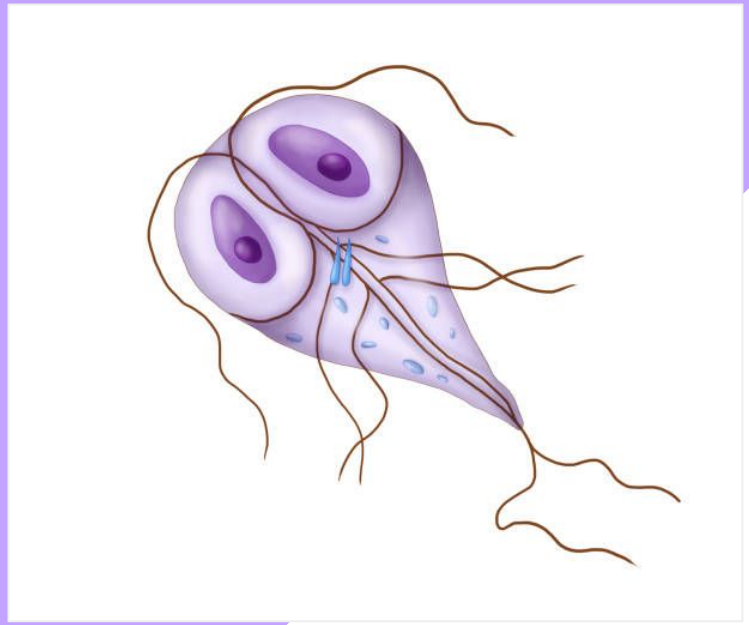
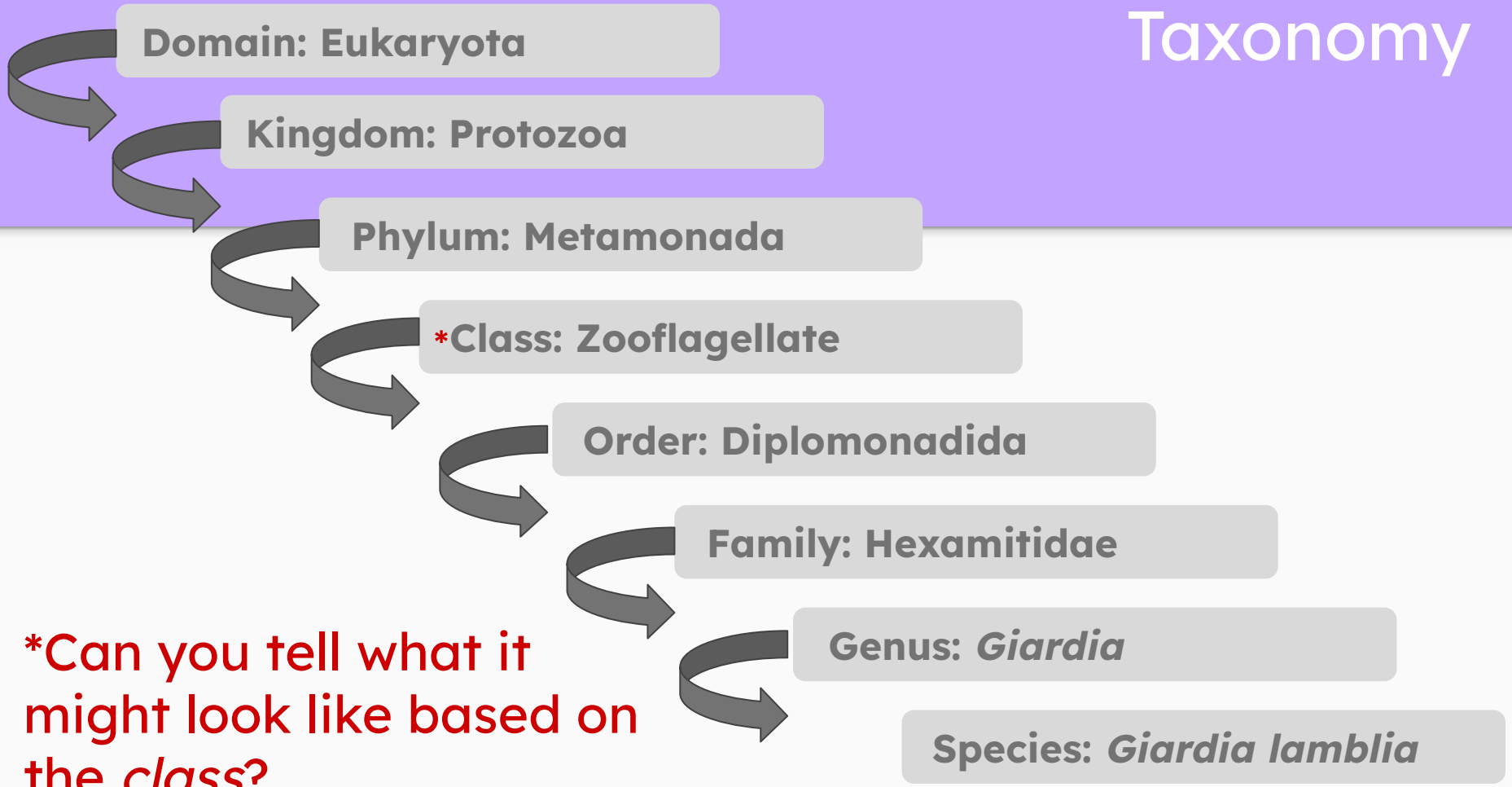
Giardia lamblia

aka *G. duodenalis, G. intestinalis*

By: Isabella Fregoso



Taxonomy

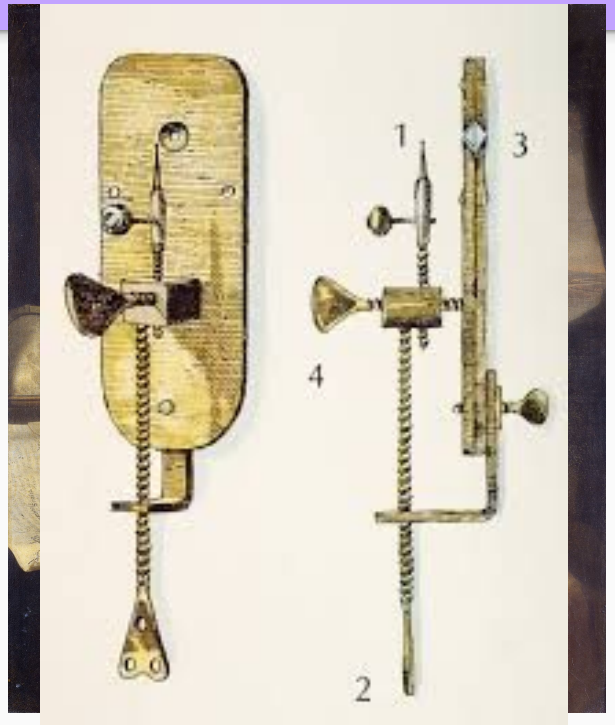


*Can you tell what it might look like based on the *class*?

History

Antonie van Leeuwenhoek (1632-1723)

- Dutch microbiologist (1681)
- “father of the microscope and microbiology”
- Coined “animalcules”
- Examined own stool
- Observed other specimens



https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10509104/

Image from Leeuwenhoek

- Fossil diatom mixture

History

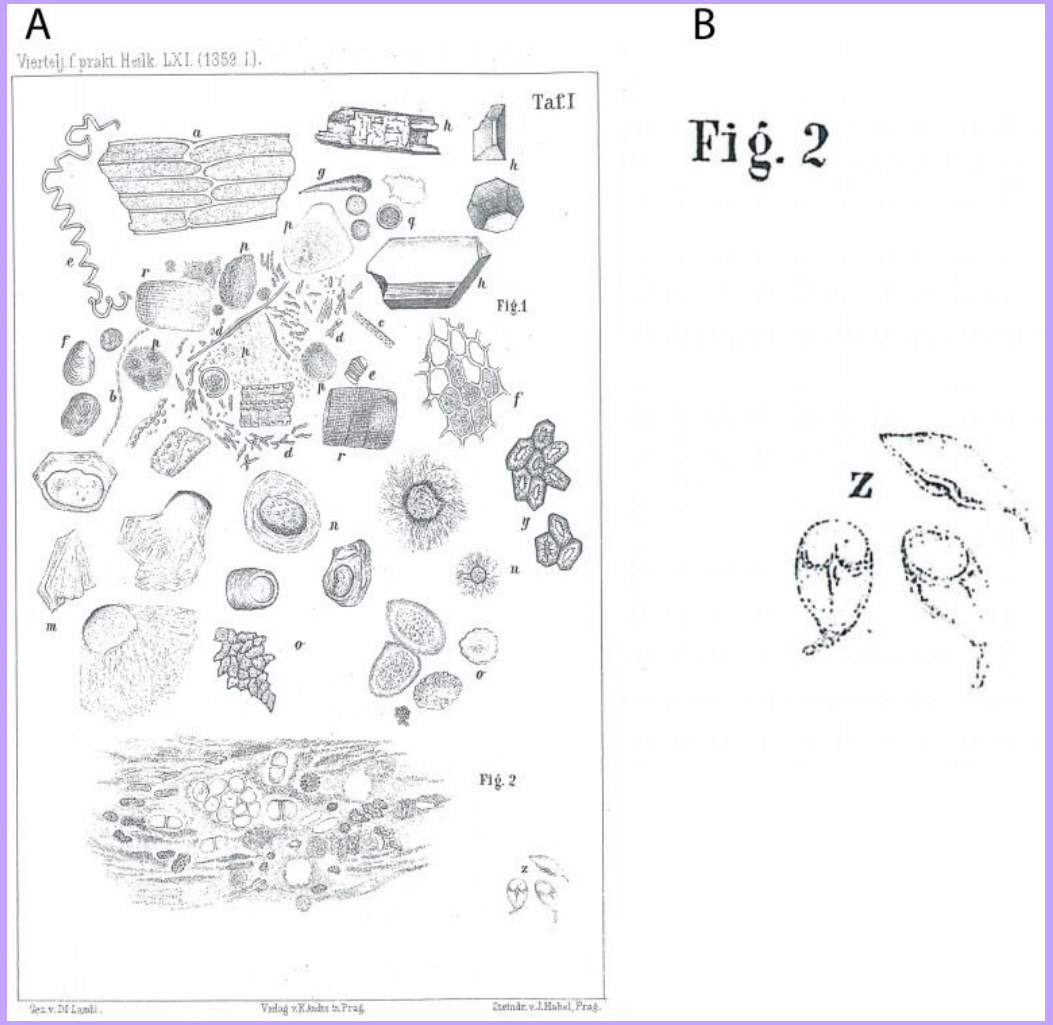
Vilem Dusan Lambl (1824-1895)

- Czech physician, Josef Löschner's Children's Hospital (1859)
- Renamed *Cercomonas intestinalis*
- 1st microscopic drawing of morphology

https://pubmed.ncbi.nlm.nih.gov/24810153/

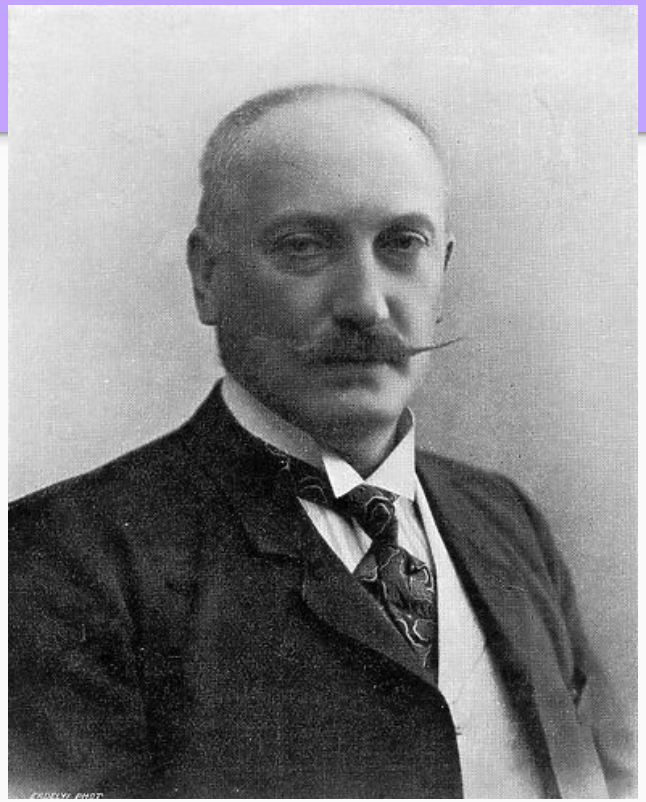
Image from Lambl's journal

- *Giardia lamblia*



History

Raphaël Blanchard 1857-1919



- French physician & professor
- Taught medical zoology
- Changed the name to *Lamblia intestinalis* in 1888

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2340880/?page=1

History

Alfred Giard (1846-1908)

- French zoologist (1895)
- Faculty Of Science And Technologies University De Lille in France
- Studied various parasites
- Created new biological terms

https://pubmed.ncbi.nlm.nih.gov/20575488/

History

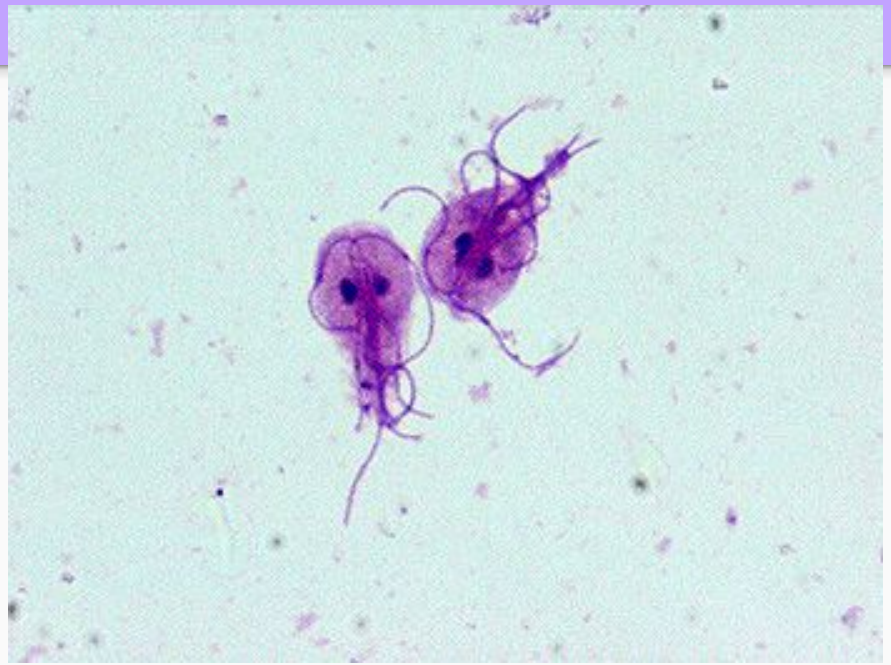
Charles Wardell Stiles (1867-1941)

- American parasitologist
- Medical professor of zoology at Johns Hopkins School of Medicine
- Renamed to *Giardia lamblia* (1915)

https://www.nal.usda.gov/exhibits/speccoll/exhibits/show/parasitic-diseases

Morphology

Trophozoite Stage
12-15μm

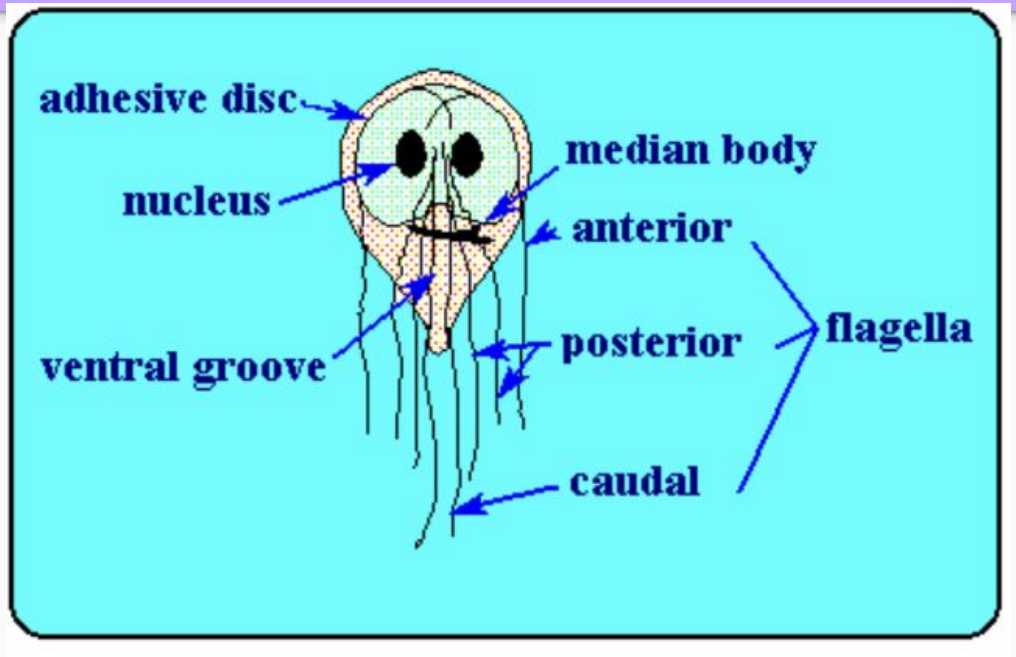


- Binucleate (oval)
- Axostyle
- Adhesive disc
- Flagella

Morphology

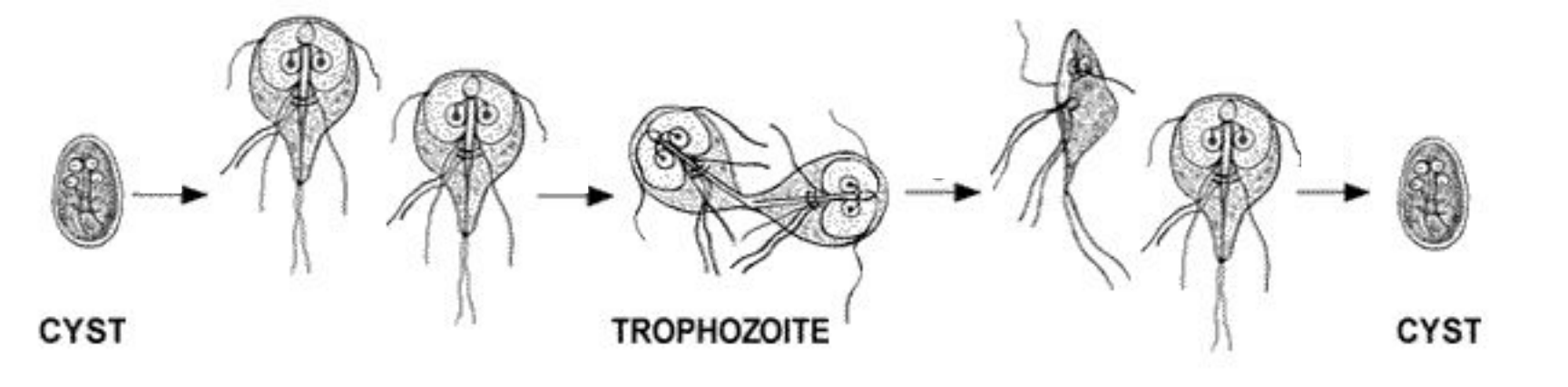
Trophozoite Stage
12-15μm

- Rounded anterior
- Tapered posterior
- Flat dorsoventrally
- Bi-lobed, concave adhesive disc
- 4 PAIRS of flagella



Reproduction

Binary Fission

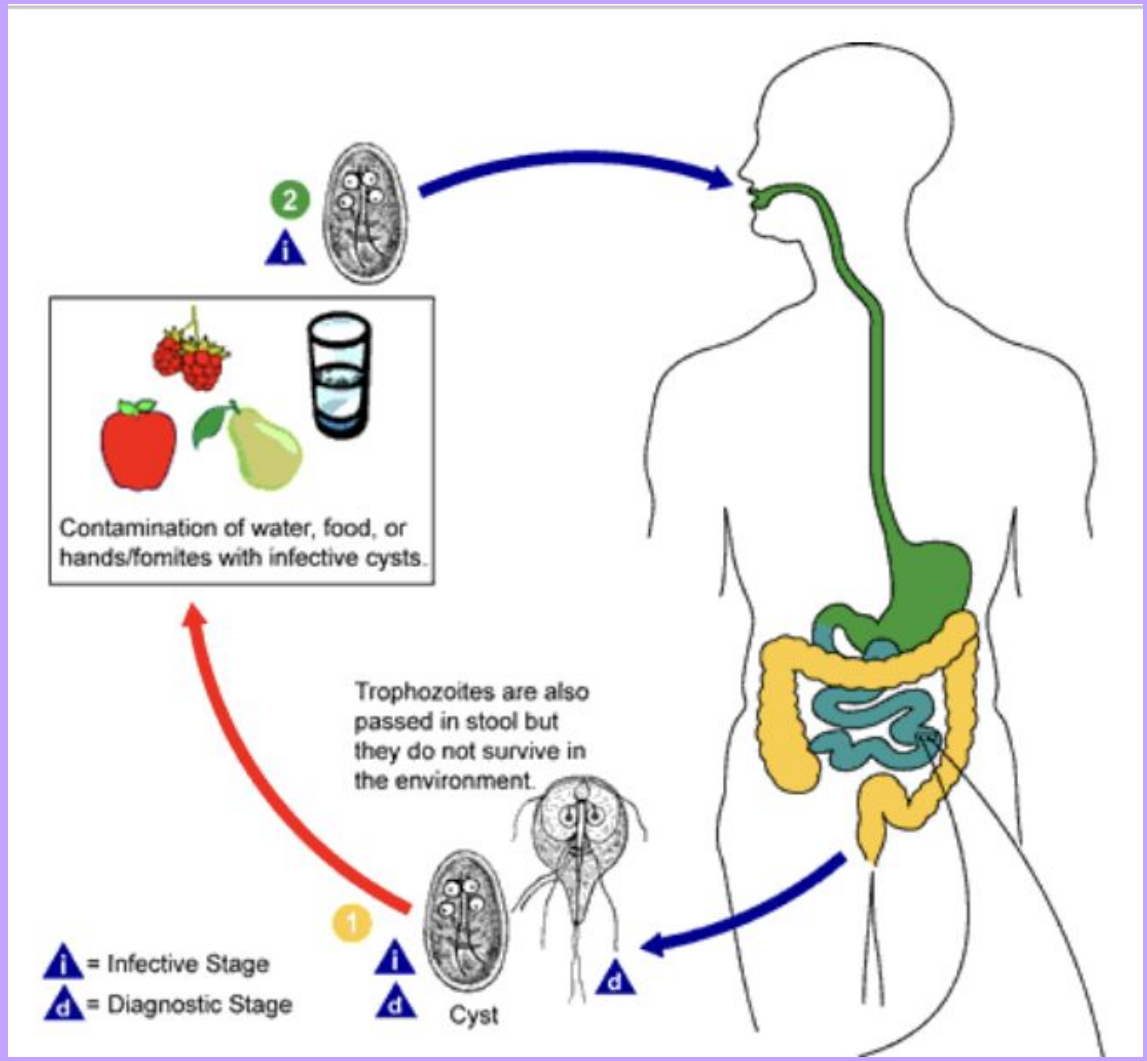


1. Nuclei
2. Flagella & sucking disc
3. Cytoplasm

Morphology

Cyst Stage
10-12μm

- Mature & immature
- Binucleate (oval)
- Axostyle
- Median body
- Cyst wall


2
i
Contamination of water, food, or hands/fomites with infective cysts.
Trophozoites are also passed in stool but they do not survive in the environment.
1
i
d
Cyst
d
i = Infective Stage
d = Diagnostic Stage

*Do you remember what other names *G. lamblia* goes by?

Life Cycle

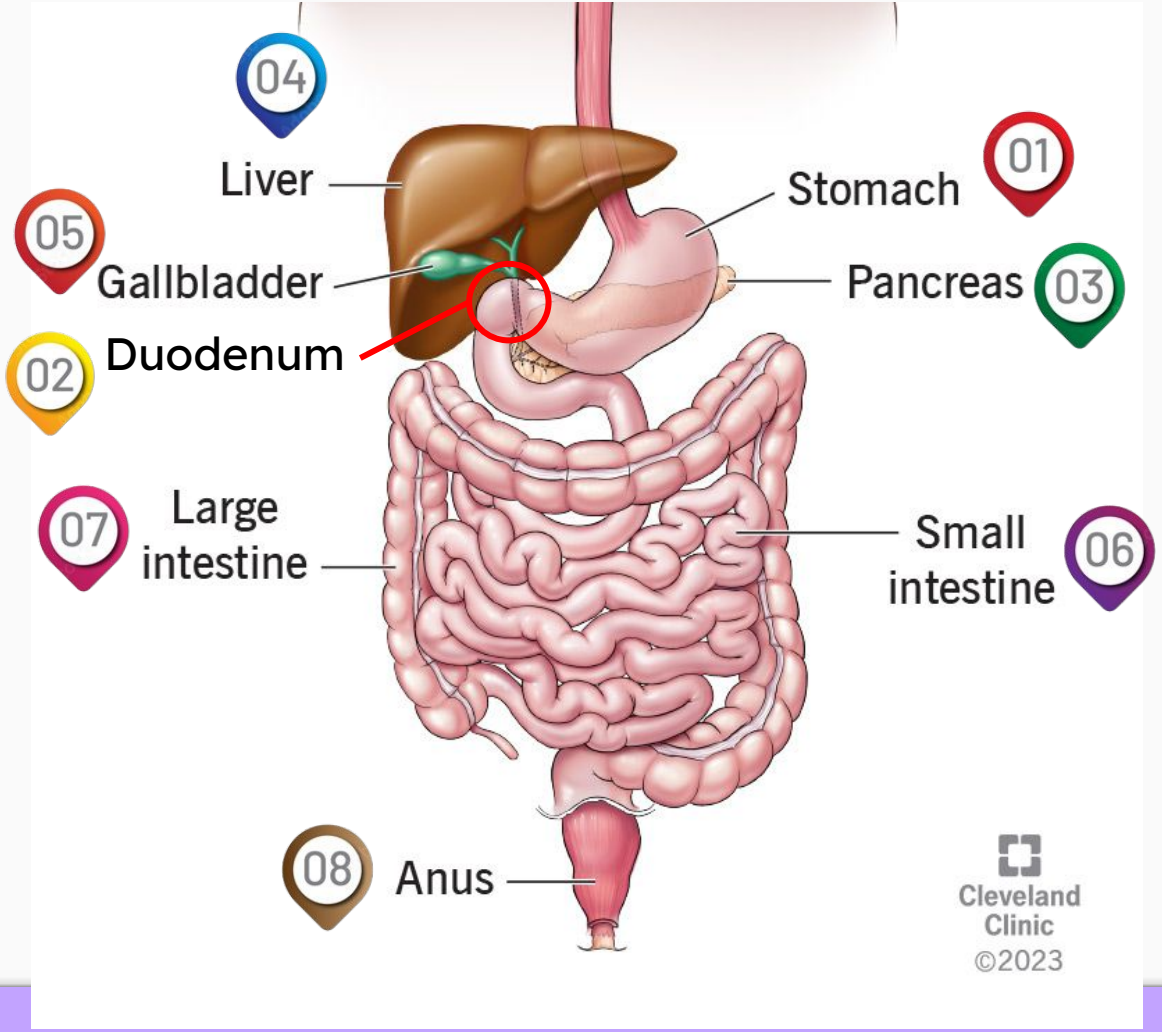
Within our body

Trophozoites

- live in upper intestine*/ duodenum*
- found in the small intestine & watery stools

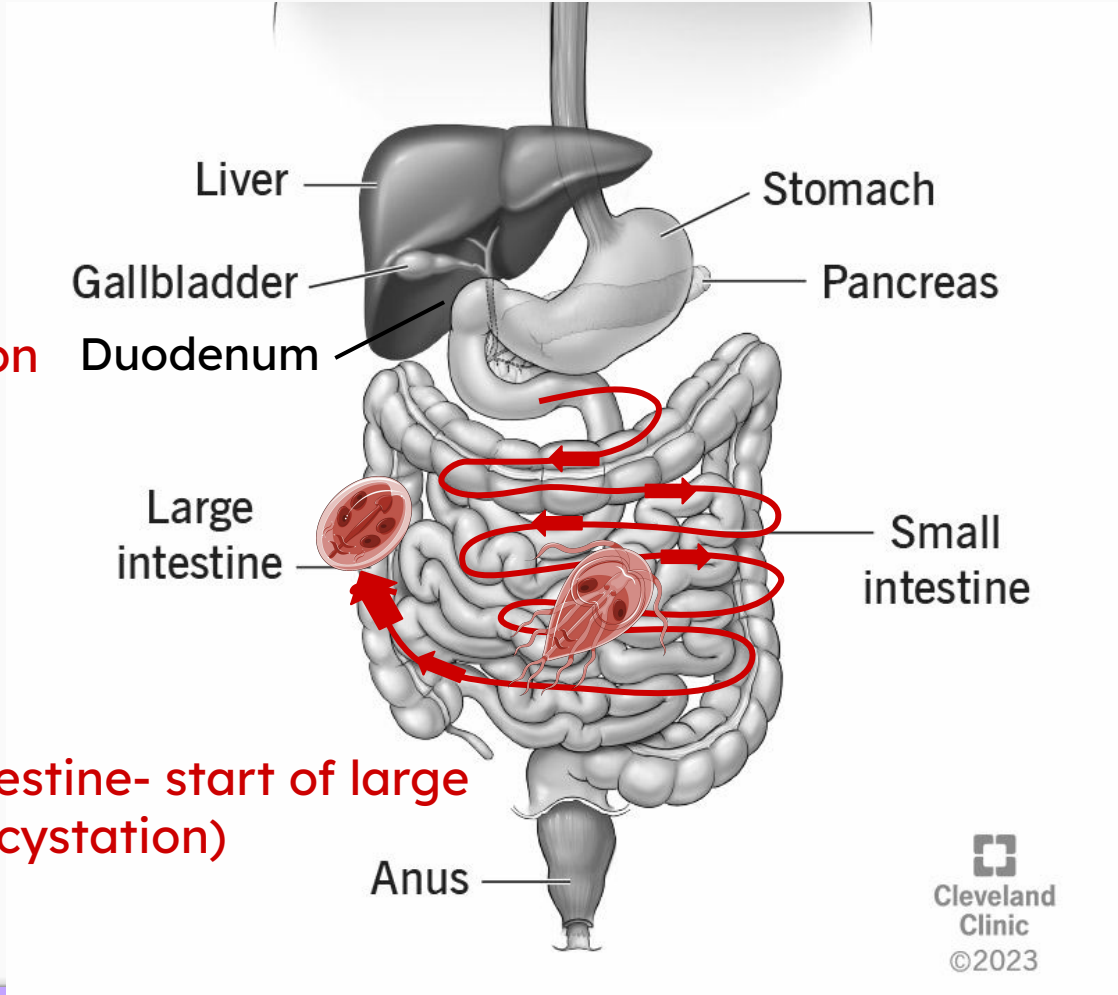
Cyst

- form, as feces is entering the colon
- swallowed and pass into GI tract

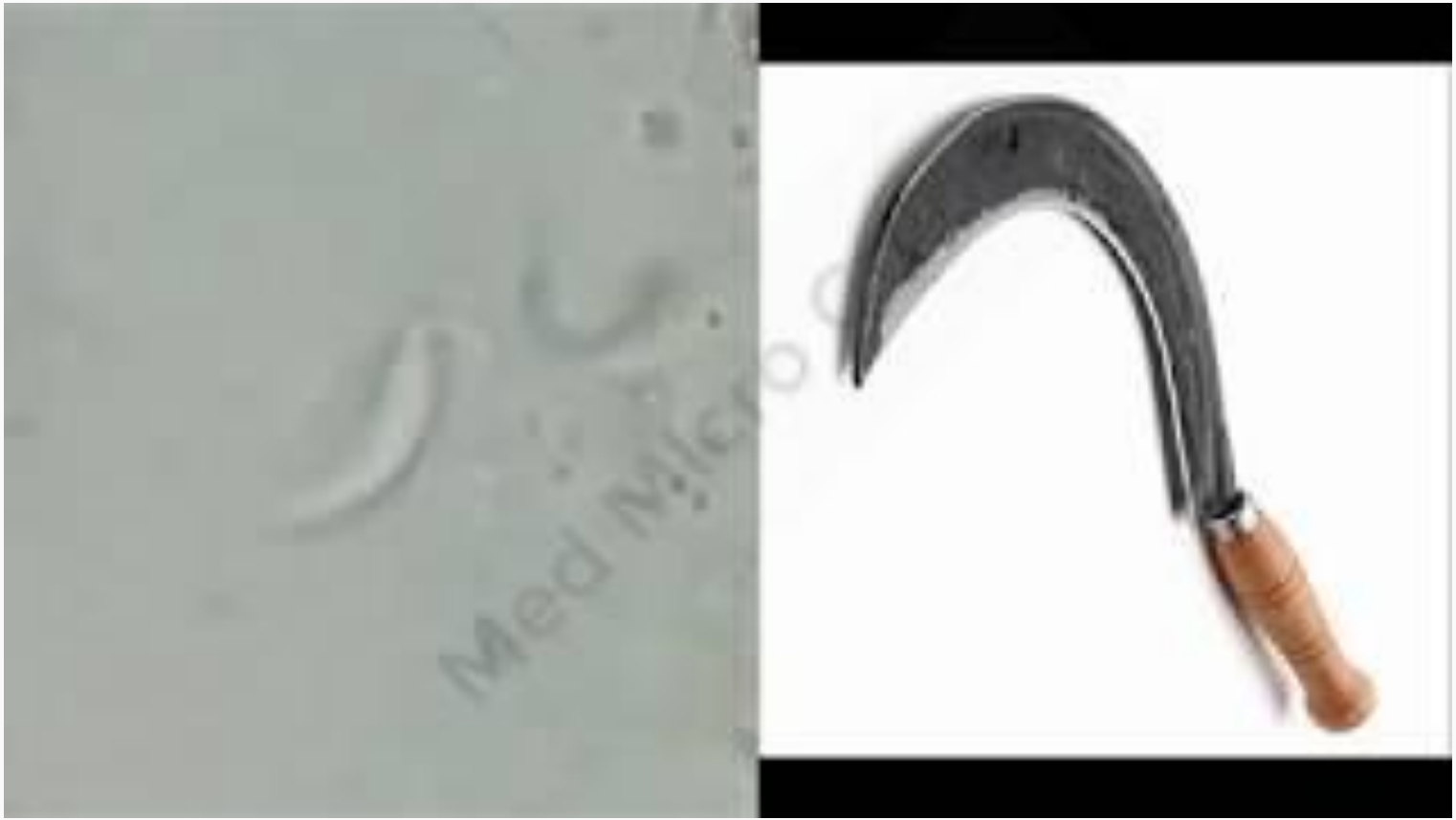


https://my.clevelandclinic.org/health/body/7041-digestive-system

excystation



End small intestine- start of large intestine (encystation)



https://youtu.be/8X4bxITNPeg?si=IAtbf8aqBbjJRkec

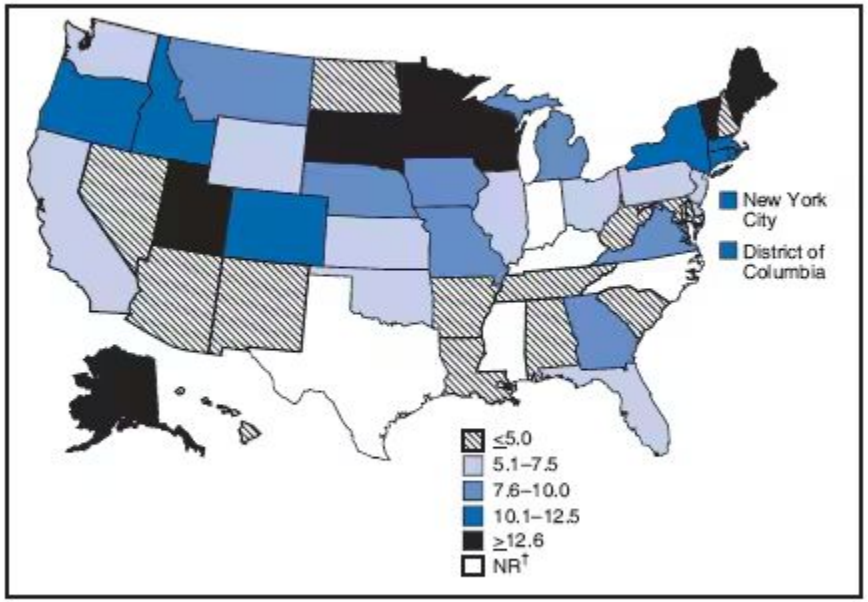
Epidemiology

Country

CDC reported 20k US cases (2003-2005)

- 0-4yrs majority
- Northeastern US

FIGURE 1. Incidence* of giardiasis, by state — United States, 2005



* Per 100,000 population.
† No cases reported to CDC.

https://www.cdc.gov/mmwr/preview/mmwrhtml/ss5607a2.htm

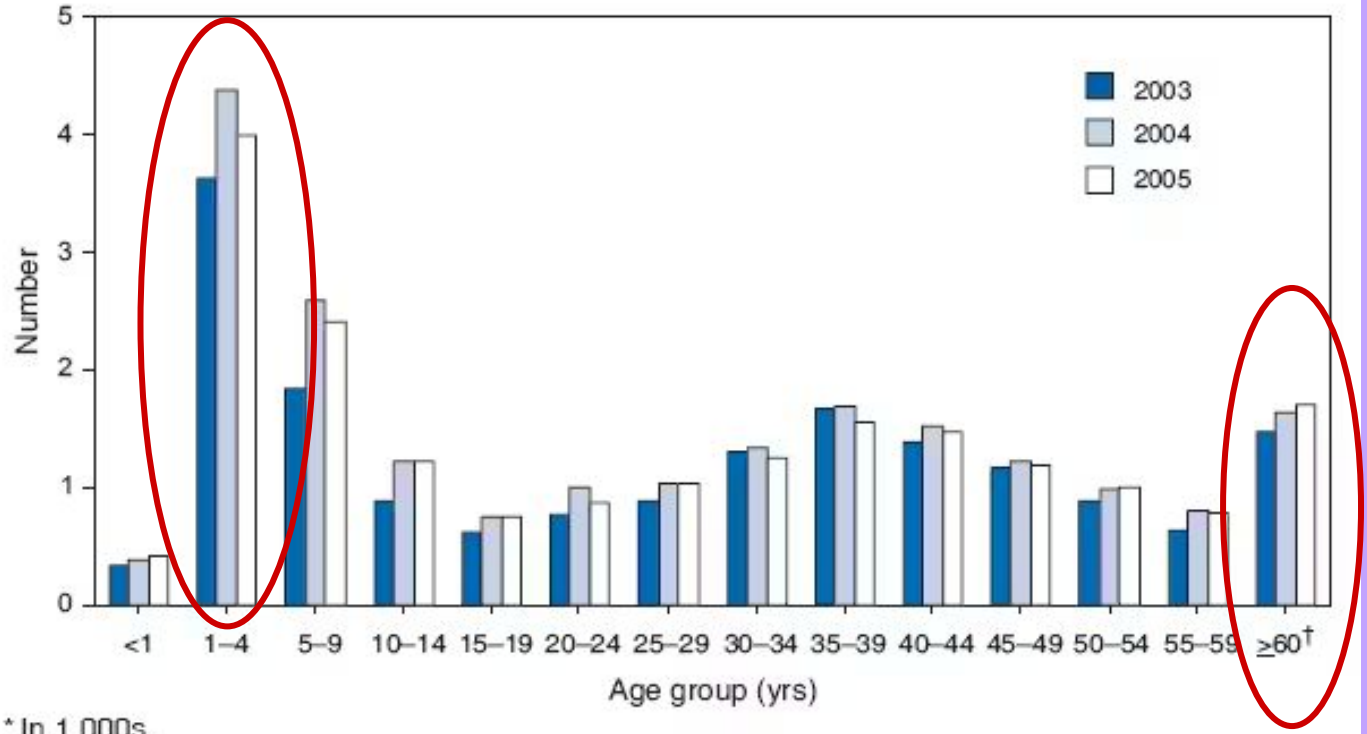
Epidemiology

Susceptible groups:

- International travelers
- Daycare workers
- Homosexual males
- Sanitation workers
- Immunocompromised/ weak immune systems

- #1 flagellate of human GI tract
- Worldwide
- Extremely prevalent
- Only 1 giardia species affect humans

FIGURE 2. Number* of giardiasis case reports, by age group and year — United States, 2003–2005



*In 1,000s.

†Case reports decreased with increased age. For each 5-year subgroup, the number of reported cases was fewer than the number reported for persons aged 55–59 years.

https://www.cdc.gov/mmwr/preview/mmwrhtml/ss5607a2.htm

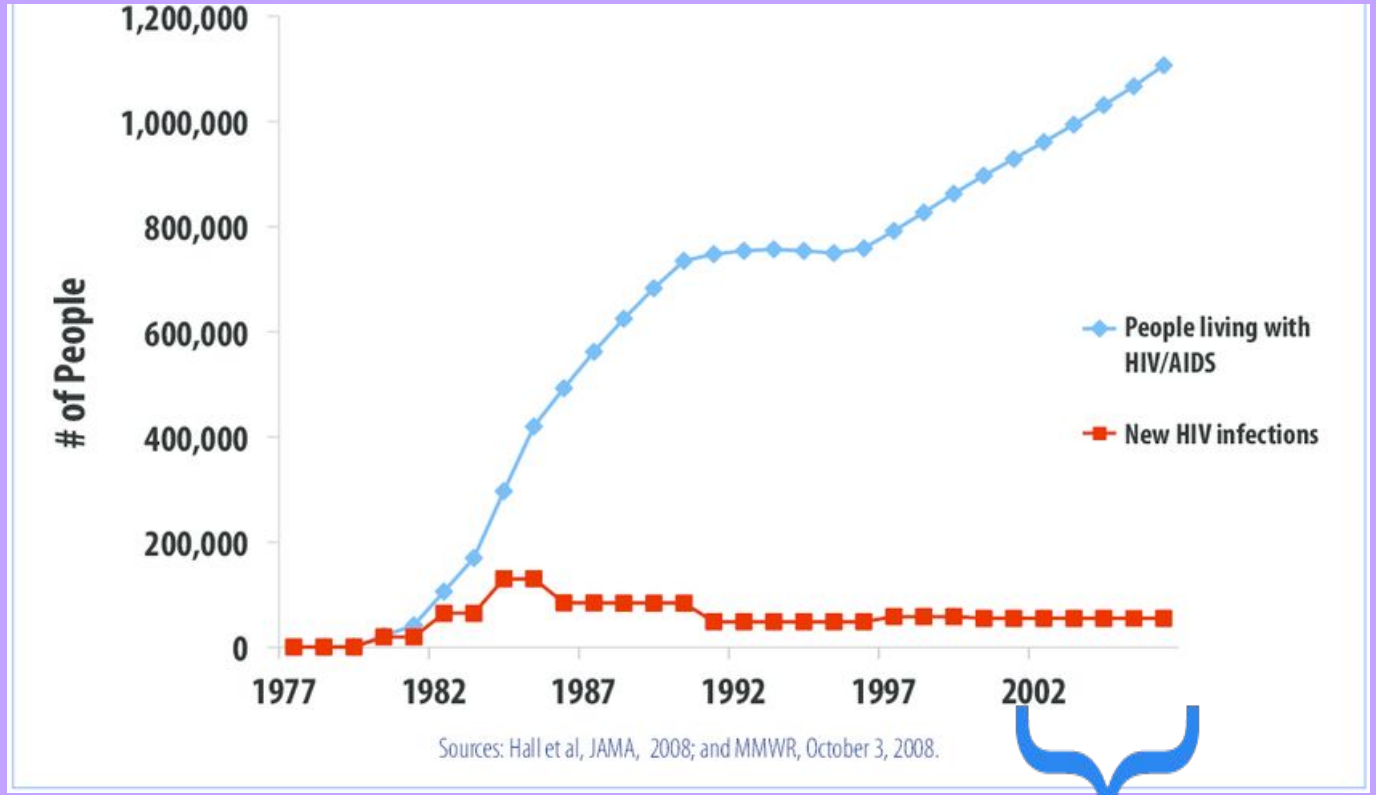
TABLE 2. Number and percentage* of giardiasis case reports, by selected demographic characteristics — United States, 2003–2005

Demographic characteristics	2003		2004		2005	
	No.	(%)	No.	(%)	No.	(%)
Sex						
Male	9,694	(48.3)	11,542	(55.1)	10,909	(54.3)
Female	7,930	(39.5)	9,099	(43.4)	8,813	(43.9)
Unknown/Missing	2,460	(12.2)	321	(1.5)	353	(1.8)
Total	**20,084**		**20,962**		**20,075**	
Race						
AI/AN†	69	(0.3)	88	(0.4)	76	(0.4)
API§	459	(2.3)	1,343	(6.4)	1,578	(7.9)
Black	957	(4.8)	1,640	(7.8)	1,398	(7.0)
White	8,430	(42.0)	8,342	(39.8)	8,321	(41.4)
Other	382	(1.9)	783	(3.7)	644	(3.2)
Unknown/Missing	9,787	(48.7)	8,766	(41.8)	8,058	(40.1)
Total	**20,084**		**20,962**		**20,075**	
Ethnicity						
Hispanic	1,173	(5.8)	1,600	(7.6)	1,524	(7.6)
Non-Hispanic	7,420	(37.0)	9,074	(43.3)	8,965	(44.7)
Unknown/Missing	11,491	(57.2)	10,288	(49.1)	9,586	(47.8)
Total	**20,084**		**20,962**		**20,075**	

* Percentages might not total 100% because of rounding.
† American Indian/Alaska Native.
§ Asian/Pacific Islander.

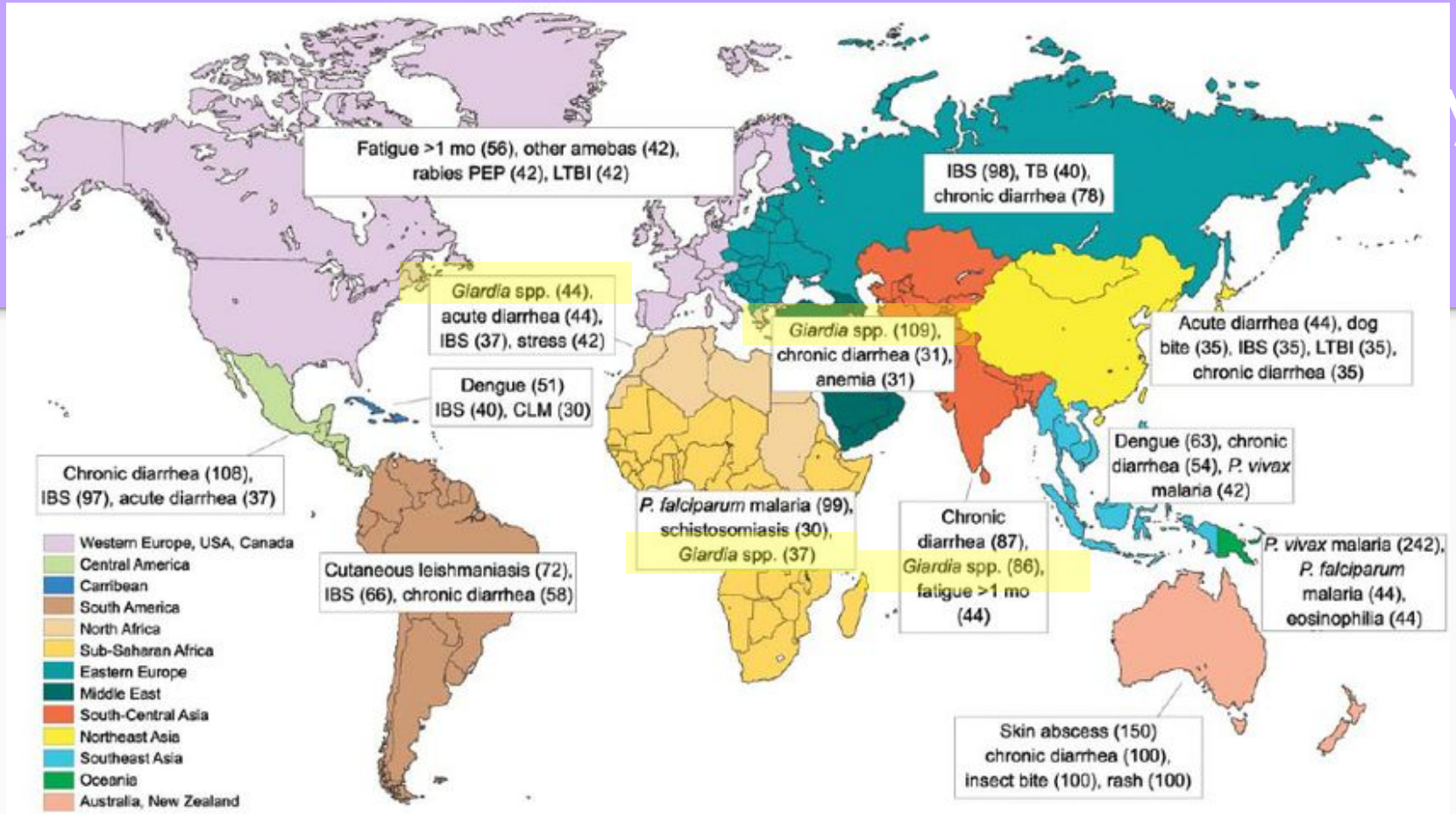
https://www.cdc.gov/mmwr/preview/mmwrhtml/ss5607a2.htm

Estimates of Annual HIV Infections and People Living with HIV/AIDS (1977-2006)



2002-2007

https://www.researchgate.net/figure/Estimates-of-Annual-HIV-Infections-and-People-Living-with-HIV-AIDS



Most frequent diagnoses in long-term travelers, by world geographic region visited (1996-2008)

Pathogenicity

Transmission:

- Contaminated water/food consumption
- Direct transmission
- Extremely contagious
- Rarely fatal

Symptoms:

- Fatty diarrhea
- Abdominal cramps
- Flatulence
- Bloating
- Nausea
- Fatigue

Pathogenicity

Possible Side Effects:

- Intestinal mucosa damage
- Food absorption interference
- Extreme dehydration
- Jaundice
- Weight Loss

- Opportunistic
- Can get into gallbladder
- Reinfect body all over again

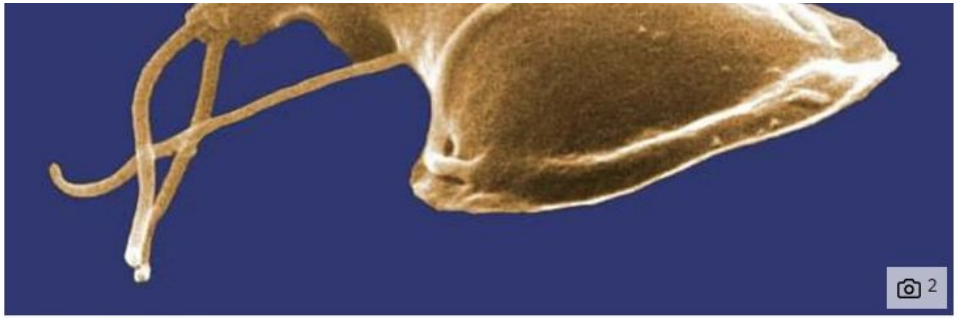
Lifestyle > Health & Families

Giardiasis: The infection outbreak found at Millstead Primary School explained

Giardiasis is an infection of the digestive system caused by tiny parasites known as Giardia lamblia

Two children at a school dealing with an infection outbreak have died, health authorities said on Wednesday.

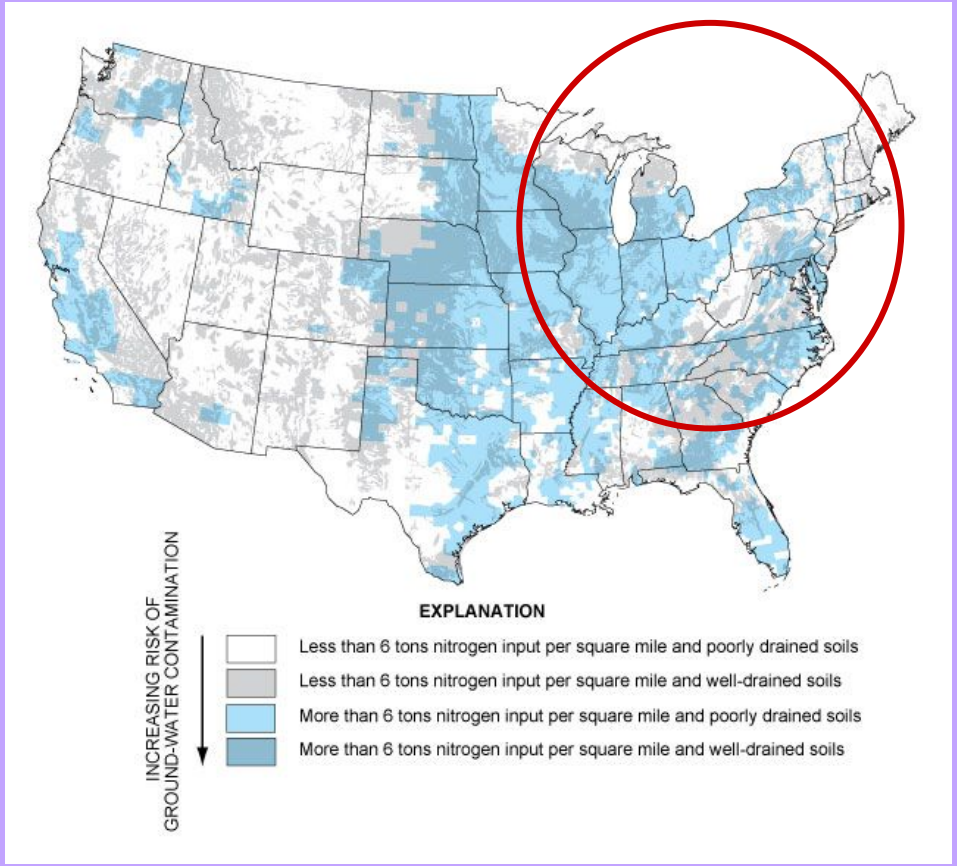
Both children were pupils at Millstead Primary School in Everton, Liverpool, which teaches children aged two to 11 years, who have special educational needs.



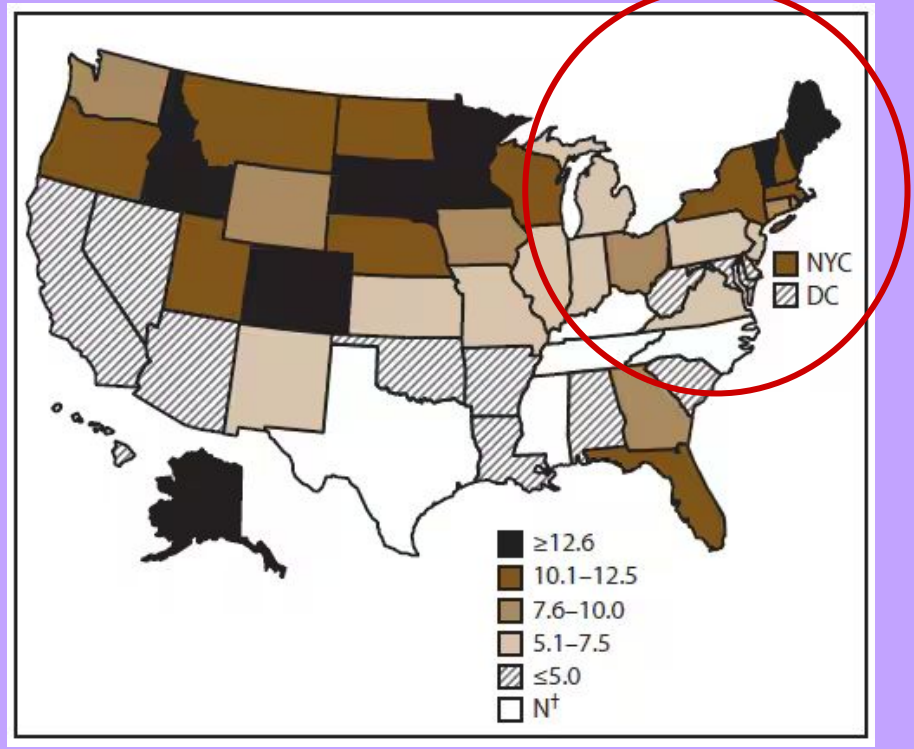
Giardia lamblia *(Wikicommons)*

https://www.independent.co.uk/life-style/health-and-families/giardiasis-millstead-school-symptoms

https://pubs.usgs.gov/fs/old.1996/fs-092-96/fs092-96.html



Giardiasis Surveillance — United States, 2009–2010



https://www.cdc.gov/mmwr/preview/mmwrhtml/ss6105a2.htm

Treatment & Control

- Metronidazole → bacteria & protozoa
- Albendazole → cytoplasmic microtubules
- Cocktail of both
- Normal saline drip
- CDC guidelines (e.g. COVID-19)

Prevention

What to do

- Proper hand hygiene
- Avoid close contact with feces
- Avoid contaminated water
- Practice safe sex

What NOT to do

- Swim in pools when you have diarrhea
- Drink contaminated water
- Ignore handwashing
- Contact infected persons/ animals

Case Study- Patient #1

2015 📍 Japan

Age: 70 yrs

Gender: Male

History: rheumatoid arthritis & pulmonary emphysema; taking immunosuppressants

Onset symptoms: upper abdominal pain & fever

- Drinks well water
- Has a pet dog
- Traveled to SE Asia within 10 yrs

Intake

Vitals

Temp 100.94℉

HR 89

BP 163/78

Chief Complaint

Right upper quadrant tenderness and fever

Labs

WBCs: 12,600 mm^3

Range 3600-9600 mm3

CRP: 12.9 mg/dL

Range ≤0.3 mg/dL

TSB: 0.69 mg/dL

Range 0.3-1.2 mg/dL

AST: 50 U/L

Range 13-33 U/L

ALT: 6-30 U/L

Range 6-30 U/L

ALP: 594 U/L

Range 100-340 U/L

GGT: 80 U/L

Range 10-47 U/L

CEA: 1.84 U/mL

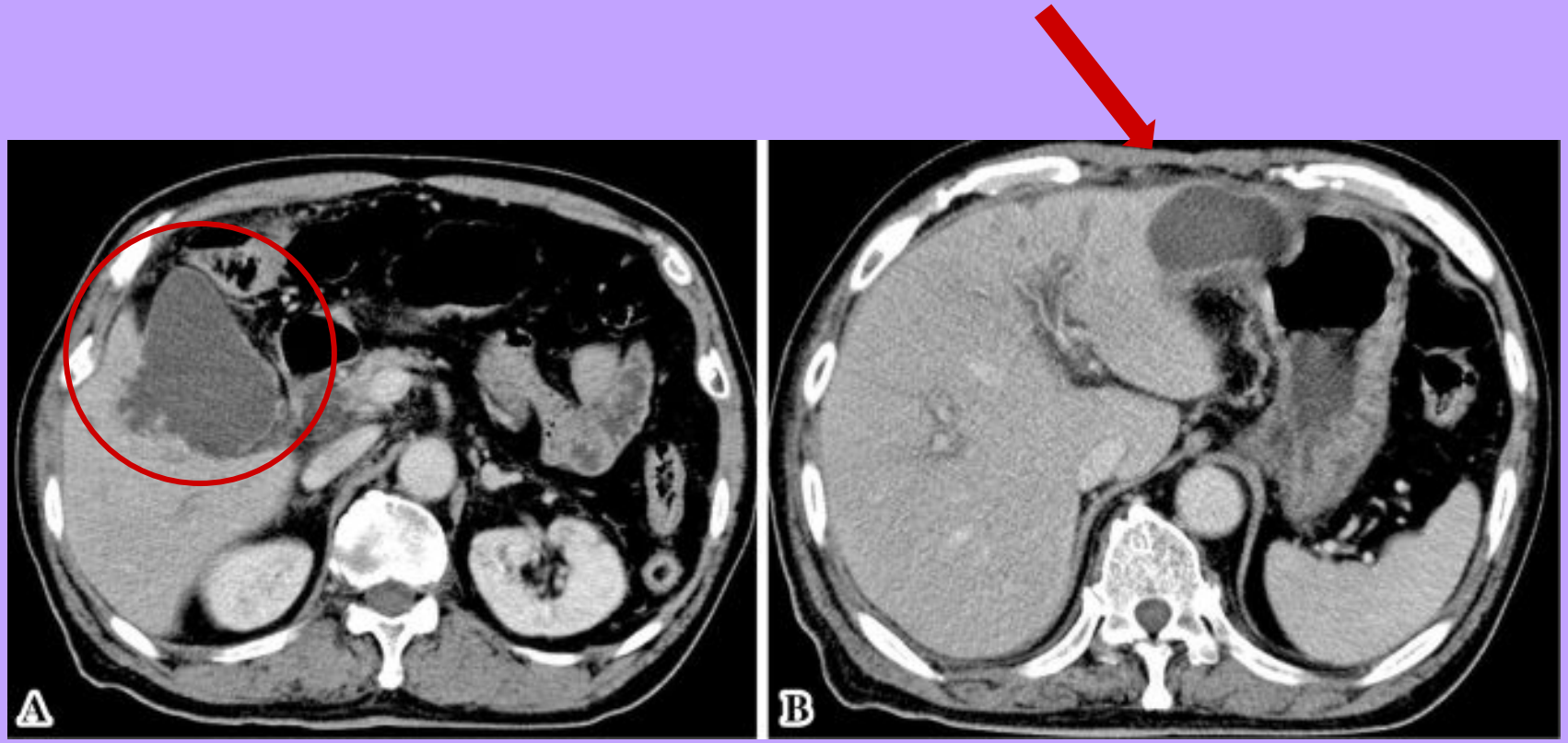
Range <5 ng/mL

CA19-9: 474 U/mL

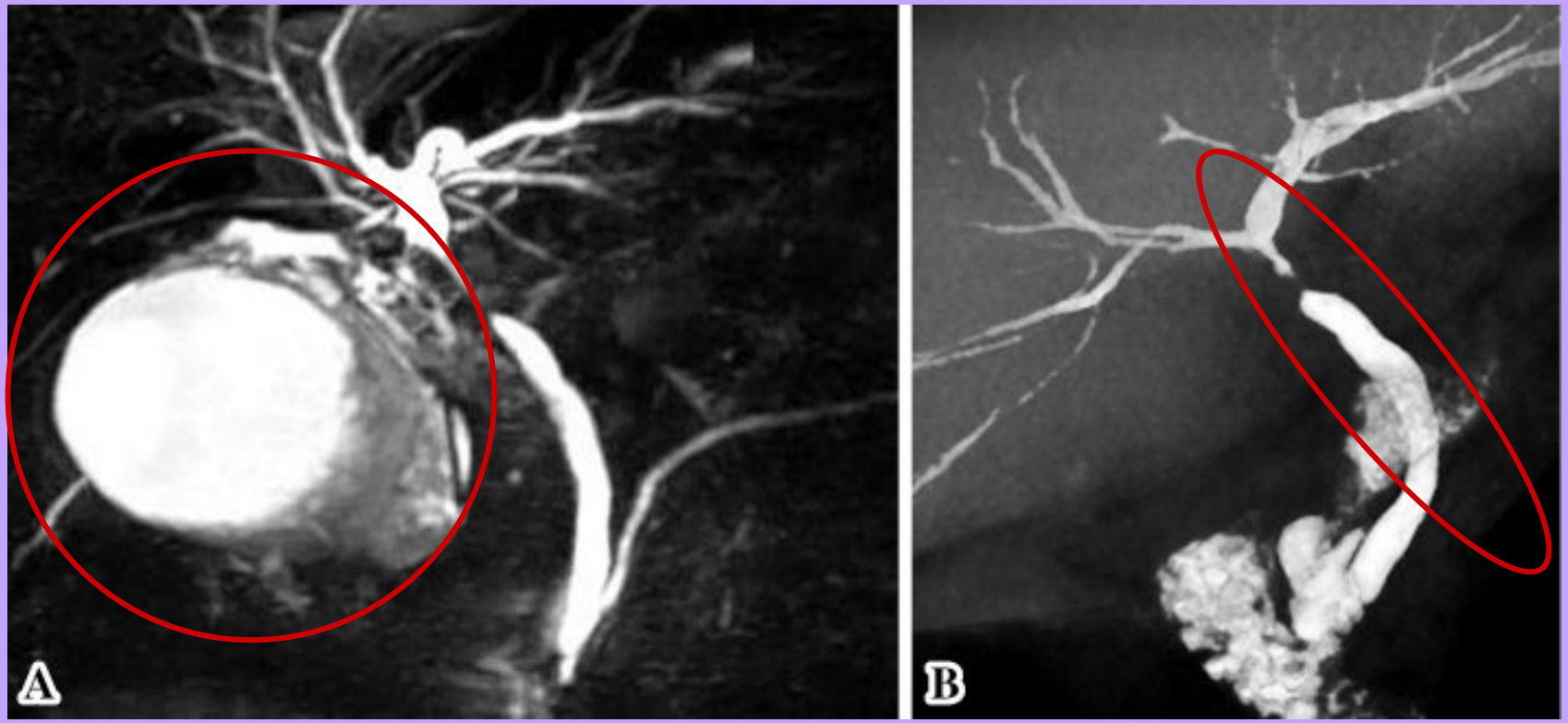
Range <374 U/mL

Tests

1. Abdominal ultrasound & CT
2. magnetic resonance cholangiopancreatography
3. drip infusion cholecysto cholangiography
4. endoscopic ultrasonography
5. endoscopic retrograde cholangiopancreatography
6. esophagogastroduodenoscopy

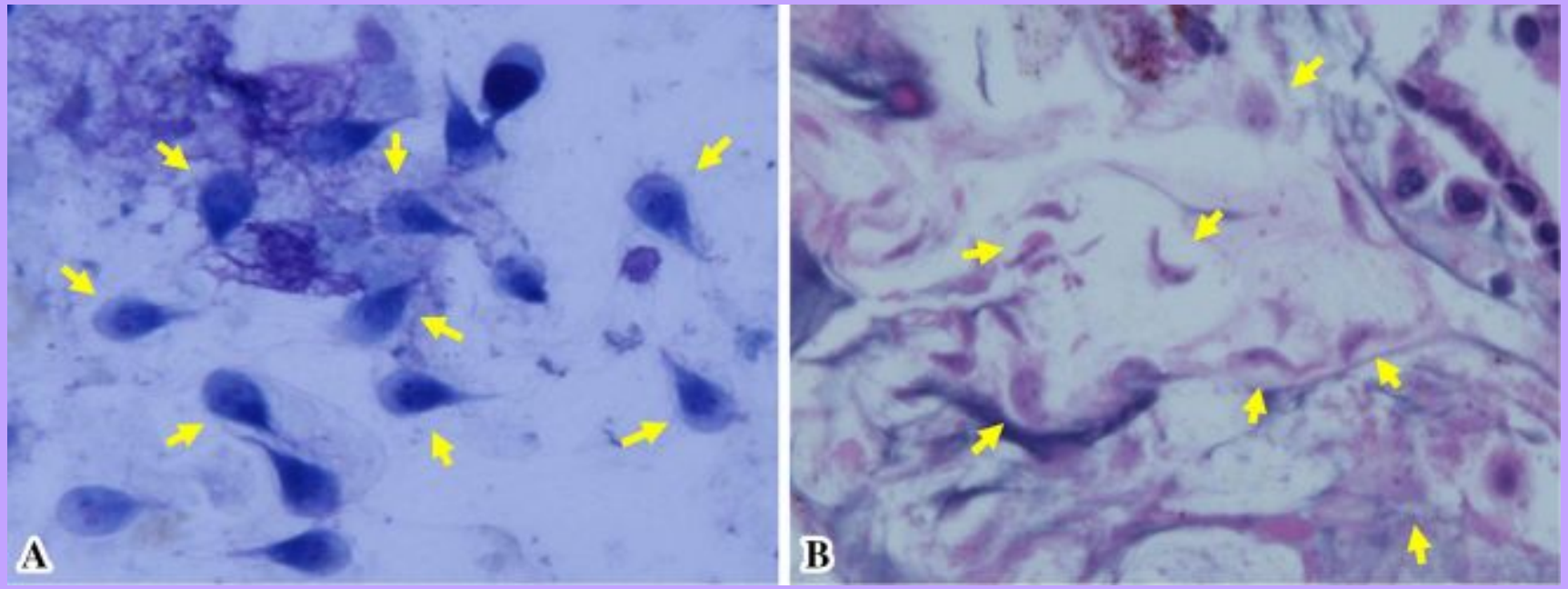


Abdominal CT



MRCP

DIC-CT



Bile duct brush cytology

Duodenum biopsy

Diagnosis & Treatment

~~Acute cholecystitis with pericholecystic abscess~~

- Cefozopran 2.0g daily IV for 14 days
- Pt had improvement, no abdominal pain by day 7

Acute acalculous cholecystitis caused by *G. lamblia*

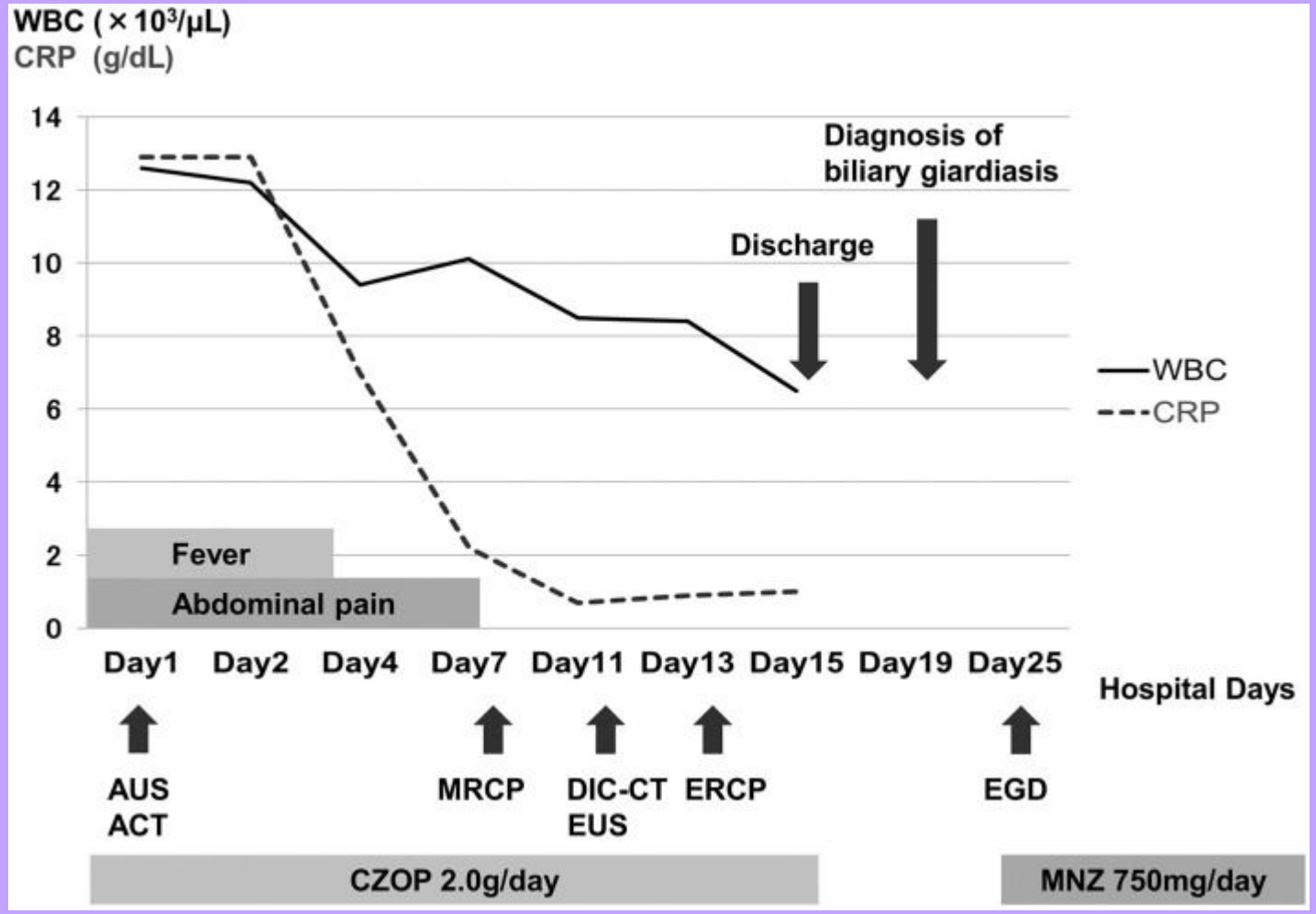
- Metronidazole 250mg 3x daily for 7 days

Timeline of patient's clinical course

Pt recovered fully

Discharged at 15 days

Finished meds at 25 days



Case Study- Patient #2

2020 📍 Turkey

Age: 47 yrs

Gender: female

History: Stage 4 metastatic ovarian serous carcinoma (2019); cytoreductive surgery

Onset symptoms: bloody diarrhea for 10 days

Chemo treatment 1- carboplatin & paciltaxel

Chemo treatment 2- pembrolizumab (for multiple rounds)

Intake

Decreased skin turgor
Pale conjunctiva/ oral mucous membranes

Initial Labs

- Hyponatremia
- Hypoalbuminemia
- lymphocytopenia
- Inc CRP (10.42 mg/dL)
- Neg *C. diff, E. histolytica*
- Pos *G. lamblia*

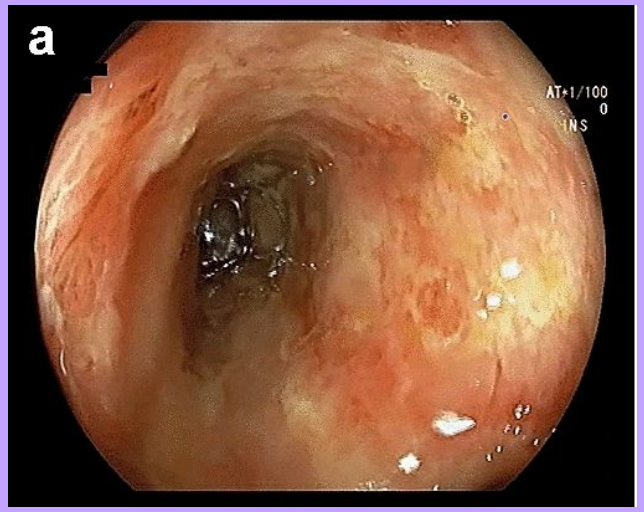
Tests

Colonoscopy and mucosal biopsy

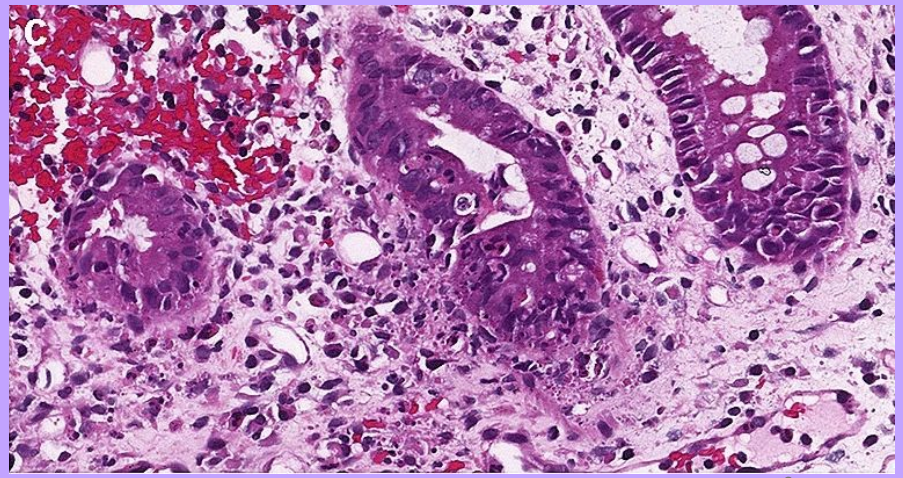
- Deep purulent ulcers in colon/ rectum

Cytopathological evaluation of biopsy

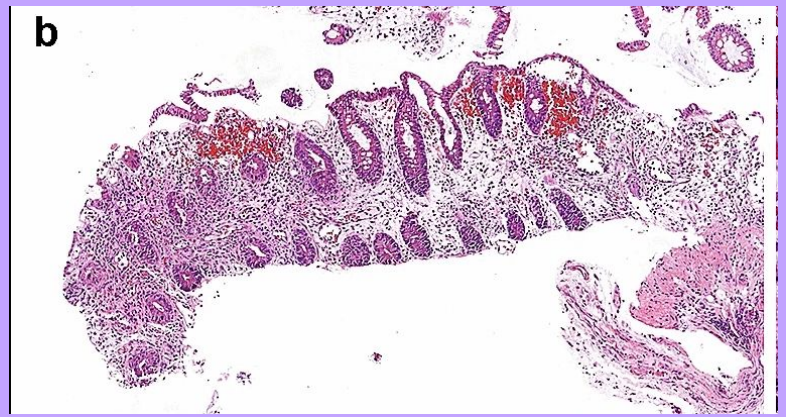
- Cryptitis and transmucosal necrosis



Colonoscopy imaging



apoptosis



inflammation

Diagnosis & Treatment

Immune mediated ischemic colitis

- Metronidazole for 10 days
- Methylprednisolone 1mg/kg/day
- Infliximab 5mg/kg

Post-treatment

Patient was unresponsive to treatment

- Pt died of septic shock after infliximab treatment

Case Study- Patient #3

2021 📍 Detroit, Michigan

- Pt traveled to Mexico day before ED visit

Age: 73 yrs

Gender: male

History: left nephrectomy, hypertension, type 2 diabetes

Onset symptoms: vomiting, diarrhea, abdominal pain, fever, chills, dec urination

Intake

- Tender abdomen
- Poor skin turgor
- Sunken eyes

Vitals

Temp 99.86℉

HR 102

BP 86/44

Resp 16

O_2 97%

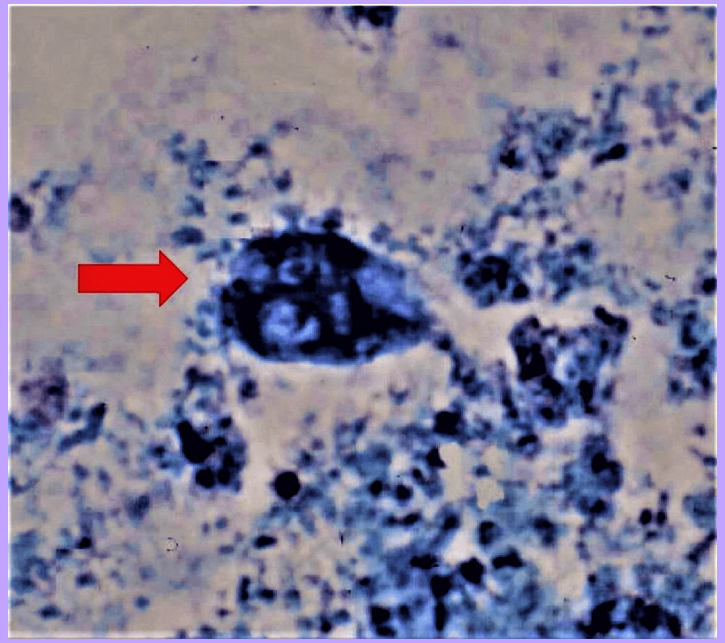
Labs

Unremarkable EXCEPT inc creatinine

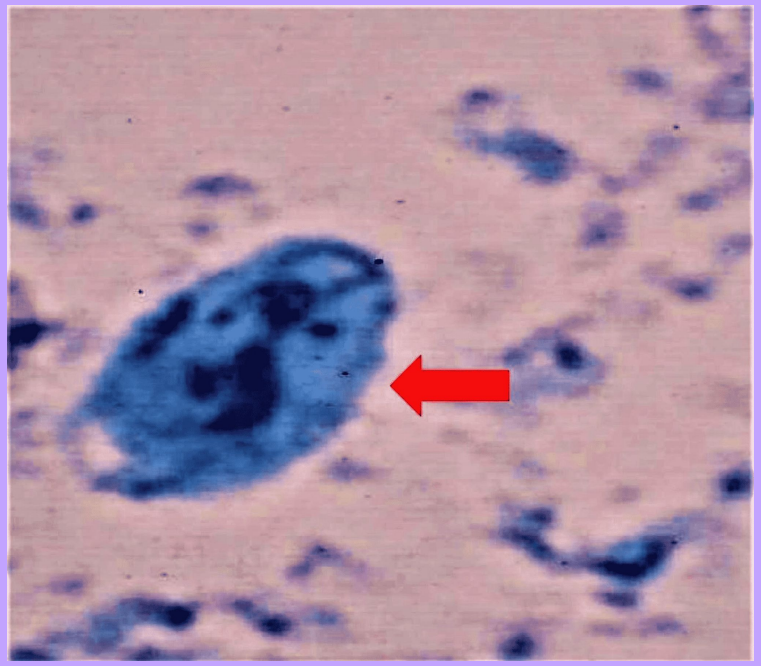
- 45mg/dL (range 7-25 mg/dL)

Pos stool sample *G. lamblia*
Pos salmonella species
Neg *C. diff*

hypokalemic



trophozoite



cyst

Diagnosis & Treatment

Confirmed *G. lamblia/* severe acute renal failure

Foley placed for strict I/O

- NS drip 3L inc 2x

Creatinine inc violently for 2 days

IV ceftriaxone 2gm/daily

Day 8

Complete recovery!

Neg salmonella

IV ceftriaxone to oral

Discharged by day 9

Given ceftriaxone for total 14 days

Questions

What are a few factors that increased risk of giardiasis in patient #1 (70yr male)?

Why did patient #2 (47 yr female) die and not pull through like patient #1?

Why was patient #3 (73yr male) recovery process so short?

References

https://www.researchgate.net/figure/Estimates-of-Annual-HIV-Infections-and-People-Living-with-HIV-AIDS-1977-2006_fig1_264388883

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https://d-nb.info/1186244860/34

https://pubmed.ncbi.nlm.nih.gov/35755560/

https://youtu.be/8X4bxITNPeg?si=IAtbf8aqBbjJRkec

https://pubmed.ncbi.nlm.nih.gov/20575488/

https://pubmed.ncbi.nlm.nih.gov/37525002/

https://www.nal.usda.gov/exhibits/speccoll/exhibits/show/parasitic-diseases-with-econom/item/8206