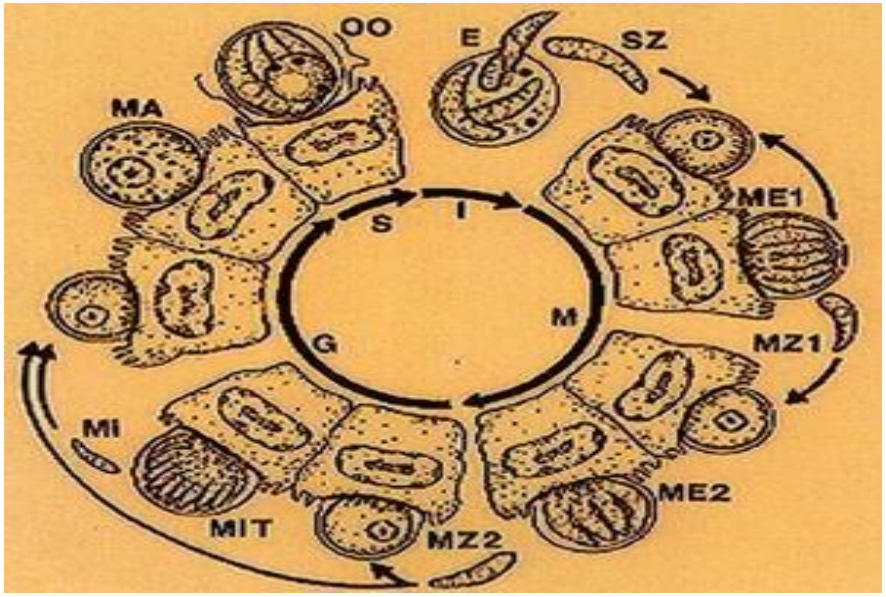
Cryptosporidium



Cryptosporidiosis

- Cryptosporidiosis, also known as crypto, is a parasitic disease caused by *Cryptosporidium*, a protozoan parasite in the phylum Apicomplexa. It affects the intestines of mammals and is typically an acute short-term infection. It is spread through the fecal-oral route, often through contaminated water, the main symptom is self-limiting diarrhea in people with intact immune systems. In immunocompromised individuals, such as ***AIDS*** patients,

- Cryptosporidium is a coccidian protozoan parasite that has gained much attention in the last 20 years as a clinically important human pathogen.
- But the first case of human cryptosporidiosis in 1976 involved a 3-year-old girl from rural Tennessee who suffered severe gastroenteritis for two weeks (Flanigan and Soave, 1993).

Geographic Distribution:

- Since the first reports of human cases in 1976, *Cryptosporidium* has been found worldwide. Outbreaks of cryptosporidiosis have been reported in several countries, the most remarkable being a waterborne outbreak in ***Milwaukee (Wisconsin) in 1993, that affected more than 400,000 people.***

Parasite Survives in spite of Chlorine treatment

- Many species of *Cryptosporidium* exist that infect humans and a wide range of animals. The parasite is protected by an outer shell that allows it to survive outside the body for long periods of time and makes it very resistant to chlorine disinfection.

Mode of infection

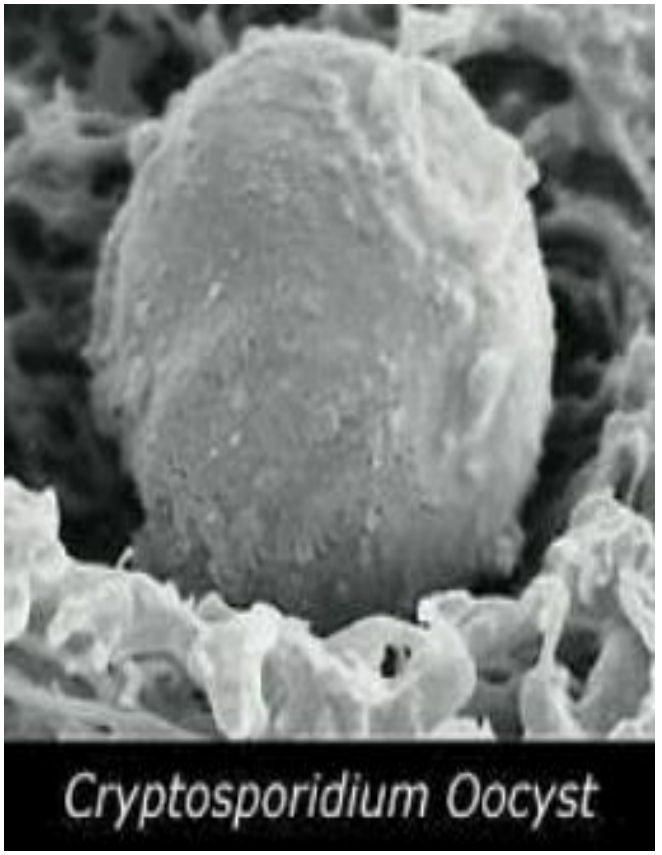
- **Swallowing** or putting something contaminated with cryptosporidium into your mouth
- **Drinking** water contaminated with cryptosporidium
- **Swimming** in water contaminated with cryptosporidium and accidentally swallowing some of it
- **Eating** uncooked food contaminated with cryptosporidium
- **Touching** your hand to your mouth if your hand has been in contact with a contaminated surface or object
- **Having close contact** with other infected persons.

Day care centers can spread the infection

- **Cryptosporidium** trans mission occurs at a high frequency in day-care centres, where infants or younger children are clustered within classrooms, share toilets and common play areas, or necessitate frequent diaper-changing (Keusch, *et al*., 1995).

Cryptosporidium cysts are hard to destroy

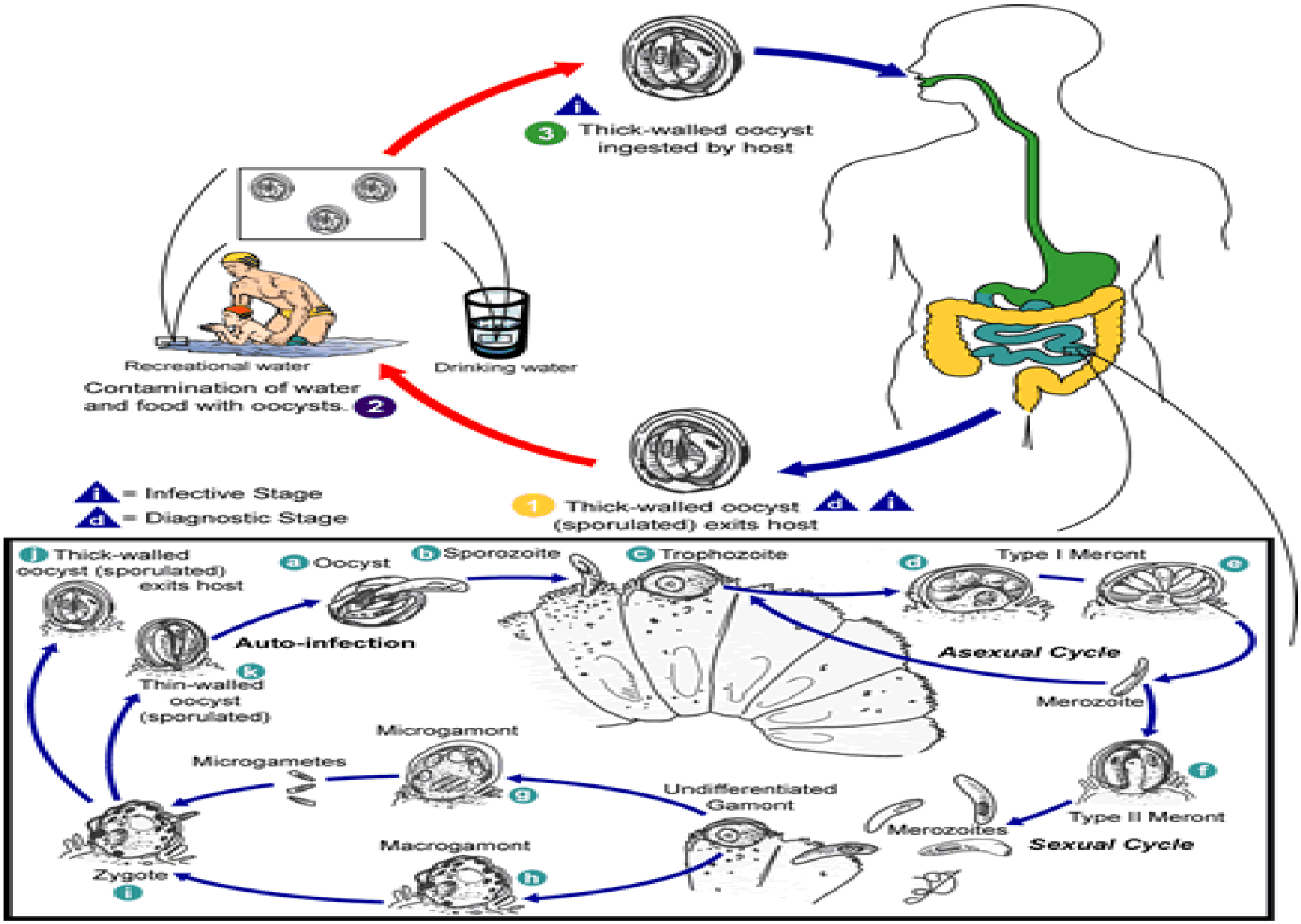
- *Cryptosporidium* can infect several different hosts, can survive most environments for long periods of time due to its "hardy cyst" (Keusch, et al., 1995), and inhabits all climates and locales.



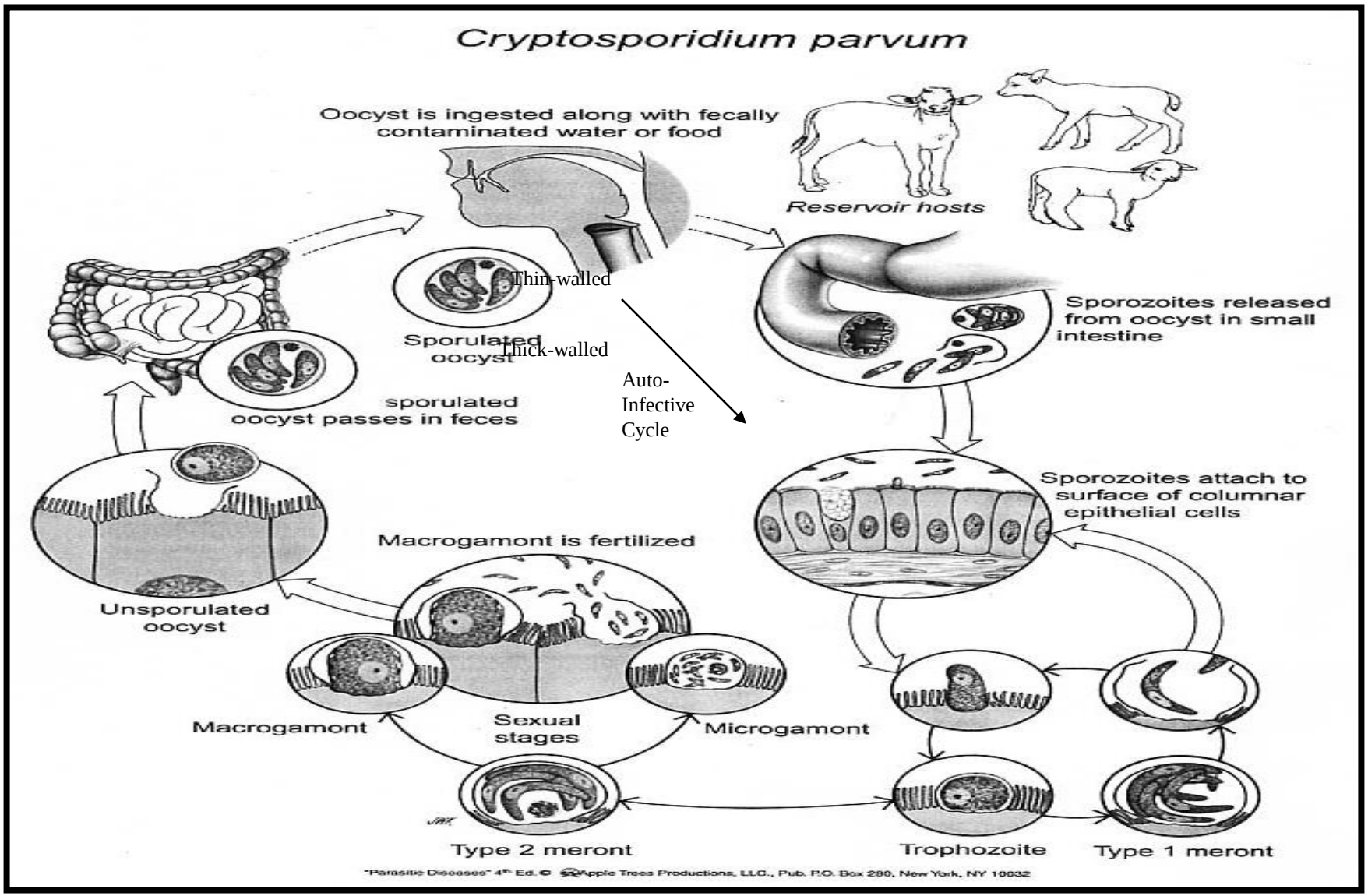
Cryptosporidium Oocyst

Life Cycle

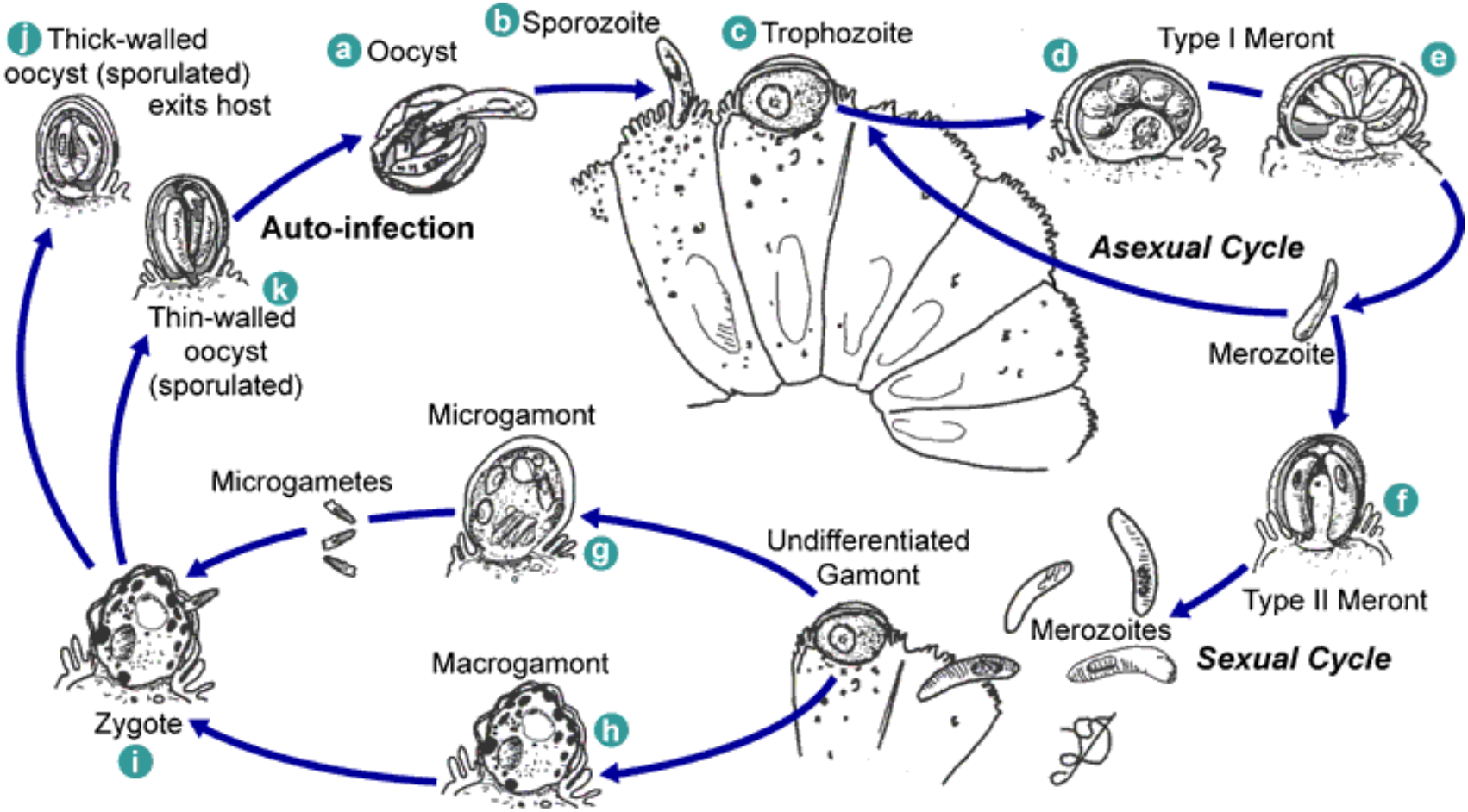
The parasite completes its life cycle, sexual and asexual phases in a single host Infection is acquired by ingesting the oocyst in contaminated food or drink.The oocyst contains four sporozoites which are released in the intestine. They infect the intestinal epithelial cells, they develop into trophozoites, which undergo asexual multiplication (schizogony) and release merozoites. These, in turn infect the neighboring epithelial cells and repeat schizogony. Some of merozoit develop into micro- and macro-gametocytes. After fertilisation, the zygote develops into the oocyst, which is shed in feces. Two different types of oocysts are produced,the thin-walled oocyst , which is primarily involved in autoinfection and the thick-walled,which is commonly excreted from the host , is infective immediately without further development. It can remain viable in the environment for long periods, as it is very hardy and resistant to most disinfectants and temperature up to 60°C. It can survive in chlorinated water, but sequential application of ozone and chlorine has been found effective.


3 Thick-walled oocyst ingested by host
Recreational water
Drinking water
Contamination of water and food with oocysts. 2
i = Infective Stage
d = Diagnostic Stage
1 Thick-walled oocyst (sporulated) exits host
j Thick-walled oocyst (sporulated) exits host
a Oocyst
b Sporozoite
c Trophozoite
d Type I Meront
e
Auto-infection
k Thin-walled oocyst (sporulated)
Asexual Cycle
Merozoite
Microgamont
Microgametes
f
Type II Meront
Undifferentiated Gamont
Merozoites
Sexual Cycle
Macrogamont
g
h
Zygote
i

Cryptosporidium parvum & hominis – Life cycle



Cycle of events in Intestines



Clinical Signs

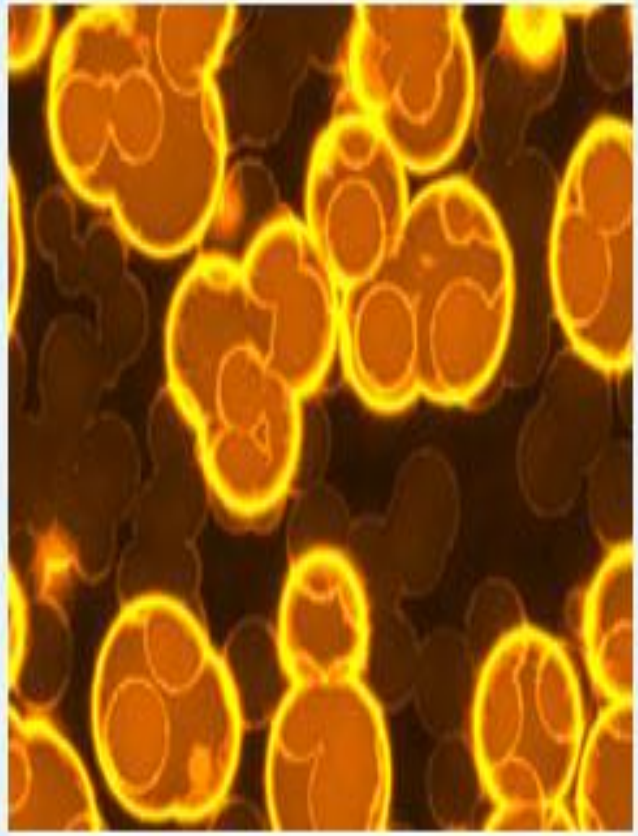
- Infection with *Cryptosporidium* sp. results in a wide range of manifestations, from asymptomatic infections to severe, life-threatening illness; incubation period is an average of 7 days (but can range from 2 to 10 days). Watery diarrhea is the most frequent symptom, and can be accompanied by dehydration, weight loss, abdominal pain, fever, nausea and vomiting.

Clinical Signs in Immunocompetent

- Frequent, watery diarrhea,Nausea,Vomiting
- Abdominal cramps,Low-grade fever
- While the small intestine is the site most commonly affected, symptomatic *Cryptosporidium* infections have also been found in other organs including other digestive tract organs, the lungs, and possibly conjunctivitis.

Several species of Cryptosporidium infects humans

- At least 8 of them have been reported in humans: C. hominis, C. parvum*, C. meleagrid is, C. felis, C. canis,C. m uris, and C.suis.



In immunocompromised persons

- Debilitating, cholera-like diarrhea (up to 20 liters/day)
- Severe abdominal cramps,Malaise,Low-grade fever
- Weight loss,Anorexia
- In immunocompetent persons, symptoms are usually short lived (1 to 2 weeks); they can be chronic and more severe in immunocompromised patients, especially those with CD4 counts <200/µl

Laboratory Diagnosis:

- **Acid-fast staining methods, with or without stool concentration**, are most frequently used in clinical laboratories. For greatest sensitivity and specificity, immunofluorescence microscopy is the method of choice
- Molecular methods are mainly a research tool.

Safety in handling Stool specimens

- Oocysts in stool specimens (fresh or in storage media) remain infective for extended periods. Thus stool specimens should be preserved in 10% buffered formalin or sodium acetate-acetic acid-formalin (SAF) to render oocysts nonviable.

Processing of Stool specimens

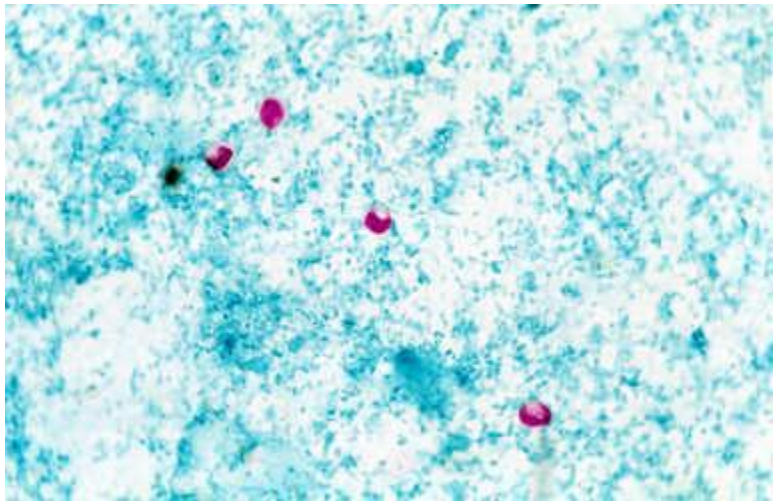
- Stool specimens may be submitted fresh, preserved in 10% buffered formalin (see above, “Safety”), or suspended in a storage medium composed of aqueous potassium dichromate (2.5% w/v, final concentration).
- Multiple stool samples should be tested before a negative diagnostic interpretation is reported. To maximize recovery of oocysts, stool samples should be concentrated prior to microscopic examination.

Shortcomings of oocyst concentration techniques are

- Sedimentation methods are generally performed using low speed centrifugation. Given their small size and mass, cryptosporidial oocysts may become trapped in the ether or ethyl acetate plug and fail to sediment properly. Increased centrifugation speed or time (500 × *g*, 10 minutes) may be warranted when attempting to recover cryptosporidial oocysts.
- Resolution of cryptosporidial infections is accompanied by increasing numbers of non-acid-fast, oocyst "ghosts." Such oocysts may not float or sediment as expected, giving rise to false-negative results.

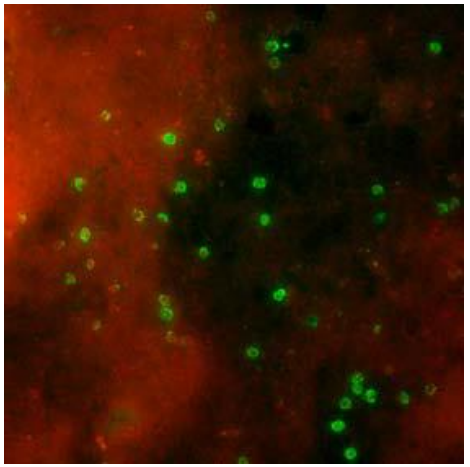
Modified acid-fast stain

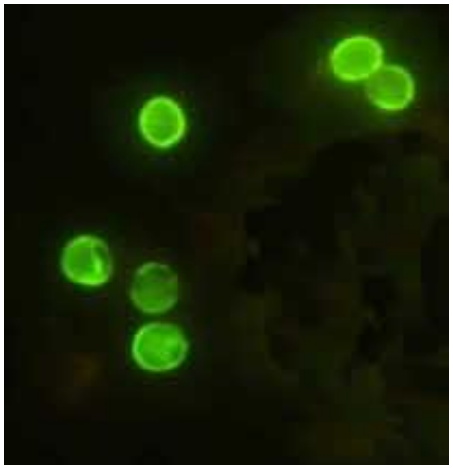
- Oocysts (4 to 6 µm) often have distinct oocyst walls and stain from light pink to bright red. However, staining may be variable. In particular, infections that are resolving can have colourless oocyst "ghosts." Mature oocysts may have discernible sporozoites



Direct fluorescent antibody (DFA) assay

- This technique offers the highest combination of sensitivity and specificity and is considered the gold standard by many laboratories. However, it does not provide a stained slide that can be archived.



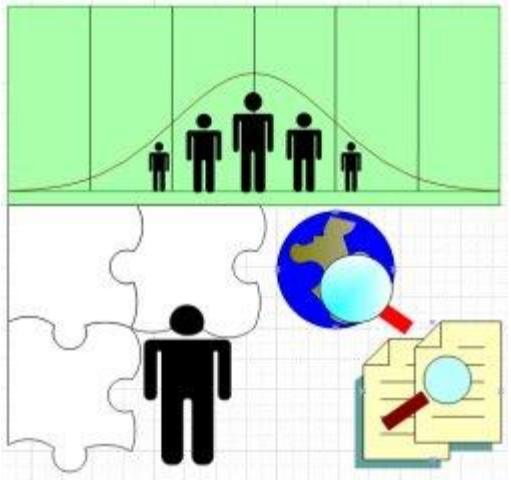


Other methods for detecting *Cryptosporidium* in stool.

- **Enzyme immunoassay (EIA)** The EIA does not rely on microscopy skills, is highly sensitive and specific, and is useful for screening large numbers of specimens.
- **Rapid immunochromatographic cartridge assays** The rapid cartridge assays may be used with preserved specimens and are quick and easy to perfor

Antibody Detection for Epidemiological studies

- Antibody detection: There are currently no commercially available serologic assays for the detection of *Cryptosporidium*-specific antibodies. However, immunoblots for detecting the 17 and 27 kDa sporozoite antigens associated with recent infection may be useful for epidemiologic investigations.

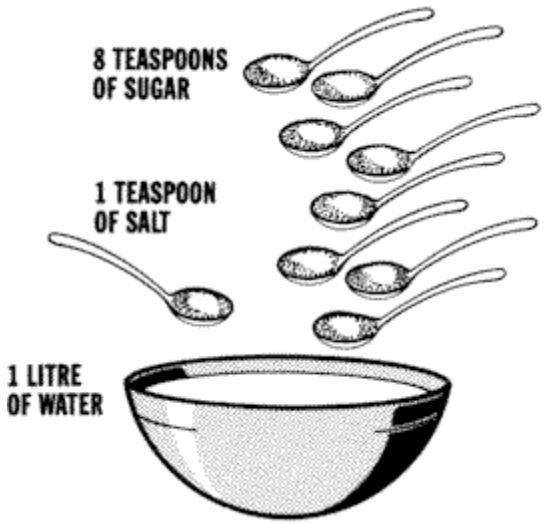


Real-Time PCR

- TaqMan-based real-time PCR assay for detection and speciation of *Cryptosporidium parvum* (bovine genotype) and *Cryptosporidium hominis* (human genotype) has been developed and validated at CDC. The assay combines the detection of two genomic targets: the 18S rRNA gene to achieve a sensitive detection of *Cryptosporidium* spp. and a gene with unknown function to provide species differentiation.

Oral rehydration is minimal essential treatment

- Since cryptosporidiosis is a self-limiting illness in immunocompetent individuals, general, supportive care is the only treatment for the illness. Oral or intravenous rehydration and replacement of electrolytes may be necessary for particularly voluminous, watery diarrhea.)



Oral rehydration treatment

- Oral rehydration treatment can include oral rehydration solution, containing glucose, sodium bicarbonate, and potassium (Flanigan and Soave, 1993)

Treatment

- There's no specific treatment for cryptosporidiosis, and recovery usually depends on the health of patient’s immune system. Most healthy people recover within two weeks without medical attention.
- The goal of treatment is to alleviate symptoms and improve your immune response.

Treatment in Immunosupressed

- Immunocompromised persons and those in poor health are at highest risk for severe illness. The effectiveness of nitazoxanide in Immunosuppressed persons is unclear. For persons with AIDS, anti-retroviral therapy, which improves immune status, will also reduce oocyst excretion and decrease diarrhea associated with cryptosporidiosis.

Cryptosporidium treatment options include

- **Anti-parasitic drugs.** Medications such as nitazoxanide (Alinia) can help alleviate diarrhea by attacking the metabolic processes of the cryptosporidium organisms. Azithromycin may be given along with one of these medications in people with compromised immune systems.