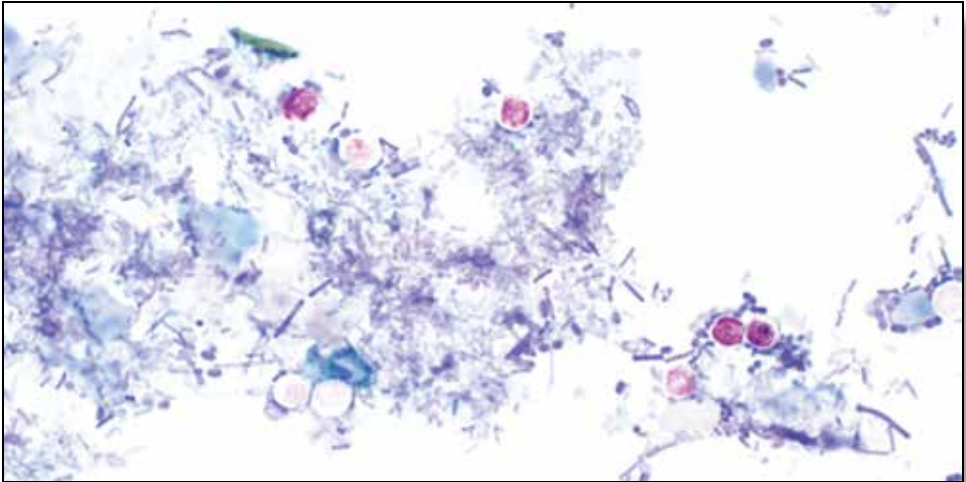


## Cryptosporidium species

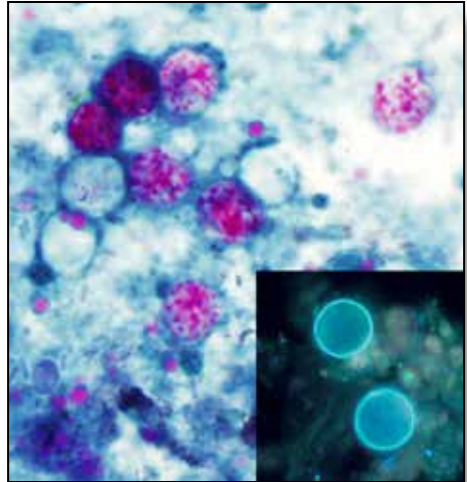
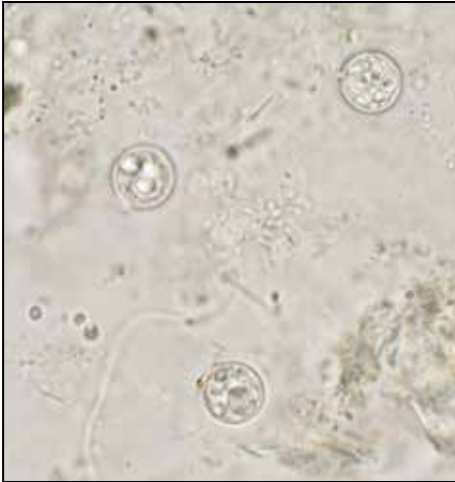


**Microscopic Morphology:** Oocysts are round to oval and measure 3–6  $\mu\text{m}$  in diameter (usual range 4–5  $\mu\text{m}$ ) and are clear to pink or dark pink/red on modified acid-fast stain. Oocysts contain four sporozoites that may occasionally be seen inside the oocyst.

**Clinical:** Infection is often asymptomatic but may result in watery diarrhea, abdominal pain, nausea and vomiting, and fever. Diarrhea and resultant dehydration may be life-threatening in immunocompromised patients, including those with AIDS.

**Comment:** *Cryptosporidium parvum* and *C. hominis* are the most common species to infect humans, although many zoonotic species are capable of infecting humans. Oocysts are not reliably detected on unstained and routine permanent stain preparations but stain well with a modified acid-fast stain. However, the preferred method for identification is immunofluorescent microscopy or enzyme immunoassay. Nucleic acid amplification methods are also commercially available.

## *Cyclospora cayetanensis*

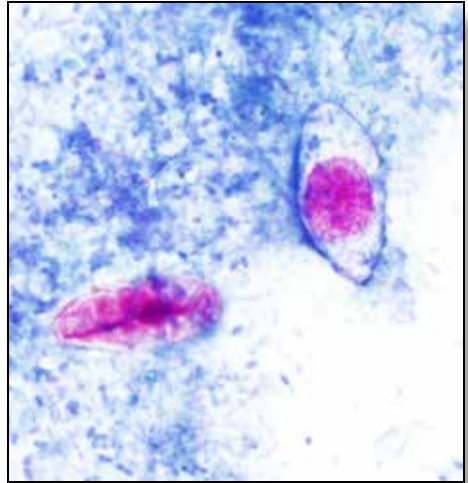
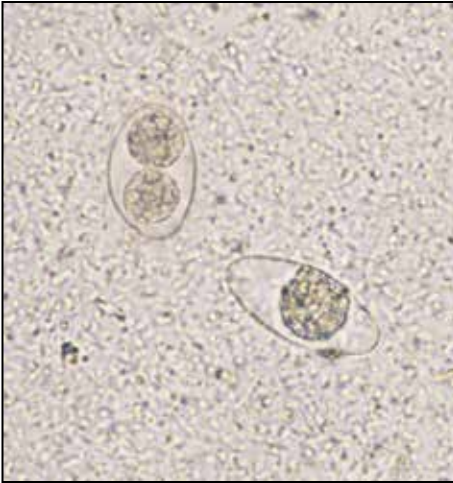


**Microscopic Morphology:** Oocysts are round to oval and measure 7–10  $\mu\text{m}$  in diameter (usual range 8–10  $\mu\text{m}$ ). They are shed in an unsporulated form so that internal sporozoites are not typically seen in stool unless there is a substantial delay in processing. Globular material is commonly seen in unsporulated forms in unstained wet preparations (above left). The oocysts are clear (unstained "ghost" cells) to pink or bright pink/red on modified acid-fast (above right) and modified safranin stains. Oocysts strongly autofluoresce under UV epifluorescence (above right, inset).

**Clinical:** Manifestations of infection ranges from asymptomatic to severe, with watery diarrhea, anorexia, weight loss, abdominal pain, myalgias, nausea, vomiting, fatigue, and low-grade fever. Infections are rare in the US and are typically associated with ingestion of contaminated fruits and vegetables imported from endemic areas. Immunocompromised patients, including those with AIDS, may experience prolonged infection. Although microscopy is considered the gold standard for detection; nucleic acid amplification methods are also commercially available.

Photo credit (fluorescent oocysts): DPDx - Laboratory identification of parasitic diseases of public health concern. Centers for Disease Control and Prevention Website. Available at: <http://www.cdc.gov/dpdx/>.

## *Cystoisospora (Isospora) belli*

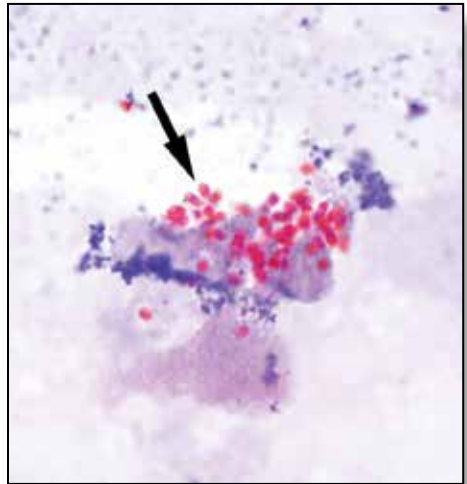
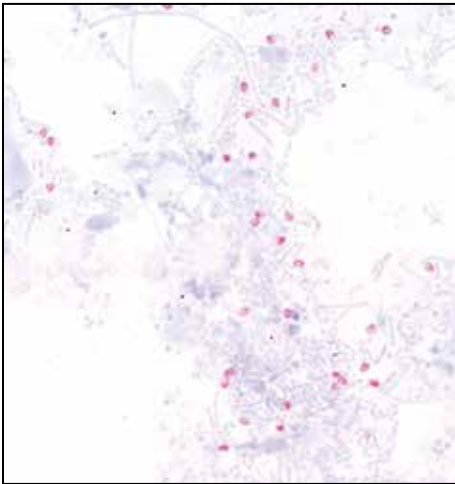


**Microscopic Morphology:** Oocysts are ellipsoidal, measure 25–30  $\mu\text{m}$  in greatest dimension (usual range 28–30  $\mu\text{m}$ ), and may contain zero to two sporocysts, each with four sporozoites. They are readily identified on wet mount (above left) and stain bright red/pink on modified acid-fast stain (above right). Accompanying eosinophils and/or Charcot-Leyden crystals may be seen.

**Clinical:** Infection typically causes watery diarrhea with malabsorption, weight loss and abdominal pain. Infection may be severe in immunocompromised patients.

**Comment:** Unlike other protozoal infections, cystoisosporiasis may be associated with eosinophilia.

## Microsporidia

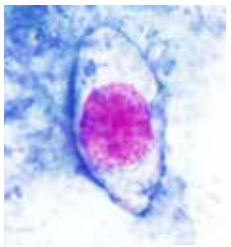
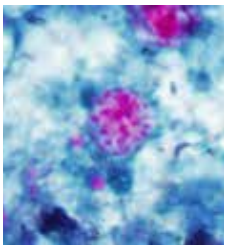




**Microscopic Morphology:** Spores are oval to ellipsoidal and are very small (0.8–4.0  $\mu\text{m}$  in greatest dimension). Size may vary with species. They stain bright red/pink using a chromotrope 2R stain such as the trichrome blue stain. They frequently exhibit a belt-like stripe in the center of the spore (above right, arrow) that helps to differentiate them from similarly-sized, paler-staining yeasts.

**Clinical:** Microsporidia can infect a wide variety of organs, causing diarrhea (most common), acalculous cholecystitis, myositis, and keratoconjunctivitis. Infection may cause debilitating diarrhea in patients with AIDS.

**Comment:** Microsporidia are obligate intracellular organisms that were previously thought to be protozoan parasites but are now known to be highly specialized fungi. They are included in this bench guide since testing for them is still commonly performed in the parasitology laboratory. The phylum Microsporidia includes multiple species of which *Encephalitozoon* spp. and *Enterocytozoon bieneusi* are among the most common to infect humans. Due to their small size, microscopic identification requires special stains, including the chromotrope 2R method and its modifications. Spores will not stain with the modified acid-fast stain used for *Cryptosporidium*. It is not possible to reliably differentiate the various microsporidia by microscopy.

# Coccidia and Microsporidia

Relative Size of Coccidia and Microsporidia			
			
<i>Cystoisospora belli</i> oocysts Modified acid-fast stain	<i>Cyclospora cayetanensis</i> oocysts Modified acid-fast stain	<i>Cryptosporidium</i> spp. oocysts Modified acid-fast stain	Microsporidia spores (chromotrope 2R stain)

Scale 10 μm