

Introduction to Multicellular Parasites

1. Define:

Helminth – The term helminth means worm, and applies to parasitic worms; these may be flat (flukes/tapeworms) or round (hookworms, *Ascaris* worms, filarial worms, etc.).

Definitive host – The definitive host is where sexual reproduction of a parasite takes place. In the case of multicellular parasites, definitive hosts support the adult forms, while larvae (which do not reproduce sexually) are often found in alternate (intermediate) hosts. Adult forms of the sheep liver fluke (*Fasciola hepatica*), are found within sheep, so sheep are the definitive hosts. Water snails are intermediate hosts. Mosquitoes are the definitive hosts of *Plasmodium* species.

Redia – Rediae (singular = redia), are larval or immature stage flukes as described in the life cycle of *Fasciola hepatica* and *Schistosoma*. Rediae form within the sac-like sporocyst that develops from a miracidium after it enters a water snail. Cell masses within redia undergo asexual reproduction to form cercariae.

Vector – The term vector applies to a living organism, often an arthropod, that carries disease causing agents (bacteria, viruses, protozoa, etc.) from one host to another. Examples presented in the laboratory include ticks, fleas, mosquitoes, lice and mites.

Monoecious – Organisms that contain both male and female reproductive organs are said to be monoecious. Many of the flatworms (Platyhelminthes) are monoecious; a characteristic that doubles their reproductive potential.

2. Helminthes/ reproductive (sometimes they have both male and female systems).
3. Digestive, nervous, and muscular systems/ monoecious (Note – Although the term hermaphroditic is used in this question, it is technically incorrect.)
4. Definitive/ intermediate
5. Two advantages are: a) The separation of adult and larval stages reduces the competition for food and living space. Fewer parasites inhabit a single host, so less damage is done. b) It also promotes survival of the population by spreading different individuals among a number of different hosts. It is less likely that all hosts will die, so at least some parasites will survive. It is harder to eliminate a parasite population when it is spread out among numerous hosts.
6. The adult forms of *Fasciola hepatica* are found in sheep (definitive hosts), usually in the liver. The flukes mate and produce large numbers of eggs that exit the sheep along with fecal material. In moist environments the eggs hatch into ciliated larvae called miracidia (singular miracidium). These seek out the intermediate host; a specific water snail, and burrow in through soft tissues. Inside the snail, each miracidium forms a sac-like sporocyst. These then give rise to multiple rediae, which in turn contain multiple cercariae. When mature, the cercariae exit the snail and swim off to form cysts on grass or other vegetation. Sheep that consume the cysts (with food or in water) become infected, and the cycle begins again.

The advantage of having adult and larval stages in separate hosts include: reducing the competition for food and living space, decreasing the damage caused the host organisms, which increases the likelihood of survival for both parasite and host, dispersing the population, and thereby increasing its chances for survival.

7. Miracidium/ water snail/ cercariae
8. The blood fluke larvae (cercariae) burrow through the skin of host organisms.
9. Burrowing through the soft skin of host organisms (e.g., between the toes of barefoot children)/ the bite of an insect vector (mosquito, *Simulium* fly, etc.)
10. *Trichinella spiralis*/ *Taenia solium*
11. *Trichinella spiralis* larvae are released within the intestine by adult female worms. They burrow from the intestine into surrounding tissues such as muscle. The larva are transferred to a new host when the muscle tissue is eaten (raw or poorly cooked). *Necator americanus* larvae hatch from eggs deposited with fecal material. They feed on bacteria in the soil until they reach a certain stage of maturity. They enter a new host by burrowing through the skin.
12. *Necator americanus* adults live in the intestine where they feed on blood. The female worms release eggs that exit the body along with fecal material. Larvae hatch from the eggs and live in moist soil for a period of time where they feed on bacteria. When they reach a certain stage of maturity, they burrow through the skin of a host organism and enter the blood stream. They travel within the circulatory system to the lungs, where they exit the blood stream and enter the alveoli. From there they migrate up the airways to the pharynx where they can be swallowed. They pass through the stomach and return to the intestine where they mature into adult worms.
13. Vectors involved in the transmission of disease causing agents
14. Ectoparasites
15. The filarial larvae of *Dirofilaria* are transmitted by mosquitoes, so are difficult to avoid. They cause heart damage, obstruction of blood vessels and death in dogs that are not treated. These parasites can also be transmitted to humans.
16. Matching letter sequence is – H, A, E, D, G, B, C, and F.