Access to safe drinking water is everyone's right

Protozoa:

Protozoans that cause diarrheal disease

1. *Giardia lamblia*
2. *Entameba histolytica*
3. *Cryptosporidium parvum*
4. *Cyclospora cayetanensis*

Anton van Leeuwenhoek

This is what he saw in his own stool sample

Morphology

*Giardia lamblia*

Trophozoite  Cyst
Pathogenesis:

Trophozoite stage induces malabsorption of fats. Mechanism(s) unknown.

Histopathological correlate: Flattened villi

Clinical Disease:

Diarrhea (steatorrhea)
- Weight loss
- Constipation
- Fatigue
Diagnosis:
1. Identify trophozoites and cysts by microscopic examination of stool
2. Identify trophozoites on microscopic examination of fluid from string test.
3. Antigen Capture-ELISA from stool sample

Drug of choice: Metronidazole

Medical Ecology:
1. Reservoir hosts - beaver, dog
2. Day-care centers are common point sources for outbreaks.
3. Break-downs at filtration plants for drinking water supplies have led to major outbreaks.

Prevention and Control:
1. Sanitary disposal of feces
Prevention and Control (cont’d):

2. Safe drinking water supply - maintain watersheds or filter water.

3. Maintain good sanitary practices at day-care facilities - difficult to enforce among small children due to PICA

4. Don't drink unfiltered water from “pristine” rivers and streams while enjoying the great outdoors.

Pathogenesis:

1. Attachment of amebae to target cells mediated by galactose, then pore-forming protein disrupts target cell membrane:

Clinical Disease:

A. Intestinal:
   1. Diarrhea
   2. Dysentery (bloody diarrhea)

B. Extra-intestinal:
   1. Liver abscess (most common site)
   2. Lung abscess
   3. Brain abscess (usually fatal)

Gross pathology of large intestine due to Entameba histolytica

Flask-shaped ulcer due to infection with Entameba histolytica

Trophozoite of Entameba histolytica in situ in flask-shaped ulcer

Trophozoites of Entameba histolytica with RBCs in cytoplasm

Multiple abscesses in liver from a fatal case of Entameba histolytica
Diagnosis:

1. Identify trophozoites and/or cysts in feces. Cannot distinguish *E. histolytica* from *E. dispar* by morphology unless cytoplasm contains RBCs.

![Trophozoite and Cyst](Photo: CDC)

**Diagnosis (cont’d):**

2. Antigen Capture ELISA using stool sample
3. PCR
4. IHA serology:
   - Intestinal - 95% predictive of active infection
   - Extra-intestinal - 100% predictive of active infection

**Drugs of Choice:**

1. Intestinal:
   - Metronidazole and Iodoquinol

2. Extra-intestinal
   - High doses of Metronidazole

**Prevention and Control:**

Sanitary disposal of feces

**Cryptosporidium hominis**

**Species of Cryptosporidium capable of infecting humans**

- Chalmers RM, Souter A, Thomas AL, Guy EC, Mason B, UK Cryptosporidium Reference Unit. NPHS Microbiology Swansea, Singleton Hospital, Swansea, United Kingdom. rachel.chalmers@nphs.wales.nhs.uk
- To improve understanding of the epidemiology and epidemiology of human cryptosporidiosis, over 8,000 Cryptosporidium isolates were submitted for typing to the species level over a four year period. The majority were either *Cryptosporidium parvum* (45.9%) or *Cryptosporidium hominis* (49.2%). Dual infection occurred in 4% of cases, most commonly in *C. parvum* and *C. hominis*. Species were identified using a combination of sequence analysis and immunological techniques. The remaining 3.5% were not typable. Epidemiology differed between infecting species. *C. parvum* cases were younger, although *C. hominis* was more prevalent in infants under one year and in females aged 15 to 44 years. Spring peaks in cases reported to national surveillance were due to *C. parvum*, while *C. hominis* was more prevalent during the late summer and early autumn as well as in patients reporting recent foreign travel. Temporal and geographical differences were observed and a decline in *C. parvum* cases persisted from 2001. Typing of isolates allowed outbreaks to be more clearly delineated, and demonstrated anthroponotic spread of *C. parvum* as well as *C. hominis*. Our findings suggest that national surveillance for Cryptosporidium should be conducted at the species level.
Histologic section of small intestine of patient suffering from HIV/AIDS, infected with *Cryptosporidium hominis*.

**Pathogenesis:**

Secretory diarrhea. May produce up to 10 liters of watery stool per day! Mechanism unknown.

**Clinical Disease:**

Secretory diarrhea. In HIV(+) patients, this infection was often fatal. There are no drugs that are effective against it.

HAART therapy has essentially eliminated *C. hominis* from HIV/AIDS patients in USA.
Excellent Review of Diarrheal Diseases

Diagnosis:

Identify oocysts on microscopic examination.

A. acid fast-stain

B. Indirect Fluorescent Antibody test

New Treatment for Giardia and Cryptosporidium

Nitazoxanide is the only approved drug for treating infections with Cryptosporidium*

* Effective in non-HIV/AIDS patients only

Medical Ecology

1. Cryptosporidium sp. infect a wide variety of animals (birds and mammals), many of which can also infect humans.

2. Sucking farm animals (calves, kids, lambs) are potential sources of infection for urban centers that get their drinking water from reservoirs that are surrounded by farmland (e.g., NYC).
Prevention and Control:

1. Sanitary disposal of feces

Prevention and Control (cont’d):

2. Protect public drinking water supplies from contamination with animal feces by creating buffer zones between the reservoir and the watershed.

Pepacton Reservoir