

XV. The Amebas (Chapter 7) 2009

- A. Taxonomic relationships among the Protozoa
 - 1. Extensive recent revisions with data from...
 - a. Molecular biology
 - b. Comparative studies of organelle ultrastructure
 - 2. Some traditionally important structures are no longer considered important phylogenically
 - a. Pseudopodia are not homologous; they evolved more than once
 - b. Flagella are ancestral organelles common to all eukaryotes

Picture Slide Phylogeny of the Eukaryotes according to Adl et al, 2006; From Roberts & Janovy, 2009

- B. Obligate parasites/commensals
 - 1. Family Endamoebidae pp 107-116
 - 2. Typical life-cycle
 - a. TROPHOZOITE
 - (1) Motile stage
 - (2) Boundary is not rigid
 - b. CYST
 - (1) Surrounded by resistant membrane
 - (2) Adapted for survival outside host
 - c. Vector usually water
 - 3. Important structures
 - a. CHROMATOID BODIES
 - (1) Stain well
 - (2) Taxonomically useful
 - (3) Ribosomes assisting in protein metabolism
 - b. ENDOSOME: nucleolus
 - c. PSEUDOPOD = "False foot"
 - (1) Usually just one per individual in this family
 - (2) Retractable extrusion of cytoplasm
 - (3) Functions in locomotion & feeding

Picture Slide: Parasites & Hollywood, *The Blob* starring Steve McQueen

- 4. *Entamoeba histolytica*
 - a. Causes amebic dysentery
 - (1) aka = *invasive intestinal amebiasis*
 - (2) Prevalence about 10% in humans worldwide
 - b. Transmitted by cysts originating in fecal material

Picture Slide: Gary Larson

- c. Location
 - (1) Usually in ileum of small intestine and colon (= large intestine)
 - (2) Pathogenic form in almost any tissue
- d. Pathology
 - (1) Ranked 3rd (behind malaria & schistosomiasis) as eukaryotic parasitic cause of human death

- (2) Mucosal lining of intestine destroyed
- (3) Host cells attacked by chemical and mechanical (= phagocytosis) means
- (4) Once in blood, host organs are invaded & destroyed

Picture Slide: Hourglass ulcer in colon, Characteristic of *E. histolytica* infections; Fig. 7.5; p. 111

Picture Slide: Trophozoite of *E. histolytica* consuming red blood cells; Fig. 7.3; p. 109

Picture Slide: Trophozoite of *E. histolytica*, The single nucleus with its central endosome and regularly distributed chromatin is visible; approximate size = 22 microns;

http://www.dpd.cdc.gov/DPDx/HTML/ImageLibrary/FreeLivingAmebic_il.htm

Slide: Cysts of *E. histolytica*, These are mature cysts and contain four nuclei. However, only two to three nuclei are visible in this plane of focus; a chromatoid bar is still present in the cyst to the right; approximate size = 17 μ m.

http://www.dpd.cdc.gov/DPDx/HTML/ImageLibrary/FreeLivingAmebic_il.htm

Word Slide:

“... Without strict sanitary control the water-borne diseases such as typhoid fever and dysentery sapped the energy and caused thousands of deaths among white settlers. It is the prevalence of these diseases which accounts for the fact that Africa, although colonized along its northern shore by Greek and Roman, remained almost unknown territory until the end of the nineteenth century.”

Frederick Cartwright (1972) *Disease and History* p. 138.

5. *Entamoeba dispar*

- a. Commensal species
- b. Morphologically indistinguishable from *E. histolytica*
- b. Historically it was thought that one species, *E. histolytica*, occurred in 2 “forms”
 - (1) Benign commensal
 - (2) Pathogenic parasite
- c. 2 “forms” now thought to be 2 species that can be distinguished by...
 - (1) Biochemical methods
 - (2) Effect upon host
- d. Eats bacteria and fecal material

Picture Slide: Distinguishing *Entamoeba histolytica* from *E. dispar* using PCR; From Clark & Diamond, 1992, *Arch Med Res.* 23:15-16

6. *Entamoeba coli*

- a. Commensal
- b. Human, monkey & pig intestines
- c. Prevalence about 30% in humans.
- d. Cysts more resistant to desiccation than cysts of *E. histolytica*

Picture slide: Trophozoite of *E. coli*, The single nucleus with its eccentric endosome and irregular chromatin is visible; approximate size = 24 microns;

http://www.dpd.cdc.gov/DPDx/HTML/ImageLibrary/FreeLivingAmebic_il.htm

Picture Slide: Cyst of *E. coli*, Four nuclei and the the endosomes of two additional nuclei are visible in this plane of focus; approximate size = 24 μ m;

http://www.dpd.cdc.gov/DPDx/HTML/ImageLibrary/FreeLivingAmebic_il.htm

7. *Endolimax nana*

1. Non-pathogen
2. Cecum & large intestine of humans, monkeys & pigs
3. About half size of *E. histolytica*

Picture Slide: Trophozoite of *Endolimax nana*, The single nucleus with its large endosome can be seen. The nuclear membrane cannot be seen since there is little chromatin associated with it; approximate size = 12 μm .

http://www.dpd.cdc.gov/DPDx/HTML/ImageLibrary/FreeLivingAmebic_il.htm

8. *Iodamoeba buetschlii*
 - a. Large glycogen vacuole stains well with iodine.
 - b. Usually non-pathogenic
 - c. Large intestine of humans, monkeys and pigs

Picture Slide: Trophozoite of *Iodamoeba butschlii*, The single nucleus with its large endosome can be seen. The large glycogen vacuole, not always seen in trophozoites, is characteristic of the species; approximate size = 15 μm .

http://www.dpd.cdc.gov/DPDx/HTML/ImageLibrary/FreeLivingAmebic_il.htm

Picture Slide: Cyst of *Iodamoeba butschlii*, The large, characteristic glycogen vacuole, is the clear spherical organelle; approximate size = 15 μm .

http://www.dpd.cdc.gov/DPDx/HTML/ImageLibrary/FreeLivingAmebic_il.htm

C. Facultative parasites

1. *Naegleria fowleri*
 - a. Lives in fresh-water
 - b. Humans can acquire it while swimming
 - (1) Invades nose
 - (2) Follows olfactory nerve to brain
 - (3) Fatal if untreated

Picture Slide: Cribriform plate of human skull;

http://www.meddean.luc.edu/lumen/MedEd/grossanatomy/h_n/cn/cn1/cn1.htm

Picture Slide: Route of entry of *N. fowleri* into brain;

http://en.wikipedia.org/wiki/Olfactory_nerve

Picture Slide: *Naegleria fowleri*, *Naegleria fowleri* trophozoites, cultured from cerebrospinal fluid. These cells have characteristically large nuclei, with a large, dark staining karyosome. The amebae are very active and extend and retract pseudopods.

Trichrome stain. From a patient who died from primary amebic meningoencephalitis in Virginia. http://www.dpd.cdc.gov/DPDx/HTML/ImageLibrary/FreeLivingAmebic_il.htm

Picture Slide: *Naegleria fowleri*, *Naegleria fowleri* trophozoite in spinal fluid. Trichrome stain. Note the typically large karyosome and the monopodial locomotion.

http://www.dpd.cdc.gov/DPDx/HTML/ImageLibrary/FreeLivingAmebic_il.htm

2. *Acanthamoeba*
 - a. Lives in water & moist soils
 - b. Vector is contaminated contact lenses
 - c. Blindness occurs if untreated