

# Giardia

From Wikipedia, the free encyclopedia

***Giardia*** (/dʒiːˈɑːrdiə/ or /ˈdʒɑːrdiə/) is a genus of anaerobic flagellated protozoan parasites of the phylum Sarcomastigophora that colonise and reproduce in the small intestines of several vertebrates, causing giardiasis. Their life cycle alternates between an actively swimming trophozoite and an infective, resistant cyst. *Giardia* were first described by the Dutch microscopist Antonie van Leeuwenhoek in 1681.<sup>[1]</sup> The genus is named after French zoologist Alfred Mathieu Giard.<sup>[2]</sup>

## Contents

- 1 Characteristics
- 2 Infection and symptoms
- 3 Prevention
- 4 Systematics
- 5 Genome
- 6 See also
- 7 References
- 8 External links

## Characteristics

Like other diplomonads, *Giardia* have two nuclei, each with four associated flagella, and were thought to lack both mitochondria and a Golgi apparatus. However they are now known to possess a complex endomembrane system as well as mitochondrial remnants, called mitosomes, through mitochondrial reduction.<sup>[3]</sup><sup>[4]</sup><sup>[5]</sup> The mitosomes are not used in ATP synthesis the way mitochondria are, but are involved in the maturation of iron-sulfur proteins.<sup>[6]</sup> The synapomorphies of genus *Giardia* include cells with duplicate organelles, absence of cytostomes, and ventral adhesive disc.<sup>[7]</sup>

## Infection and symptoms

*Giardia* lives in the intestines of infected humans or other animals, individuals of which become infected by ingesting or coming into contact with contaminated foods, soil, or water tainted by the feces of an infected carrier.<sup>[8]</sup>

The symptoms of *Giardia*, which may begin to appear 2 days after infection, include violent diarrhea, excess gas, stomach or abdominal cramps, upset stomach, and nausea. Resulting dehydration and nutritional loss may

*Giardia*



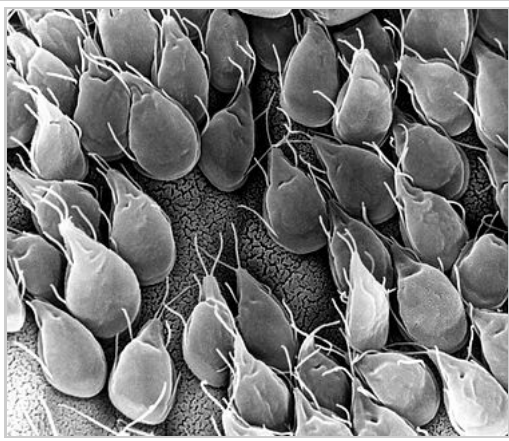
*Giardia* trophozoite, SEM

### Scientific classification

Domain: Eukaryota  
(unranked): Excavata  
Phylum: Sarcomastigophora  
Class: Zoomastigophora  
Order: Diplomonadida  
Family: Hexamitidae  
Genus: *Giardia*  
Künstler, 1882

### species

*Giardia agilis*  
*Giardia ardeae*  
*Giardia lamblia*  
*Giardia microti*  
*Giardia muris*  
*Giardia psittaci*



An SEM micrograph of the small intestine of a gerbil infested with *Giardia* reveals a mucosa surface almost entirely obscured by attached trophozoites

need immediate treatment. A typical infection can be slight, resolve without treatment, and last between 2–6 weeks, although it can sometimes last longer and/or be more severe. Coexistence with the parasite is possible (symptoms fade), but an infected individual can remain a carrier and transmit it to others. Medication containing tinidazole or metronidazole decreases symptoms and time to resolution. Albendazole is also used, and has an anti-helminthic (anti-worm) property as well, ideal for certain compounded issues when a general vermifugal agent is preferred. *Giardia* causes a disease called Giardiasis, which causes the villi of the small intestine to atrophy and flatten, resulting in malabsorption in the intestine. Lactose intolerance can persist after the eradication of *Giardia* from the digestive tract.<sup>[9]</sup>

## Prevention

Person-to-person transmission accounts for the majority of *Giardia* infections and is usually associated with poor hygiene and sanitation. *Giardia* is found on the surface of the ground, in the soil, in undercooked foods, and water along with improper cleaning of fecal material from the hands after handling infected feces.<sup>[10]</sup> Water-borne transmission is associated with the ingestion of contaminated water. In the U.S., outbreaks typically occur in small water systems using inadequately treated surface water. Venereal transmission happens through fecal-oral contamination. Additionally, diaper changing and inadequate hand washing are risk factors for transmission from infected children. Lastly, food-borne epidemics of *Giardia* have developed through the contamination of food by infected food-handlers.<sup>[11]</sup>

The CDC recommends hand-washing and avoiding potentially contaminated food and untreated water.<sup>[12]</sup>

Boiling suspect water for one minute is the surest method to make water safe to drink and kill disease-causing microorganisms such as *Giardia lamblia* if in doubt about whether water is infected.<sup>[13]</sup> Chemical disinfectants or filters may be used.<sup>[14][15]</sup>

According to a review of the literature from 2000, there is little evidence linking the drinking of water in the N. American wilderness and Giardia.<sup>[16]</sup> The researcher notes that treatment of drinking water for *Giardia* may not be as important as recommended hand-washing in wilderness regions in North America.<sup>[16]</sup> CDC surveillance data (for 2005 and 2006) reports one outbreak (6 cases) of waterborne giardiasis contracted from drinking wilderness river water in Colorado.<sup>[17]</sup> However, less than 1% of reported giardiasis cases are associated with outbreaks.<sup>[18]</sup>

## Systematics

About 40 species have been described from different animals, but many of them are probably synonyms.<sup>[19]</sup> Currently, five to six morphologically distinct species are recognised.<sup>[20]</sup> *Giardia lamblia* (= *G. intestinalis*, = *G. duodenalis*) infect humans and other mammals, *G. muris* is found from other mammals, *G. ardeae* and *G. psittaci* from birds, *G. agilis* from amphibians and *G. microti* from voles.<sup>[2]</sup> Other described, (but not certainly valid) species include:<sup>[21]</sup> Many different species of *Giardia* exist and to discriminate between species very specific PCR (Polymerase Chain Reactions) have been developed to detect specific *Giardia* spp. Gene probe-based detection is also used to differentiate between species of *Giardia*. A more common and less time

consuming means of identifying different species of *Giardia* includes microscopy and immunofluorescence techniques.<sup>[22]</sup>

- *Giardia beckeri*
- *Giardia beltrani*
- *Giardia botauri*
- *Giardia bovis*
- *Giardia bradypii*
- *Giardia canis*
- *Giardia caprae*
- *Giardia cati*
- *Giardia caviae*
- *Giardia chinchillae*
- *Giardia dasi*
- *Giardia equi*
- *Giardia floridae*
- *Giardia hegneri*
- *Giardia herodiadis*
- *Giardia hyderabadensis*
- *Giardia irarae*
- *Giardia marginalis*
- *Giardia melospizae*
- *Giardia nycticori*
- *Giardia ondatrae*
- *Giardia otomyis*
- *Giardia pitymysi*
- *Giardia pseudoardeae*
- *Giardia recurvirostrae*
- *Giardia sanguinis*
- *Giardia serpentis*
- *Giardia simoni*
- *Giardia sturnellae*
- *Giardia suricatae*
- *Giardia tucani*
- *Giardia varani*
- *Giardia viscaciae*
- *Giardia wenyoni*

Genetic and biochemical studies have revealed the heterogeneity of *Giardia lamblia*, which contains probably at least eight lineages or cryptic species.<sup>[23]</sup>

## Genome

A *Giardia* isolate (WB) was the first diplomonad to have its genome sequenced. Its 11.7 million basepair genome is compact in structure and content with simplified basic cellular machineries and metabolism. Currently the genomes of several other *Giardia* isolates and diplomonads (the fish pathogens *Spironucleus vortens* and *S. salmonicida*) are being sequenced.<sup>[24]</sup>

A second isolate (the B assemblage) from humans has been sequenced along with a species from a pig (the E assemblage).<sup>[25]</sup> There are ~5000 genes in the genome. The E assemblage is more closely related to the A assemblage than is the B. A number of chromosomal rearrangements are present.

## See also

- List of parasites (human)

## References

1. Stanley L. Erlandsen; Ernest A. Meyer (1 March 1984). *Giardia and Giardiasis: Biology, Pathogenesis, and Epidemiology*. Springer. pp. 131–. ISBN 978-0-306-41539-5.
2. Adam RD (July 2001). "Biology of *Giardia lamblia*". *Clin. Microbiol. Rev.* **14** (3): 447–75. doi:10.1128/CMR.14.3.447-475.2001. PMC 88984. PMID 11432808.
3. Anna Karnkowska; et al. (May 2016). "A Eukaryote without a Mitochondrial Organelle". *Current Biology*.
4. Soltys BJ, Falah M, Gupta RS (July 1996). "Identification of endoplasmic reticulum in the primitive eukaryote *Giardia lamblia* using cryoelectron microscopy and antibody to Bip". *J. Cell. Sci.* **109** (Pt 7): 1909–17. PMID 8832413.
5. Dolezal P; Smíd O; Rada P; et al. (August 2005). "Giardia mitochondria and trichomonad hydrogenosomes share a common mode of protein targeting". *Proc. Natl. Acad. Sci. U.S.A.* **102** (31): 10924–9. doi:10.1073/pnas.0500349102. PMC 1182405. PMID 16040811.

6. Tovar J, et al. (2003). "Mitochondrial remnant organelles of Giardia function in iron-sulphur protein maturation". *Nature*. **426** (6963): 172–6. doi:10.1038/nature01945. PMID 14614504.
7. Cepicka, Ivan (September 2008). "Fornicata". *Tree of Life Web Project*.
8. Filice, F.P. (1952). "Studies on the cytology and life history of a *Giardia* from the laboratory rat". *U. C. Publications in Zoology*. Berkeley CA: University of California Press. 5sex7 (2).
9. LaCour 2003
10. CDC Giardia 2011
11. *Giardiasis* (<http://emedicine.medscape.com/article/176718-overview>) at eMedicine
12. "Parasites - Giardia, Prevention & Control". *Centers for Disease Control and Prevention*. CDC. Retrieved 26 April 2015.
13. "Emergency Disinfection of Drinking Water". United State Environment Protection Agency. Retrieved 21 June 2015. Retrieved 24 February 2011
14. Betancourt, WQ; Rose, JB (2004). "Drinking water treatment processes for removal of Cryptosporidium and Giardia". *Veterinary parasitology*. **126** (1–2): 219–34. doi:10.1016/j.vetpar.2004.09.002. PMID 15567586.
15. Exner, M; Gornik, V (2004). "Parasitic zoonoses transmitted by drinking water. Giardiasis and cryptosporidiosis". *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz*. **47** (7): 698–704. doi:10.1007/s00103-004-0863-y. PMID 15254826.
16. Welch TP (2000). "Risk of giardiasis from consumption of wilderness water in North America: a systematic review of epidemiologic data". *International Journal of Infectious Diseases*. **4** (2): 100–3. doi:10.1016/S1201-9712(00)90102-4. PMID 10737847.
17. Yoder, J; Roberts, V; Craun, GF; Hill, V; Hicks, LA; Alexander, NT; Radke, V; Calderon, RL; Hlavsa, MC; Beach, MJ; Roy, SL (Sep 12, 2008). "Surveillance for waterborne disease and outbreaks associated with drinking water and water not intended for drinking—United States, 2005–2006.". *Morbidity and mortality weekly report. Surveillance summaries (Washington, D.C.: 2002)*. Centers for Disease Control and Prevention, (CDC). **57** (9): 39–62. PMID 18784643.
18. Giardiasis Surveillance—United States, 2009–2010 (<http://www.cdc.gov/mmwr/preview/mmwrhtml/ss6105a2.htm>)
19. Meyer E.A.; Radulescu S. (1979). "*Giardia* and Giardiasis". *Advances in Parasitology*. **17**: 1–47. doi:10.1016/S0065-308X(08)60548-5. PMID 395833. "no"
20. Brusca, R.C.; Brusca, G.J. (2003). *Invertebrates* (2nd ed.). Sinauer Associates. ISBN 0878930973.
21. "Giardia Kunstler". *Tree of Life Web Project*. September 2008.
22. Mahbubani 1992
23. Thompson RC, Monis PT (2004). "Variation in Giardia: implications for taxonomy and epidemiology". *Adv. Parasitol.* **58**: 69–137. doi:10.1016/S0065-308X(04)58002-8. PMID 15603762.
24. Andersson, JO; et al. (2010). "The Genome of Giardia and Other Diplomonads". *Anaerobic Parasitic Protozoa: Genomics and Molecular Biology*. Caister Academic Press. ISBN 978-1-904455-61-5.
25. Jerlström-Hultqvist J, Ankarklev J, Svärd SG (2010). "Is human giardiasis caused by two different Giardia species?". *Gut Microbes*. **1** (6): 379–82. doi:10.4161/gmic.1.6.13608. PMC 3056102. PMID 21468219.

## External links

- "Giardia". *Parasites*. Centers for Disease Control and Prevention. March 2011.
- Mahbubani MH, Bej AK, Perlin MH, Schaefer FW, Jakubowski W, Atlas RM (January 1992). "Differentiation of *Giardia duodenalis* from other Giardia spp. by using polymerase chain reaction and gene probes". *J. Clin. Microbiol.* **30** (1): 74–8. PMC 264999. PMID 1734070.
- LaCour, Michelle (2003). "Who Is Giardia?". *GIARDIA*. Stanford University.
- "*Giardia*". *NCBI Taxonomy Browser*. 5740.

Retrieved from "https://en.wikipedia.org/w/index.php?title=Giardia&oldid=757998726"

Categories: Metamonads | Excavata genera | Microscopic organisms described by Antonie van Leeuwenhoek

- This page was last modified on 2 January 2017, at 22:44.
- Text is available under the [Creative Commons Attribution-ShareAlike License](#); additional terms may apply. By using this site, you agree to the [Terms of Use](#) and [Privacy Policy](#). **Wikipedia®** is a registered trademark of the [Wikimedia Foundation, Inc.](#), a non-profit organization.