Helminthes Parasites

- ✓ The word 'helminthes' is a general term meaning 'worm', but there are many different types of worms. Prefixes are therefore used to designate types: platy-helminthes for flat-worms and nemat-helminths for round-worms.
- ✓ All helminthes are multicellular eukaryotic invertebrates with tube-like or flattened bodies exhibiting bilateral symmetry. They are triploblastic (with endo-, meso- and ecto-dermal tissues) but the flatworms are acoelomate (do not have body cavities) while the roundworms are pseudocoelomate (with body cavities not enclosed by mesoderm). In contrast, segmented annelids (such as earthworms) are coelomate (with body cavities enclosed by mesoderm).
- ✓ Many helminthes are free-living organisms in aquatic and terrestrial environments whereas others occur as parasites in most animals and some plants. Parasitic helminthes are an almost universal feature of vertebrate animals; most species have worms in them somewhere.

Biodiversity

Three major assemblages of parasitic helminthes are recognized:

- ✓ The Nemathelminthes (nematodes)
- ✓ The Platyhelminthes (flatworms), the latter being subdivided into the Cestoda (tapeworms) and the Trematoda (flukes):

nematode cestode trematode



- ✓ Nematodes (roundworms) have long thin unsegmented tube-like bodies with anterior mouths and longitudinal digestive tracts. They have a fluid-filled internal body cavity (pseudocoelum) which acts as a hydrostatic skeleton providing rigidity (so-called 'tubes under pressure'). Worms use longitudinal muscles to produce a sideways thrashing motion. Adult worms form separate sexes with well-developed reproductive systems.

- ✓ Cestodes (tapeworms) have long flat ribbon-like bodies with a single anterior holdfast organ (scolex) and numerous segments. They do not have a gut and all nutrients are taken up through the tegument. They do not have a body cavity (acoelomate) and are flattened to facilitate perfusion to all tissues. Segments exhibit slow body flexion produced by longitudinal and transverse muscles. All tapeworms are hermaphroditic and each segment contains both male and female organs.

- ✓ Trematodes (flukes) have small flat leaf-like bodies with oral and ventral suckers and a blind sac-like gut. They do not have a body cavity (acoelomate) and are dorsoventrally flattened with bilateral symmetry. They exhibit elaborate gliding or creeping motion over substrates using compact 3-D arrays of muscles. Most species are hermaphroditic (individuals with male and female reproductive systems) although some blood flukes form separate male and female adults.

- Unlike other pathogens (viruses, bacteria, protozoa and fungi), helminthes do not proliferate within their hosts. Worms grow, mature and then produce offspring which are voided from the host to infect new hosts.
- Worms develop slowly compared to other infectious pathogens so any resultant diseases are slow in onset and chronic in nature. Although most helminthes infections are well tolerated by their hosts and are often asymptomatic, subclinical infections have been associated with significant loss of condition in infected hosts. Other helminthes cause serious clinical diseases characterized by high morbidity and mortality.

Life-cycles:

Helminthes form three main life-cycle stages: **eggs**, **larvae** and **adults**. Adult worms infect definitive hosts (those in which sexual development occurs) whereas larval stages may be free-living or parasitize invertebrate vectors, intermediate or paratenic hosts.

- Nematodes produce eggs that embryonate in utero or outside the host. The emergent larvae undergo 4 metamorphoses before they mature as adult male or female worms.
- Cestode eggs released from gravid segments embryonate to produce 6-hooked embryos (hexacanth oncospheres) which are ingested by intermediate hosts. The oncospheres penetrate host tissues and become metacestodes (encysted larvae). When eaten by definitive hosts, they excyst and form adult tapeworms.
- Trematodes have more complex life-cycles where 'larval' stages undergo asexual amplification in snail intermediate hosts. Eggs hatch to release free-swimming miracidia, which actively infect snails and multiply in sac-like sporocysts to produce numerous rediae. These stages mature to cercariae, which are released from the snails and either actively, infect new definitive hosts or form encysted metacercariae on aquatic vegetation which is eaten by definitive hosts.

nematode cycle	Cestode cycle	Trematode cycle
egg - larvae (L1-L4) - adult	egg - metacestode - adult	egg-miracidium-sporocyst-redia-cercaria-(metacercaria)-adult

- Helminthes eggs have tough resistant walls to protect the embryo while it develops. Mature eggs hatch to release larvae either within a host or into the external environment. The four main modes of transmission by which the larvae infect new hosts are faecal-oral, transdermal, vector-borne and predator-prey transmission:

faecal-oral trasdermal vector-borne predator-prey