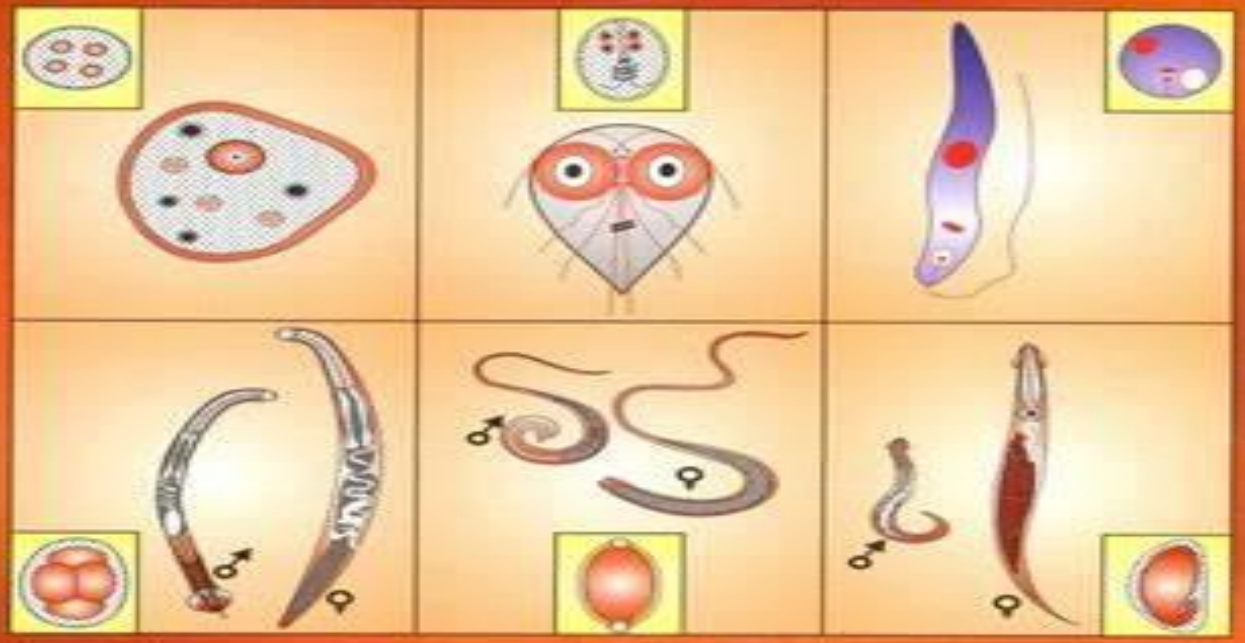
Tikrit University
College of Pharmacy

Microbiology II
-Medical Parasitology

MEDICAL PARASITOLOGY

lec.9: Trematodes



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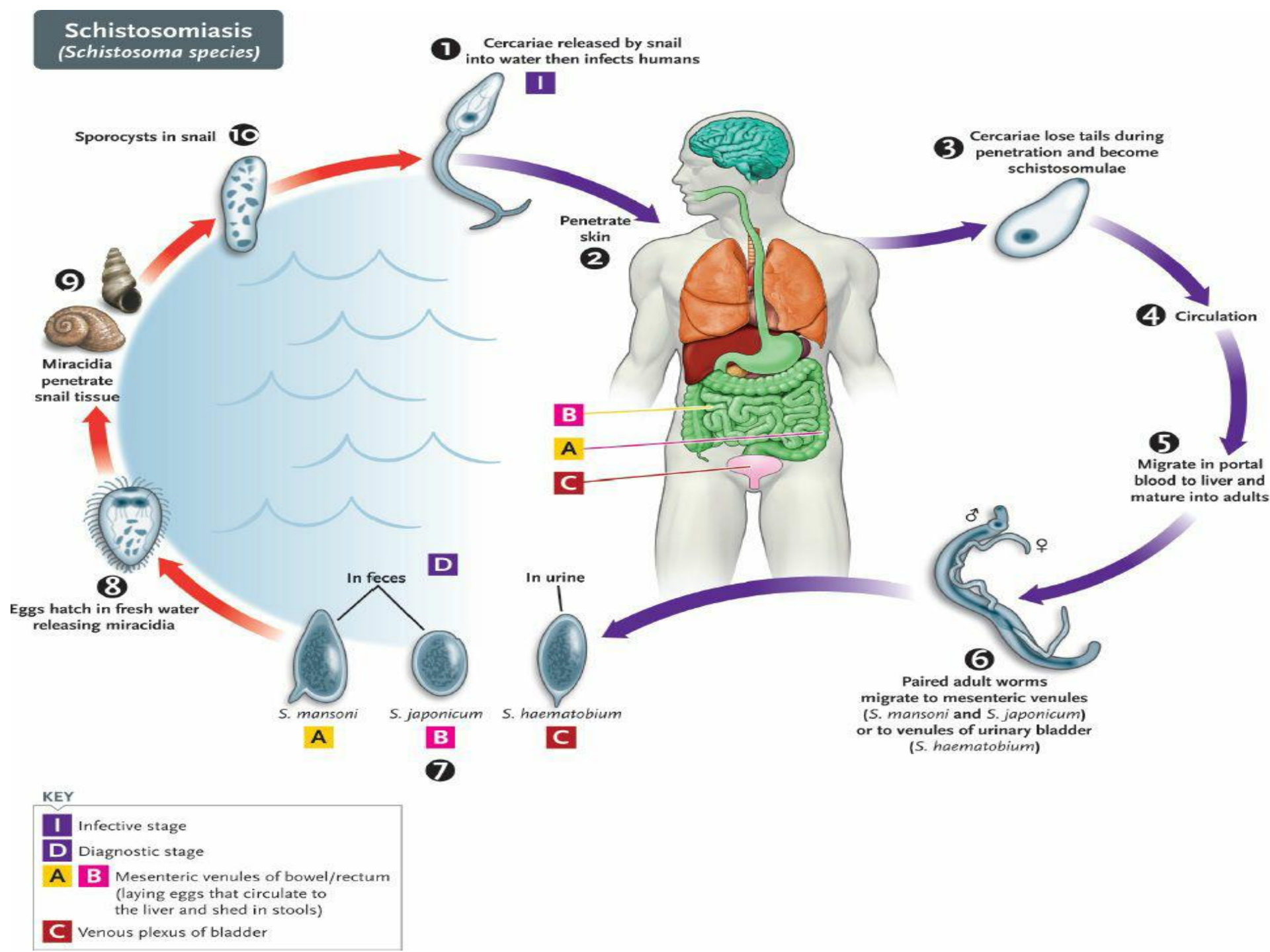
II- Introduction: Trematodes

Trematoda (flukes). The most important trematodes are *Schistosoma* species (blood flukes), *Clonorchis sinensis* (liver fluke), and *Paragonimus westermani* (lung fluke). Schistosomes have by far the greatest impact in terms of the number of people infected, morbidity, and mortality. Three trematodes of lesser importance, *Fasciola hepatica*, *Fasciolopsis buski*, and *Heterophyes heterophyes*. The life cycle of the medically important trematodes involves a sexual cycle in humans (definitive host) and asexual reproduction in **freshwater snails** (intermediate hosts) . Transmission to humans takes place either via penetration of the skin by the free-swimming **cercariae** of the schistosomes or via ingestion of cysts in undercooked (raw) fish or crabs in *Clonorchis* and *Paragonimus* infection, respectively.


Schistosomiasis
(Schistosoma species)
1 Cercariae released by snail into water then infects humans
I
Sporocysts in snail 10
Penetrate skin 2
3 Cercariae lose tails during penetration and become schistosomulae
4 Circulation
5 Migrate in portal blood to liver and mature into adults
9
Miracidia penetrate snail tissue
B
A
C
8
Eggs hatch in fresh water releasing miracidia
D
In feces
In urine
S. mansoni
A
S. japonicum
B
S. haematobium
C
7
6 Paired adult worms migrate to mesenteric venules (S. mansoni and S. japonicum) or to venules of urinary bladder (S. haematobium)
KEY
I Infective stage
D Diagnostic stage
A B Mesenteric venules of bowel/rectum (laying eggs that circulate to the liver and shed in stools)
C Venous plexus of bladder

SCHISTOSOMA

Disease

Schistosoma causes schistosomiasis. *Schistosoma mansoni* and *Schistosoma japonicum* affect the **gastrointestinal tract**,whereas *Schistosoma haematobium* affects the **urinary tract**.

Important Properties

In contrast to the other trematodes, which are hermaphrodites, adult schistosomes exist as **separate sexes** but live attached to each other. The female resides in a groove in the male, the gynecophoric canal (“schist”), where he continuously fertilizes her eggs . The three species can be distinguished by the appearance of their eggs in the microscope: *S. mansoni* eggs have a **prominent lateral spine,** whereas *S.japonicum* eggs have a very small lateral spine and *S. haematobium* eggs have a terminal spine .

S. mansoni and *S. japonicum* adults live in the **mesenteric veins,** whereas *S. haematobium* lives in the veins draining the urinary bladder. Schistosomes are therefore known as **blood flukes**.

Humans are infected when the free-swimming, fork-tailed **cercariae** penetrate the skin . They differentiate to larvae (schistosomula), enter the blood, and are carried via the veins into the arterial circulation. Those that enter the superior mesenteric artery pass into the portal circulation and reach the liver, where they mature into adult flukes. *S. mansoni* and *S. japonicum* adults migrate against the portal flow to reside in the mesenteric venules. *S. haematobium* adults reach the bladder veins through the venous plexus between the rectum and the bladder.

In their definitive venous site, the female lays fertilized eggs, which penetrate the vascular endothelium and enter the gut or bladder lumen, respectively. The eggs are excreted in the stools or urine and must enter fresh water to hatch.

Once hatched, the ciliated larvae (miracidia) penetrate **snails** and undergo further development and multiplication to produce many cercariae. (The three schistosomes use different species of snails as intermediate hosts.) Cercariae leave the snails, enter fresh water, and complete the cycle by penetrating human skin.

Pathogenesis & Epidemiology

Most of the pathologic findings are caused by the presence of eggs in the liver, spleen, or wall of the gut or bladder. Eggs in the liver induce granulomas, which lead to fibrosis, hepatomegaly, and portal hypertension. The granulomas are formed in response to antigens secreted by the eggs. Hepatocytes are usually undamaged, and liver function tests remain normal. Portal hypertension leads to **splenomegaly**. *S. mansoni* eggs damage the wall of the distal colon (inferior mesenteric venules), whereas *S. japonicum* eggs damage the walls of both the small and large intestines (superior and inferior mesenteric venules).

The damage is due both to digestion of tissue by proteolytic enzymes produced by the egg and to the host inflammatory response that forms granulomas in the venules. The eggs of *S.haematobium* in the wall of the bladder induce granulomas and fibrosis, which can lead to **carcinoma of the bladder**. Schistosomes have evolved a remarkable process for **evading the host defenses**. There is evidence that their surface becomes coated with host antigens, thereby limiting the ability of the immune system to recognize them as foreign. The epidemiology of schistosomiasis depends on the presence of the specific freshwater snails that serve as intermediate hosts. *S. mansoni* is found in Africa and Latin America (including Puerto Rico), whereas *S. haematobium* is found in Africa and the Middle East. *S. japonicum* is found only in Asia and is the only one for which domestic animals (e.g., water buffalo and pigs) act as important reservoirs. More than 150 million people in the tropical areas of Africa, Asia, and Latin America are affected.

Clinical Findings

Most patients are asymptomatic, but chronic infections may become symptomatic. The acute stage, which begins shortly after cercarial penetration, consists of itching and dermatitis followed 2 to 3 weeks later by fever, chills, diarrhea, lymphadenopathy, and hepatosplenomegaly. Eosinophilia is seen in response to the migrating larvae. This stage usually resolves spontaneously.

The chronic stage can cause significant morbidity and mortality. In patients with *S. mansoni* or *S. japonicum* infection, gastrointestinal hemorrhage, hepatomegaly, and massive splenomegaly can develop. The most common cause of death is exsanguination from ruptured esophageal varices. Patients infected with *S. haematobium* have hematuria as their chief early complaint. Superimposed bacterial urinary tract infections occur frequently.

“Swimmer’s itch,” which consists of pruritic papules, is a frequent problem in many lakes in the United States. The papules are an immunologic reaction to the presence in the skin of the cercariae of nonhuman schistosomes. The pruritic papules appear within minutes to hours after exposure, indicating that this is an immediate (IgE–mediated) hypersensitivity. These nonhuman schistosomes are incapable of replicating in humans and do not cause disseminated disease.

Laboratory Diagnosis

Diagnosis depends on finding the characteristic ova in the feces or urine. The large lateral spine of *S. mansoni* and the rudimentary spine of *S. japonicum* are typical, as is the large terminal spine of *S. haematobium* . Serologic tests are not useful. Moderate eosinophilia occurs.

Treatment

Praziquantel is the treatment of choice for all three species.