

Gastrointestinal infections



Prof. MUDr. Petr Husa, CSc.

Klinika infekčních chorob LF MU a FN Brno



Global significance of GI infections

- Estimates are that over 1.8 million children still die each year (more than 6000/day)
- The second most common infections in developed countries (after respiratory infections)



Gastrointestinal infections in CR 2007-2016

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Campylobacter	24 254	20 175	20 371	21 164	18 811	18 412	18 389	20 903	21 102	24291
Salmonella	18 204	11 009	10 805	8 622	8 752	10 507	10 280	13 633	12 739	11912
Shigella	349	229	178	450	164	266	257	92	88	70
Bacterial other	2 831	3 305	3 178	3 343	4 607	5 168	5 797	6 763	8 146	7563
Viral	6 025	6 639	6 066	8 517	9 955	6 877	7 778	9 438	18 858	9491
Food poisoning	70	84	106	100	381	14	203	177	793	127

Gastrointestinal infections

- bacterial
- viral
- parasitic

Bacterial GI infections

- transmission of pathogenic microbes
 - zoonosis
 - human
- food-poisoning (toxins in food)

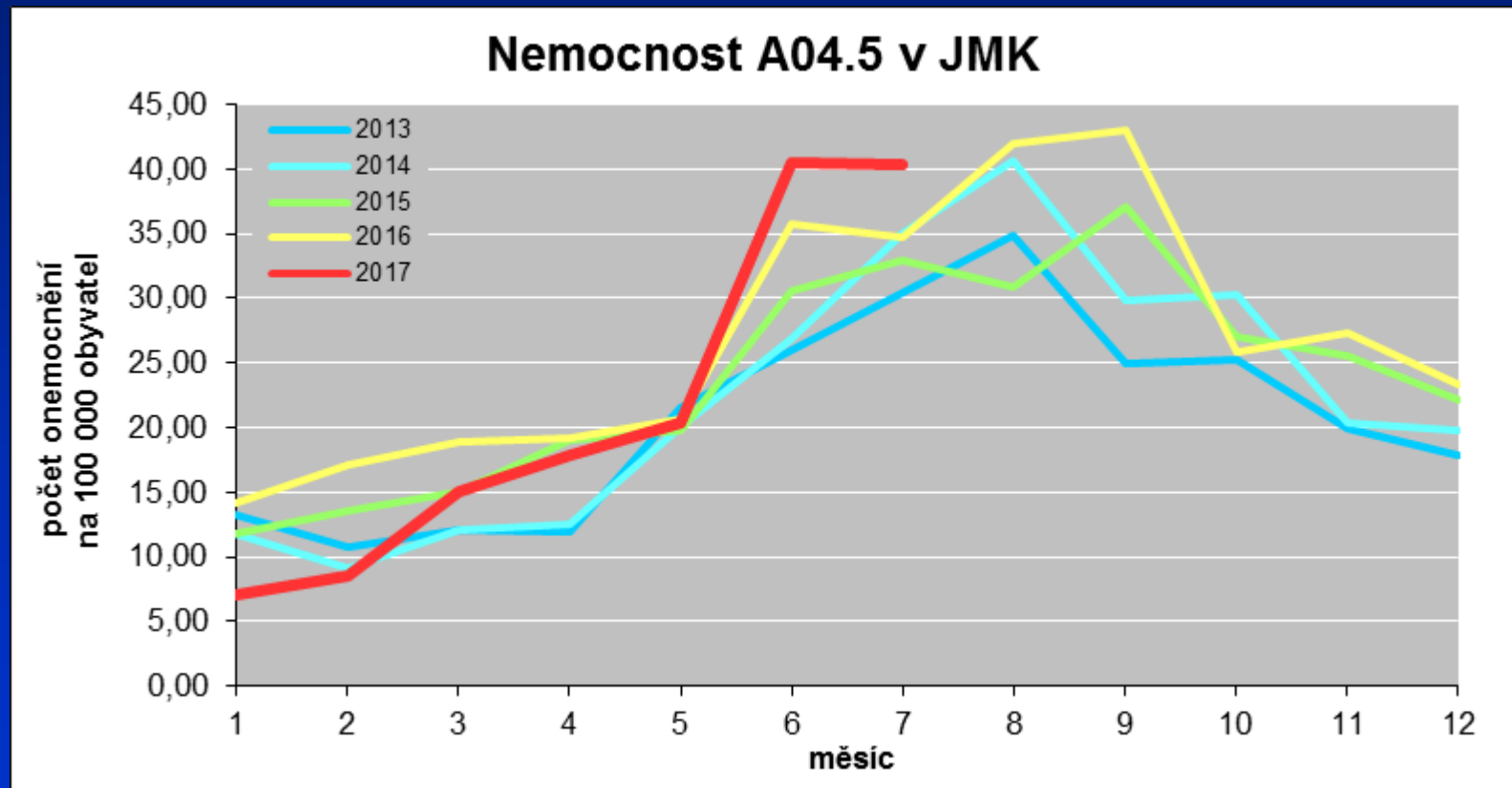
Zoonosis

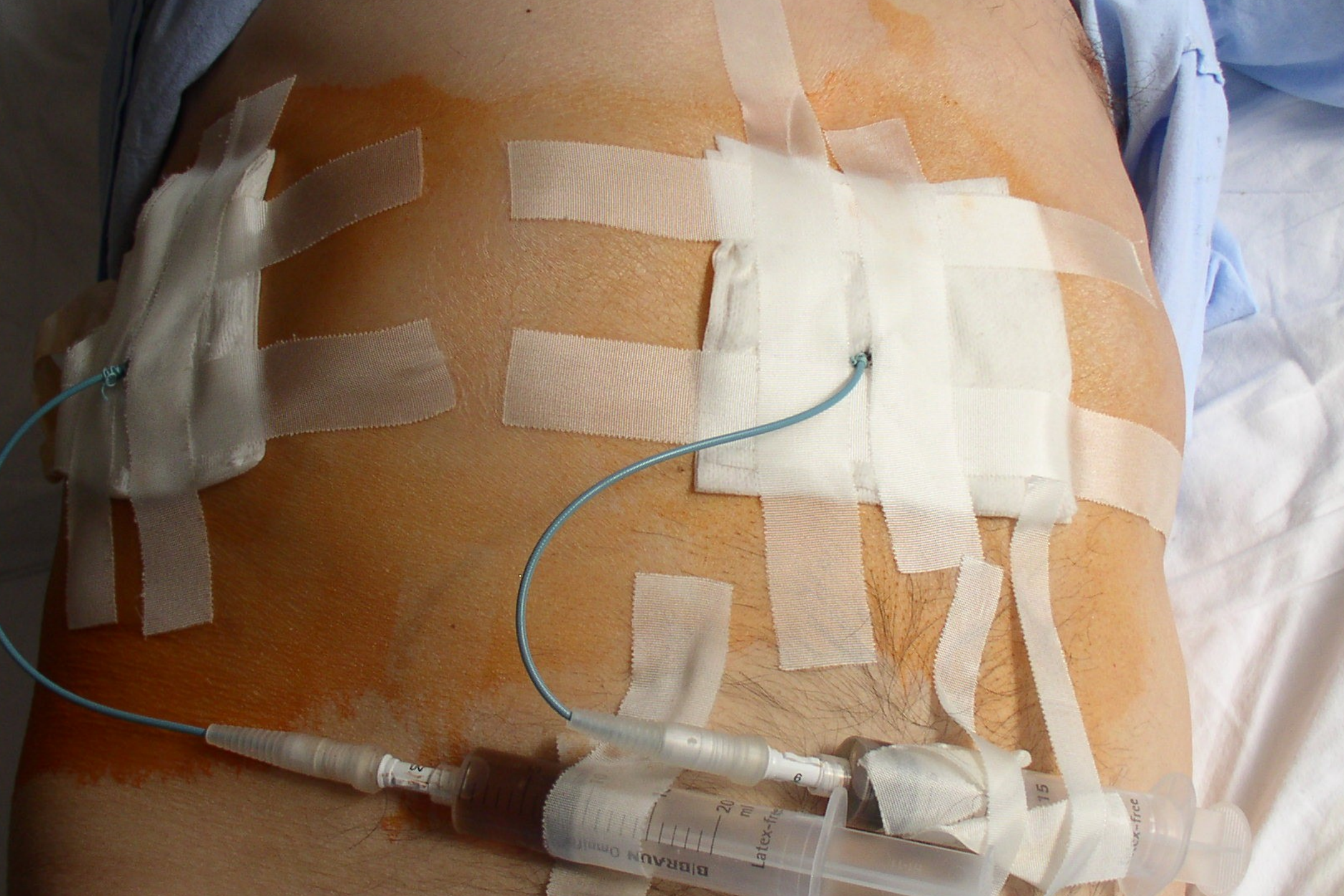
- salmonellosis (*S. Enteritidis*)
- campylobacteriosis (*C. jejuni*)
- yersiniosis (*Y. enterocolitica*)
- EHEC (*E. coli*)

Campylobacteriosis

- now the most common zoonosis in CR a many other European countries (especially undercooked poultry)
- *Campylobacter jejuni*
- clinical course – from inaparent to serious acute enterocolitis with right lower abdominal quadrant pain, fever, and bloody diarrhoea
- sepsis is possible in IS patients
- reactive arthritis, erythema nodosum – possible immune-mediated complications
- rehydration, diet, complicated forms: macrolides

Campylobacteriosis in Southern Moravia 2013-2017







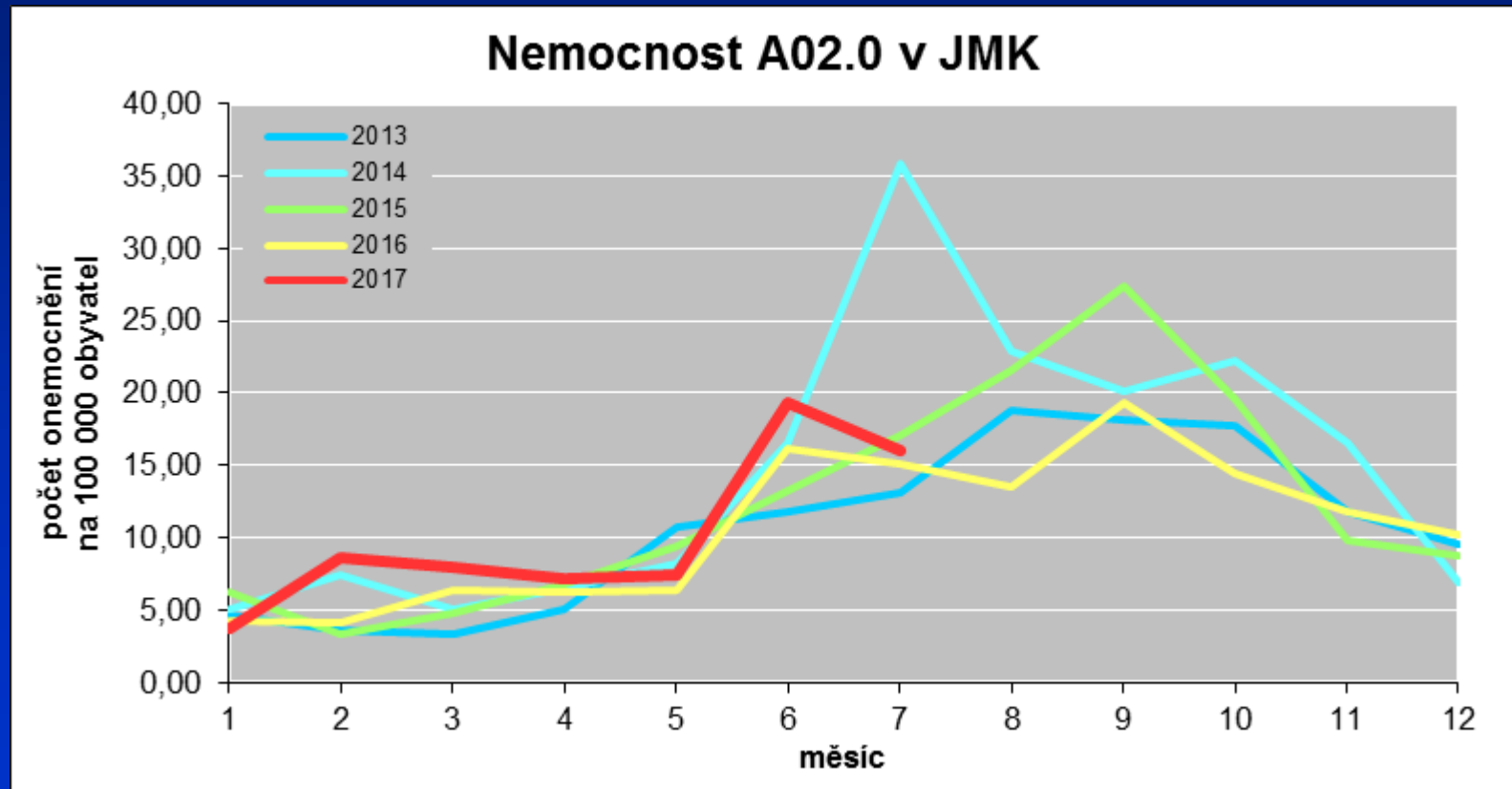
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20
ml
0.2
ml

Salmonellosis

- the second most common zoonosis in CR and most European countries
- at present in CR minimally 90 % cases caused by *S. Enteritidis*, rarely *S. Typhimurium*
- gastroenteritidis
- enterotoxin production and active penetration into intestinal epithel
- septic form (extraintestinal abscesses) in IS patients
- reactive arthritis, erythema nodosum – possible immune-mediated complications
- rehydration, diet, complicated forms: fluoroquinolones, co-trimoxazol, ampicilin, chloramphenicol

Salmonellosis in Southern Moravia 2013-2017



Yersiniosis

- worldwide zoonosis, relatively more common in Northern Europe
- *Yersinia enterocolitica*
- more often in winter
- fever, diarrhea, often bloody, syndrome of the lower right quadrant (mesenteric lymphadenitis)
- complication: sepsis, metastatic abscesses (esp. liver)
- reactive arthritis, erythema nodosum - possible immune-mediated complications
- rehydration, diet, complicated forms: fluoroquinolones, co-trimoxazol, ampicillin, chloramphenicol

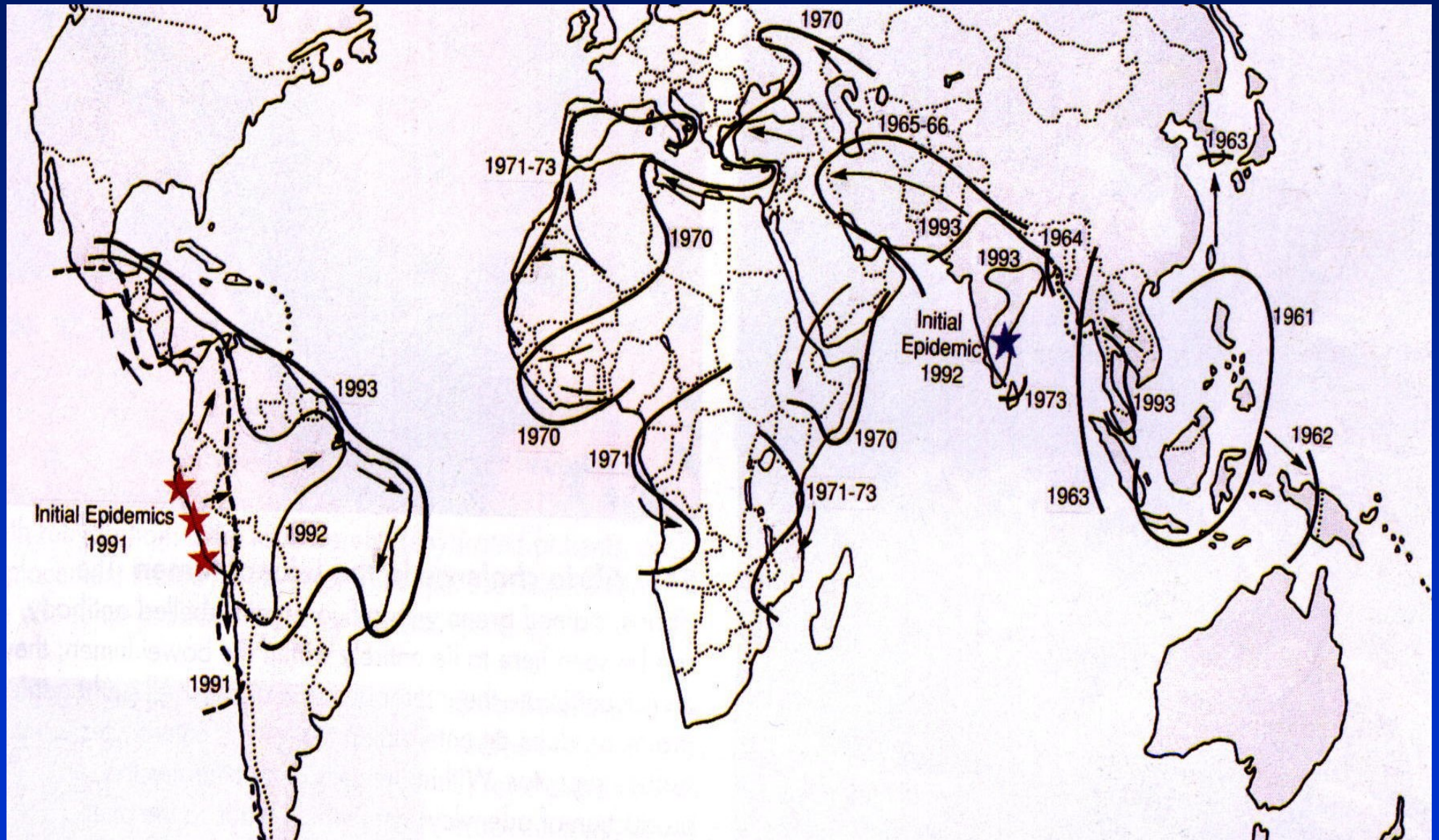
Human bacterial infections

- cholera
- shigellosis
- *E.coli* enterocolitis (except for EHEC – zoonosis)
- *Clostridium difficile* infection

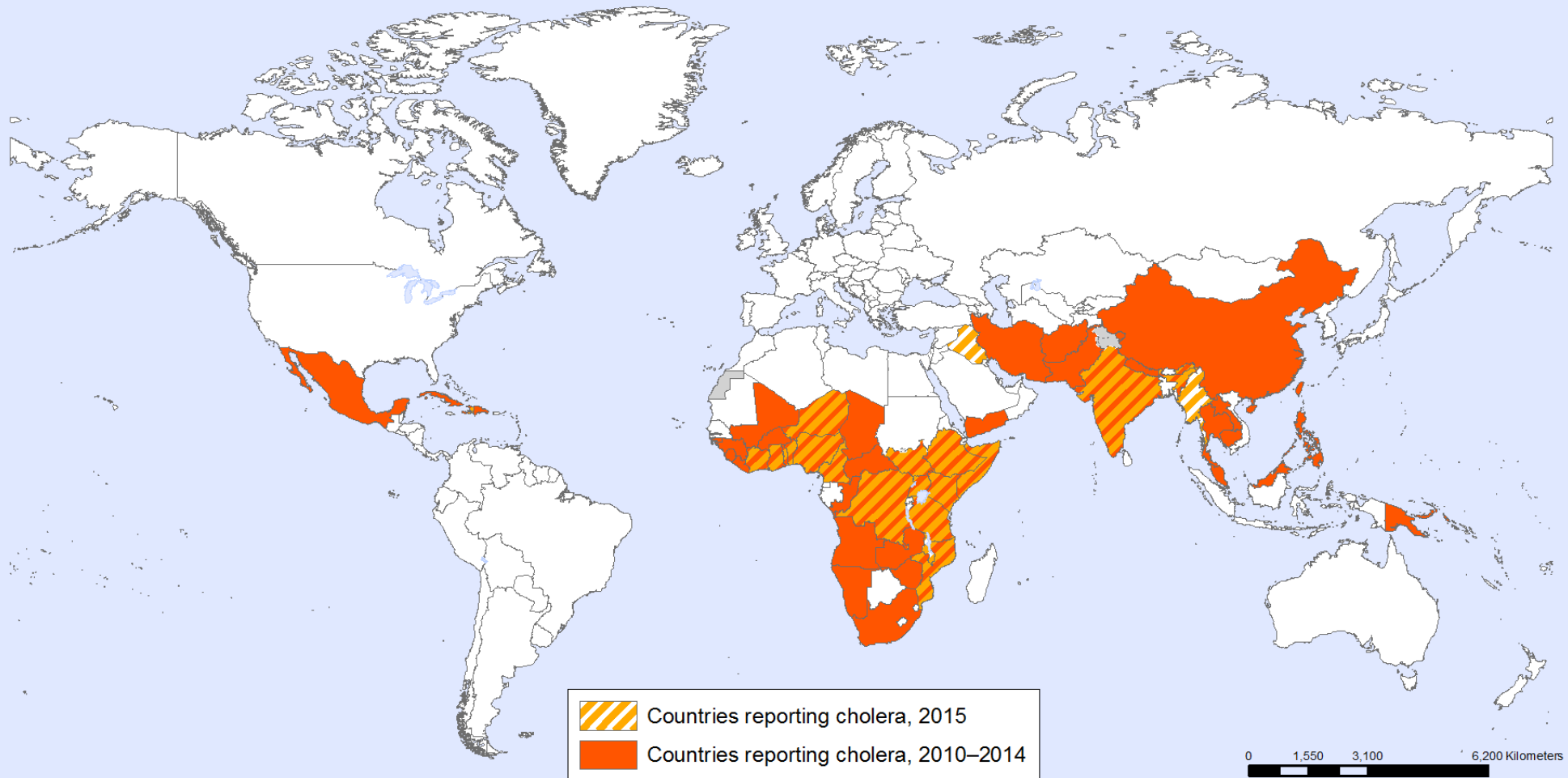
Cholera

- endemic in South and South-East India
- *Vibrio cholerae* faecally contaminated water – drinking water, undercooked animals from this water
- boiling destroys this bacteria
- at least 7 cholera pandemics worldwide during last 200 years
- 1st-6th pandemics - classic type (1817-1923)
- 7th pandemic - biotyp El Tor (since 1960s)
- 8th pandemic - O139 Bengal (since 1992)

Cholera – 7th and 8th pandemics



Countries reporting cholera, 2010–2015



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

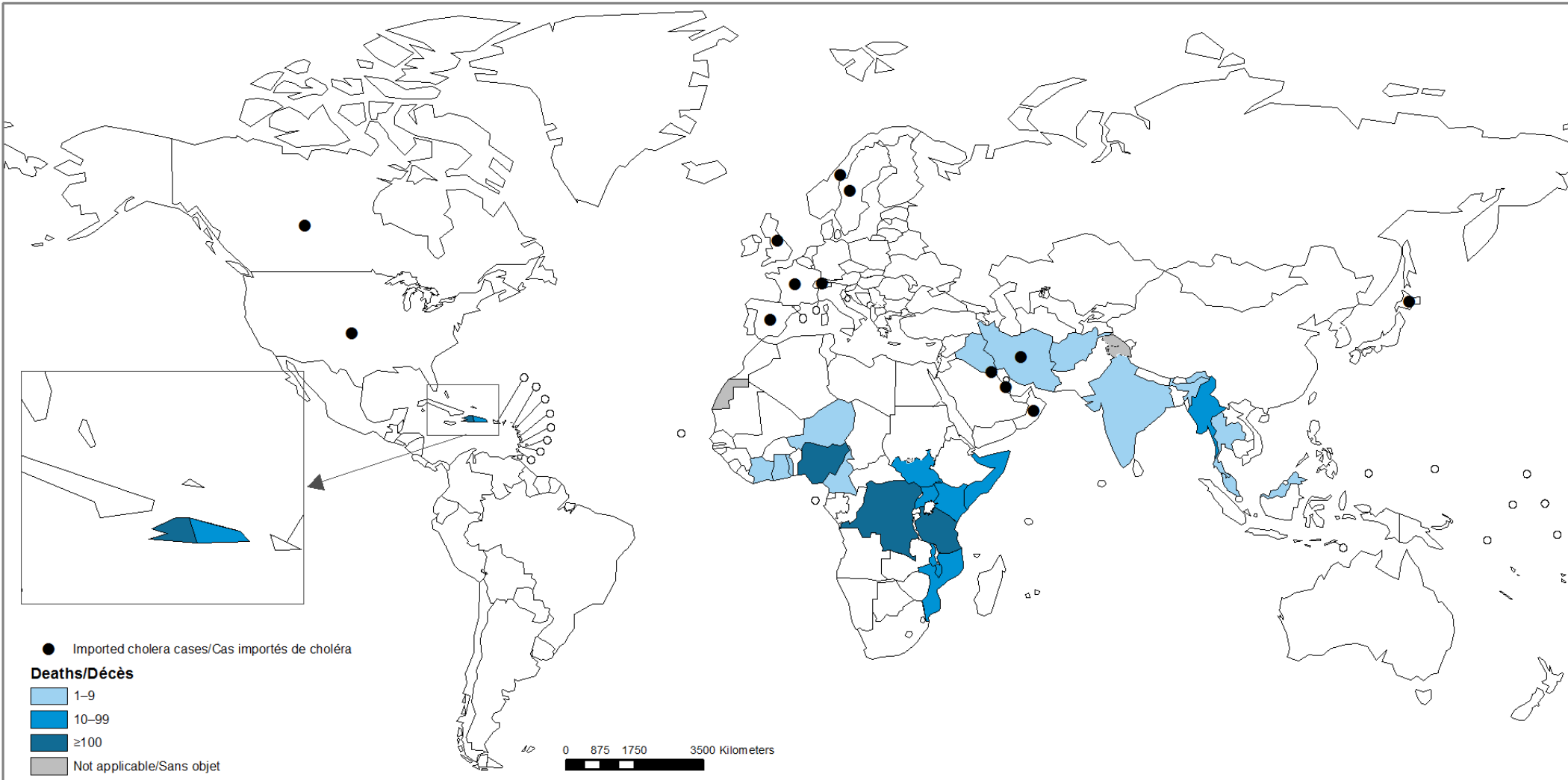
Data Source: World Health Organization
Map Production: Information Evidence
and Research (IER)
World Health Organization



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Countries reporting cholera deaths and imported cases in 2015

Pays ayant déclaré des décès dus au choléra et des cas importés en 2015



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Les appellations employées dans la présente publication et la présentation des données qui y figurent n'impliquent de la part de l'Organisation mondiale de la Santé aucune prise de position quant au statut juridique des pays, territoires, villes ou zones, ou de leurs autorités, ni quant au tracé de leurs frontières ou limites. Les lignes discontinues et en pointillé sur les cartes représentent des frontières approximatives dont le tracé peut ne pas avoir fait l'objet d'un accord définitif.

Data Source: Control of Epidemic Diseases Unit
World Health Organization

Map Production: Information Evidence and Research (IER)
World Health Organization



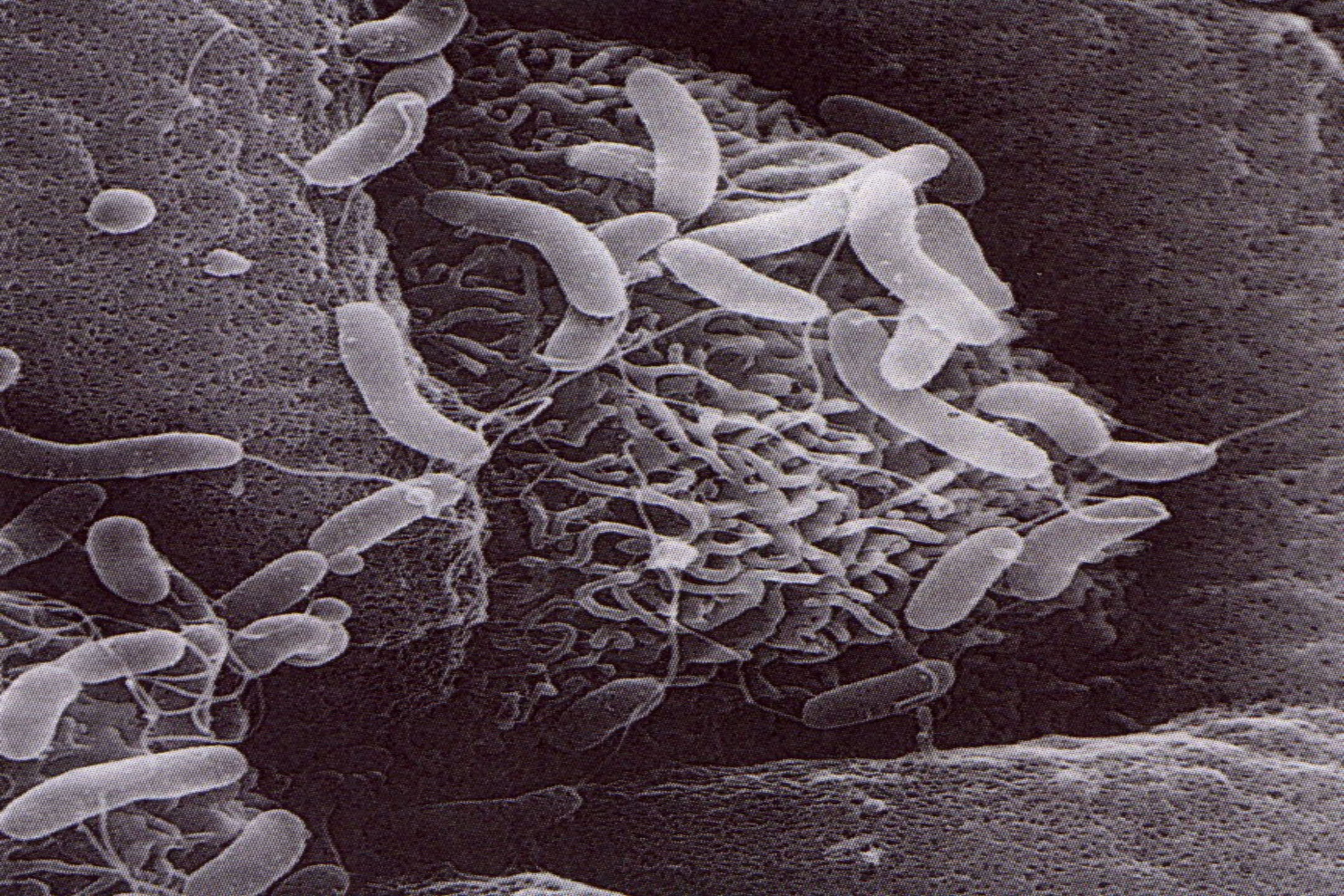
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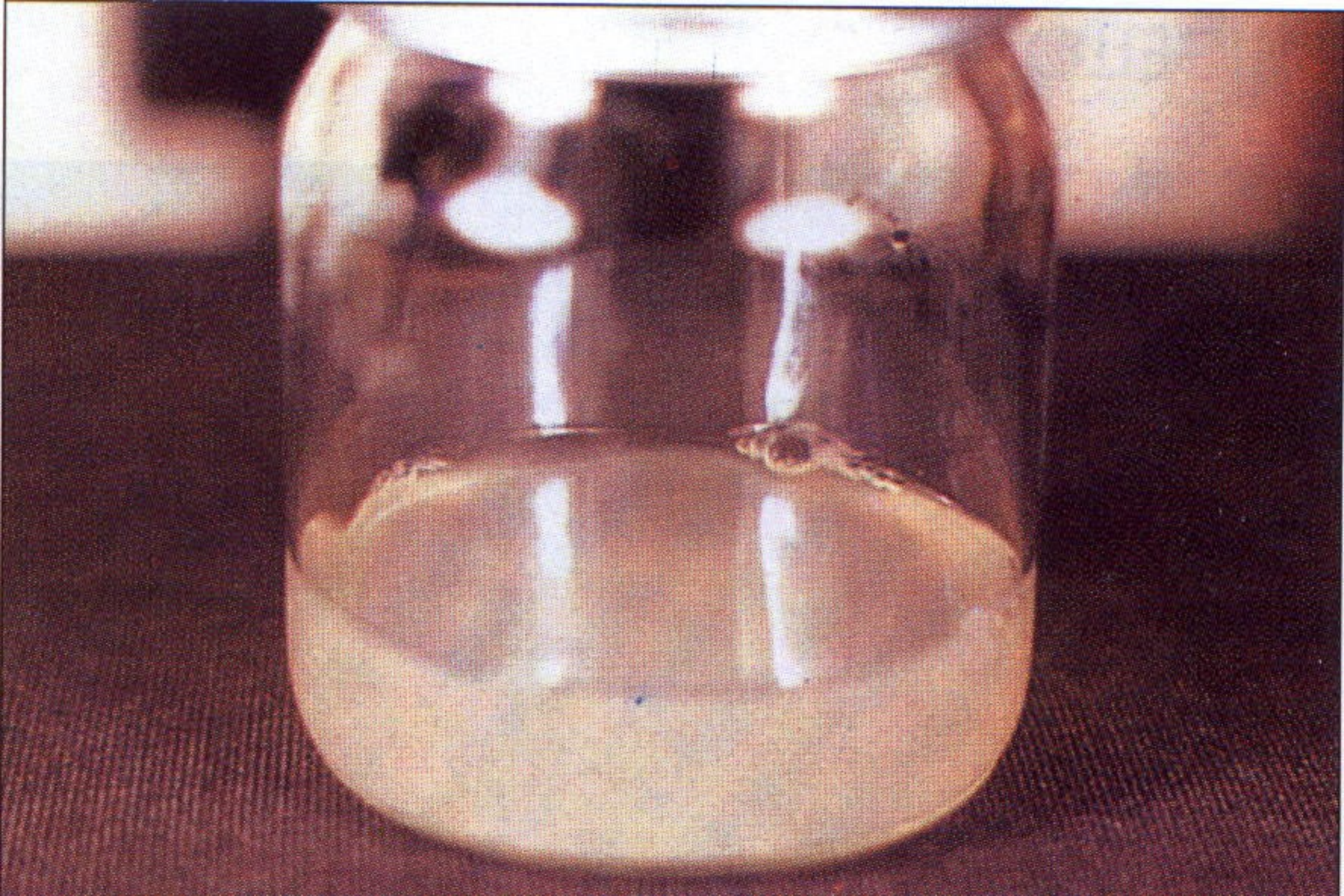


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Cholera

- enterotoxin production - profuse diarrhea, vomiting and rapid dehydration (especially when is the infection caused by classic type)
- the collection of stool by special swabs and culture
- the necessity of quick rehydration
- antibiotics – above all epidemiological significance (fluroquinolones, co-trimoxazol, doxycycline, chloramphenicol)
- vaccination available (combined vaccine with ETEC), not generally recommended – low efficacy, short duration of protection





Shigellosis

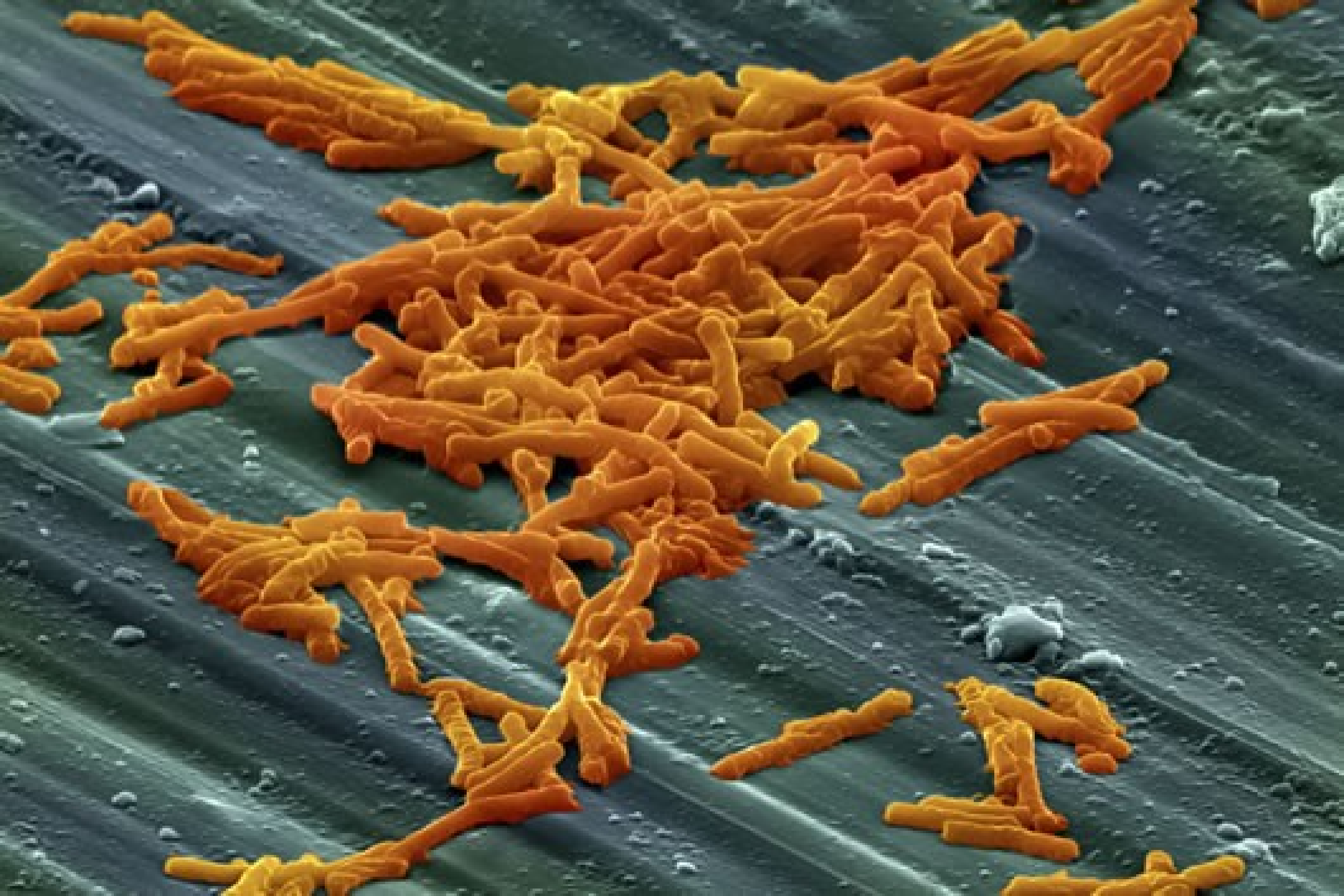
- one of the most contagious intestinal infections
- associated with poor hygiene conditions – war conflicts, natural catastrophes
- *Shigella sonnei*, *S. flexneri*
- colitis (tenesmus, often mucus, pus, and blood in stool)
- rehydration, diet, complicated forms: fluoroquinolones, co-trimoxazol, ampicilin, chloramphenicol

E. coli enterocolitis

- Enterotoxigenic - ETEC
- Enteroinvasive - EIEC
- Enteropathogenic - EPEC
- Enterohemorrhagic - EHEC
- Enteroagregative - EAEC
- Difuse adherent

Clostridium difficile infection (CDI)

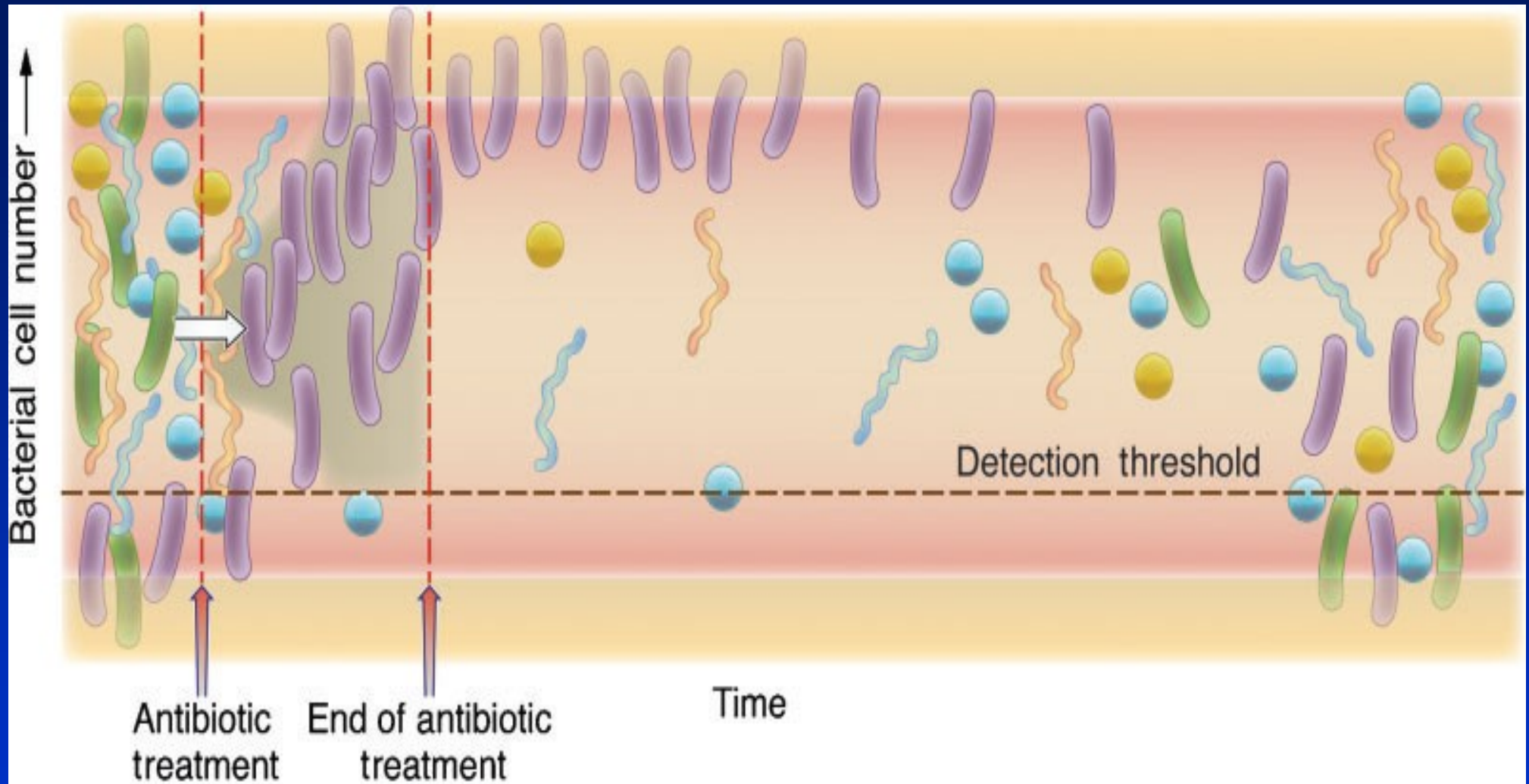
- *C. difficile* - G⁺ anaerobic spore-forming bacteria
- spores survive for many months outside an organism – extremely resistant
- common nosocomial infections in developed countries
- development of vegetative forms in the colon
- production of exotoxins (usually both at once)
 - toxin A (enterotoxin – necrotic)
 - toxin B (cytotoxin)
 - binary toxin (unknown mechanism)





Important factors for CDI

- presence of toxigenic strain of *C.difficile*
- antibiotic treatment – aminopenicilins, cephalosporins, lincosamides...
- less frequently without antibiotic treatment – oncologic patients
- age \geq 65 years, comorbidities, IS
- function of GI tract – peristalsis, only perenteral nutrition, disturbances of mucous immunity

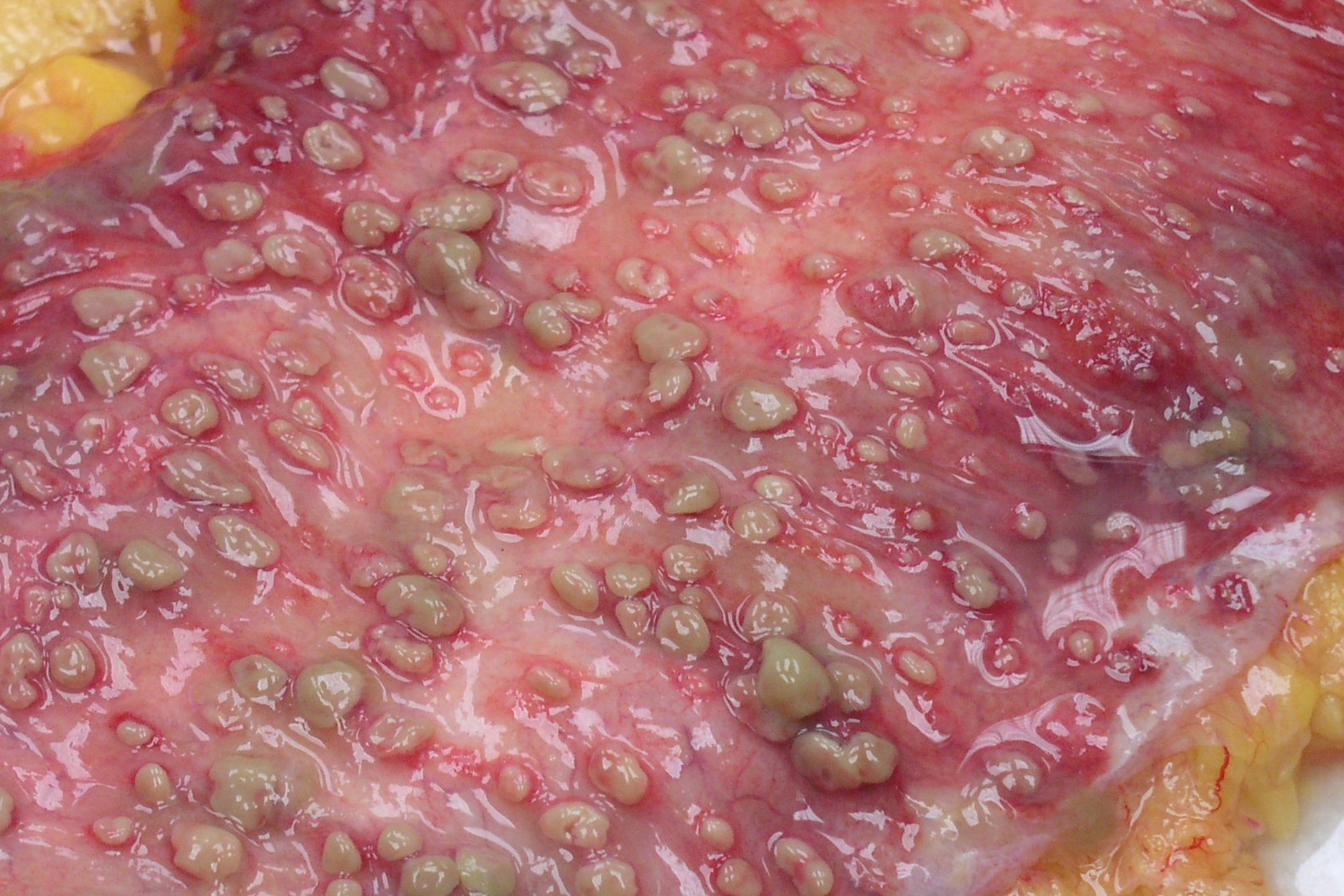


Long-term impacts of antibiotic exposure on the human intestinal microbiota.
Jernberg C., Löfmark S, Edlund Ch. et al. *Microbiology* (2010), 156, 3216–3223

CDI – clinical forms

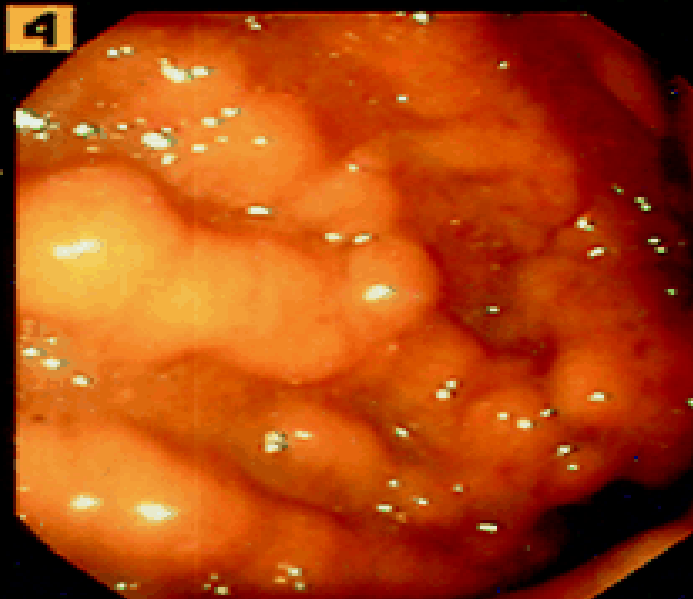
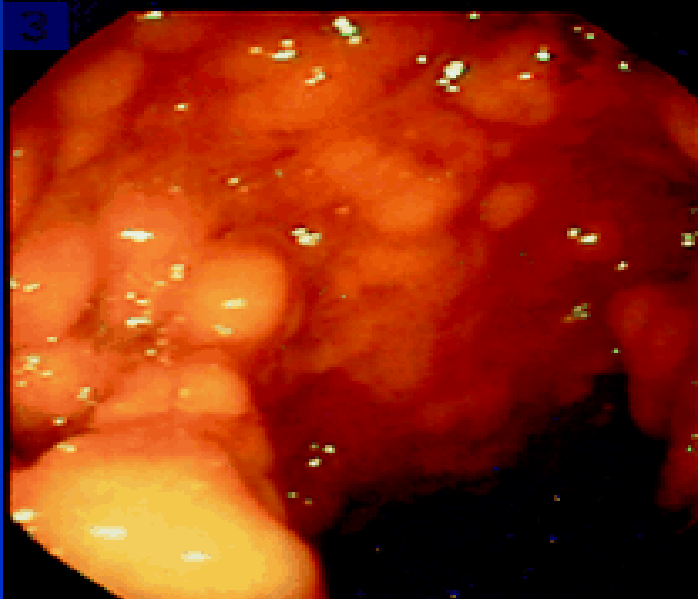
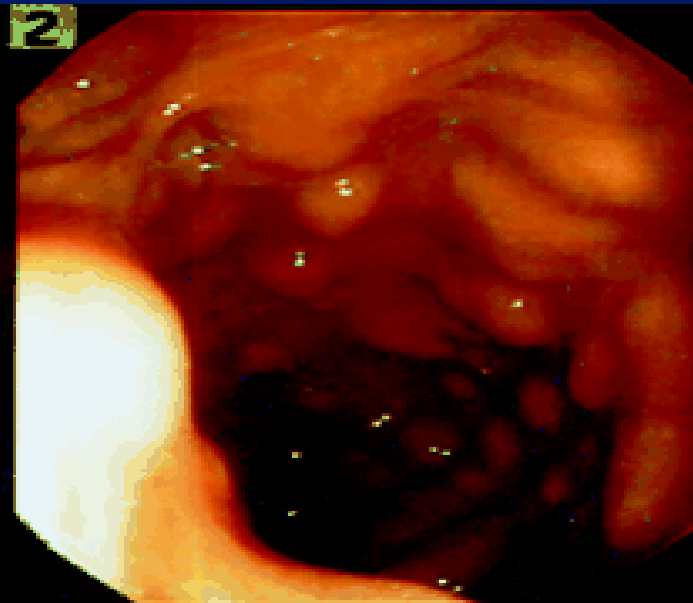
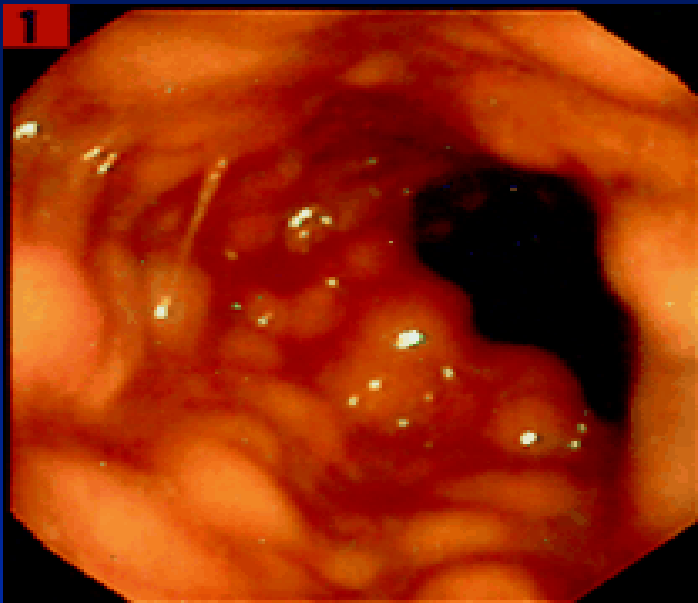
- a) asymptomatic carriers (2-3 % of adults, in children much more, prevalence is increasing with the length of hospitalization - 10-25 % or more)
- b) uncomplicated colitis (diarrhea, fever, no pseudomembranes)
- c) pseudomembranous colitis - PMC (sepsis, leucocytosis, abdominal pain, and bloody stool)
- d) toxic megacolon (paresis and necrosis of the gut, possible perforation, infectious shock)





Diagnosis of CDI

- antibiotics in history
- clinical findings
- microbiological testing – detection of toxins (ELISA), specific antigen (GDH), culture, cytotoxic test, PCR
- coloscopy (pseudomembranes)
- ultrasound, CT – auxilliary methods



CDI therapy

- termination of ATB therapy
- colitic diet, rehydration, rehabilitation
- do not use antimotility drugs - danger of toxic megacolon
- pharmacotherapy – 10-14 days
 - metronidazol 3 × 500 mg oral or intravenous
 - vancomycin 4 × 125 mg oral
 - fidaxomicin 2 × 200 mg oral
- faecal bacteriotherapy – faecal transplant
- colectomy

Food poisoning

- **with short incubation period** (1-6 hours)-thermostable toxins –
nausea, vomiting

Staphylococcus aureus

Bacillus cereus

- **with long incubation period** (6-18 hours)- termolabile toxins -
diarrhea

Bacillus cereus

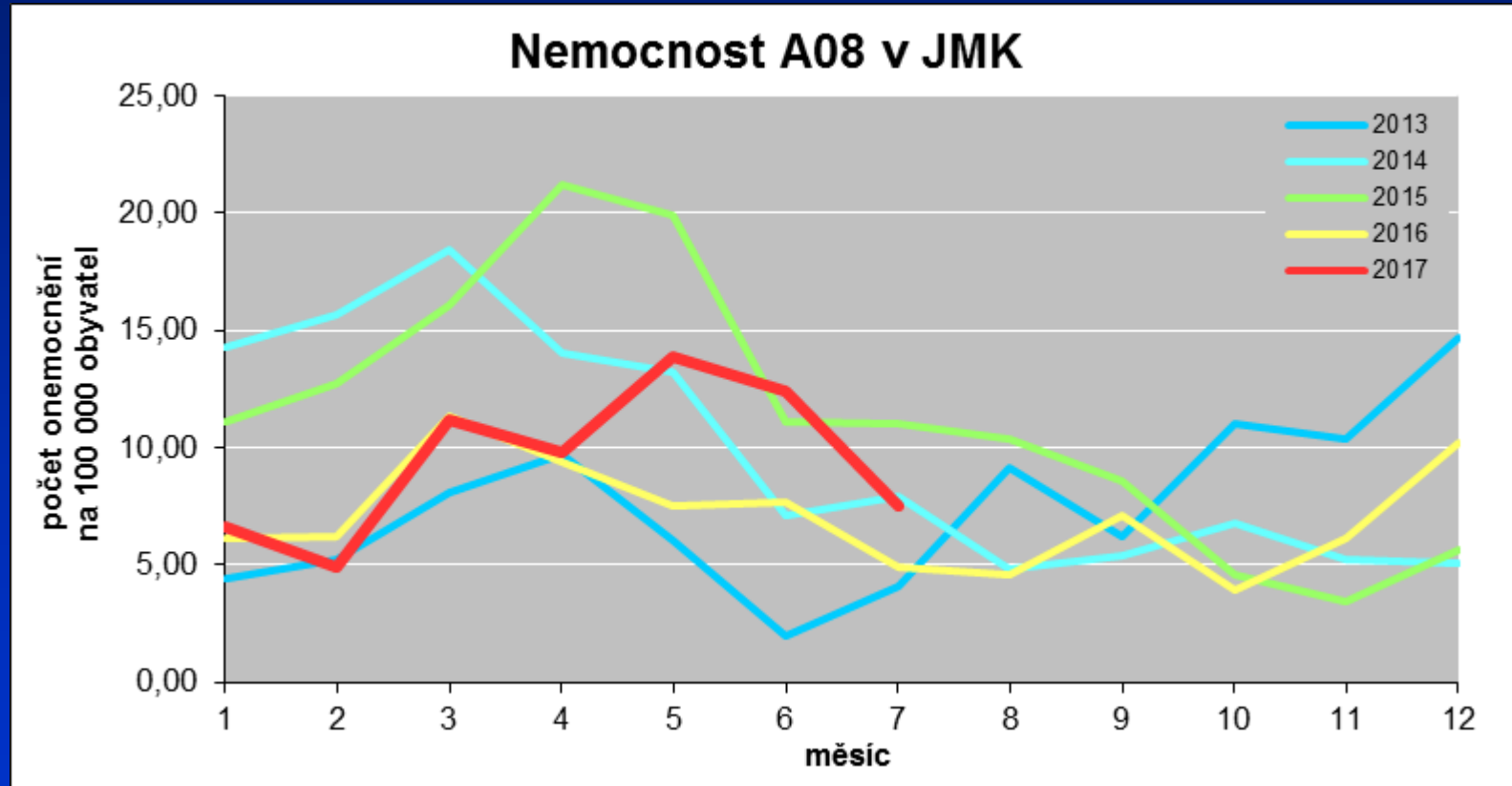
Clostridium perfringens A

- absence of fever, outbreaks
- rehydration, diet

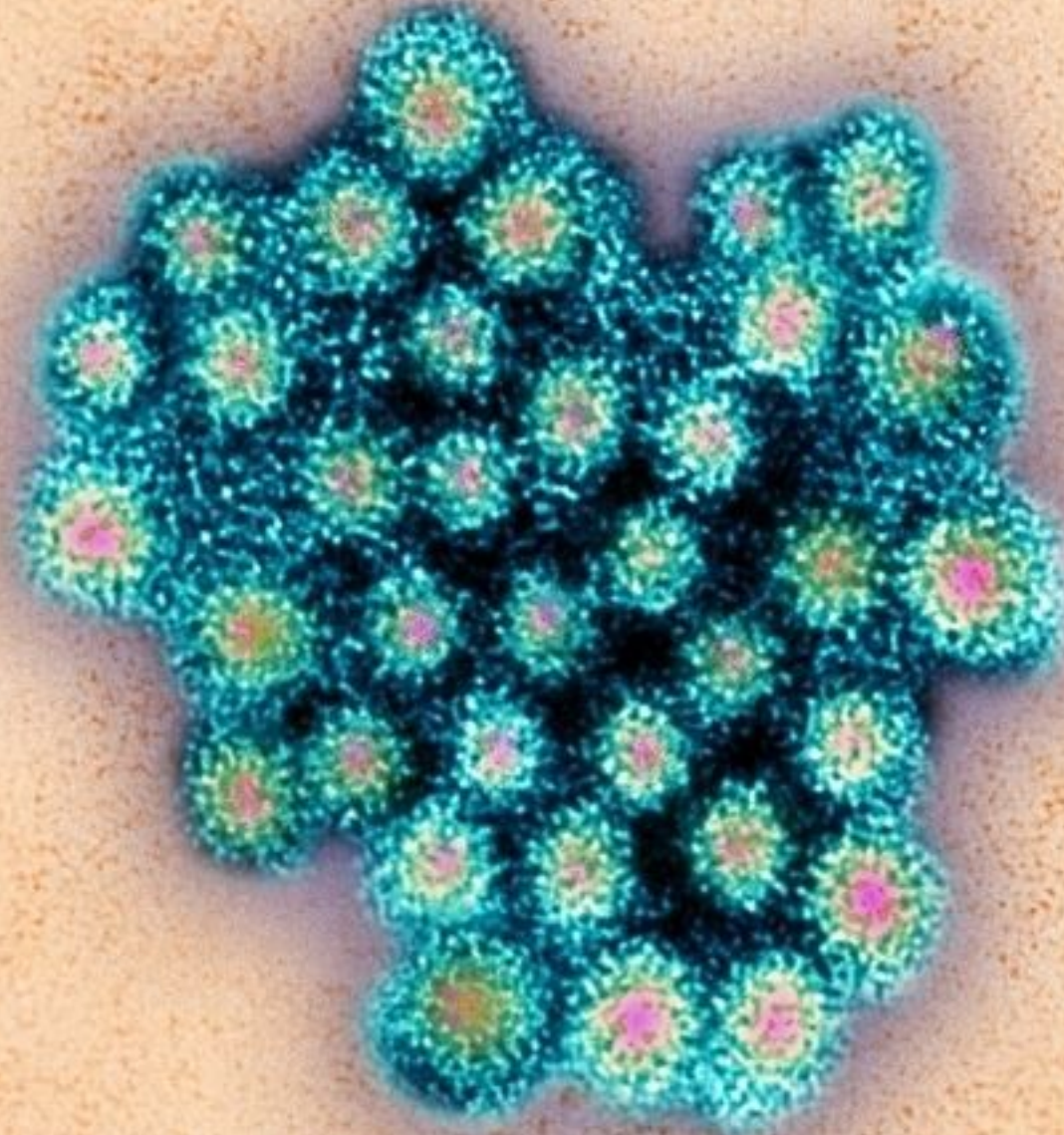
Viral gastroenteritis

- noroviruses (Norwalk, Norwalk-like virus) – older children, adults
 - rotaviruses (small children- 6-24 months, seniors) – fecal-oral, air-borne infection, vaccine available
 - adenoviruses
 - astroviruses
 - coronaviruses
-
- symptomatic therapy

Viral GI infections in Southern Moravia 2013-2017



Norovirus



Incubation periods of GI infections

Pathogen	Incubation period
Campylobacter	1-7 days
Salmonella	6-48 hours
Yersinia	4-10 days
Shigella	1-5 days
Clostridium difficile	3-30 days
Staphylococcus aureus	1-6 hours
Bacillus cereus termostabile toxin	1-6 hours
Bacillus cereus termolabile toxin	8-16 hours
Clostridium perfringens A	8-16 hours
Rotavirus	1-2 days
Adenovirus	1-2 days
Norovirus	18-72 hours

Parasitic infection of GI tract

- protozoal
- helminthic
- fungal

Protozoal infections

Human

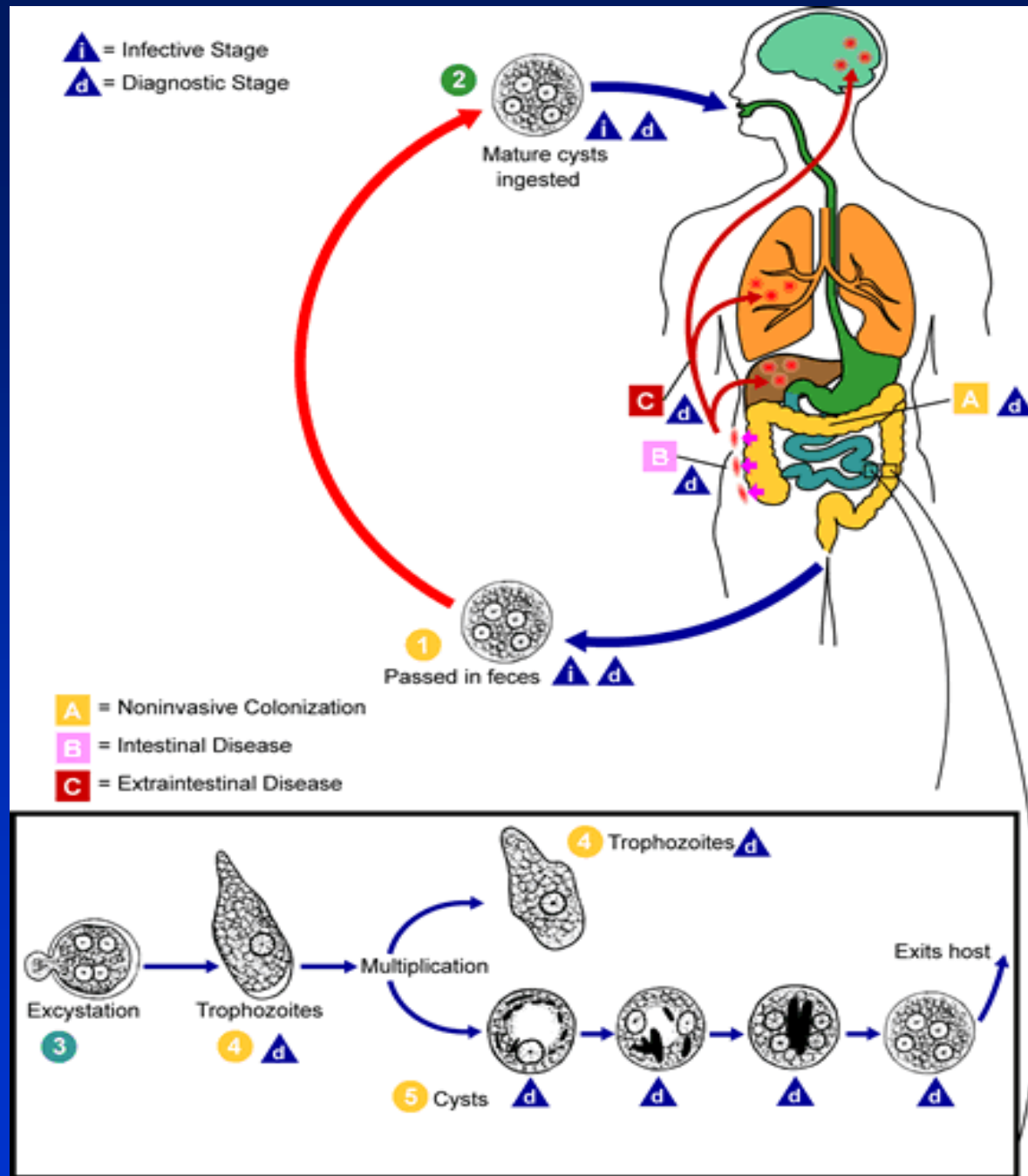
- Amebiasis (*Entamoeba histolytica*)
- Lambliasis = giardiasis (*L.*, *G. intestinalis*)

Zoonotic

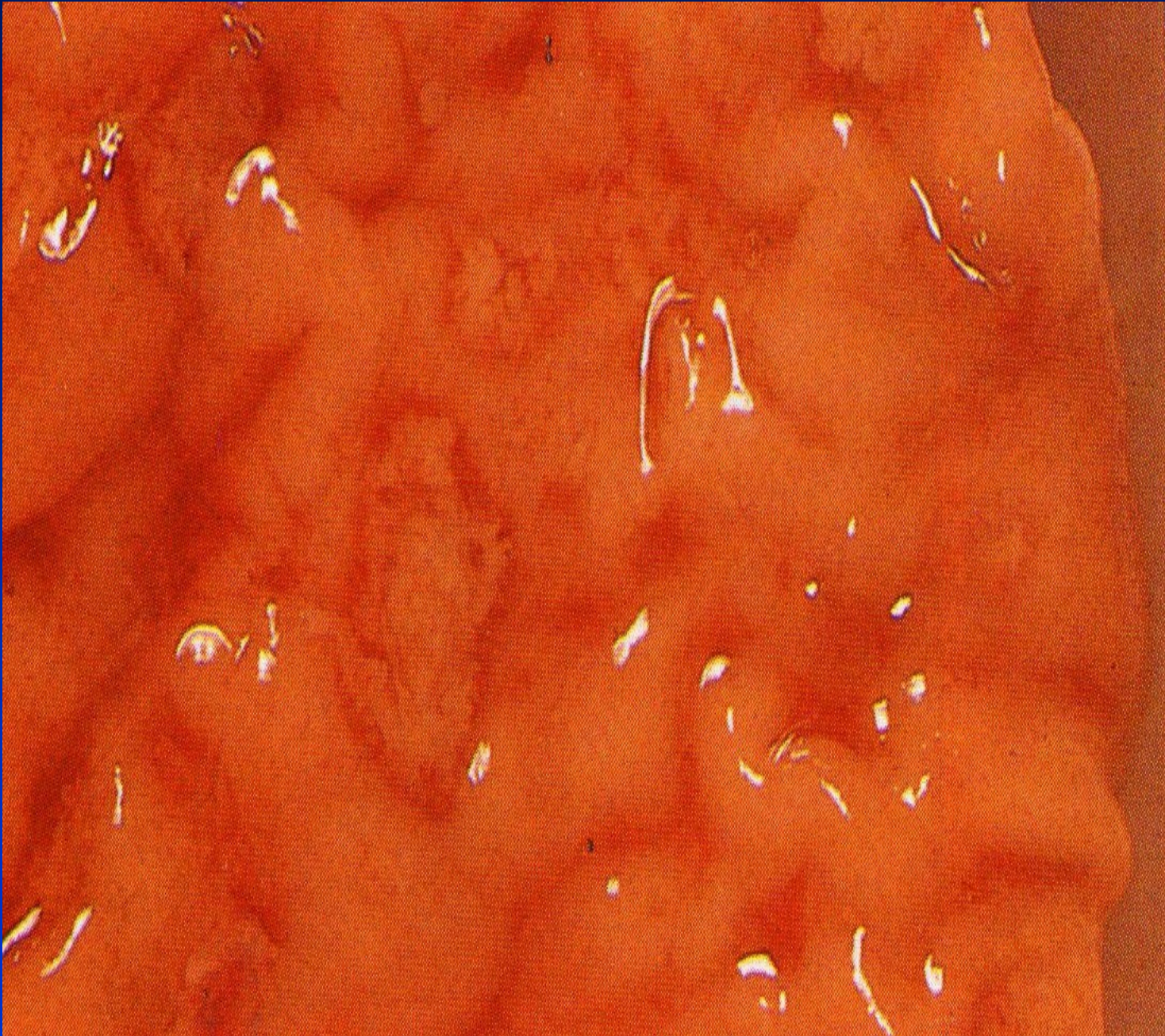
- cryptosporidiosis (*Cryptosporidium parvum*)
- isosporosis (*Isospora belli*)
- microsporidiosis (*Enterocytozoon bineusi*)
- cyclosporiasis (*Cyclospora cayetanensis*)

Amebiasis

Entamoeba histolytica



Amebic colitis



Amebic abscess



CT – day 0

Amebic abscess



CT – drainage of 2 abscesses – day 2

Map 3
150dB/C3
Persist Med
Fr Rate Med
2D Opt:Gen

ATL

D X

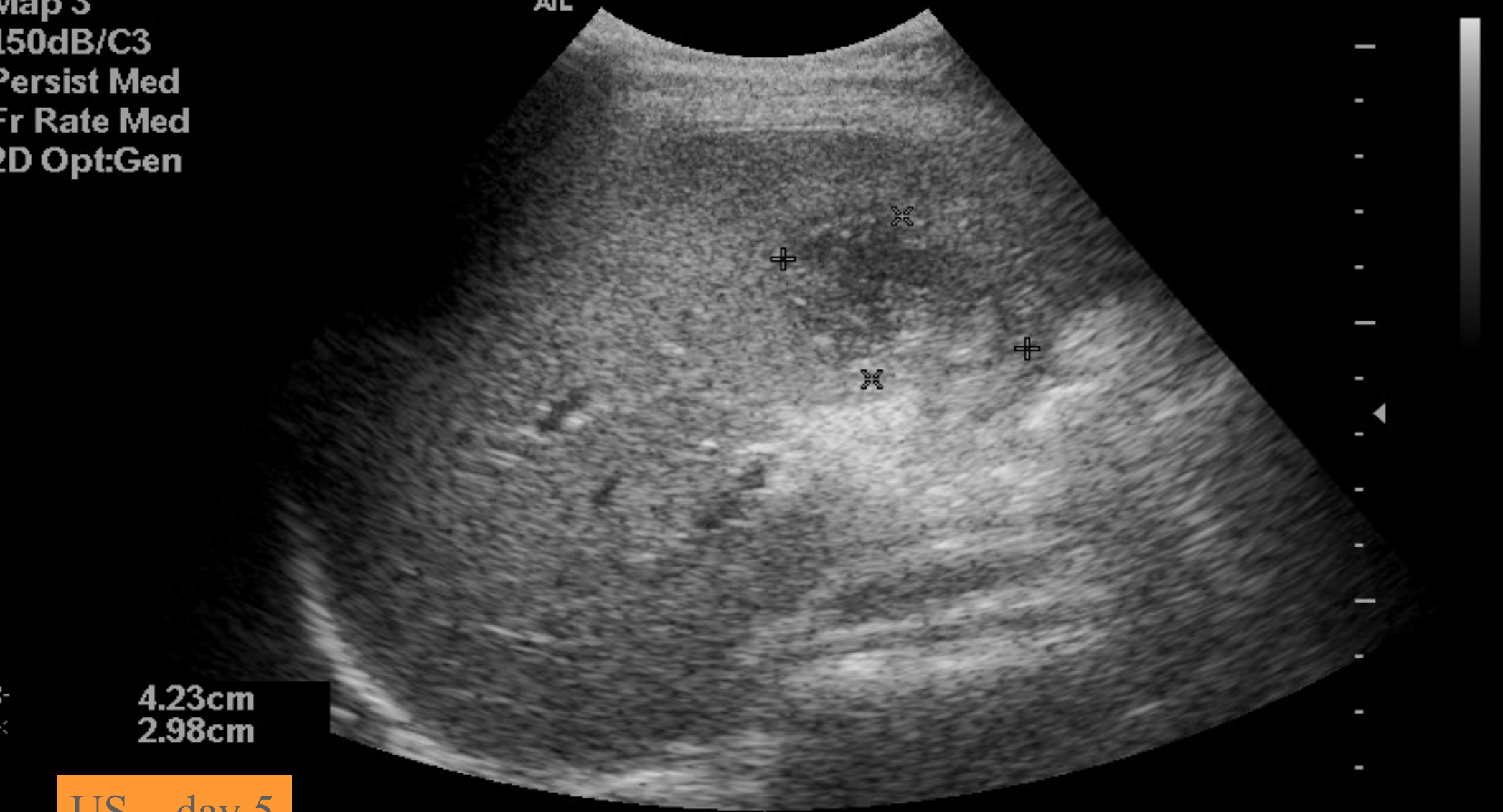
5.76cm

US – day 0



Map 3
150dB/C3
Persist Med
Fr Rate Med
2D Opt:Gen

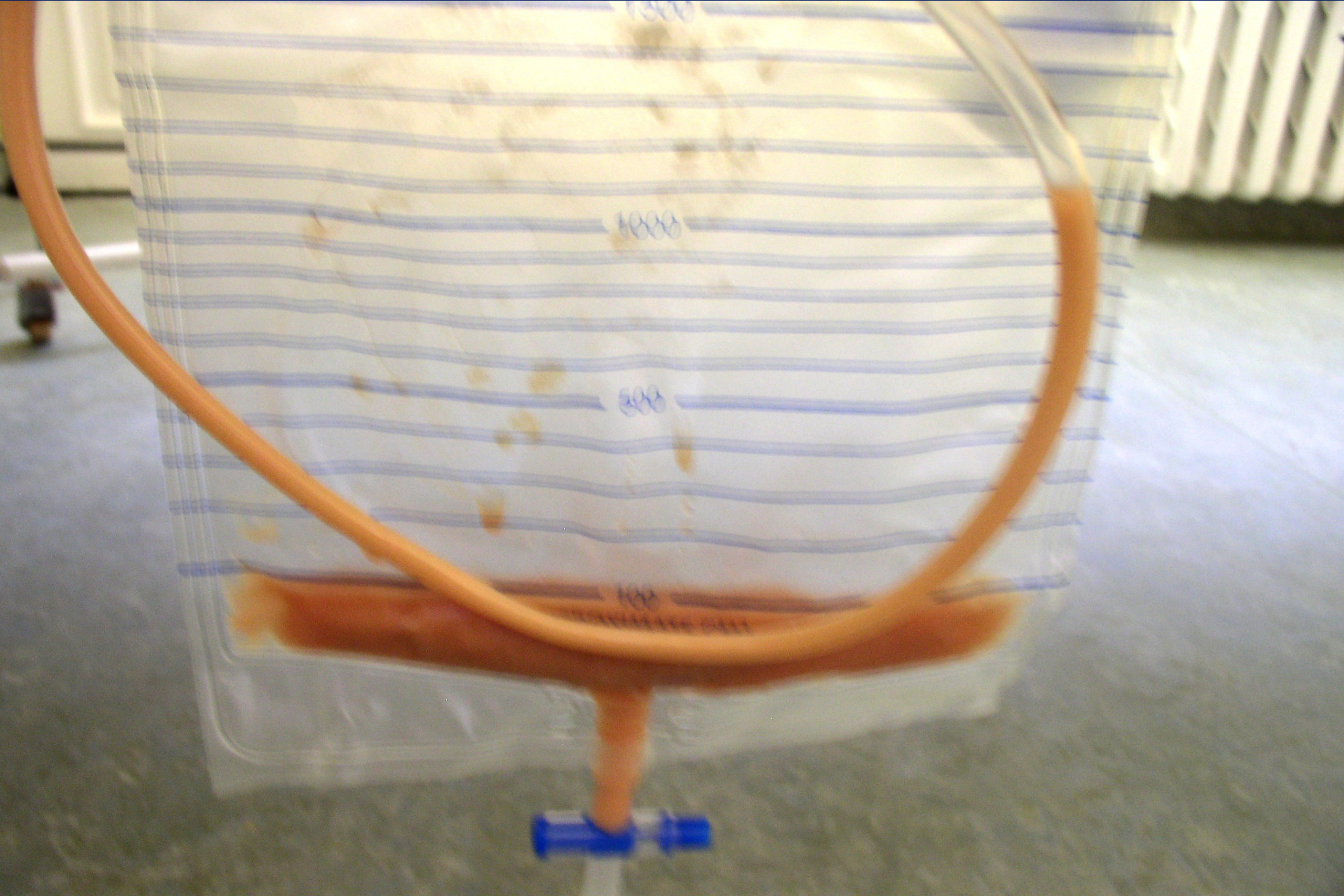
ATL



+ 4.23cm
* 2.98cm

US - day 5





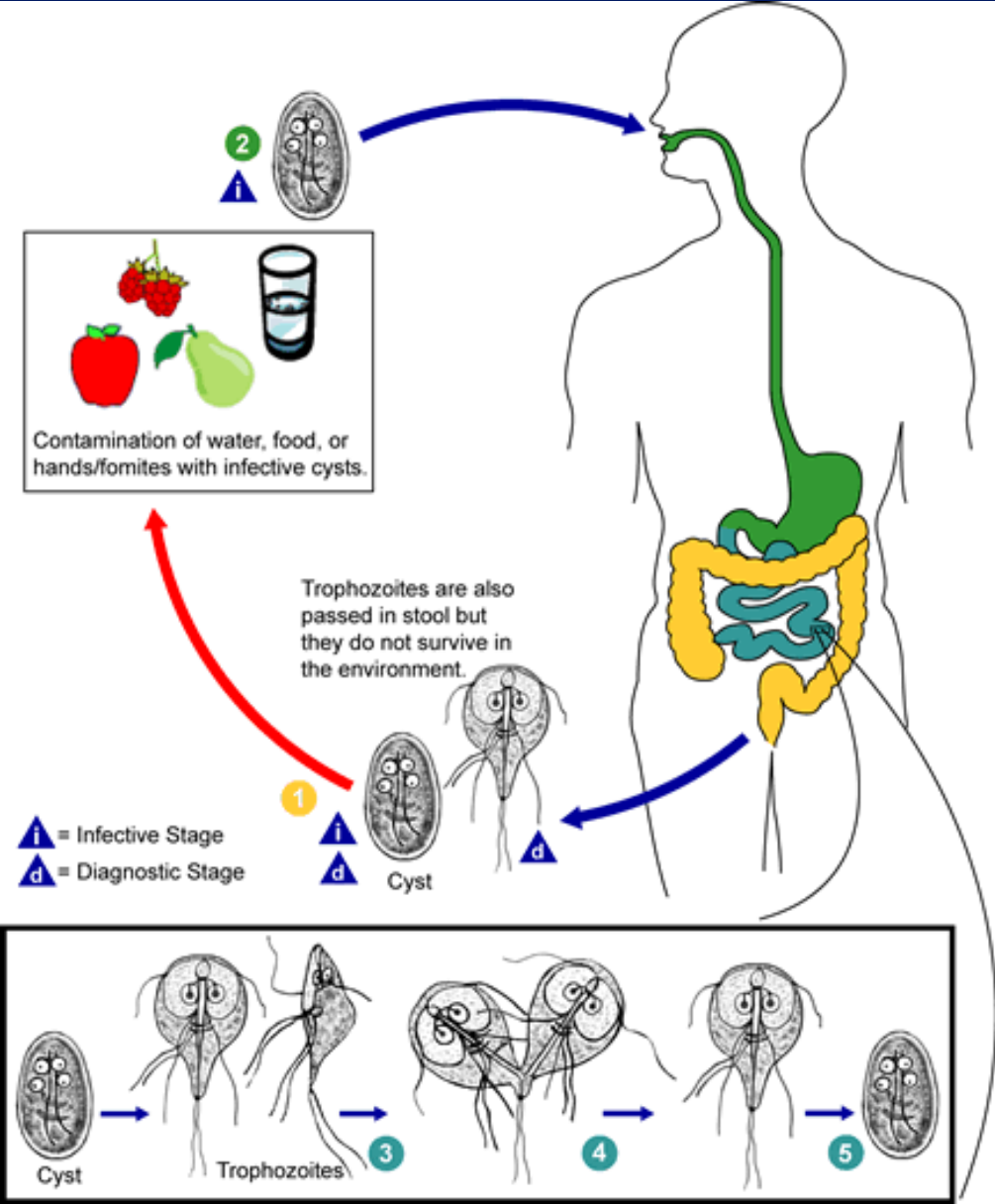


Amebic abscess –
transcutaneous puncture

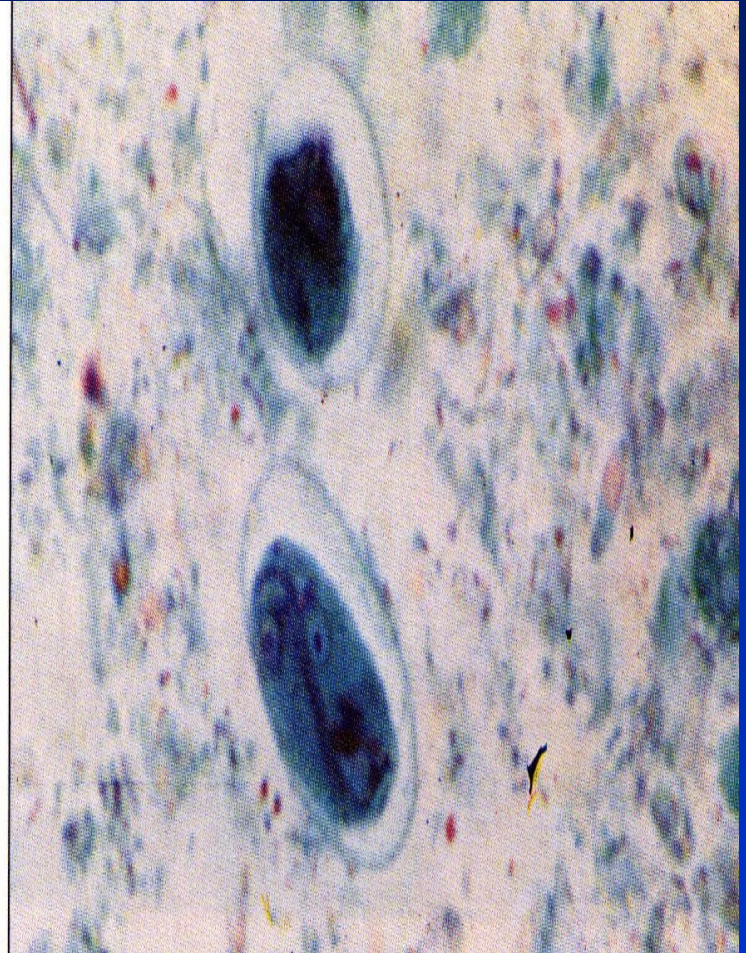


Lambliasis, girardiasis

*Lamblia, Giardia
intestinalis*



Lambliasis
microskopy



Lamblasis
scan



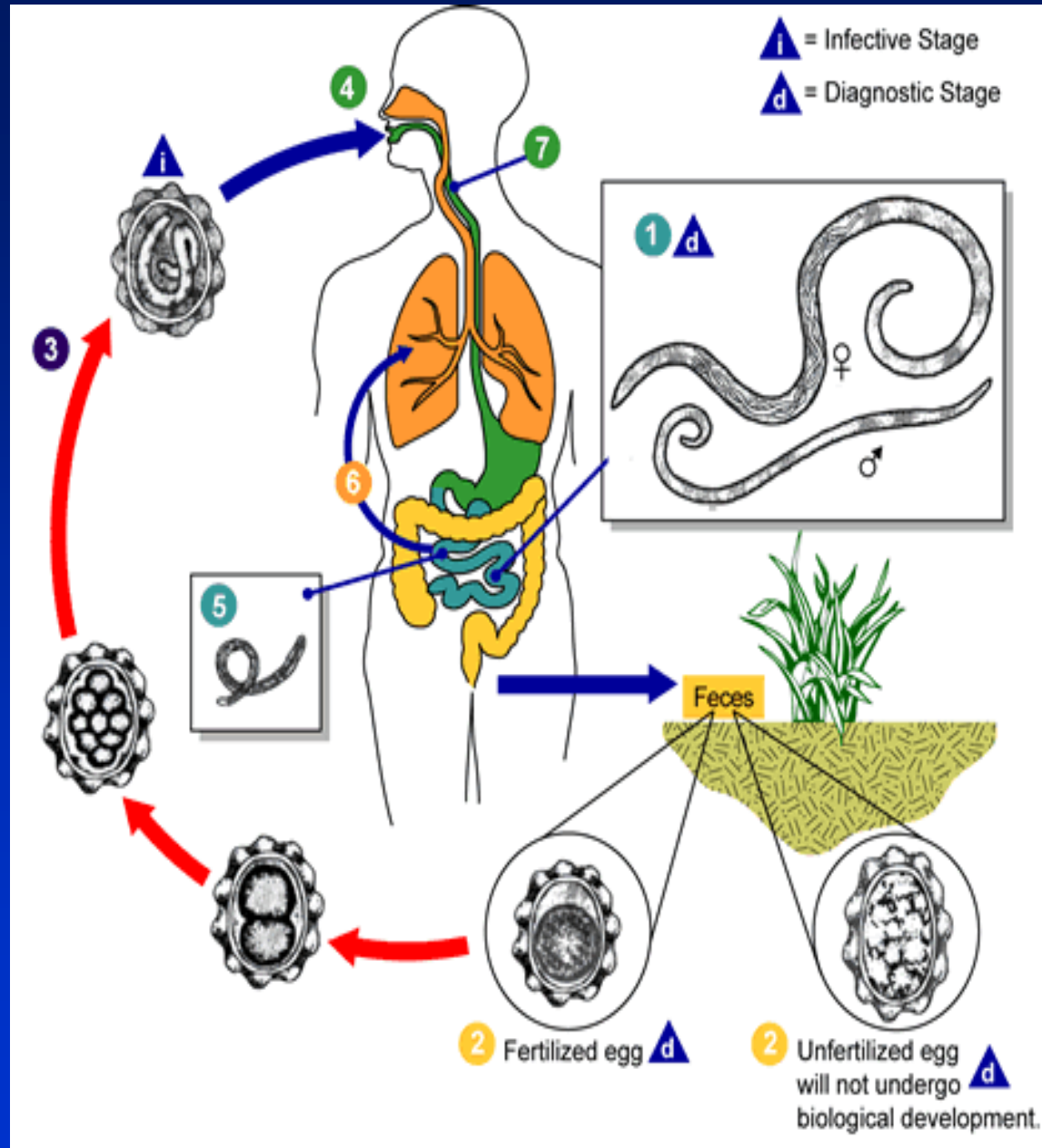
Helmintic GI infections

- **Roundworms (Nematodes)** - ascariasis, enterobiosis=oxyuriasis, trichuriasis
- **Tapeworms (Cestodes)** - teniasis, diphylobotriosis, hymenolepsiosis, echinococcosis, alveococcosis
- **Flukes (Trematodes)** - schistosomiasis

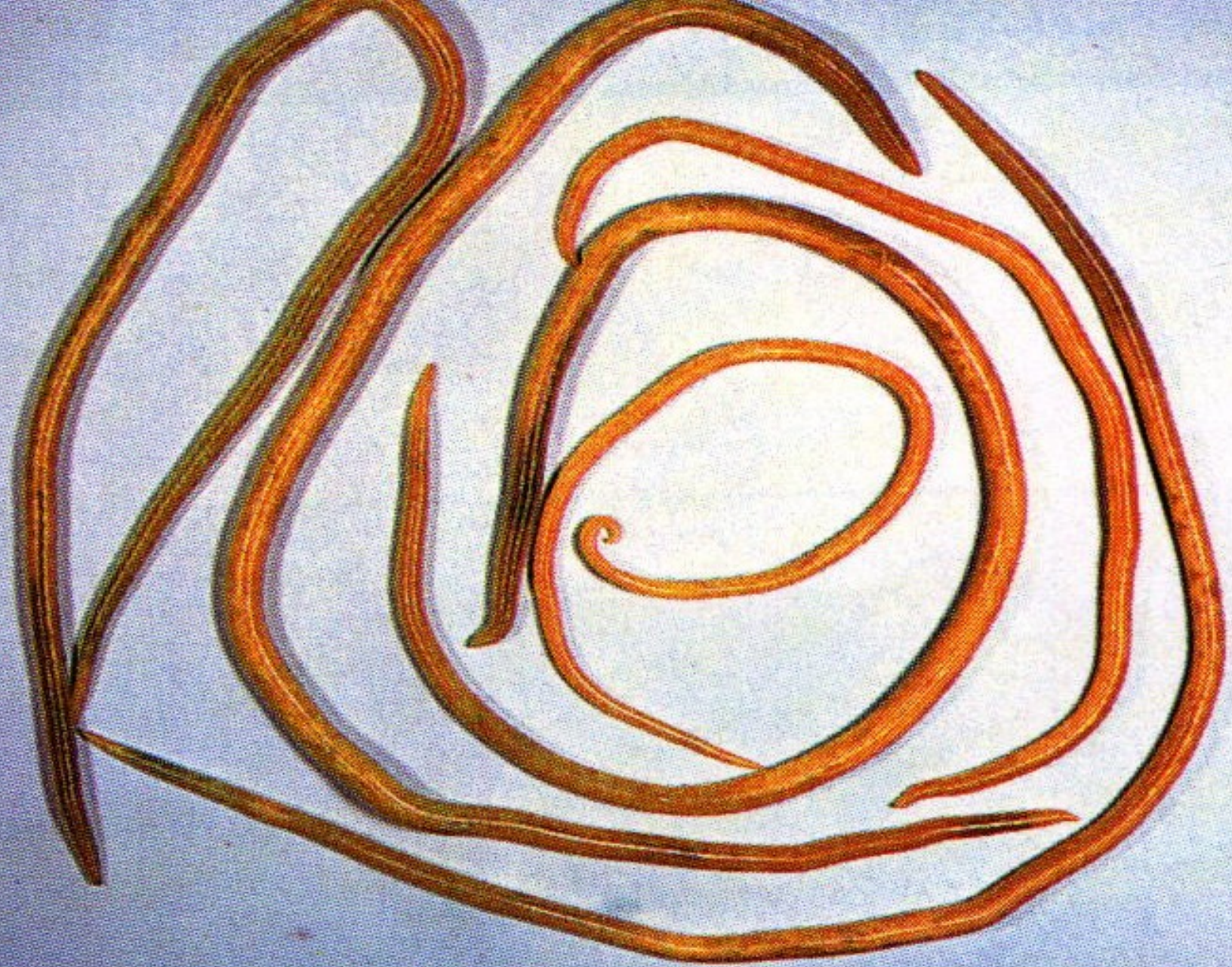
Roundworms (Nematodes)

- *Ascaris lumbricoides*
- *Enterobius, Oxyuris vermicularis*
- *Trichuris trichiura*

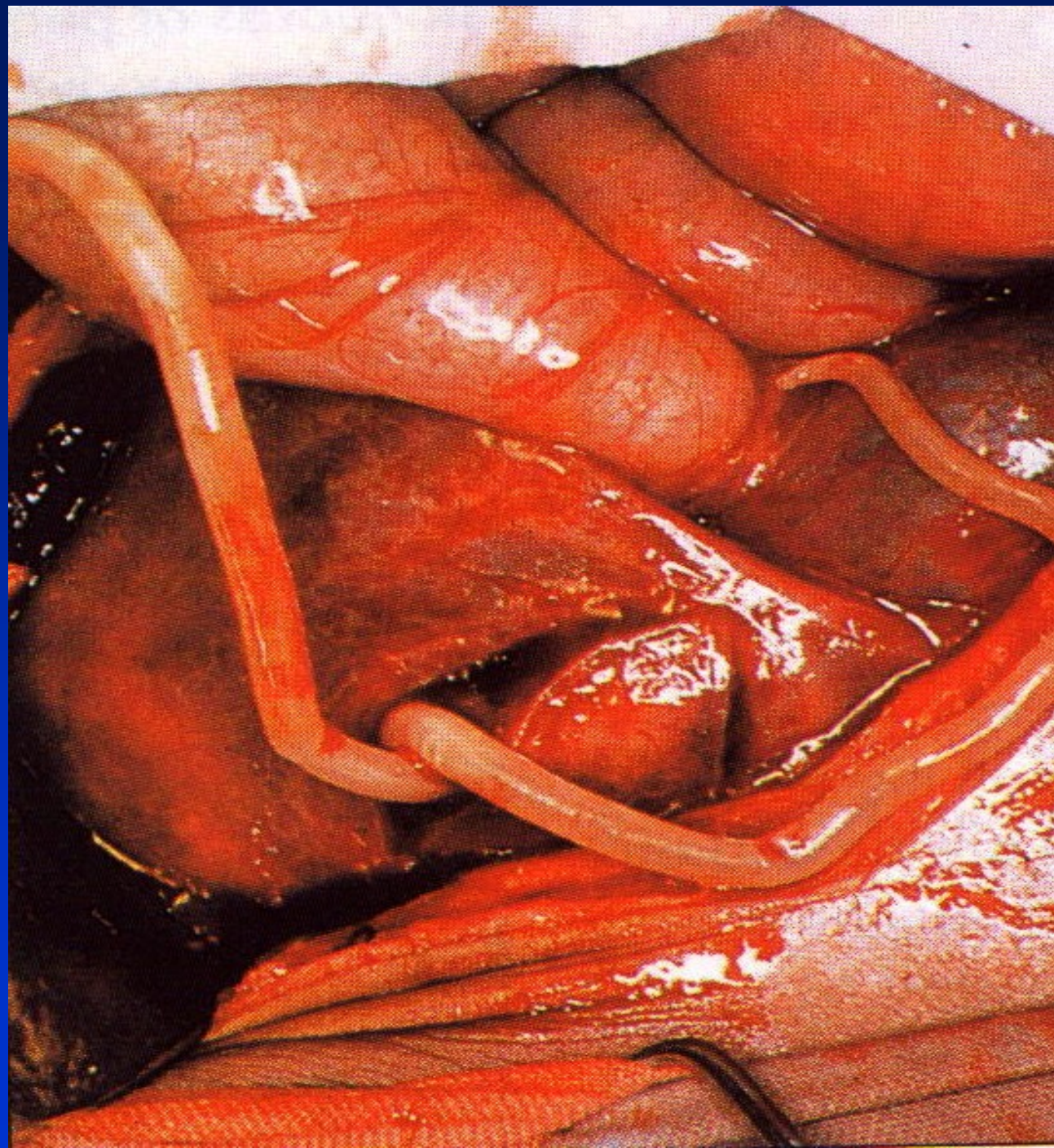
Ascariasis



Ascaris lumbricoides

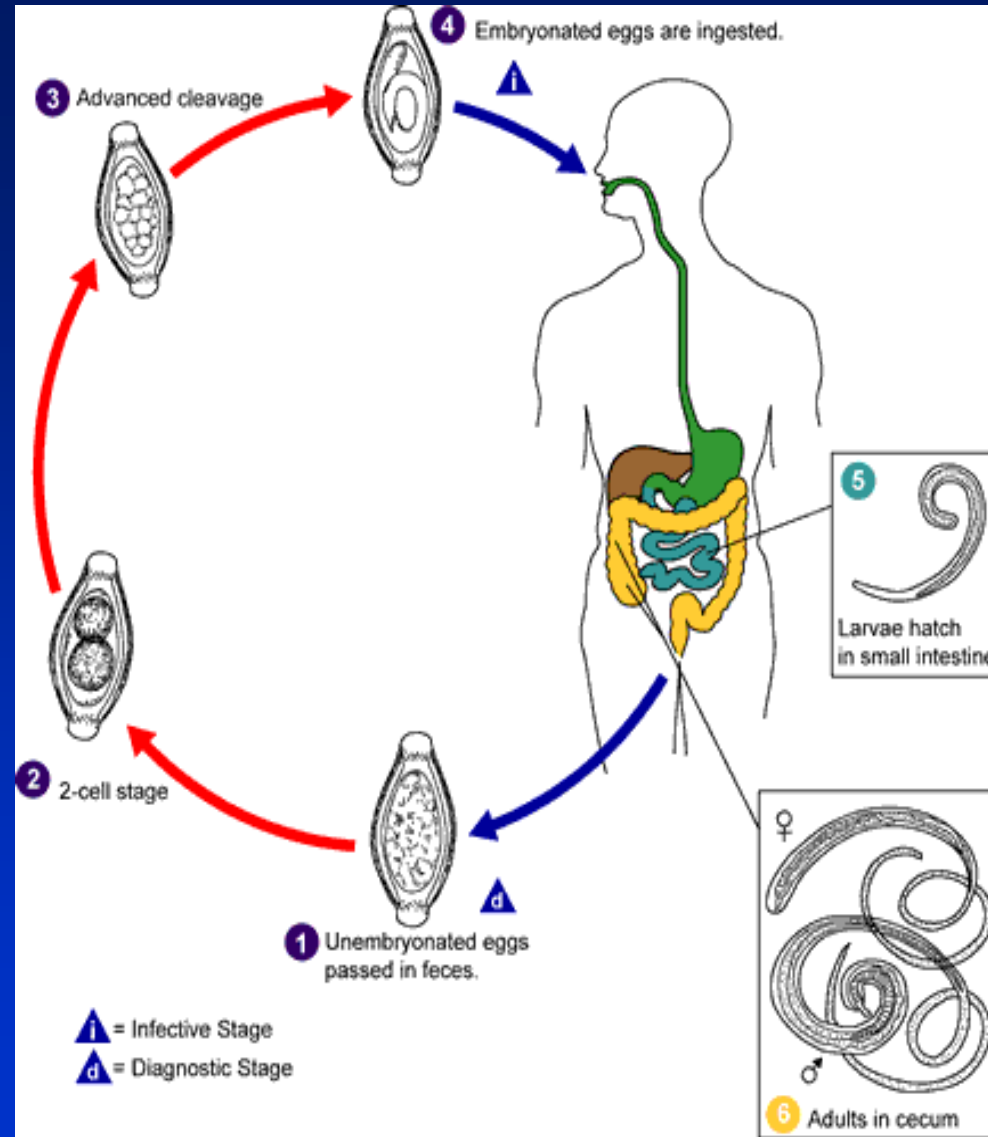




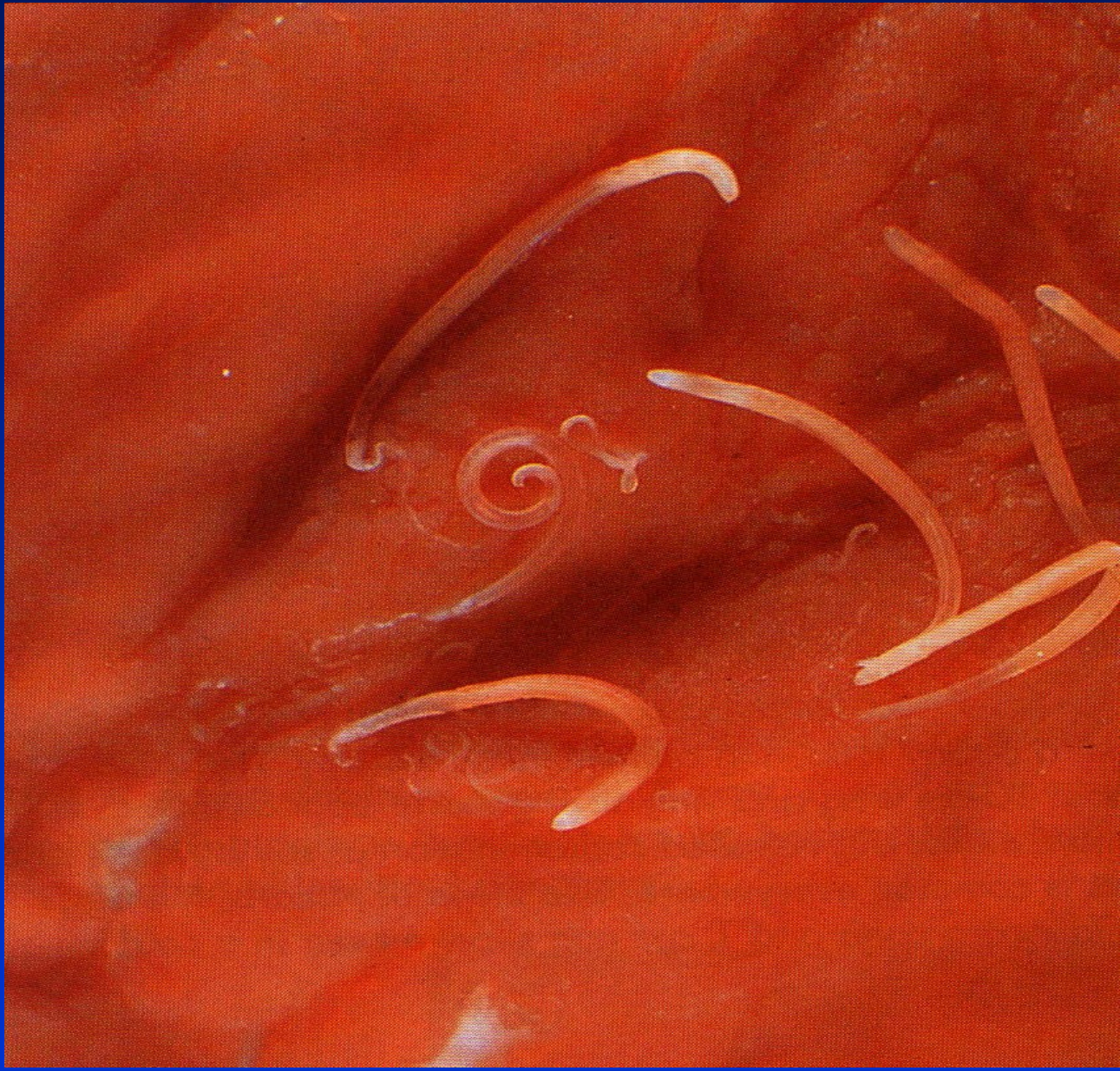


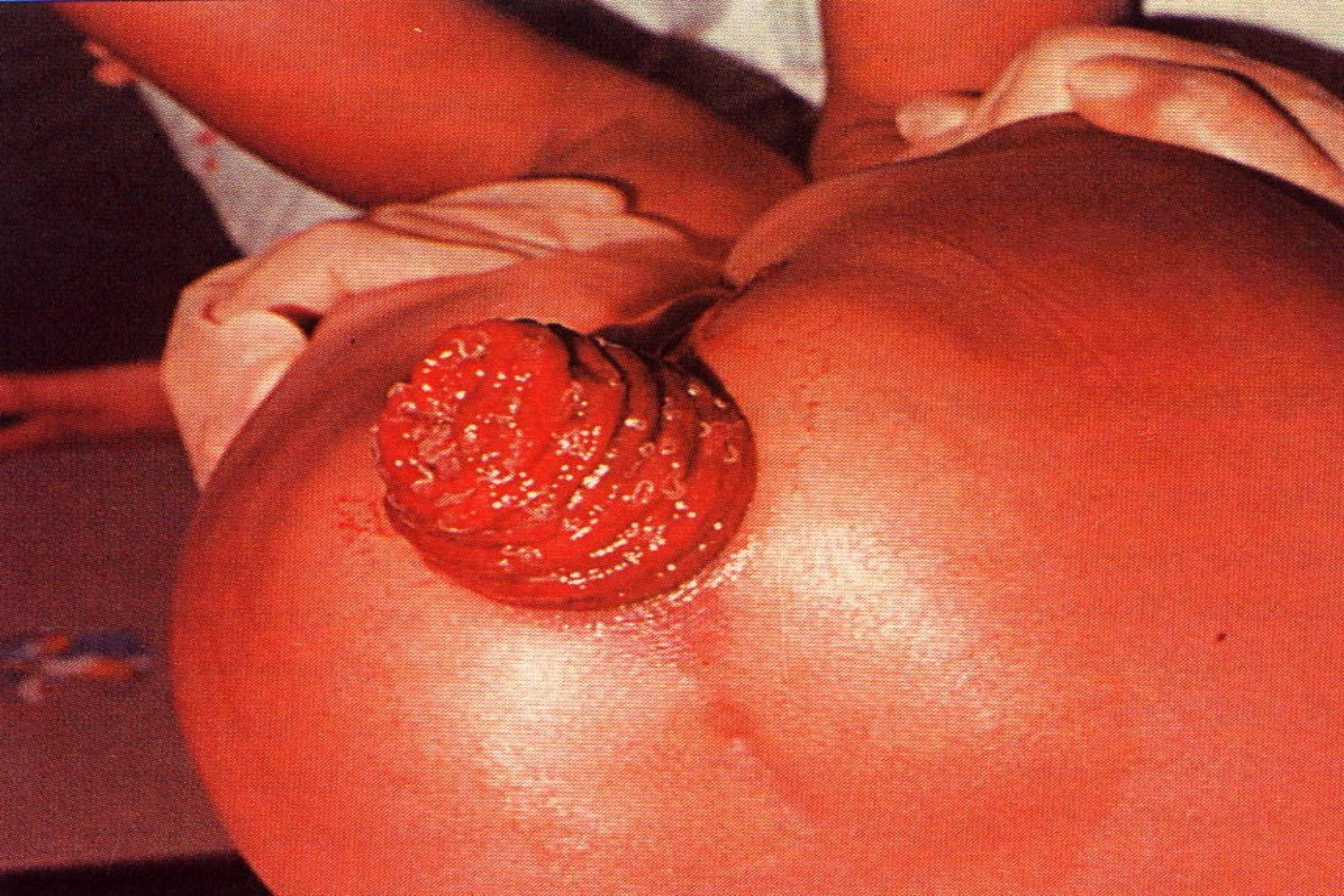


Trichuriasis

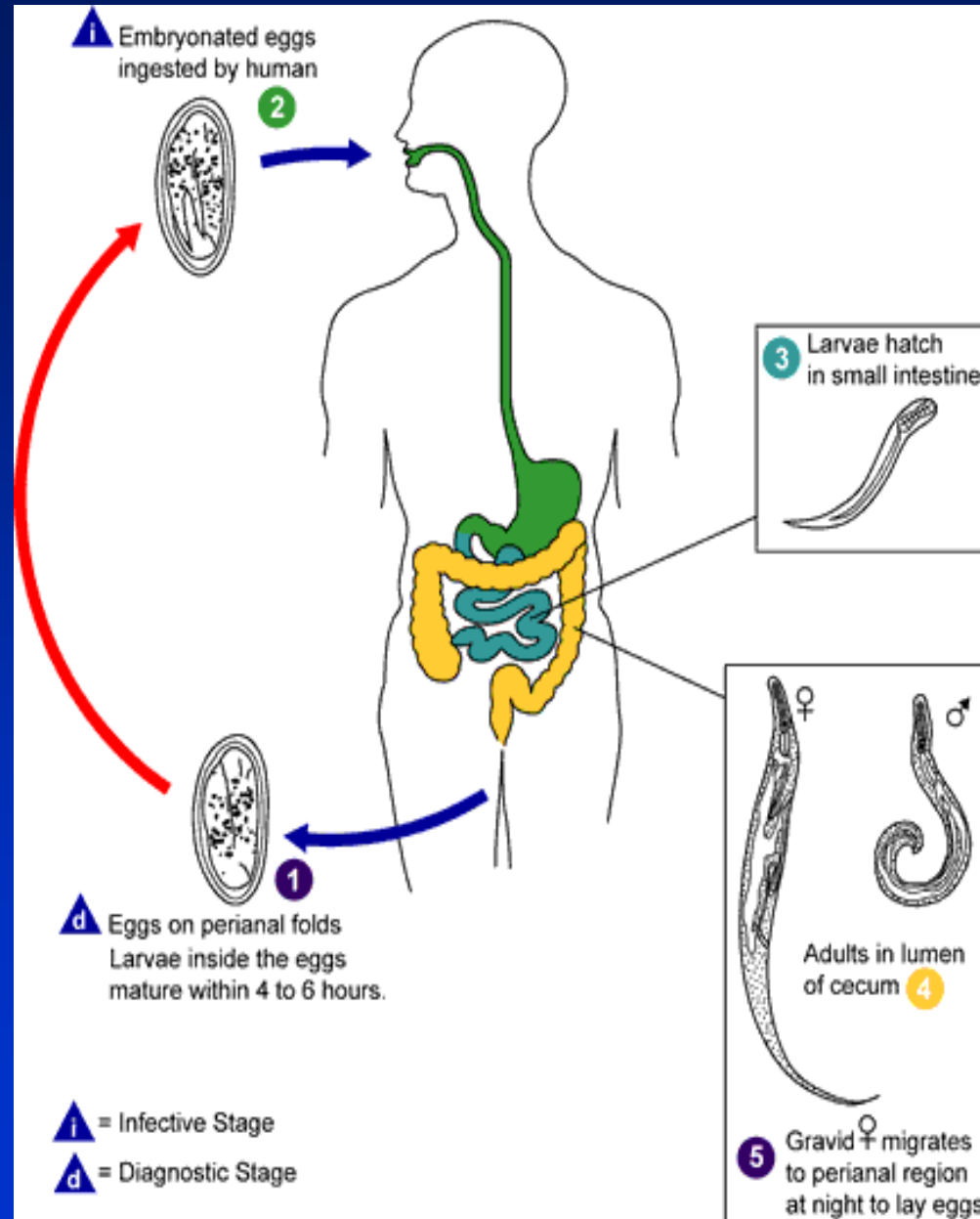


Trichuris trichiura



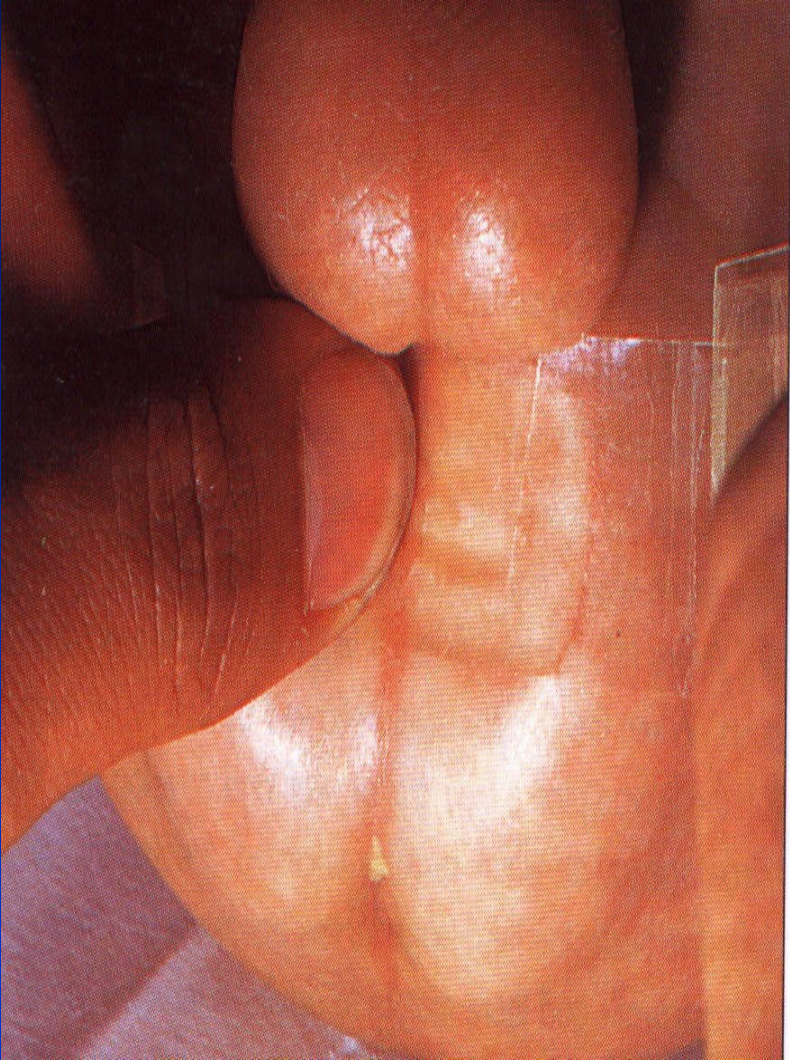


Enterobiosis, oxyuriasis



*Enterobius, Oxyuris
vermicularis*

**Enterobiosis,
oxyuriasis**



Tapeworms (Cestodes)

Man as final host

- *Taenia saginata*
- *Taenia solium*
- *Diphyllobotrium latum* , *D. pacificum*
- *Hymenolepsis nana*

Animal as final host

- *Echinococcus granulosus*
- *Echinococcus (Alveococcus) multilocularis*

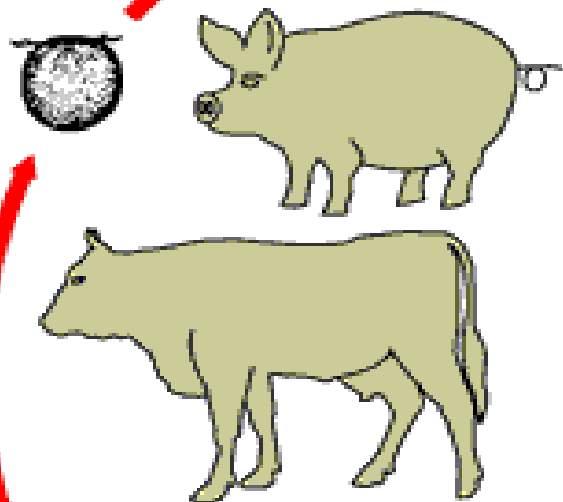
i Oncospheres develop into cysticerci in muscle



4 Humans infected by ingesting raw or undercooked infected meat

Oncospheres hatch, penetrate intestinal wall, and circulate to musculature

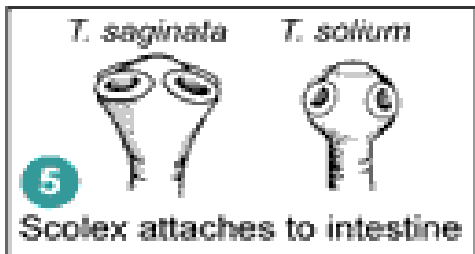
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2

Cattle (*T. saginata*) and pigs (*T. solium*) become infected by ingesting vegetation contaminated by eggs or gravid proglottids

Taenia saginata
Taenia solium



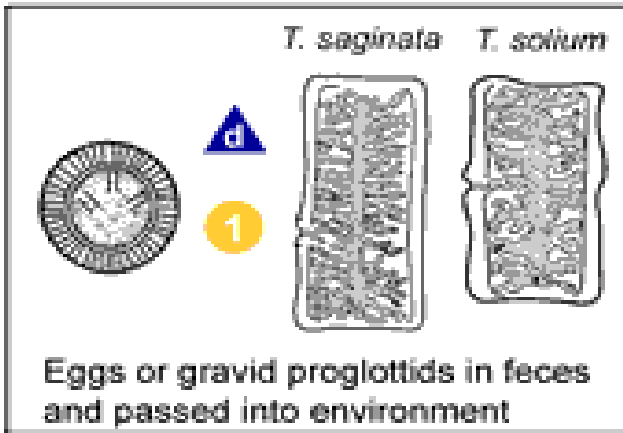
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Scolex attaches to intestine



6

Adults in small intestine

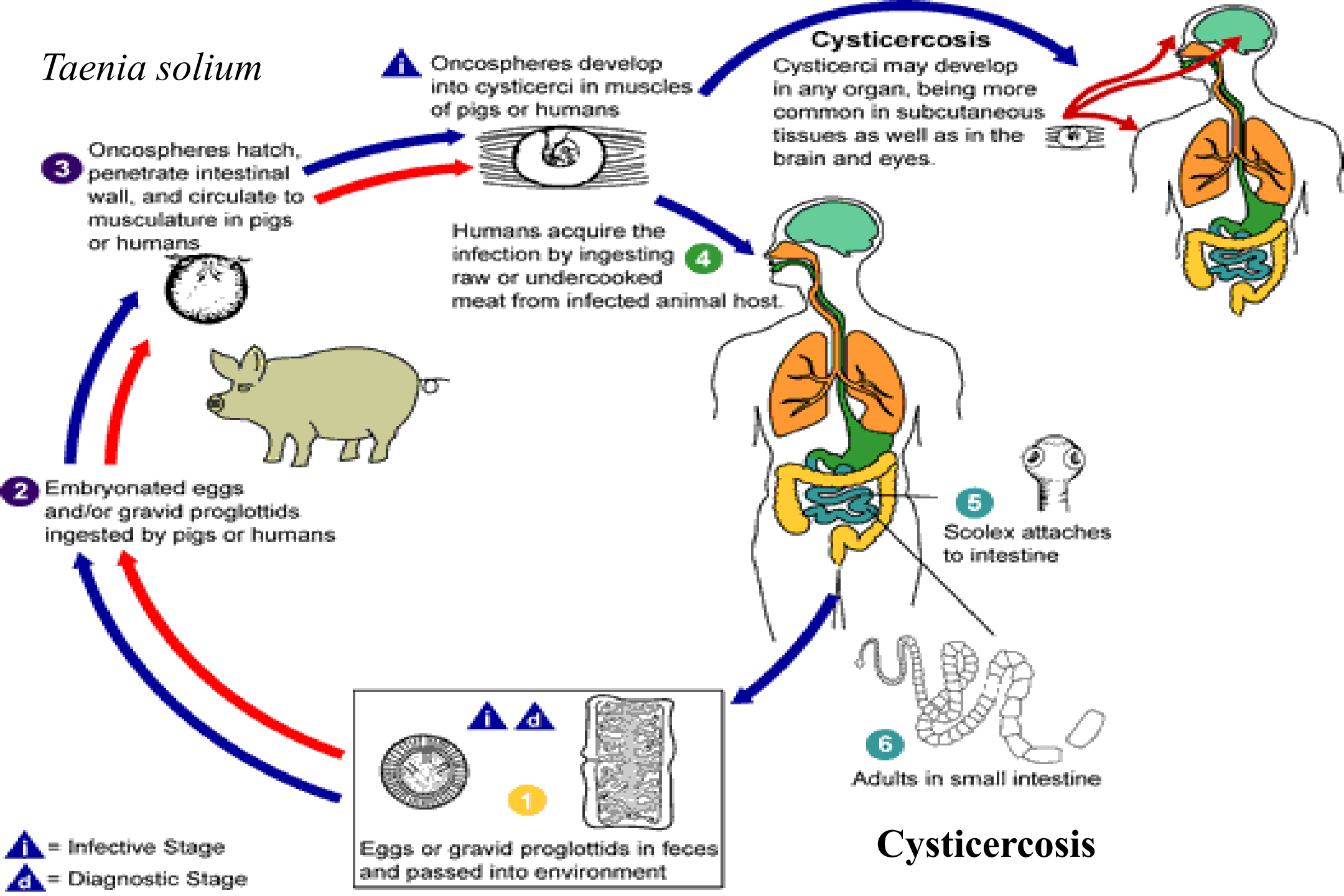


Eggs or gravid proglottids in feces and passed into environment

i = Infective Stage
d = Diagnostic Stage

Taeniosis

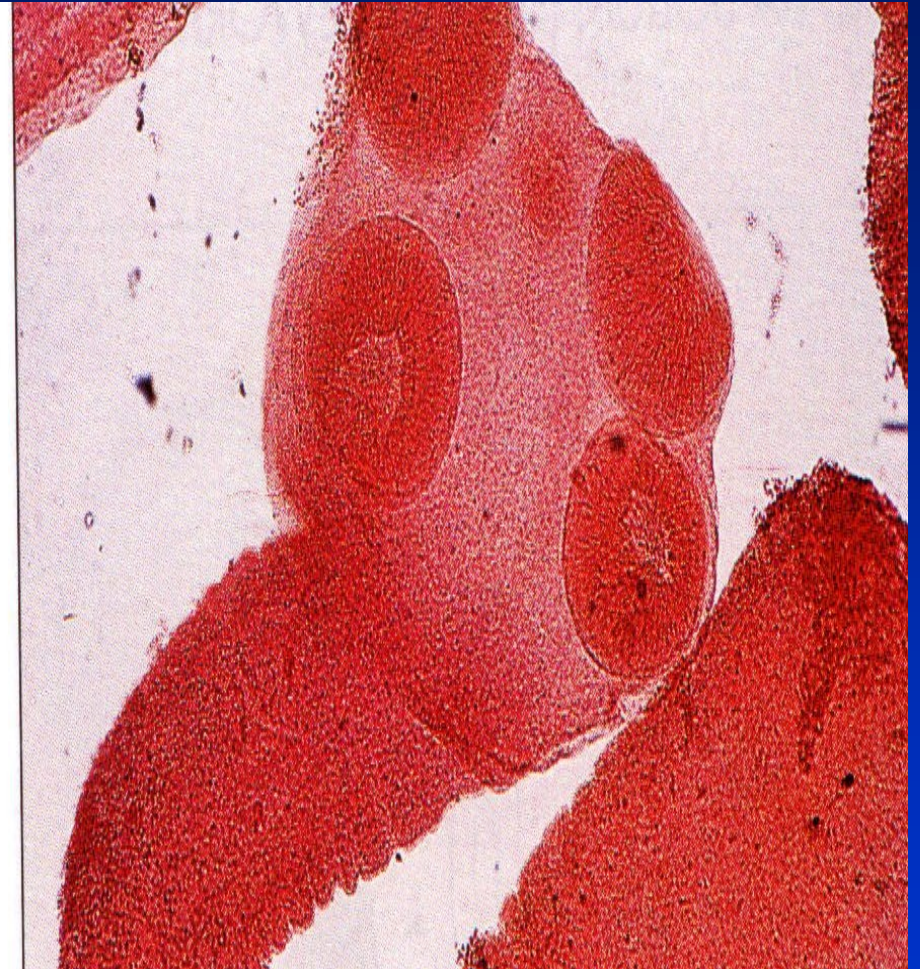
Taenia solium



Taenia solium



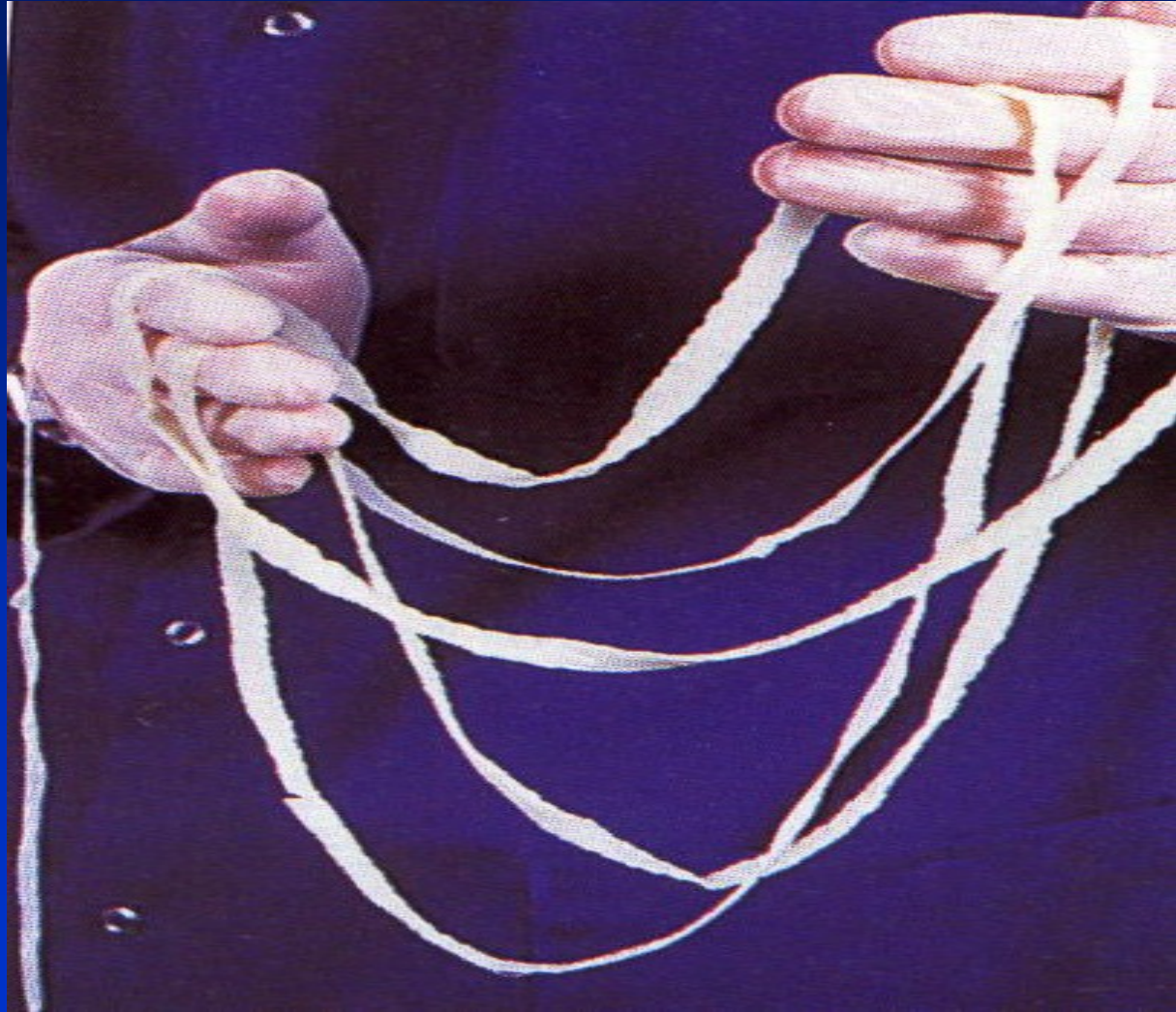
Taenia saginata



Taenia solium



Taenia saginata



Cysticercosis (pig)



Cysticercosis (man)

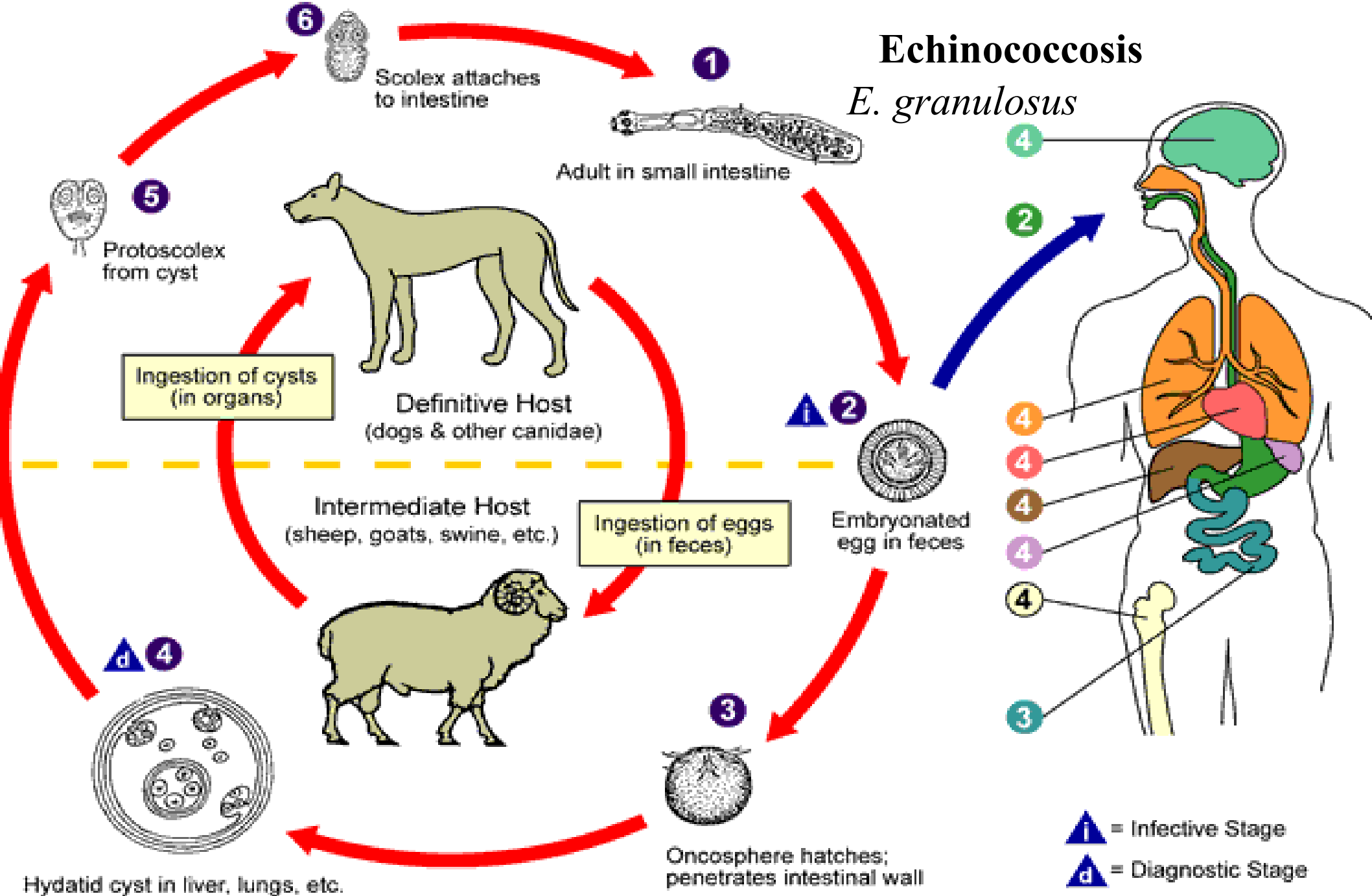


Cysticercosis (cow)



Echinococcosis

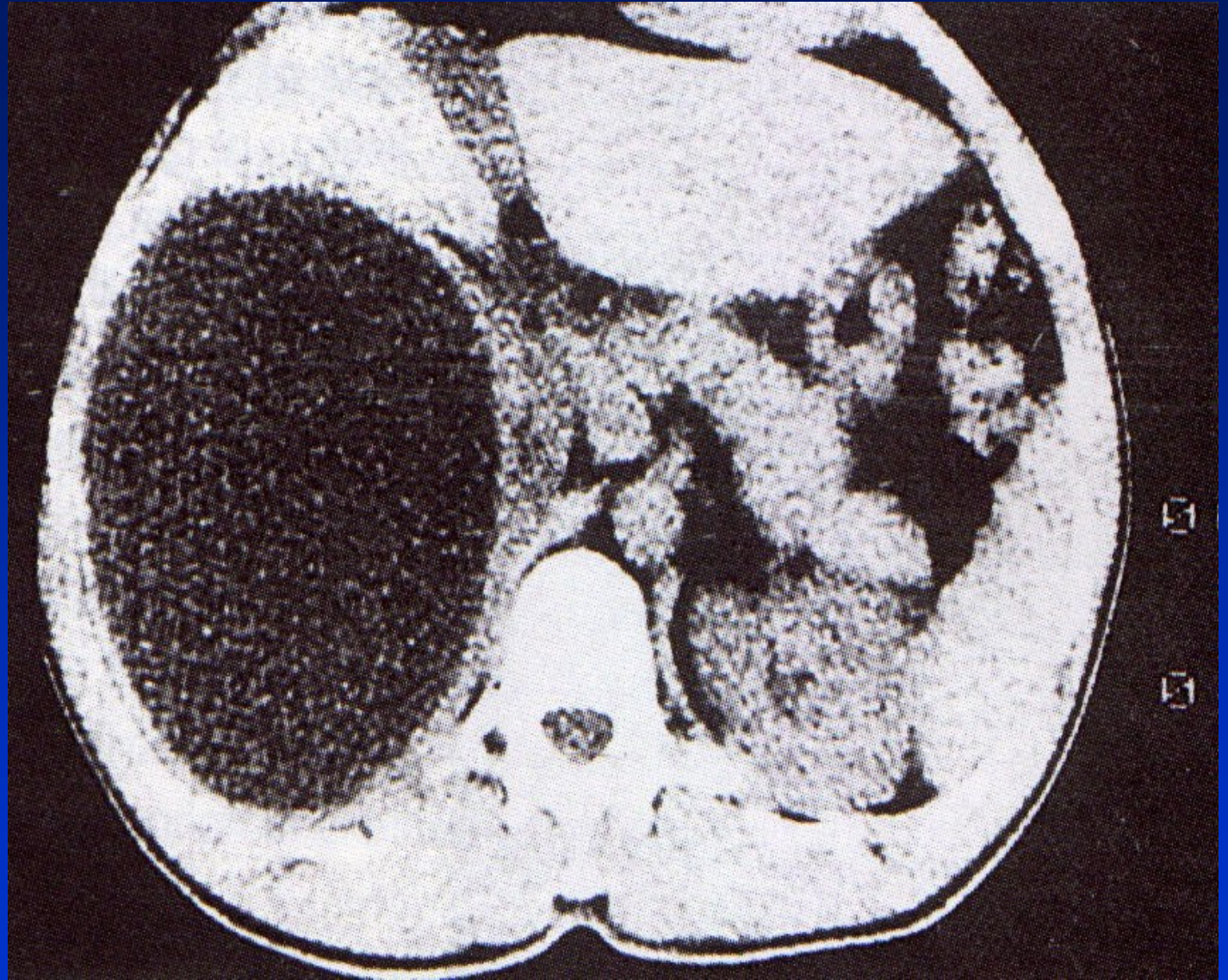
E. granulosus



Echinococcus
granulosus
(dog)



Echinococcus granulosus – liver cysts
(man)



*Echinococcus
granulosus* – liver cysts
(man)

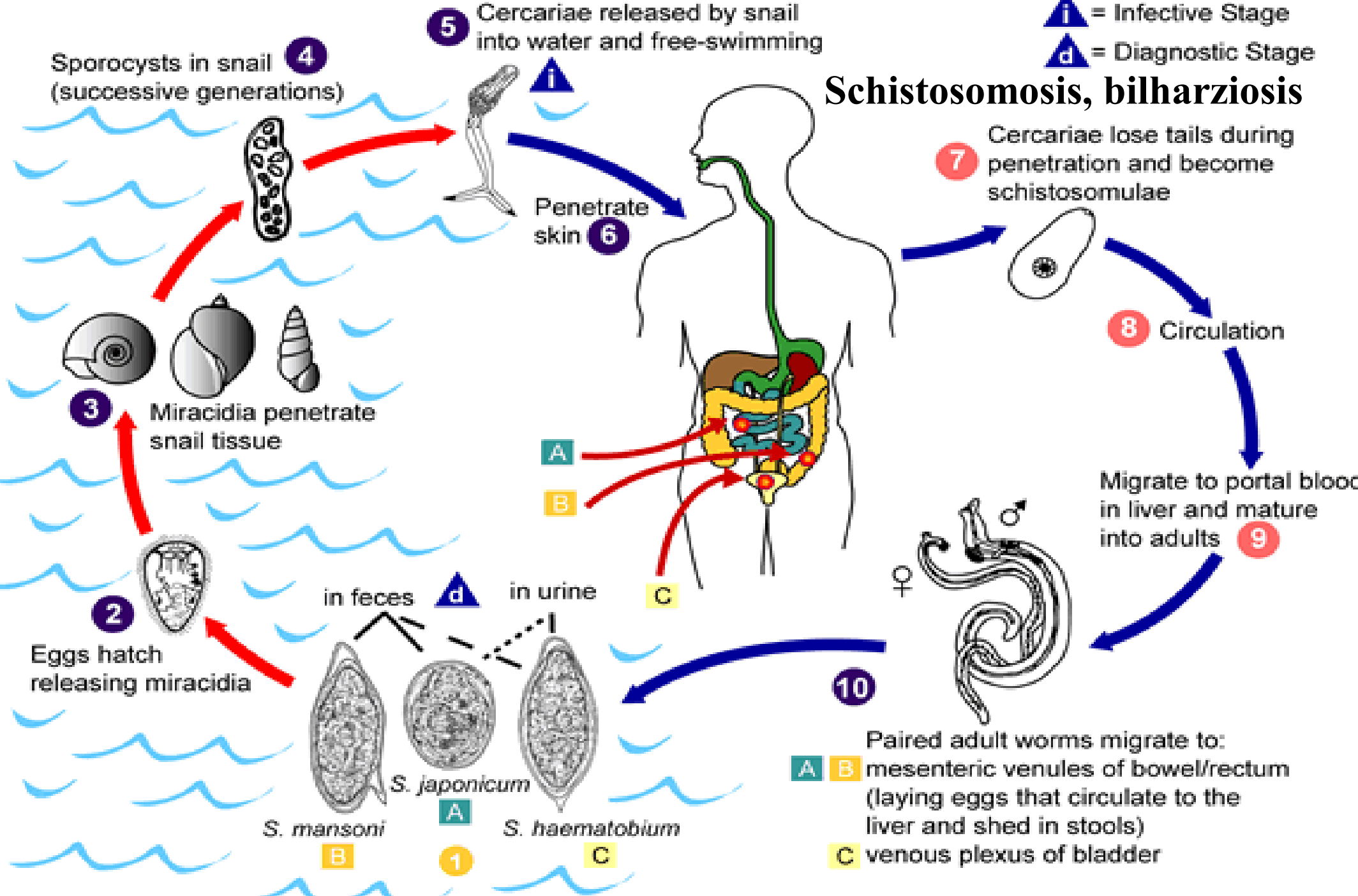


Flukes (Trematodes)

- schistosomiasis (bilharsiasis)
 - ✓ *S. hematobium*
 - ✓ *S. intestinalis (mansoni)*
 - ✓ *S. japonicum*
 - ✓ *S. mekongi*

i = Infective Stage
d = Diagnostic Stage

Schistosomosis, bilharziosis





Atlantic Ocean

Indian Ocean

Pacific Ocean

Caribbean Sea



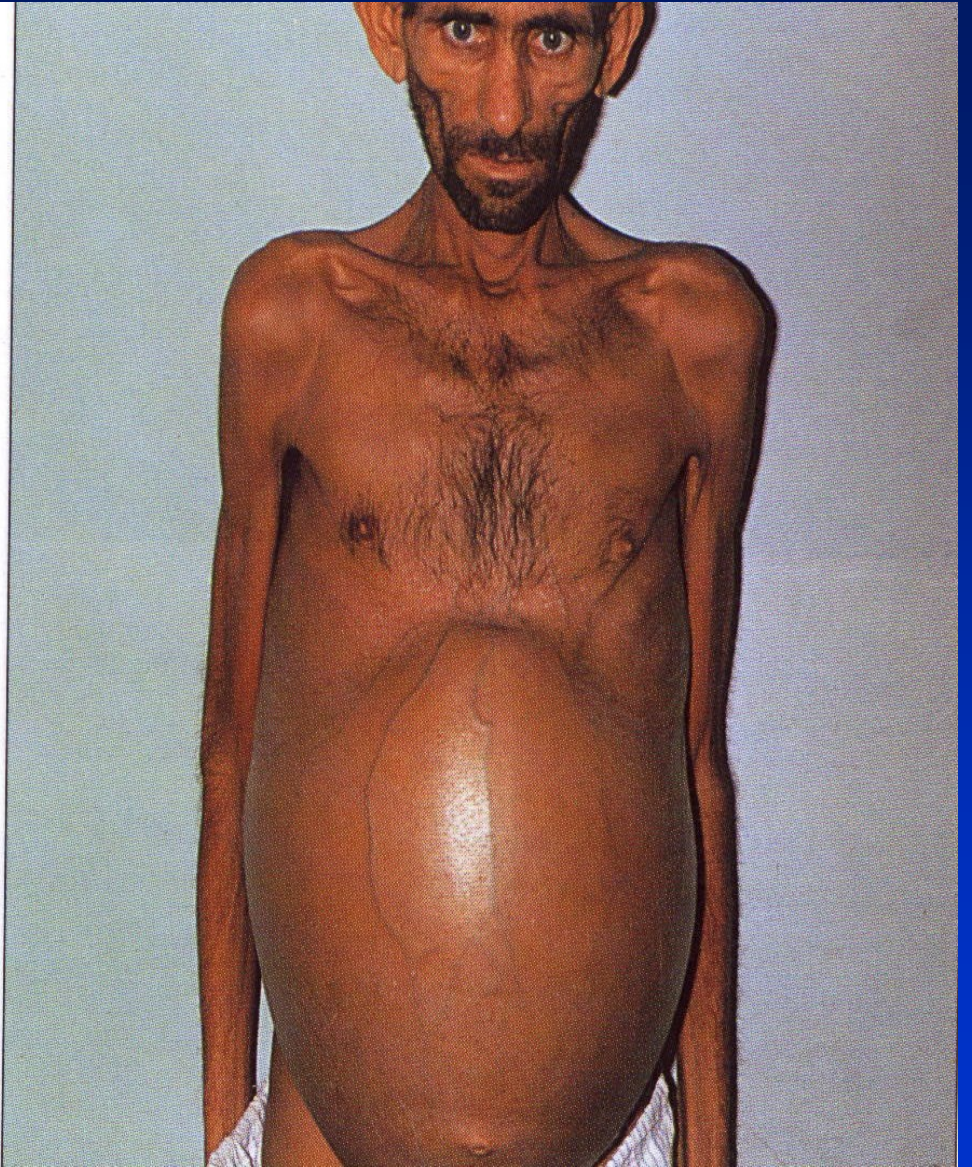
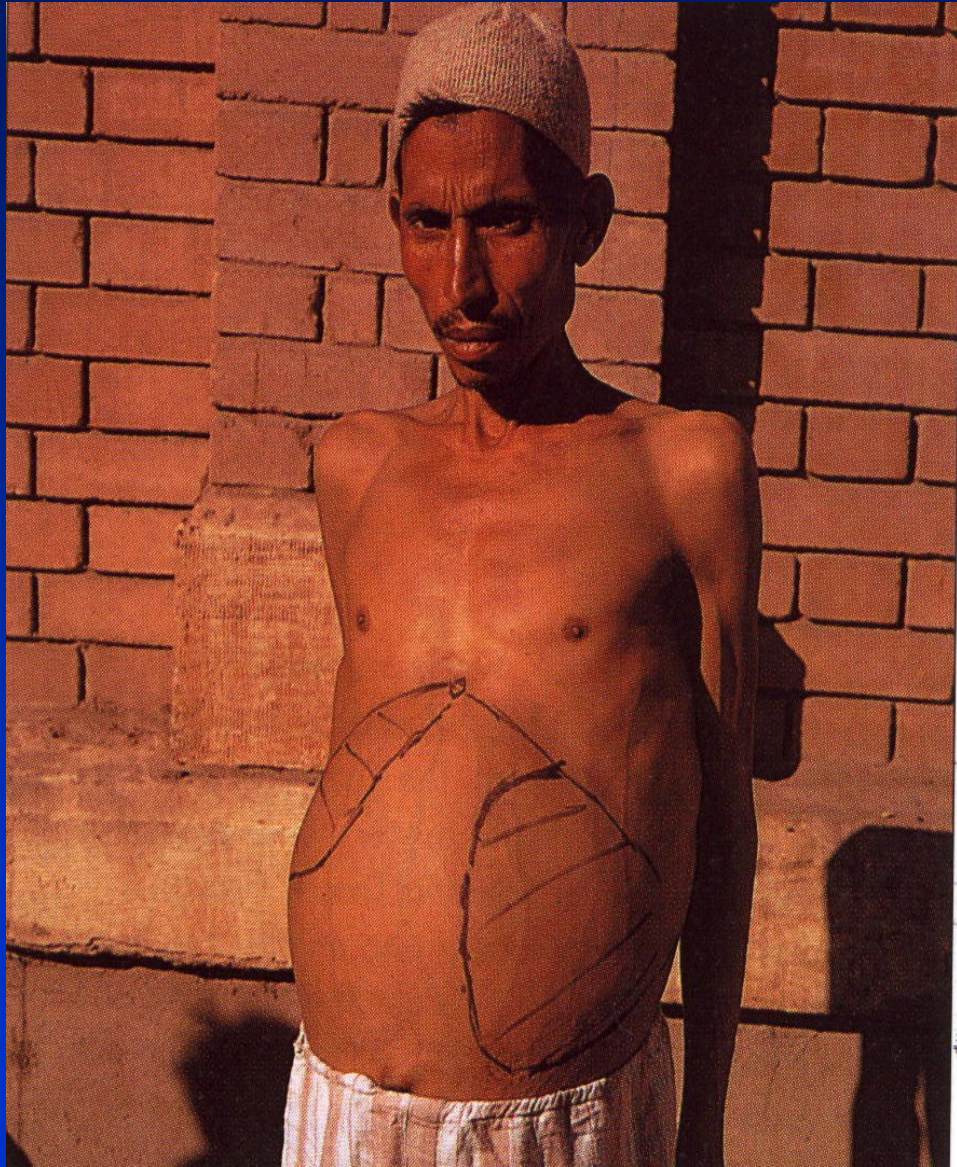
Schistosomiasis-Endemic Areas

- Both (Hepatic- Intestinal and Urinary)
- Very Low Risk for Both (Hepatic- Intestinal and Urinary)
- Hepatic- Intestinal
- Very Low Risk for Hepatic- Intestinal
- Very Low Risk for Urinary
- Not Endemic











Fungal GI infections

- about all candidiasis
- different members of *Candida* sp. (mostly *C.albicans*)
- mouth cavity, oesophagus, anorectal
- mostly IS patients
- fluconazol, itraconazol, ketoconazol, amphotericin B



Thank you for your attention!

phusa@fnbrno.cz