Entamoeba
(protist: amoeba)

Overview

Protists are single-celled organisms with membrane-bound nuclei (eukaryotes). Protists which move and feed using pseudopodia (false feet) are known as amoebae. Rather than forming a monophyletic group, amoebae are divided into three major disparate groups: Heterolobosea (supergroup Excavata), Rhizaria (supergroup SAR) and Amoebozoa (supergroup Amorphea). The latter contains four classes of amoebae differing in their types of pseudopodia and organelles: Tubulinea, Discosea, Gracilipodia and Archamoebae. The parasite *Entamoeba* belongs to the archamoebae which form broad pseudopodia but do not produce fruiting bodies like mycetozoa (slime molds). They are naked amoebae (without tests or shells) and have simple life-cycles (without temporary flagellated stages). Most archamoebae are parasites or endocommensals in the digestive tracts of arthropod or vertebrate hosts. They form motile feeding trophozoites with single broad lobopodia and are transmitted between hosts by environmentally resistant cysts. Individual species are differentiated on the basis of cyst morphology and nuclear structure, although many have a vesicular nucleus with a central endosome. Infections by the species *E. histolytica* may cause amoebic dysentery and secondary 'abscesses' in humans.

Classification:
Domain: Eukaryota (membrane-bound nucleus)
Supergroup: Amorphea (unikonts with single flagellum, or nonflagellated amoebae)
Phylum: Amoebozoa (locomotion by noneruptive pseudopodia, asexual development)
Subphylum: Conosa (archamoebae & mycetozoa, many flagellated forms, flagellar root with microtubular cone)
Class: Archamoebae (amoebae (no flagellates), cysts rounded, uni-/multi-nucleate, amitochondriate)
Family: Entamoebidae (uninucleate amoeboid forms, symbiotic in digestive tract of vertebrates)
Genus: *Entamoeba* (parasitic in digestive tracts of vertebrates)
Species: *E. histolytica* (causes amoebic dysentery in humans and primates)

Parasite biodiversity and host range: Protists are unicellular eukaryotes that move using undulipodia (flagella or cilia), pseudopodia (false-feet) or a unique gliding motion. Amoebae form pseudopodia to move and feed. Several types of amoebae are recognized on the basis of differences in their biology and morphology, with recent molecular phylogenetic studies supporting their classification into three major disparate phyla: Heterolobosea (supergroup Excavata), Amoebozoa (supergroup Amorphea) and Rhizaria (supergroup SAR). Most species are free-living in aquatic and terrestrial habitats where they feed on other micro-organisms, but several species have become symbiotic in metazoan organisms as endocommensals or opportunistic-facultative parasites (representatives tabulated below).

Higher taxonomy	Class/Order	Family	Genus	Hosts	Tissues (disease)*
Supergroup: Excavata (with conspicuous ventral feeding groove)					
Group: **Discoba** (diverse group supported robustly by molecular studies)					
Phylum: Heterolobosea (amoebo-flagellates, most form cysts)	O: Schizopyrenida (no fruiting bodies)	Vahlkampfidae (eruptive limax pseudopodia, flagellated stages)	*Naegleria*	mammals	central nervous system (PAM)
Supergroup: Amorphea (unikonts with single flagellum, or nonflagellated amoebae)					
Phylum: **Amoebozoa** (locomotion by noneruptive pseudopodia, asexual development)					
Subphylum: Conosa (archamoebae & mycetozoa)	C: Archamoebae (amitochondriate, rounded cysts)	Entamoebidae (uninucleate, endozoic)	*Entamoeba*	mammals	colon (dysentery), central nervous system (SAM)
Subphylum: Lobosa (lobose amoebae)	C: Discosea (flattened forms, protoplasmic flow polyaxial)	Vexilliferidae (dactylopodia, parasomes)	*Paramoeba* *Neoparamoeba*	fish	gills (AGD)
	C: Longamoebea (flattened elongated cells, stellate cysts)	Acanthamoebidae (acanthopodial subpseudopodia)	*Acanthamoeba, Balamuthia*	mammals	central nervous system (GAE)
Supergroup: SAR (Stramenopiles + Alveolata + Rhizaria) (3 groups robustly supported by molecular studies)					
Group: **Rhizaria** (amoebae with fine pseudopodia in simple, branching or anastomosing patterns)					
Phylum: Cercozoa	Filosa (with filopodia, naked or testate)			free-living (aquatic, terrestrial)	
Phylum: Endomyxa	heterotrophic amoeboid or plasmodial cells			free-living, some parasitoids	
Phylum: Retaria	Foraminifera (with reticulopodia), Radiolaria (with axopodia)			free-living (aquatic)	

*PAM = primary amoebic meningoencephalitis; SAM = secondary amoebic meningoencephalitis;
GAE = granulomatous amoebic encephalitis; AGD = amoebic gill disease.

Amoebae that move using noneruptive pseudopodia are placed in the phylum Amoebozoa, either in the subphylum Lobosa (with lobose pseudopodia) or Conosa (with microtubular cones). Conose amoebozoans include the Mycetozoa (slime molds with fruiting bodies) and the unique Archamoebae, thought to be 'ancient' as they lack mitochondria and dictyosomes (Golgi bodies) but possess mitosomes (presumably modified/reduced mitochondria). Most archamoebae are parasites or endocommensals in the digestive tracts of arthropod or vertebrate hosts. They are naked amoebae (without tests or shells) and have simple life-cycles (without temporary flagellated stages). They form motile feeding trophozoites with single broad lobopodia and most form environmentally resistant cysts to facilitate transmission and dispersal. Some 50 *Entamoeba* spp. have been described primarily in mammals and a few in birds, reptiles and fish. Four basic groups are recognized on the basis of parasite morphology: those not forming cysts and those forming uninucleate, quadrinucleate or octonucleate cysts. In many instances, these morphotypic groupings were supported by molecular phylogenetic studies. *Entamoeba histolytica* is predominantly found in primates (including humans) and occasionally in dogs, cats, cattle, pigs and rodents. This species may cause amoebic dysentery in humans as well as extra-intestinal amoebic abscesses in soft tissues. The parasite has a worldwide distribution and is prevalent in tropical and subtropical countries (estimated prevalence as high as one tenth of the world's population, with 100,000 deaths annually). It is readily confused with *Entamoeba dispar*, a species which is identical in appearance but is not considered to be pathogenic (although it has recently been found in some diarrhoeic patients). The species *E. hartmanni* was originally thought to be a 'small race' of *E. histolytica*, but it has not been associated with disease. Another species *Entamoeba polecki* has occasionally been found in association with disease in pigs, monkeys and rarely humans. The species *Entamoeba moshkovskii* was originally only found in sewage, but it has also recently been found in symptomatic patients. *E. gingivalis* is found in the oral cavity of humans, sometimes in individuals with gum disease. The nonpathogenic species *E. coli* is commonly found in humans throughout the world. *Entamoeba invadens* is considered to be a serious pathogen of reptiles, especially in captive snakes and lizards. Other enteric amoebae found in humans, *Iodamoeba butschlii*, *Endolimax nana* and *Dientamoeba fragilis* (now considered to be a flagellate), are still considered to be nonpathogenic endocommensals.

***Entamoeba* species**	**Hosts**	**Location**	**Clinical signs**	**Distribution**
species with quadrinucleate mature cysts (*E. histolytica*-like group)				
E. anatis	Anseriformes: anatid (ducks); Otidiformes: otidid (bustards)	caecum	enteritis	South Africa, Asia, North America
E. bangladeshi	Primates: hominid (human)	large intestines	nonpathogenic	Bangladesh
E. ctenopharyngodoni	freshwater Cypriniformes: cyprinid (grass carp)	rectum	nonpathogenic	China
E. curens	Anura: ranid (pond frogs), bufonid (toads)	large intestines		India
E. dispar	Primates: hominid (human, chimpanzee), cercopithecid (red-tailed monkey, langurs, leaf monkeys, mandrill), atelid (woolly monkey), pitheciid (white-faced saki), hylobatid (siamang)	large intestines	nonpathogenic (but found in some patients with diarrhoea)	worldwide
E. ecuadoriensis	sewage	-	-	Ecuador
E. equi	Perissodactyla: equid (horse)	large intestines	enteritis	South America
E. hartmanni (syn. *E. minuta p.p., minutissima, tenuis*)	Primates: hominid (human), atelid (howler monkeys, woolly monkeys), cercopithecid (langurs, leaf monkeys, mandrill)	large intestines	nonpathogenic	worldwide
E. histolytica (syn. *E. africana, brasiliensis, caudata, dysenteriae, minuta p.p., nipponica, schaudinni, tetragena, venaticum*)	Primates: hominid (human), cercopithecid (langurs, colobus, leaf monkeys, rhesus, Barbary macaque, pig-tailed macaque, mandrill, patas monkey, DeBrazza's monkey, vervet monkey, grivet monkey, green monkey, white-nosed monkey, Campbell's monkey, Celebes crested macaque), atelid (howler monkey, spider monkeys, woolly monkeys), callitrichid (tamarins), lemurid (brown lemur); occasionally Carnivora: canid (dog), felid (cat); Artiodactyla: suid (pig), bovid (cattle); Rodentia: murid (rats, mice)	large intestines (may spread to soft tissues, esp. liver, brain)	dysentery, ulceration, abscesses	worldwide
E. ilowaiskii	Anura: ranid (pond frogs)	large intestines	pathogenic	unknown
E. insolita	Testudines: testudinid (tortoise)	large intestines	enteritis	unknown
E. invadens (syn. *E. serpentis*)	Serpentes: pythonid (African rock python, Indian python, blood python), colubrid (mussurana, indigo snake, black racer, eastern racer, Brazilian bird snake, Brazilian smooth snake, viperine snake,	intestines (may spread to soft tissues)	regurgitation, diarrhoea, tissue invasion	worldwide

	grass snake, king snake, garter snake, pond snake, striped house snake, water snakes); boid (tree boa, slender, boa constrictor, anaconda), elapid (spitting cobra, black-and-white cobra, black-necked cobra), viperid (copperhead, Gaboon viper, night adder); Sauria: anguid (slow-worm), lacertid (wall lizards), varanid (Komodo dragon, Bengal monitor, water monitor, lace monitor), scincid (blue-tongued skink), iguanid (green iguana), diplodactylid (crested geckos), sphenodontid (tuatara); Testudines: testudinid (red-footed tortoise, spider tortoise, giant tortoise), kinosternid (loggerhead musk turtle), emydid (wood turtle, painted turtle, box turtles), cheloniid (loggerhead sea turtle, green sea turtle); Crocodilia: crocodylid (crocodiles), alligatorid (alligator)			
E. knowlesi	Testudines: emydid (box turtle), platysternid (big-headed turtle)	large intestines	nonpathogenic	Asia
E. lagopodis	Anseriformes: anatid (ducks); Galliformes: phasianid (ptarmigans)	caecum	nonpathogenic	unknown
E. moshkovskii	sewage, recently in Primates: hominid (human)	large intestines	nonpathogenic (but found in some patients with diarrhoea)	Europe, North America, Africa, India, Australia
E. nuttali (syn. *E. ateles, cynomolgi, duboscqi*)	Primates: hominid (chimpanzee), cercopithecid (rhesus, macaques, baboon), plus experimental infection in Rodentia: cricetid (hamster)	large intestines	enteritis (may spread to soft tissues)	Japan, China, Sri Lanka
E. pyrrhogaster	Anura: ranid (pond frogs), bufonid (toads); Urodela: salamandrid (fire newts, crested newts)	large intestines	nonpathogenic	Asia
E. ranarum	Anura: ranid (pond frogs), Urodela: ambystomatid (mole salamander)	large intestines (may spread to soft tissues)	enteritis, extraintestinal lesions	worldwide
E. salpae	marine Perciformes: sparid (Salema porgy)	gut	nonpathogenic	Europe
E. terrapinae	Testudines: emydid (painted turtle)	colon	nonpathogenic	worldwide
E. testudinis	Testudines: testudinid (tortoises), emydid (painted turtle)	colon	nonpathogenic	unknown
E. varani	Sauria: varanid (Nile monitor)	colon	nonpathogenic	Africa
species with uninucleate mature cysts (*E. bovis*-like group)				
E. antelocaprae	Artiodactyla: bovid (antelope)	large intestines	lesions, inflammation	Americas
E. bovis	Artiodactyla: bovid (cattle, buffalo)	large intestines	nonpathogenic	Africa
E. bubalis	Artiodactyla: bovid (buffalo)	large intestines	nonpathogenic	Philippines
E. chattoni	Primates: cercopithecid (macaques, rhesus), occasionally hominid (human)	large intestines	nonpathogenic	Africa
E. dilimani (syn. *E. debliecki p.p.*)	Artiodactyla: bovid (goat)	large intestines	nonpathogenic	Philippines
E. gadi	marine Gadiformes: gadid (pollock)	rectum	nonpathogenic	North America
E. nezumia	marine Gadiformes: macrourid (grenadier)	stomach, intestines	nonpathogenic	North Atlantic
E. ovis (syn. *E. debliecki p.p.*)	Artiodactyla: bovid (sheep, goat)	large intestines	nonpathogenic	worldwide
E. pimelodi	freshwater Siluriformes: pimelodid (catfish)	gut	nonpathogenic	South America
E. polecki (syn. *E. debliecki p.p.*)	Artiodactyla: suid (pig), bovid (cattle, sheep, goat); Primates: cercopithecid	large intestines	subclinical, occasionally	South-East Asia, Americas, Europe,

	(macaques, langur), callitrichid (tamarins); occasionally hominid (human)		diarrhoea	Middle-East
E. suis (syn. *E. debliecki p.p.*)	Artiodactyla: suid (pig)	large intestines	nonpathogenic	Asia, Europe, Americas
E. struthionis	Struthioniformes: struthionid (ostrich)	large intestines	nonpathogenic	Europe
species with octonucleate mature cysts (*E. coli*-like group)				
E. chiropteris	Chiroptera: vespertilionid (lesser Asiatic yellow bat)	large intestines	nonpathogenic	India
E. citelli	Rodentia: sciurid (squirrel)	large intestines	nonpathogenic	unknown
E. cobayae (syn. *E. caviae*)	Rodentia: caviid (guinea pig)	large intestines	nonpathogenic	worldwide
E. coli (syn. *E. hominis, loeschi*)	Primates: hominid (human), atelid (howler monkeys, woolly monkeys), cercopithecid (langurs, redtail monkey, mandrill)	large intestines	nonpathogenic	worldwide
E. criceti	Rodentia: cricetid (hamster)	large intestines	nonpathogenic	unknown
E. cuniculi	Lagomorpha: leporid (rabbit)	large intestines	nonpathogenic	Russia, Korea
E. dipodomysi	Rodentia: heteromyid (kangaroo rat)	large intestines	nonpathogenic	North America
E. flaviviridis	Sauria: phyllodactylid (wall geckos), scincid (mabuya skinks)	intestines	nonpathogenic	Sudan
E. funambulae	Rodentia: sciurid (palm squirrel)	large intestines	nonpathogenic	India
E. gallinarum	Galliformes: phasianid (fowl)	caecum	nonpathogenic	worldwide
E. lacerticoli	Sauria: xantusiid (night lizard), iguanid (desert iguana, fence lizard, side-blotched lizard, zebra-tailed lizard, chuckwalla)	intestines	nonpathogenic	North America
E. marmotae	Rodentia: sciurid (marmot)	large intestines	nonpathogenic	unknown
E. muris (syn. *E. ratti*)	Rodentia: murid (rats, mice), cricetid (hamster)	large intestines, caecum	nonpathogenic	worldwide
E. wenyoni	Artiodactyla: bovid (goat), camelid (camel)	large intestines	nonpathogenic	unknown
species with cysts (number of nuclei unknown)				
E. chiangraiensis	freshwater Synbranchiformes: synbranchid (Asian swamp eel)	gut	nonpathogenic	Asia
species without cysts (*E. gingivalis*-like group)				
E. barreti	Testudines: chelydrid (snapping turtles)	colon	nonpathogenic	unknown
E. caprae	Artiodactyla: bovid (goat)	large intestines	nonpathogenic	unknown
E. gedoelsti (syn. *E. intestinalis*)	Perissodactyla: equid (horse)	caecum, large intestines	nonpathogenic	unknown
E. gingivalis (syn. *E. buccalis, canibuccalis, equibuccalis, maxillaris, suigingivalis*)	Primates: hominid (human), cercopithecid (macaques); Artiodactyla: suid (pig), Perissodactyla: equid (horse); Carnivora: canid (dog), felid (cat)	oral cavity	nonpathogenic (but found in some humans with gum disease)	worldwide
E. molae	marine Tetraodontiformes: molid (sunfish)	hindgut	nonpathogenic	North America
species for which cyst formation is uncertain				
E. synodontis	freshwater Siluriformes: mochokid (wahrindi)	gut	nonpathogenic	Africa

Parasite morphology: The parasite alternates between two different developmental stages: trophozoites and cysts. The trophozoites are irregular in shape measuring from 10-40 μm in diameter and contain a vesicular nucleus with a central endosome (karyosome), peripheral chromatin and radial achromatic fibrils (imparting a 'cart-wheel' appearance). Trophozoites have granular cytoplasm containing food vacuoles and invasive forms commonly engulf host erythrocytes. The trophozoites move by protoplasmic streaming and form single clear broad pseudopodia (lobopodia). The cysts are spherical measuring 10-16 μm in diameter and contain four nuclei when mature. Immature cysts may also contain a characteristic oblong chromatoid bar formed by semicrystalline aggregations of ribosomes.

Site of infection: Most *Entamoeba* spp. have been detected in the large intestines of their vertebrate hosts, often ranging from the caecum to the rectum. Several species have also been found in extra-intestinal locations, particularly soft tissues such as the liver and brain. *E. histolytica* trophozoites generally reside in the lumen of the large intestines but they may invade the colonic mucosa, perforate the gut and cause extra-intestinal lesions in other organs (especially liver, lungs and brain). Cysts are not formed in host tissues but are passed in faeces to the external environment.

Pathogenesis: In most infections, trophozoites stay confined to the gut lumen (effectively behaving as commensals) and do not cause any disease manifestations (asymptomatic). However, under certain conditions (still to be determined), *E. histolytica* trophozoites may adhere to colonic epithelial cells (using galactose-specific lectin receptors) and then invade the mucosa. This results in mild to severe clinical signs involving diarrhoea, amoebic dysentery (with mucus and blood), abdominal pain, weight loss and fatigue. Disease onset may be gradual over weeks, while disease duration may be persistent becoming worse with time. Invasion of the gut mucosa may cause flask-shaped erosive ulcers ('amoebomas') resulting in amoebic colitis. Trophozoites involved in tissue invasion are often observed to have ingested host erythrocytes. Parasite enzymes (such as cysteine proteases, lipases and amoebapores (pore-forming proteins)), normally used for digestive processes, may also cause lysis, necrosis and apoptosis of host cells. The species name '*histo-lytica'* literally means 'tissue-destroyer'. Considerable variation has been observed in the pathogenicity (virulence) of different isolates, with multiple mechanisms being implicated, including parasite adherence, multiplication, phagocytosis, cytolysis and immunomodulation. Invasive strains are resistant to complement-mediated lysis, but provoke cell-mediated inflammatory responses involving neutrophils and macrophages. Some infections may progress to extra-intestinal involvement when trophozoites penetrate the submucosa and disseminate via the circulation or lymphatics to other organs; mainly the liver via the portal circulation, but sometimes the lungs and occasionally the brain, heart, spleen or skin (*E. histolytica* causes SAM, secondary amoebic meningoencephalitis). The parasites may form space-occupying lesions or amoebic 'abscesses' up to several centimetres in diameter (not conventional abscesses as they are bacteriologically sterile). Liver disease is characterized by fever, hepatomegaly and abdominal pain. Ulcers and 'abscesses may perforate the lining of the infected organ and rupture into the peritoneum, pleural cavity or pericardium causing complicated infections, hyperaemia, acute inflammation with predominantly neutrophils, septicaemia and fatalities.

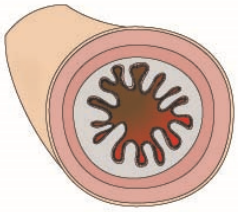
Developmental cycle and mode of transmission: Infections undergo faecal-oral transmission between hosts via the contamination of food and water by cysts from infected hosts and their subsequent ingestion by new susceptible hosts. *E. histolytica* trophozoites passing posteriad condense into spherical precysts (containing chromatoidal bars) which then mature into cysts (containing four nuclei). The cysts are very resistant to environmental conditions and may survive for months in suitable moist conditions, especially in the tropics. When cysts are ingested with contaminated food or water, excystation occurs within hours in the intestines and multiple trophozoites emerge from each cyst (nuclear division and cytokinesis may produce eight emergent trophozoites). The trophozoites colonize the large intestines over days where they feed and divide by binary fission. Rapid population growth may occur culminating in disease although the clinical course of infection generally becomes progressively worse over weeks. Most infections have been traced to human sources of infection, as many infected people are asymptomatic cyst-shedders who act as reservoir hosts. Nonetheless, zoonotic transmission from companion animals and vermin has been implicated epidemiologically, and coprophagous insects may help disseminate infections by mechanical transmission of cysts to food.

Differential diagnosis: Infections are conventionally diagnosed by repeated stool examinations for motile trophozoites and non-motile cysts. *E. histolytica* trophozoites may be detected by direct microscopy of fresh warm aliquots mixed with saline, but they rapidly lose their motility in aged, cooled or refrigerated samples. Similarly, aspirates of 'abscesses' must be examined quickly to detect haematophagous trophozoites. Amoebae can be cultured in various axenic or xenic (monophasic or diphasic) media to amplify their numbers. Most often, faecal samples are fixed to comply with transport and laboratory occupational health and safety requirements. Cysts can be concentrated from samples (ethyl acetate, formol-ether techniques) stained with iodine, or detected in permanent faecal smears stained with Trichrome or iron haematoxylin. Considerable expertise is required to differentiate pathogenic species from harmless commensals on the basis of nuclear and cyst morphology. Because cyst excretion can be intermittent, multiple faecal samples should be examined before amoebic infections can be ruled out. *E. histolytica, E. dispar, E. polecki* and *E. moshkovskii* all form medium-sized cysts with four nuclei, and can only be reliably differentiated by molecular characterization (isoenzymes, antigens or nucleotide sequences). *E. hartmanni* forms smaller cysts with four nuclei and *E. coli* forms larger cysts with up to eight nuclei. Serological tests for specific host antibodies (complement fixation, agglutination, fluorescence, and enzyme immuno-assays) have been developed to help diagnose invasive and/or extra-intestinal infections, but they cannot be used to detect asymptomatic carriers as lumen-only infections rarely elicit immunological responses. Monoclonal antibodies have been incorporated into several copro-antigen test kits, and immuno-chromatographic assays have been used to type parasite antigens. Isoenzyme electrophoresis (notably glucose phosphate isomerase, hexokinase, malic enzyme, and phosphoglucomutase zymodemes) have previously been used to differentiate amoebae species, but have now been superseded by polymerase chain reaction (PCR) amplification of unique nucleotide sequences (notably genes encoding rRNA or membrane antigens).

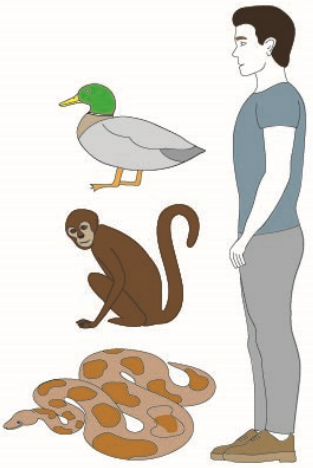
Human enteric amoebae	Cyst diameter	Number of nuclei per cyst	Nuclear characteristics	Erythrophagocytosis
Entamoeba histolytica	10-15 µm	4	cartwheel	present in invasive forms
Entamoeba dispar	10-15 µm	4	cartwheel	absent
Entamoeba moshkovskii	10-15 µm	4	cartwheel	absent
Entamoeba polecki	10-15 µm	4	cartwheel	absent
Entamoeba hartmanni	5-9 µm	4	cartwheel	absent
Entamoeba coli	15-30 µm	8	cartwheel	absent
Iodamoeba butschlii	9-15 µm	1	granular endosome	absent
Endolimax nana	6-9 µm	1	endosome halo	absent
Dientamoeba fragilis	no cyst		now considered to be a flagellate	

Treatment and control: Patients may be treated with luminal, hepatic and/or tissue amoebicides as warranted, although complete cure is difficult to attain. Older drugs such as emetine and dehydroemetine are still used intramuscularly, while oral 5-nitroimidazole formulations (metronidazole, tinidazole and ornidazole) are effective tissue amoebicides, sometimes in association with tetracycline. Chloroquine has been shown to kill amoebae in liver lesions but not elsewhere. Large hepatic 'abscesses' may require surgical drainage of the 'anchovy-sauce' pus. Paromomycin, diloxanide and iodoquinol have been used to treat luminal and asymptomatic infections. Disease has been strongly associated with poor sanitation, especially with respect to disposal of human faeces and the quality of water supplies. High infection rates have been found in orphanages, mental institutions, military camps and amongst lower socio-economic groups living in crowded conditions. Disease may be more severe in populations that subsist primarily on high carbohydrate and low protein diets. Control may be facilitated by maintaining high standards of hygiene, especially for those involved in food handling and preparation. Food should be protected from flies and cockroaches, and potable water supplies should be treated (filtration and/or chlorination). Water and sewer systems should be properly maintained and sewage treatment or faecal waste disposal/containment should be used to reduce environmental contamination.

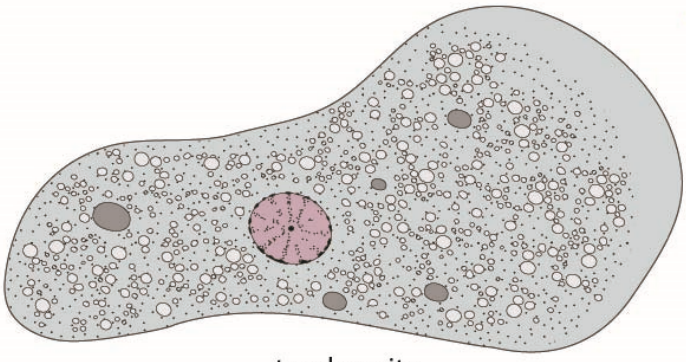
Entamoeba



colon
(dysentery, ulceration, hepatic abscesses, secondary amoebic meningoencephalitis)



Vertebrate Hosts
(mammals, some reptiles, birds))

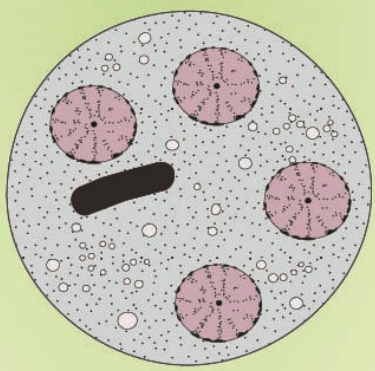


single clear lopopod

trophozoite
(10-40 µm)

cysts ingested

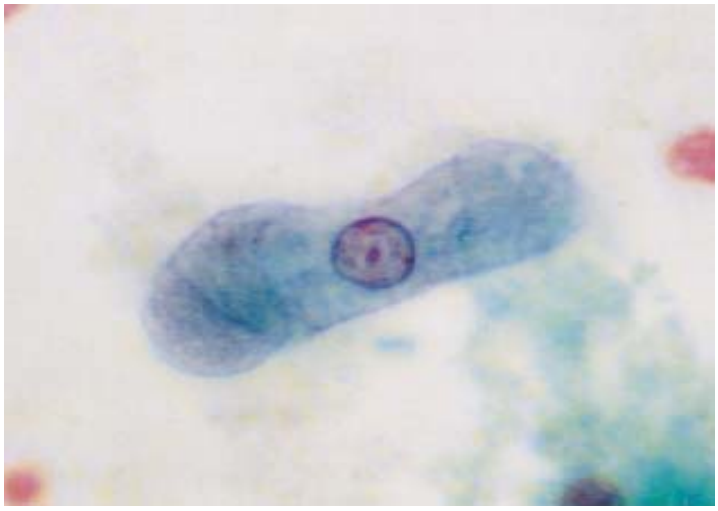
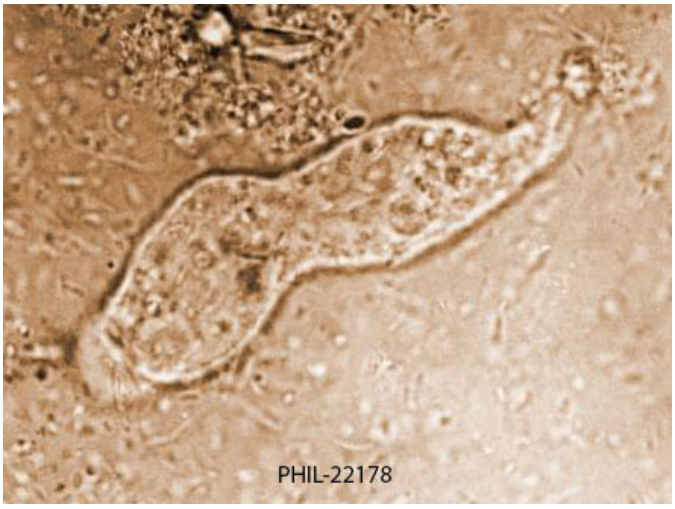
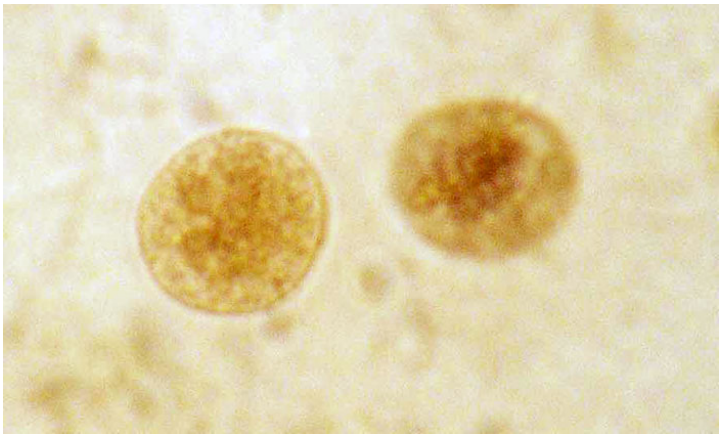
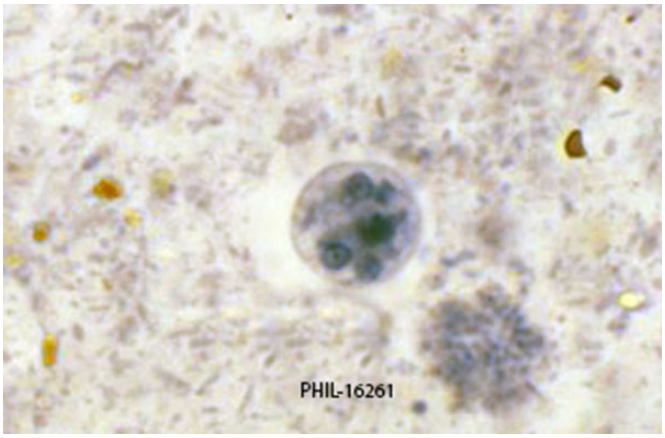
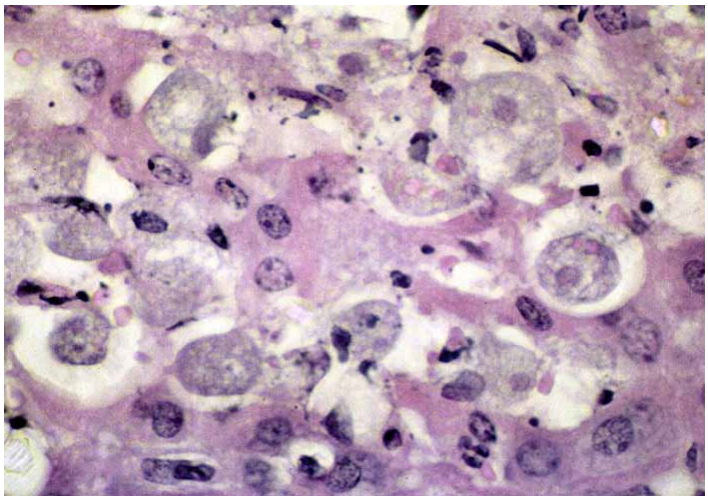
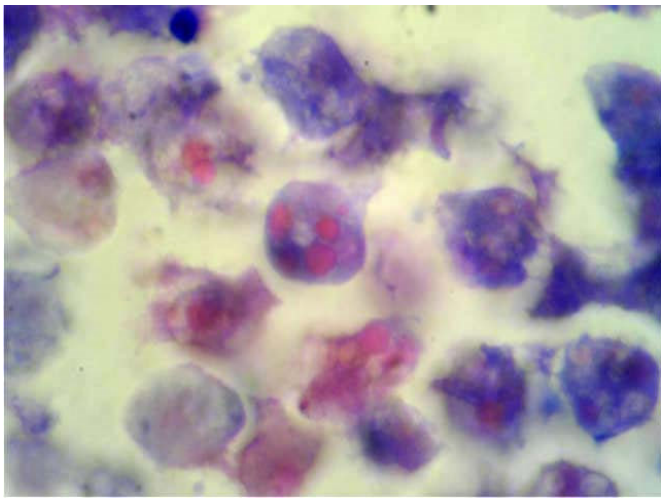
cysts excreted in faeces



often with chromatoid bar

cyst
(10-16 µm)

faecal-oral transmission
via contaminated food/water

	
Entamoeba trophozoite	*Entamoeba* trophozoite
	
Entamoeba cysts	*Entamoeba* cyst
	
Entamoeba liver lesion	*Entamoeba* brain lesion