Classification of Human Parasites, Vectors, and Similar Organisms

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When common names are used to describe parasites and parasitic infections, these names may refer to different parasites in different parts of the world. To eliminate these problems in interpretation of names, a binomial system of nomenclature is used in which the scientific name consists of the genus and species.

Classification systems have been developed to indicate the relationship among the various species of parasites, and these schemes have been based primarily on life cycles and morphology of the organism. Closely related species are placed in the same genus, related genera in the same family, related families in the same order, related orders in the same class, and related classes in the same phylum, one of the major categories in the animal kingdom. Organisms in each category will have characteristics in common.

Parasites of humans are classified in six major divisions. These include the Protozoa (amebae, flagellates, ciliates, sporozoans, coccidia, microsporidia), the Nematoda or roundworms, the Platyhelminthes or flatworms (cestodes, trematodes), the Pentastomids or tongue worms (may be grouped with the arthropods), the Acanthocephala or thorny-headed worms, and the Arthropoda (e.g., insects, spiders, mites, ticks). Although these categories appear to be clearly defined, there may be confusion in attempting to classify parasites, often due to the lack of known specimens or the presence of strains or races of the same species with slightly different characteristics.

Reproductive mechanisms have been used as a basis for determining definitions of species, but there are many exceptions within parasite groups. Another difficulty in recognition of species is the ability and tendency of the organisms to alter their morphological forms according to age, host, or nutrition, which may result in different names for the same organism. In many cases, there may be alternation of parasitic and free-living phases in the life cycle. These organisms may be very different and difficult to recognize as belonging to the same species. However, newer molecular methods of grouping organisms have often confirmed taxonomic conclusions reached hundreds of years before by experienced taxonomists. As studies continue in parasitic genetics, immunology, and biochemistry, the species designation will be defined more clearly by use of highly sophisticated molecular techniques.

No attempt has been made to include every possible organism, but only those considered to be clinically relevant in the context of human parasitology. Not every organism listed below is a human pathogen. Also, although new classification names are proposed frequently and there may be some disagreement among scientists, this list is designed to provide nomenclature that is currently in use.

### Protozoa

**Amebae (Intestinal)**

- Entamoeba histolytica
- Entamoeba dispar*
- Entamoeba hartmanni
- Entamoeba coli
- Entamoeba polecki
- Endolimax nana
- Iodamoeba bütschlii
- Blastocystis hominis

**Flagellates (Intestinal)**

- Giardia lamblia†
- Chilomastix mesnili
- Dientamoeba fragilis
- Trichomonas hominis
- Enteromonas hominis
- Retortamonas intestinalis

### Ciliates (Intestinal)

- Balantidium coli

### Coccidia, Microsporidia (Intestinal)

**Coccidia**

- Cryptosporidium parvum
- Cyclospora cayetanensis
- Isospora belli
- Sarcocystis hominis
- Sarcocystis suihominis

**Microsporidia**

- Enterocytozoon bieneusi
- Encephalitozoon intestinalis

### Sporozoa, Flagellates (Blood, Tissue)

**Sporozoa (Malaria and Babesiosis)**

- Plasmodium vivax
- Plasmodium ovale
- Plasmodium malariae
- Plasmodium falciparum
- Babesia species
Flagellates (*Leishmaniae, Trypanosomes*)
- *Leishmania tropica* complex
- *Leishmania mexicana* complex
- *Leishmania braziliensis* complex
- *Leishmania donovani* complex
- *Leishmania peruviana*
- *Trypanosoma brucei gambiense*
- *Trypanosoma brucei rhodesiense*
- *Trypanosoma cruzi*
- *Trypanosoma rangeli*

Amebae, Flagellates (Other Body Sites)
- Naegleria fowleri
- Acanthamoeba species
- Entamoeba gingivalis
- Balamuthia mandrillaris (Leptomyxid ameba)

Flagellates
- Trichomonas vaginalis
- Trichomonas tenax

Coccidia, Sporozoa, Microsporidia (Other Body Sites)
- Toxoplasma gondii
- Sarcocystis “lindemanni”
- Pneumocystis carinii
- Nosema connori
- Vittaforma corneae
- Pleistophora
- Trachipleistophora hominis
- Brachiola
- Encephalitozoon hellem
- Encephalitozoon cuniculi
- Encephalitozoon intestinalis
- Encephalitozoon bieneusi
- “Microsporidium”
- Enterocytozoon bieneusi

Nematodes (Roundworms)

**Intestinal**
- Ascaris lumbricoides
- Enterobius vermicularis
- Ancylostoma duodenale
- Necator americanus
- Strongyloides stercoralis
- Trichosonhylus species
- Trichuris trichiura
- Capillaria philippinensis

**Tissue**
- Trichinella spiralis
- Visceral larva migrans (Toxocara canis or Toxocara cati)

**Blood and Tissues (Filarial Worms)**
- Wuchereria bancrofti
- Brugia malayi
- Brugia timori
- Loa loa
- Onchocerca volvulus
- Mansonella ozzardi
- Mansonella streptocerca
- Mansonella perstans
- Dirofilaria immitis (usually lung lesion; in dogs, heartworm)
- Dirofilaria species (may be found in subcutaneous nodules)

Cestodes (Tapeworms)

**Intestinal**
- Diphyllobothrium latum
- Dipylidium caninum
- Hymenolepis nana
- Hymenolepis diminuta
- Taenia solium
- Taenia saginata

**Tissue (Larval Forms)**
- Taenia solium
- Echinococcus granulosus
- Echinococcus multilocularis
- Taenia multiceps (formerly Multiceps multiceps)
- Taenia serialis
- Spirometra mansonioides
- Spirometra mansoni
- Diphyllobothrium species

Trematodes (Flukes)

**Intestinal**
- Fasciolopsis buski
- Echinostoma ilocanum
- Heterophyes heterophyes
- Metagonimus yokogawai
<table>
<thead>
<tr>
<th>Liver/Lung</th>
<th>Arthropods</th>
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<tbody>
<tr>
<td>Clonorchis (Opisthorchis) sinensis</td>
<td><strong>Arthropods</strong></td>
</tr>
<tr>
<td>Opisthorchis viverrini</td>
<td>Diplopoda</td>
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<tr>
<td>Fasciola hepatica</td>
<td>Millipedes</td>
</tr>
<tr>
<td>Paragonimus westermani</td>
<td>Chilopoda</td>
</tr>
<tr>
<td>Paragonimus mexicanus</td>
<td>Centipedes</td>
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<tr>
<td>Paragonimus species</td>
<td><strong>Crustacea</strong></td>
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</tbody>
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<table>
<thead>
<tr>
<th>Blood</th>
<th>Pentastomids (Tongue Worms)</th>
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<tbody>
<tr>
<td>Schistosoma mansoni</td>
<td>Copepoda: copepods (Cyclops)</td>
</tr>
<tr>
<td>Schistosoma haematobium</td>
<td>Decapoda: crayfish, lobsters, crabs</td>
</tr>
<tr>
<td>Schistosoma japonicum</td>
<td><strong>Arachnida</strong></td>
</tr>
<tr>
<td>Schistosoma intercalatum</td>
<td>Scorpiones: scorpions</td>
</tr>
<tr>
<td>Schistosoma mekongi</td>
<td>Araneae: spiders (black widow, brown recluse)</td>
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</tbody>
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<thead>
<tr>
<th>Tissue (Larval Forms)</th>
<th>Nasopharyngeal (Adult Worms)</th>
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<tbody>
<tr>
<td>Armillifer species</td>
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<tr>
<td>Linguatula serrata</td>
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<tr>
<td>Sebekia species</td>
<td><strong>Insecta</strong></td>
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<th>Pentastomids (Tongue Worms)</th>
<th>Intestine</th>
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<tbody>
<tr>
<td>Armillifer species</td>
<td>Macrocantohynchus hirudinaceus</td>
</tr>
<tr>
<td>Linguatula serrata</td>
<td>Moniliformis moniliformis</td>
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</tbody>
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<tr>
<th>Acanthocephalans (Thorny-Headed Worms)</th>
<th>Pentastomida</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armillifer species</td>
<td>Tongue worms (see above)</td>
</tr>
</tbody>
</table>

* Entamoeba histolytica is being used to designate pathogenic zymodemes, while Entamoeba dispar is now being used to designate nonpathogenic zymodemes. However, unless trophozoites containing ingested red blood cells (E. histolytica) are seen, the two organisms cannot be differentiated on the basis of morphology. The laboratory report should indicate: Entamoeba histolytica/Entamoeba dispar. + Although some individuals have changed the species designation for the genus Giardia to Giardia intestinalis or Giardia duodenalis, there is no general agreement. Therefore, for this listing, we will retain the name Giardia lamblia. ‡ Pneumocystis carinii has now been reclassified with the fungi.

**Suggested Reading**