

Gastrointestinal infections



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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 2006-2015

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Campylobacter	22 713	24 254	20 175	20 371	21 164	18 811	18 412	18 389	20 903	21 085
Salmonella	25 102	18 204	11 009	10 805	8 622	8 752	10 507	10 280	13 633	12 727
Shigella	289	349	229	178	450	164	266	257	92	88
Bacterial other	2 471	2 831	3 305	3 178	3 343	4 607	5 168	5 797	6 762	8 138
Viral	5 597	6 025	6 639	6 066	8 517	9 955	6 877	7 778	9 438	18 817
Food poisoning	48	70	84	106	100	381	14	203	177	793

Gastrointestinal infections

- bacterial
- viral
- parasitic

Bacterial GI infections

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

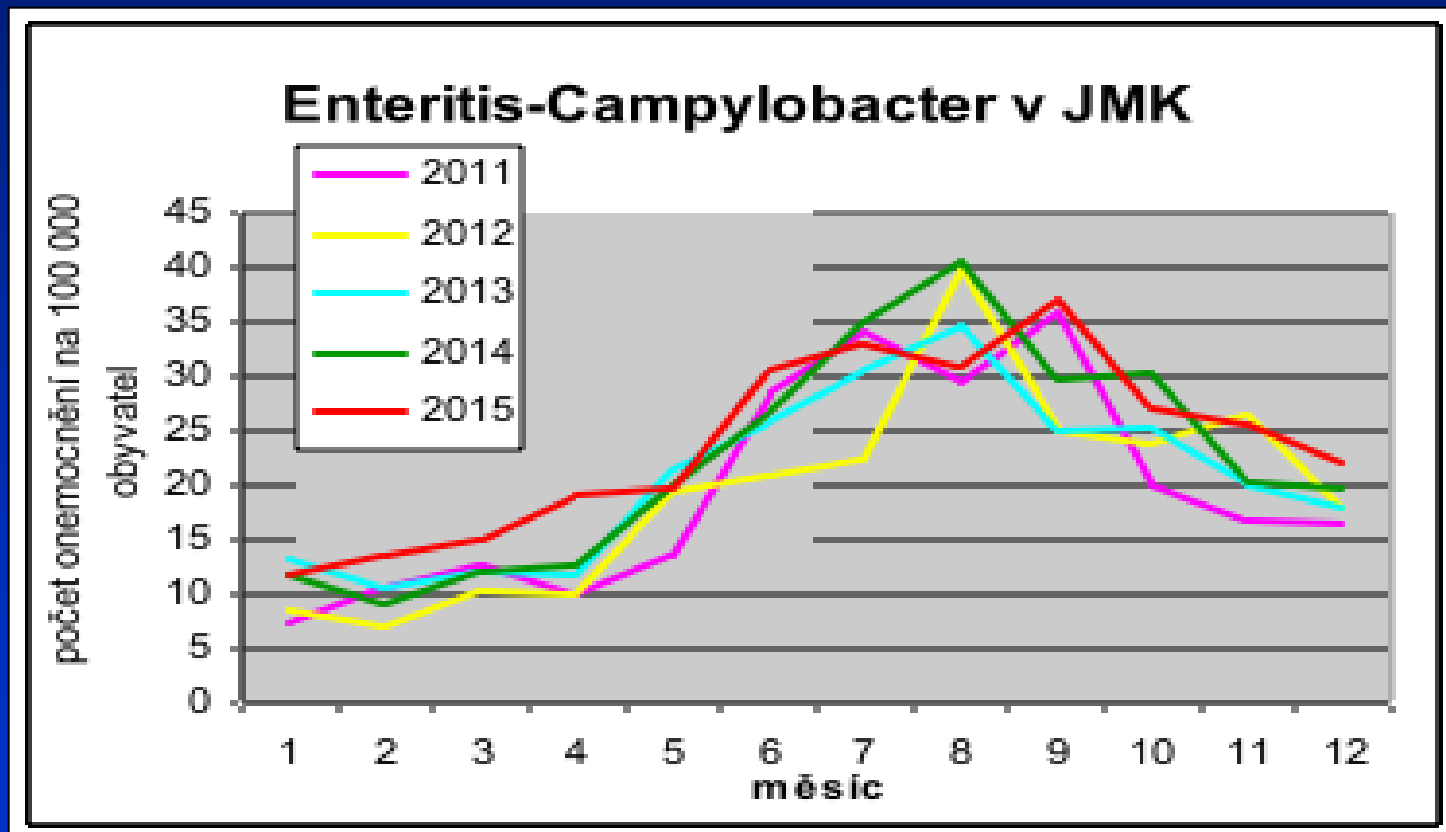
Zoonosis

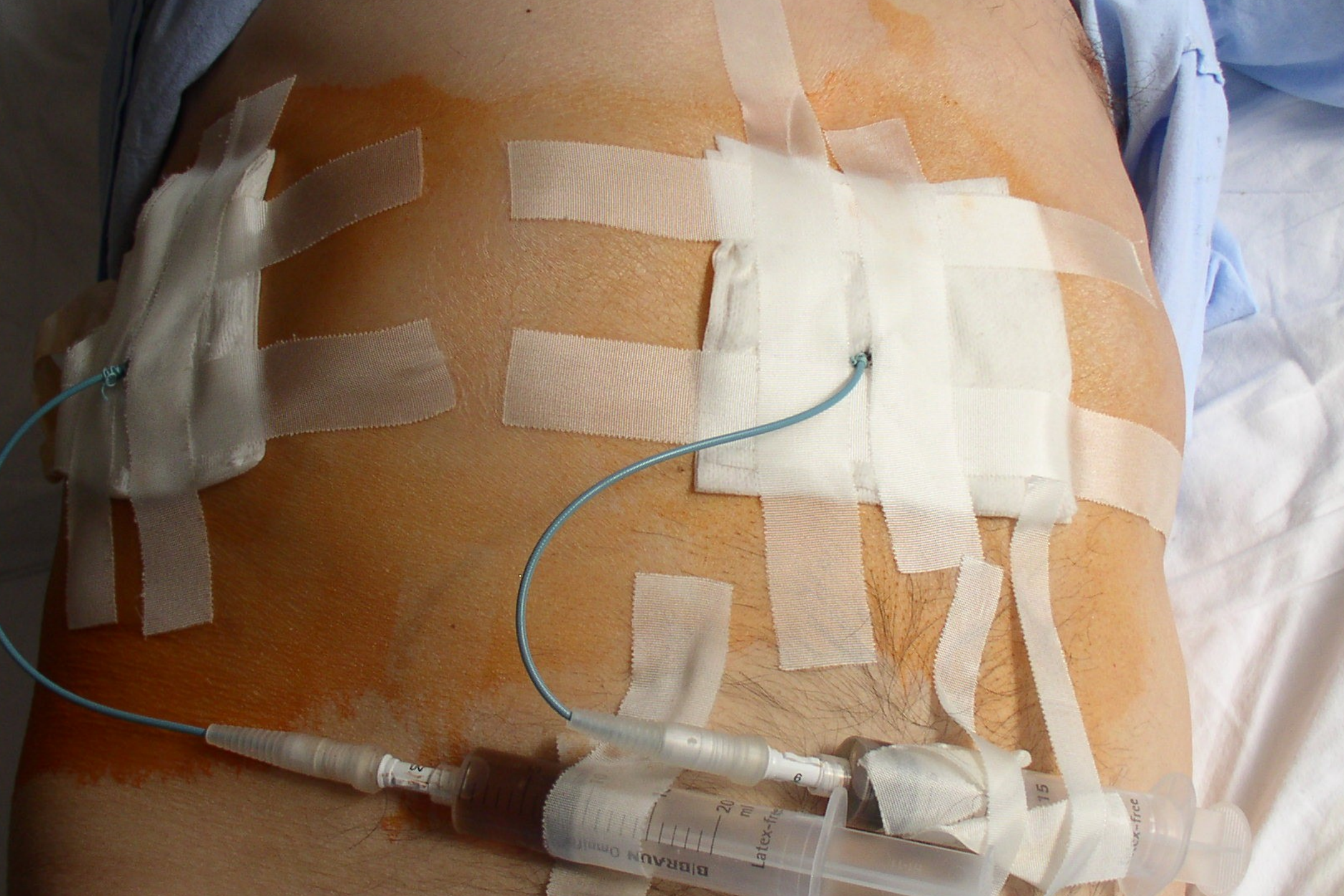
- salmonellosis (*S. Enteritidis*)
- campylobacteriosis (*C. jejuni*)
- yersiniosis (*Y. enterocolitica*)
- EHEC (*E. coli*)

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 2011-2015







ANA
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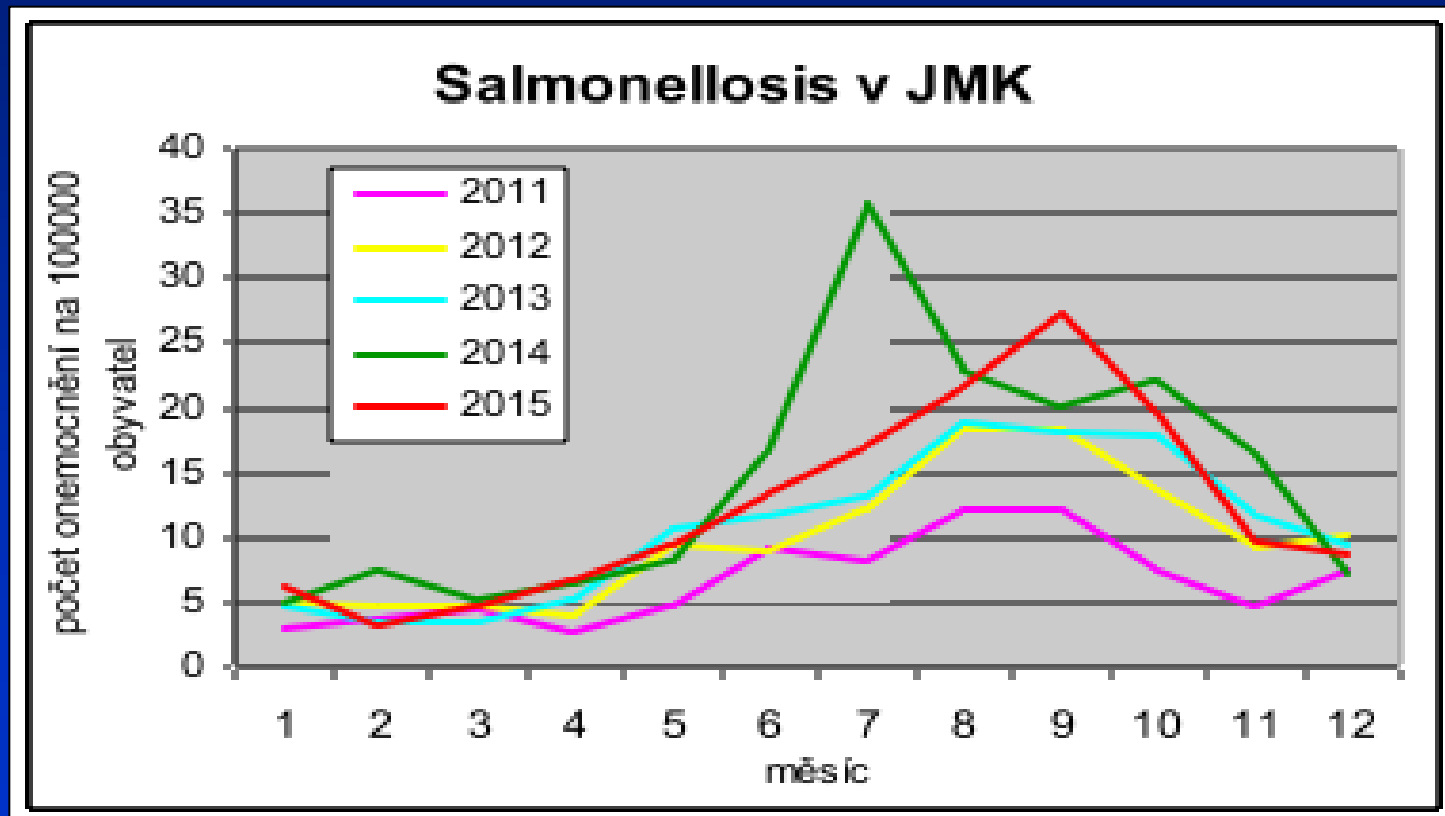
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Salmonellosis

- 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 2011-2015



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

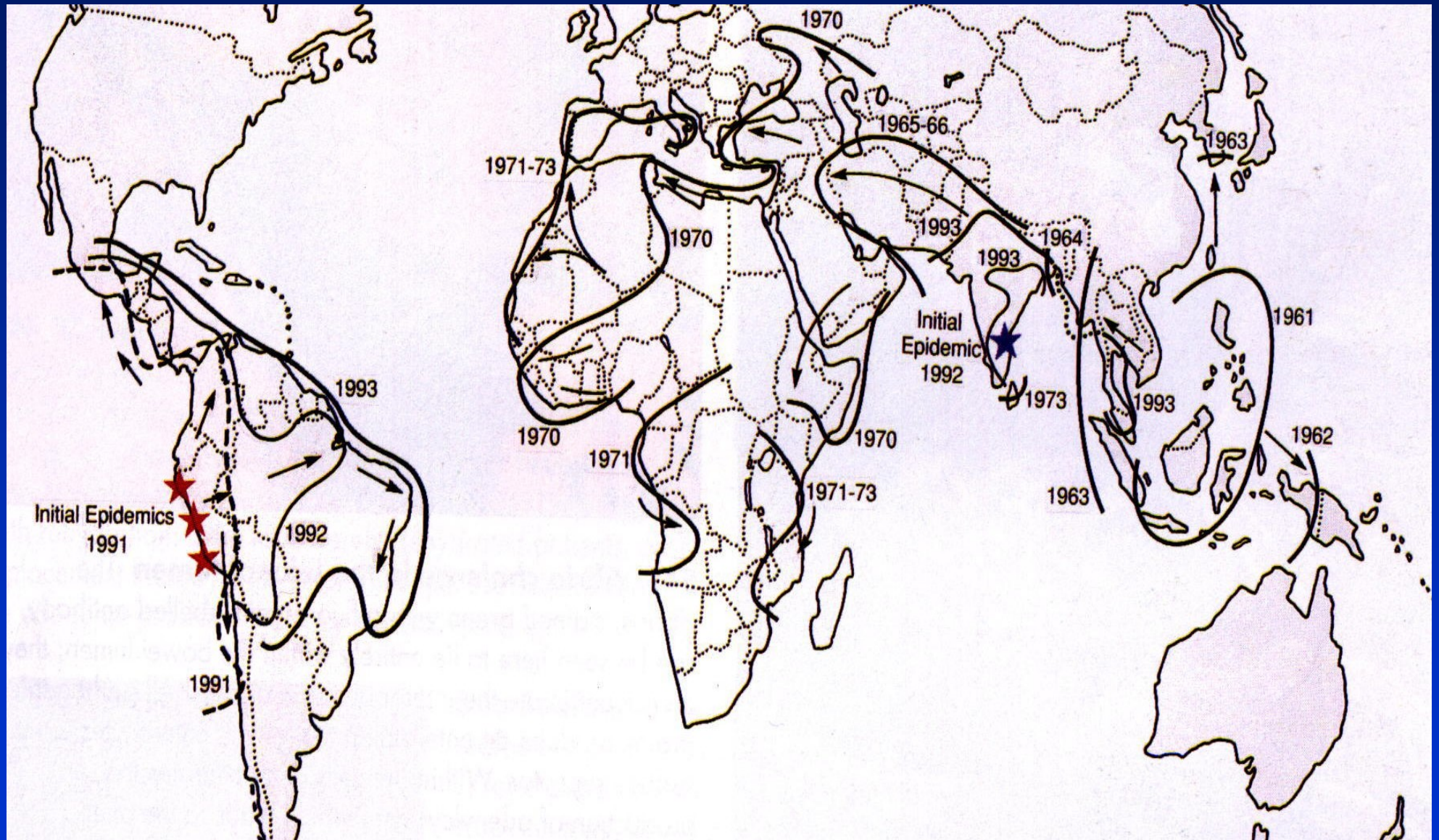
Human bacterial infections

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

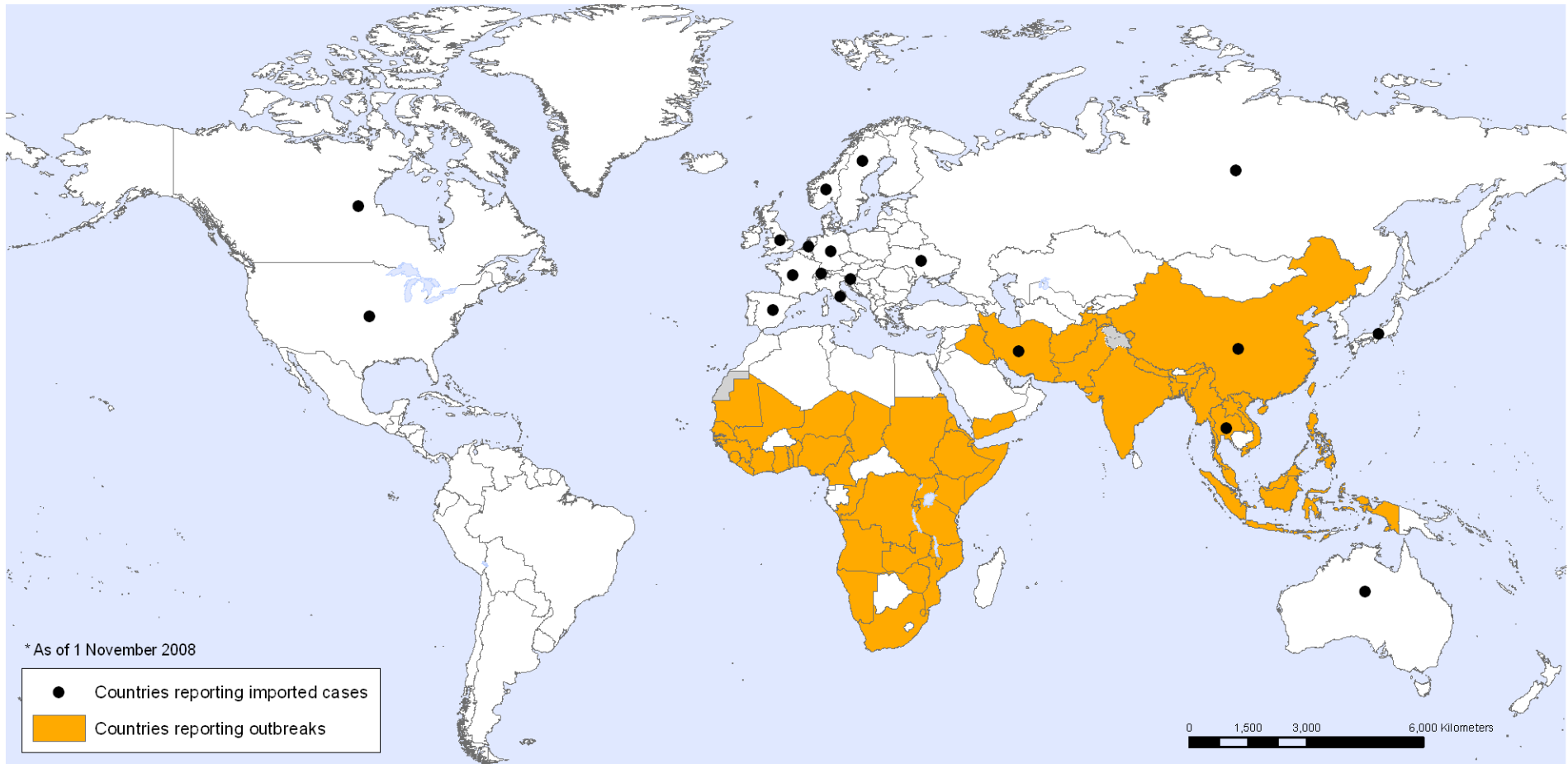
Cholera

- 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



Cholera, countries reporting outbreaks and imported cases, 2006–2008*



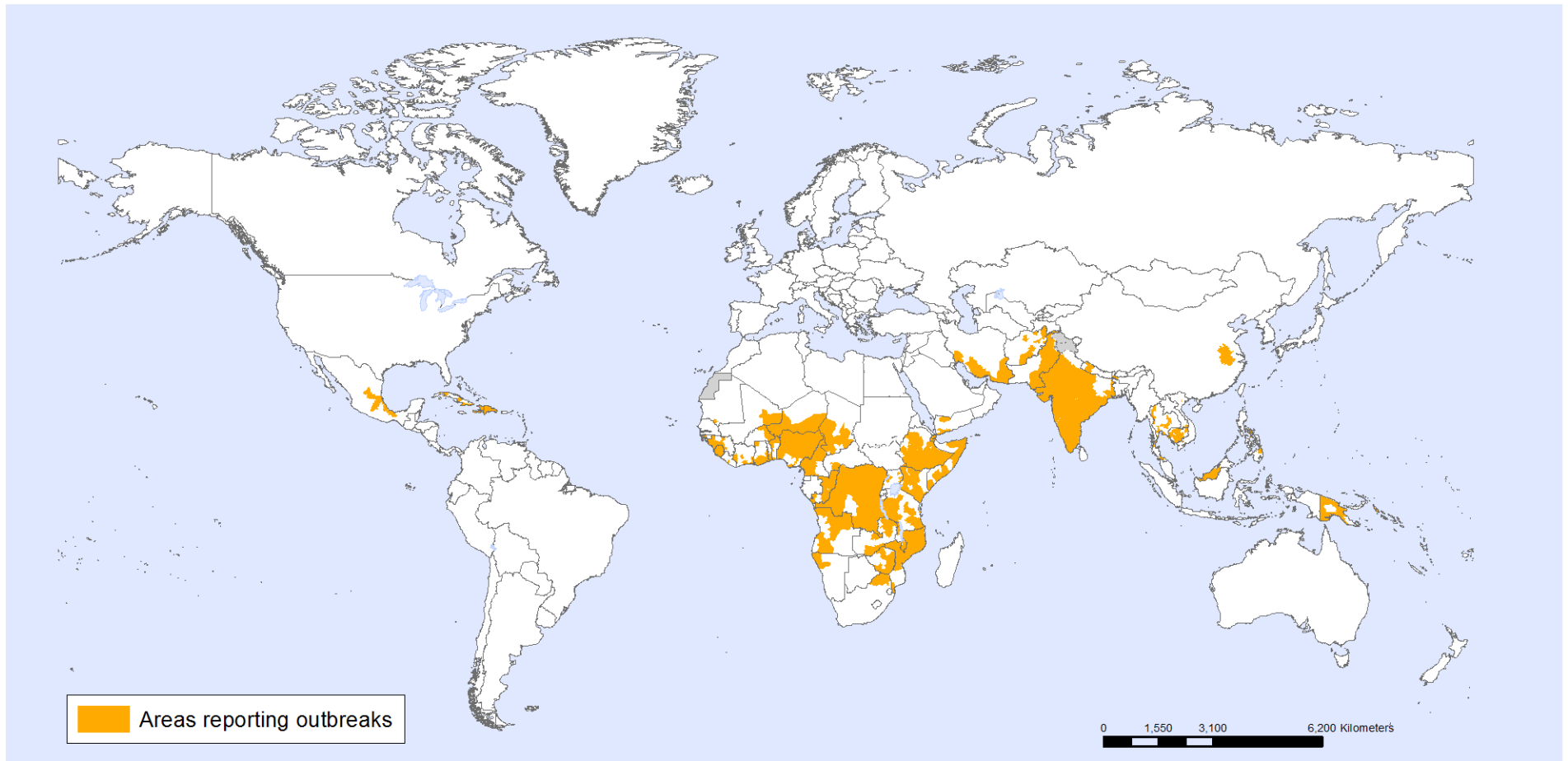
The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers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

Data Source: World Health Organization
Map Production: Public Health Information
and Geographic Information Systems (GIS)
World Health Organization



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Cholera, areas reporting outbreaks, 2010–2013



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.

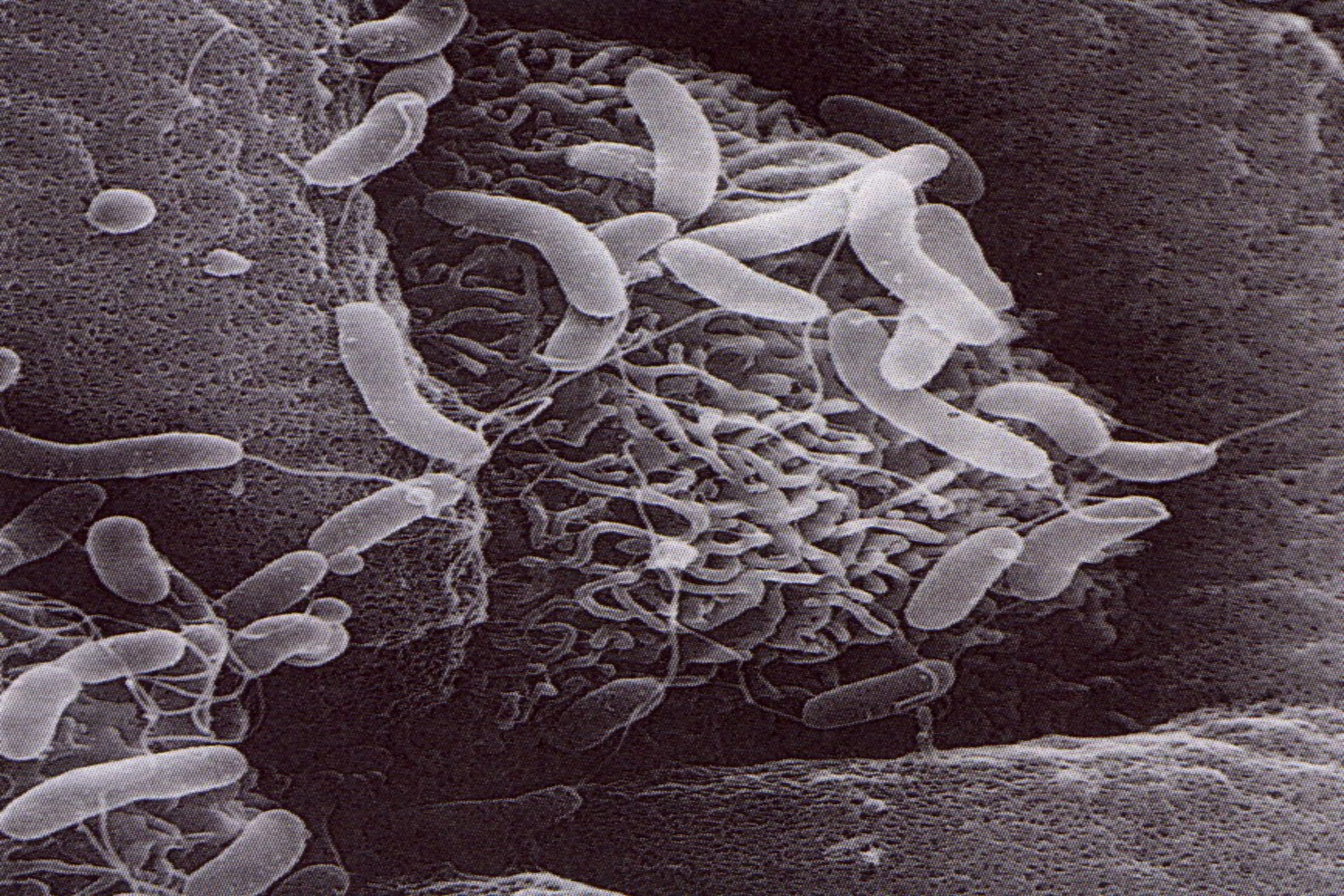
Data Source: World Health Organization
Map Production: Health Statistics and
Information Systems (HSI)
World Health Organization

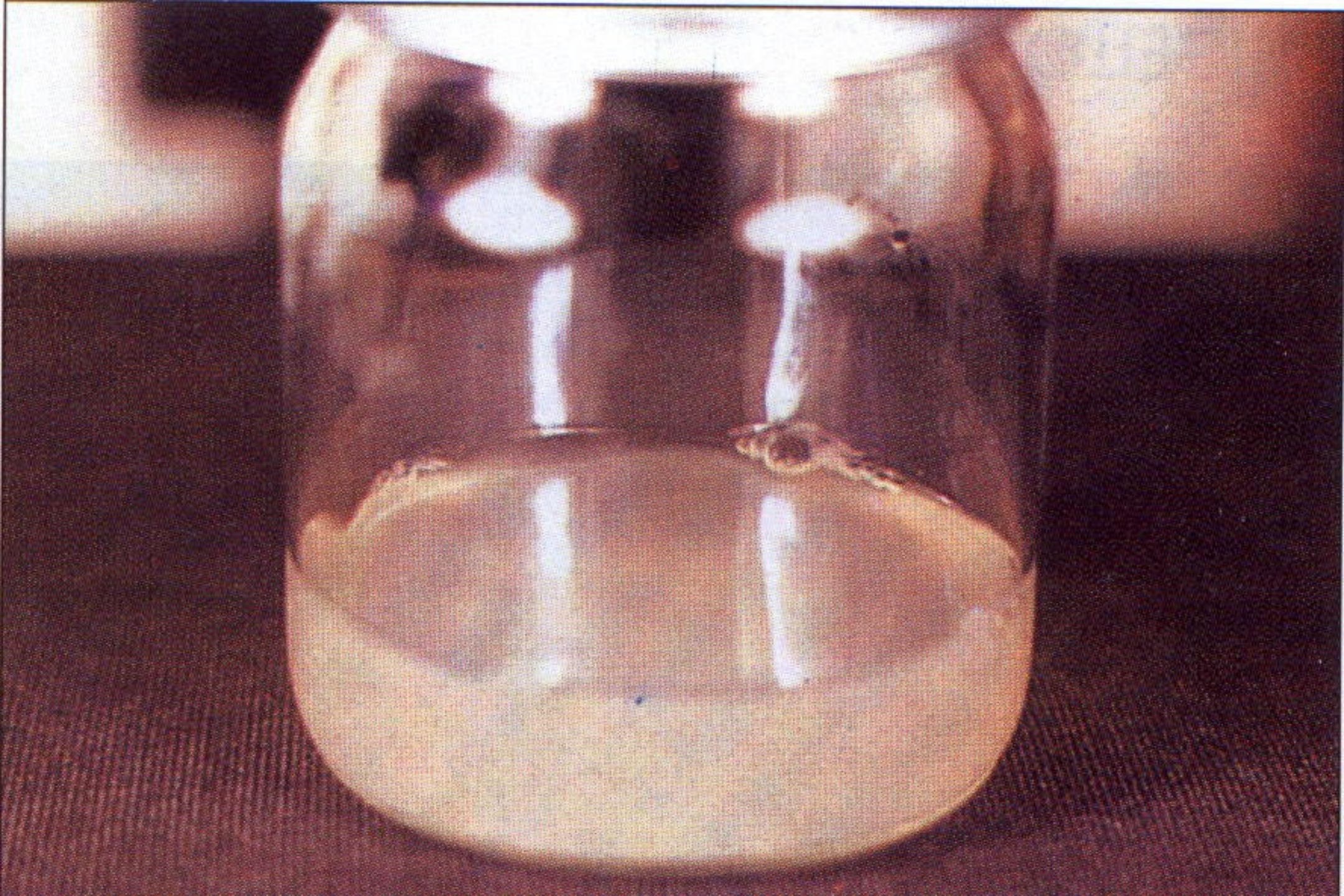


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Cholera

- 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

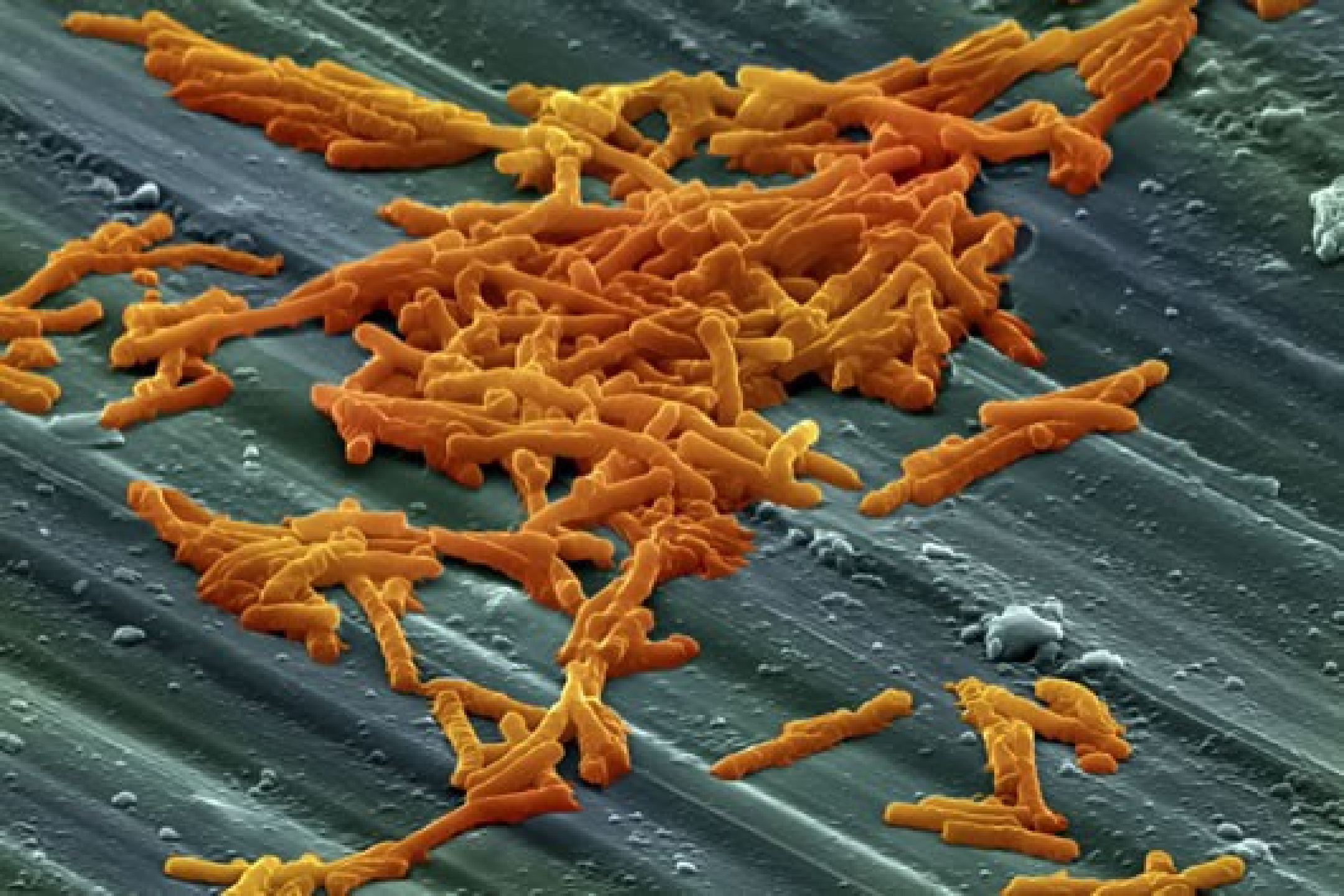
- one of the most contagious intestinal infections
- associated with poor hygiene conditions – war conflicts, natural catastrophes
- *Shigella sonnei*, *S. flexneri*
- colitis (tenesmus, often mucus, pus, and blood in stool)
- rehydration, diet, complicated forms: fluoroquinolones, co-trimoxazol, ampicilin,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

E. coli enterocolitis

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

Clostridium difficile infection (CDI)

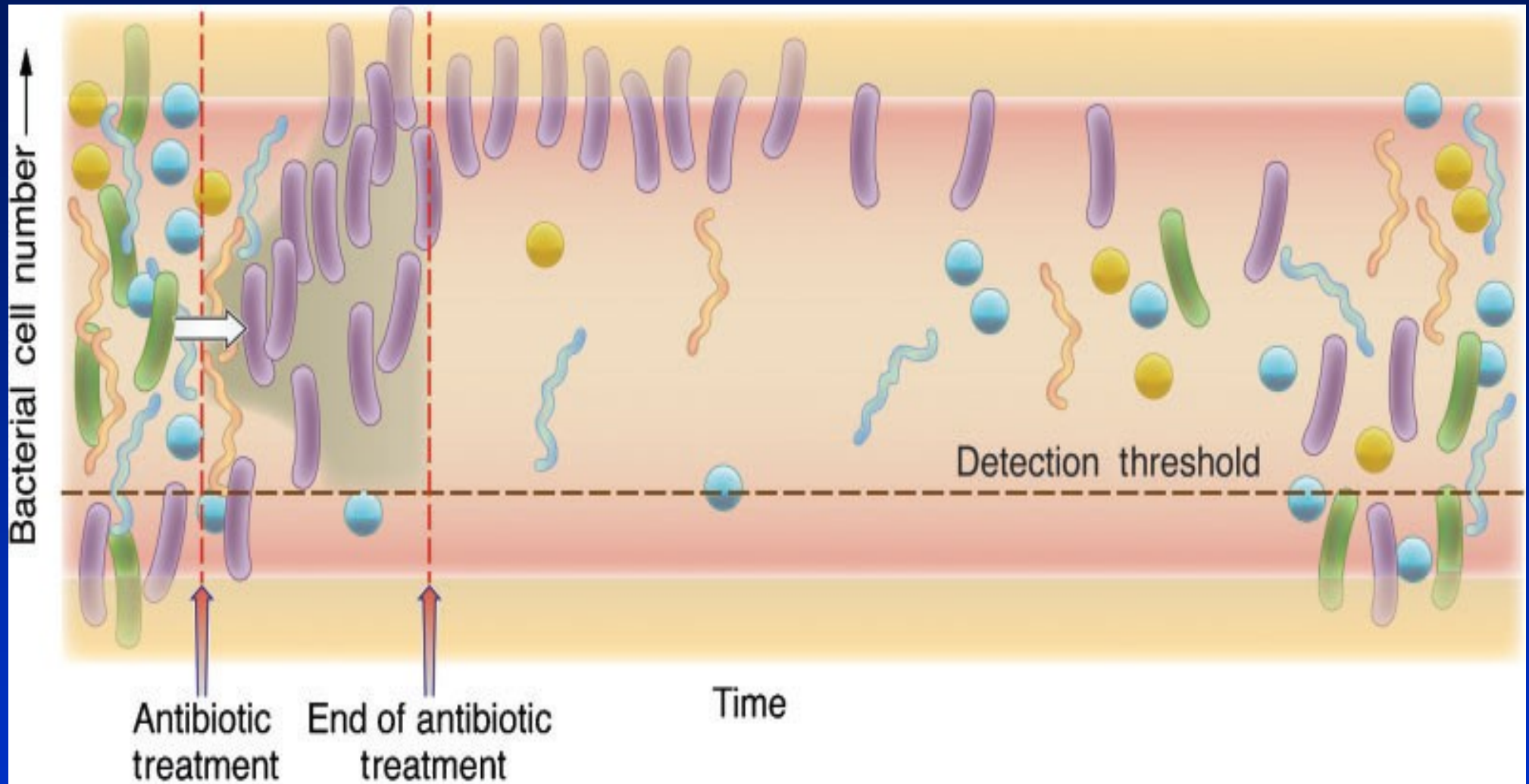
- *C. difficile* - G⁺ anaerobic spore-forming bacteria
- spores survive for many months outside an organism – extremely resistant
- common nosocomial infections in developed countries
- development of vegetative forms in the colon
- production of exotoxins (usually both at once)
 - toxin A (enterotoxin – 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 ≥ 65 years, comorbidities, IS
- function of GI tract – peristalsis, only perenteral nutrition, disturbances of mucous immunity

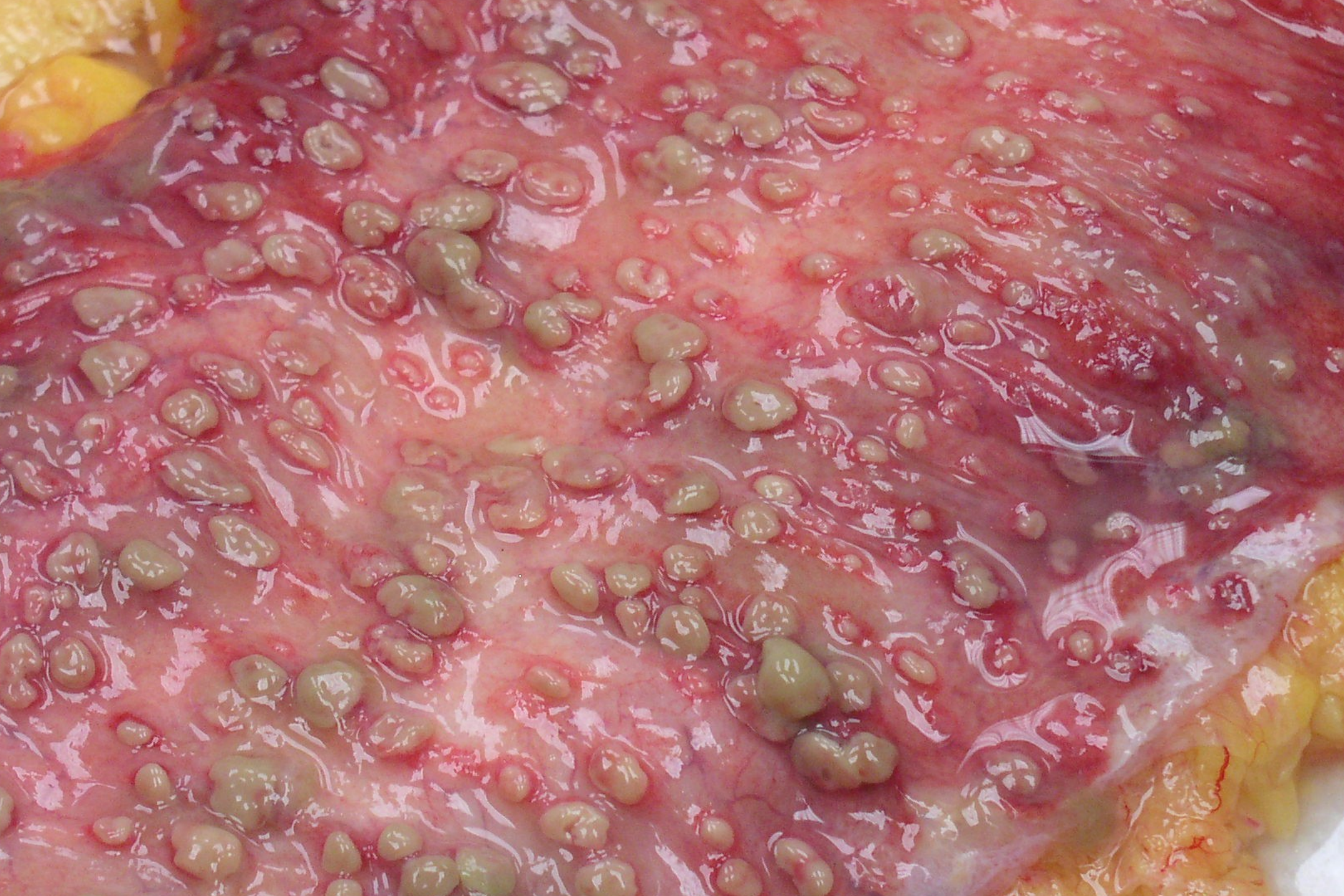


Long-term impacts of antibiotic exposure on the human intestinal microbiota.
Jernberg C., Löfmark S, Edlund Ch. et al. *Microbiology* (2010), 156, 3216–3223

CDI – clinical forms

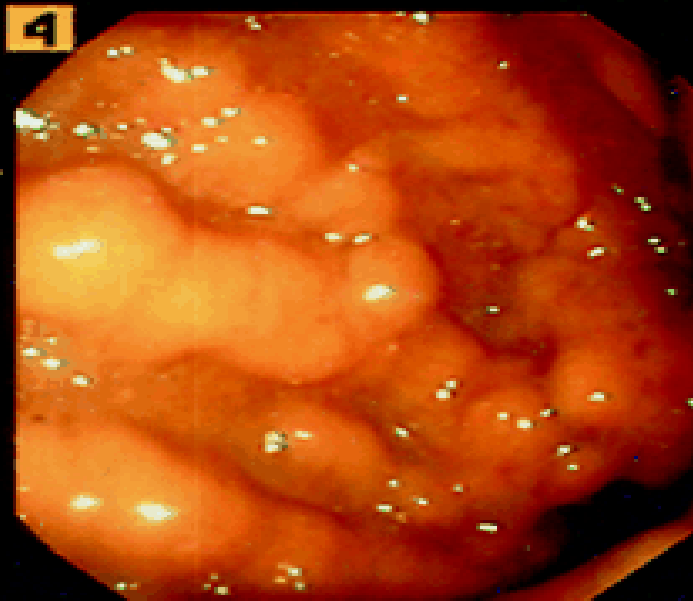
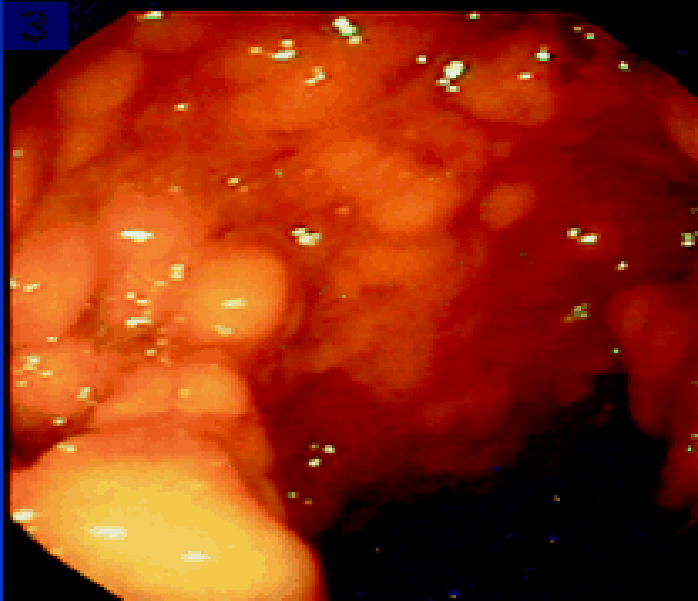
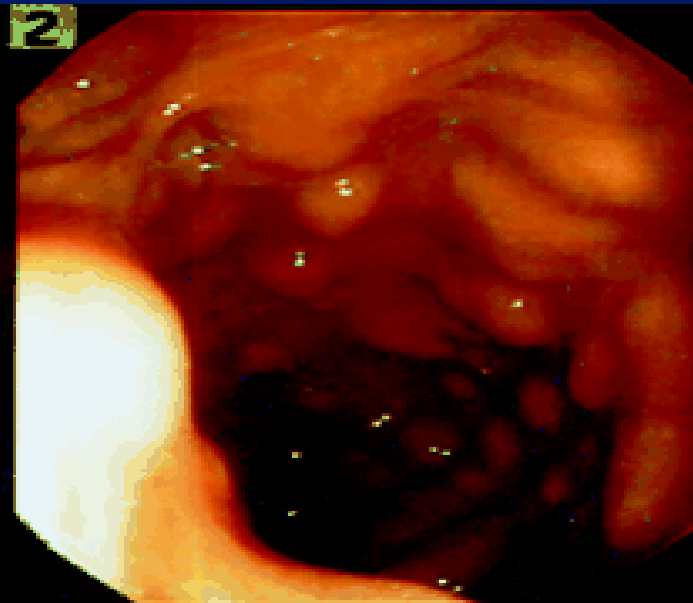
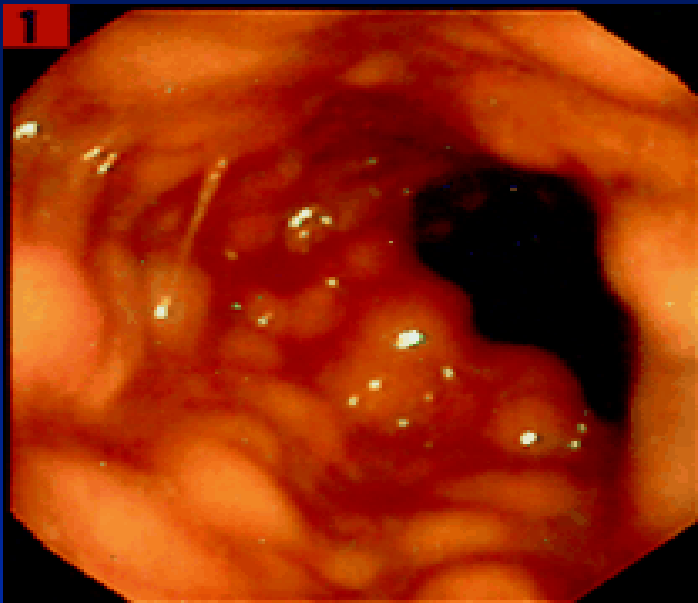
- a) asymptomatic carriers (2-3 % of adults, in children much more, prevalence is increasing with the length of hospitalization - 10-25 % or more)
- b) uncomplicated colitis (diarrhea, fever, no pseudomembranes)
- c) pseudomembranous colitis - PMC (sepsis, leucocytosis, abdominal pain, and bloody stool)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

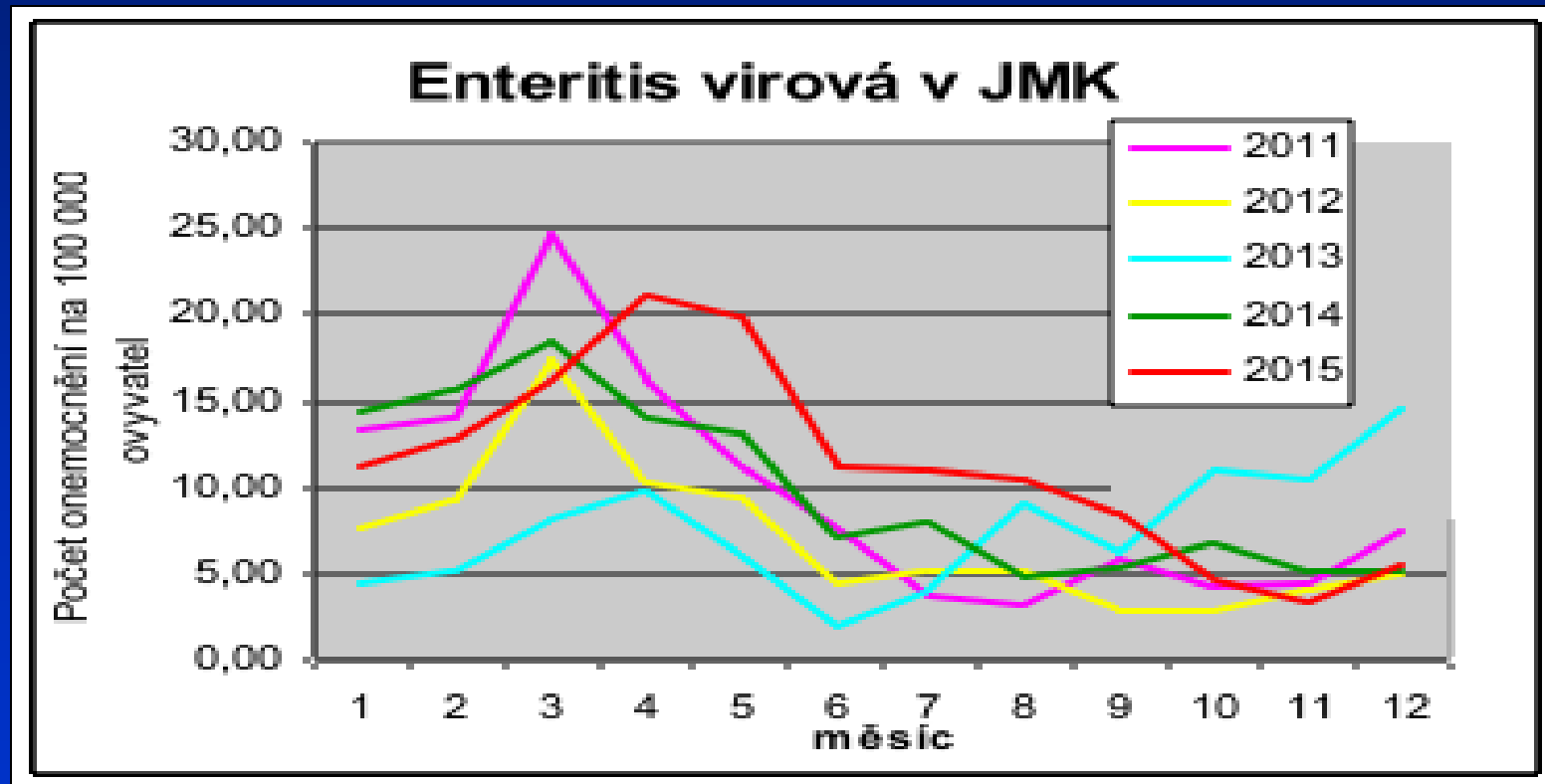
Clostridium perfringens A

- absence of fever, outbreaks
- rehydration, diet

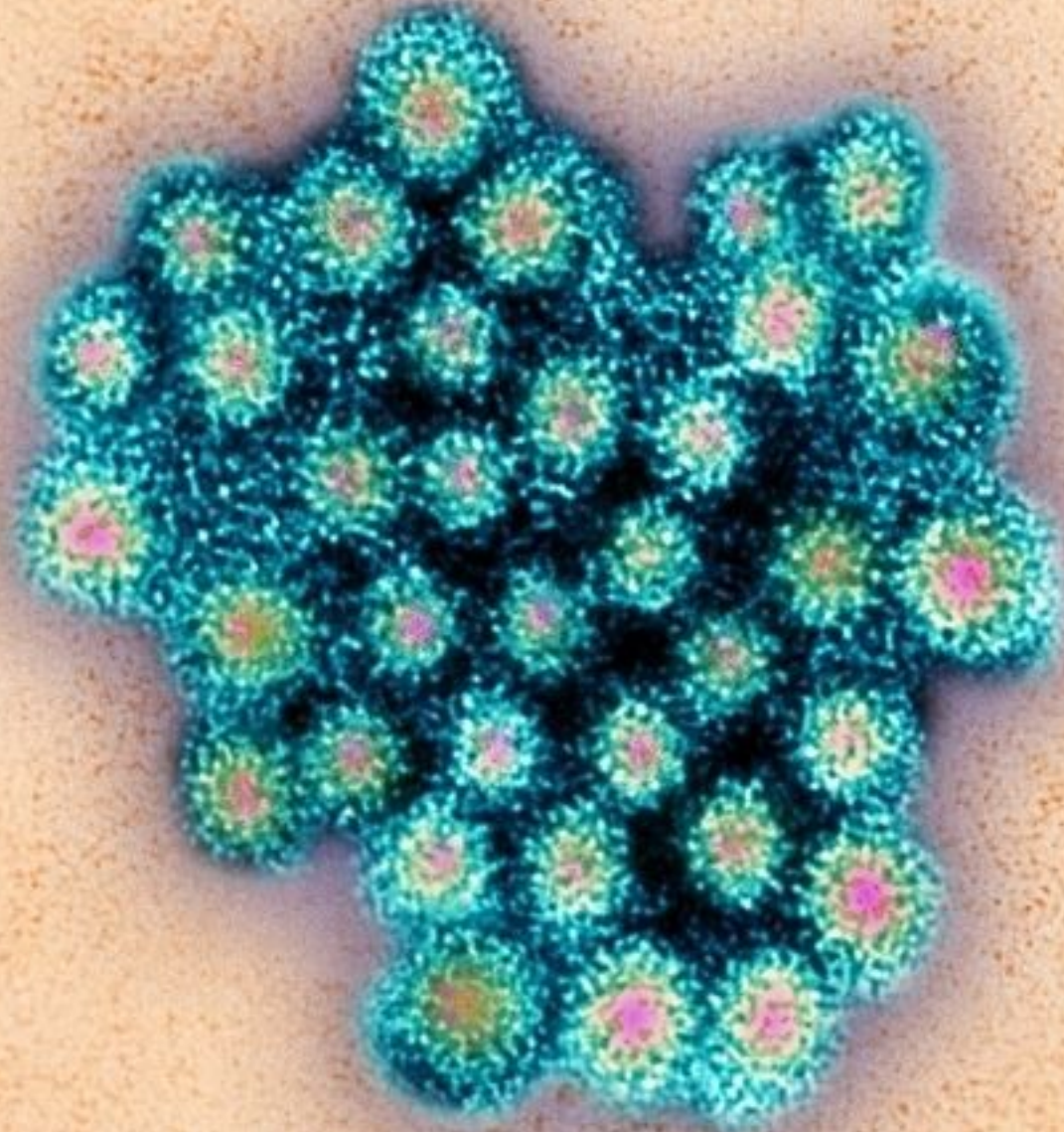
Viral gastroenteritis

- 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 2011-2015



Norovirus



Incubation periods of GI infections

Patogen	Inkubační doba
kampylobakter	1–7 dnů
salmonela	6–48 hodin
yersinie	4–10 dnů
shigela	1–5 dnů
<i>Clostridium difficile</i>	3–30 dnů
<i>Staphylococcus aureus</i>	1–6 hodin
<i>Bacillus cereus</i> (dle toxinu)	1–6 hodin či 8–16 hodin
<i>Clostridium perfringens</i> typu A	8–16 hodin
rotavirus	1–2 dny
adenovirus	1–2 dny
norovirus	18–72 hodin

Parasitic infection of GI tract

- protozoal
- helminthic
- fungal

Protozoal infections

Human

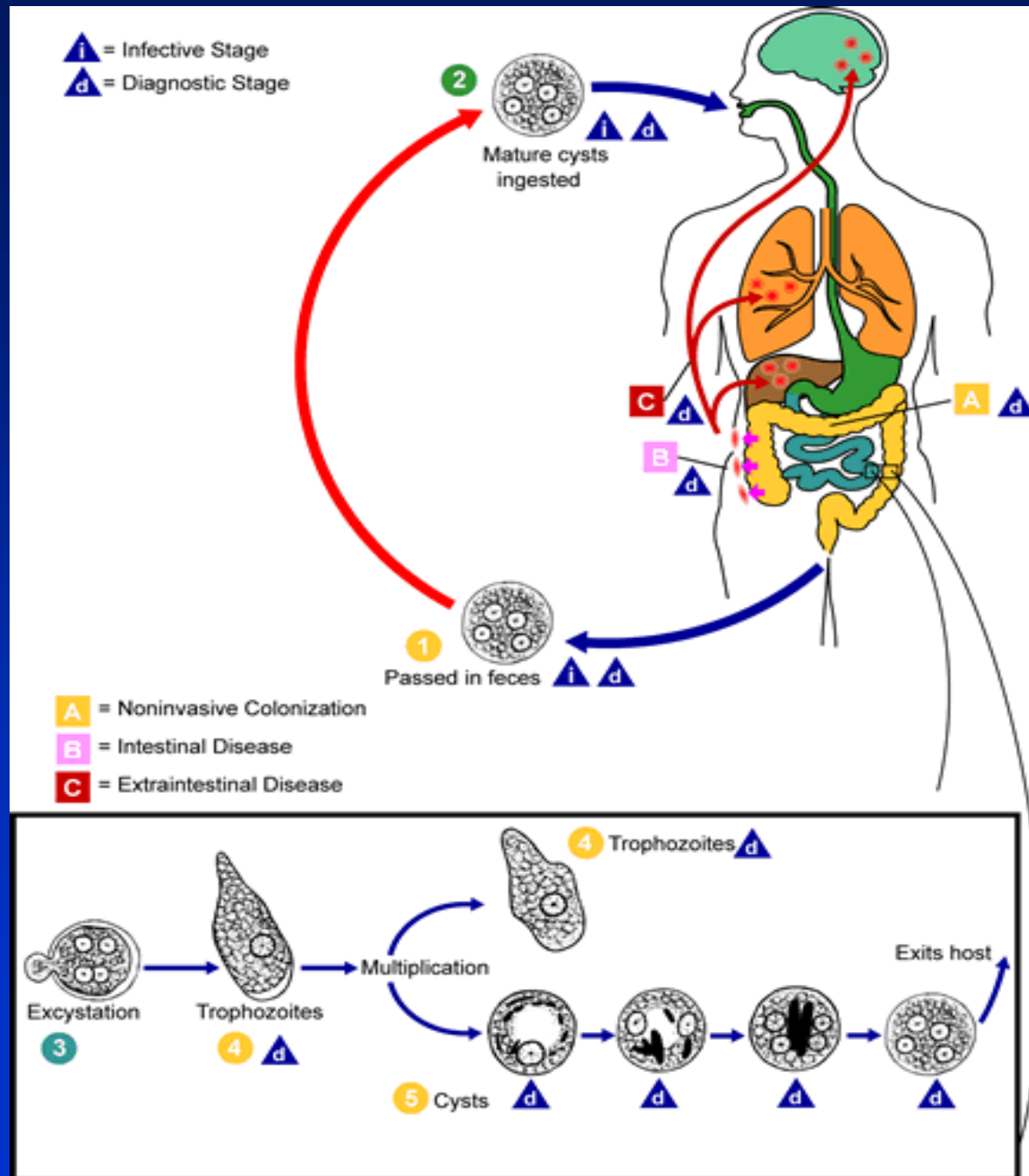
- Amebiasis (*Entamoeba histolytica*)
- Lambliasis = giardiasis (*L.*, *G. intestinalis*)

Zoonotic

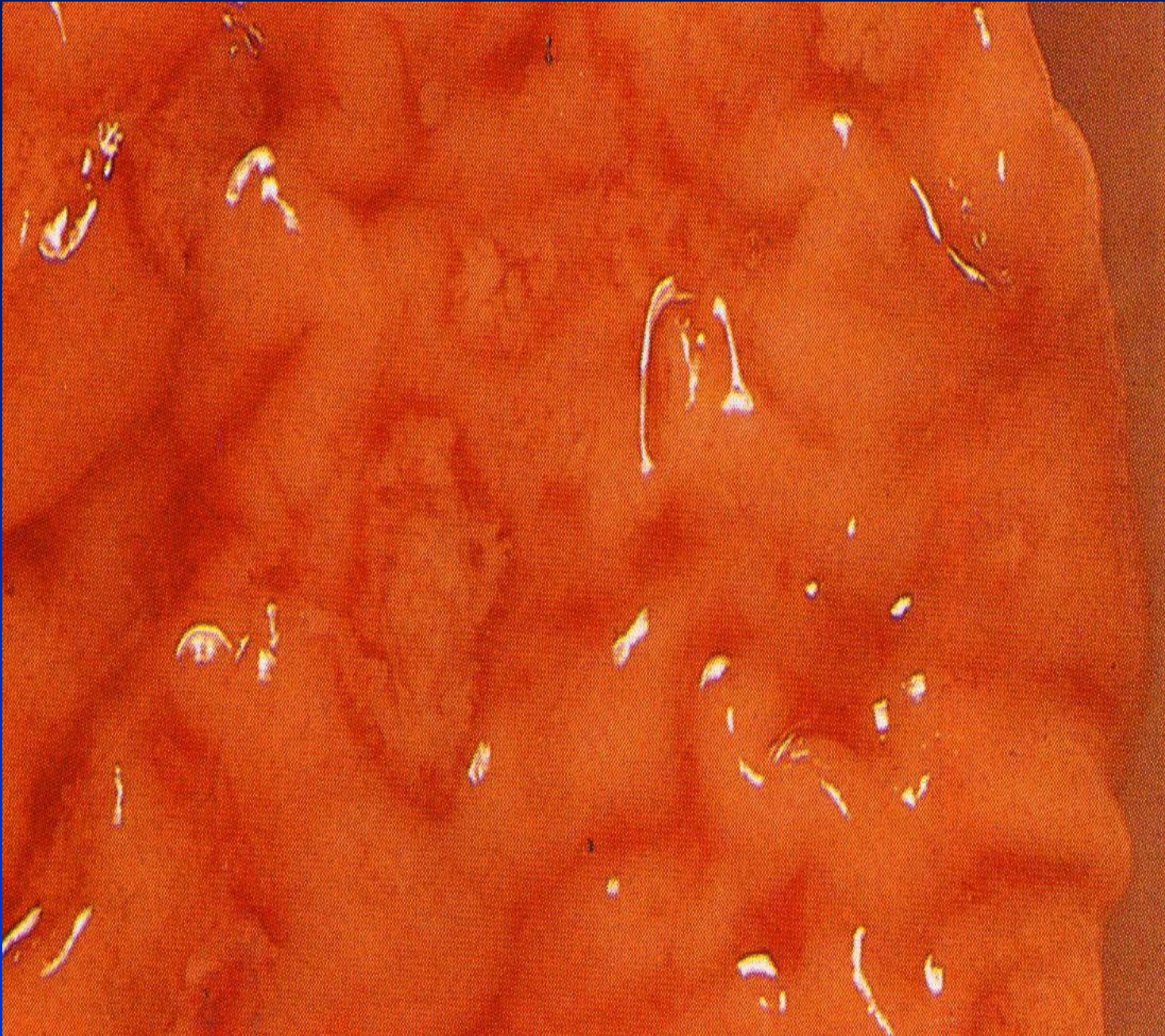
- cryptosporidiosis (*Cryptosporidium parvum*)
- isosporosis (*Isospora belli*)
- microsporidiosis (*Enterocytozoon bineusi*)
- cyclosporiasis (*Cyclospora cayetanensis*)

Amebiasis

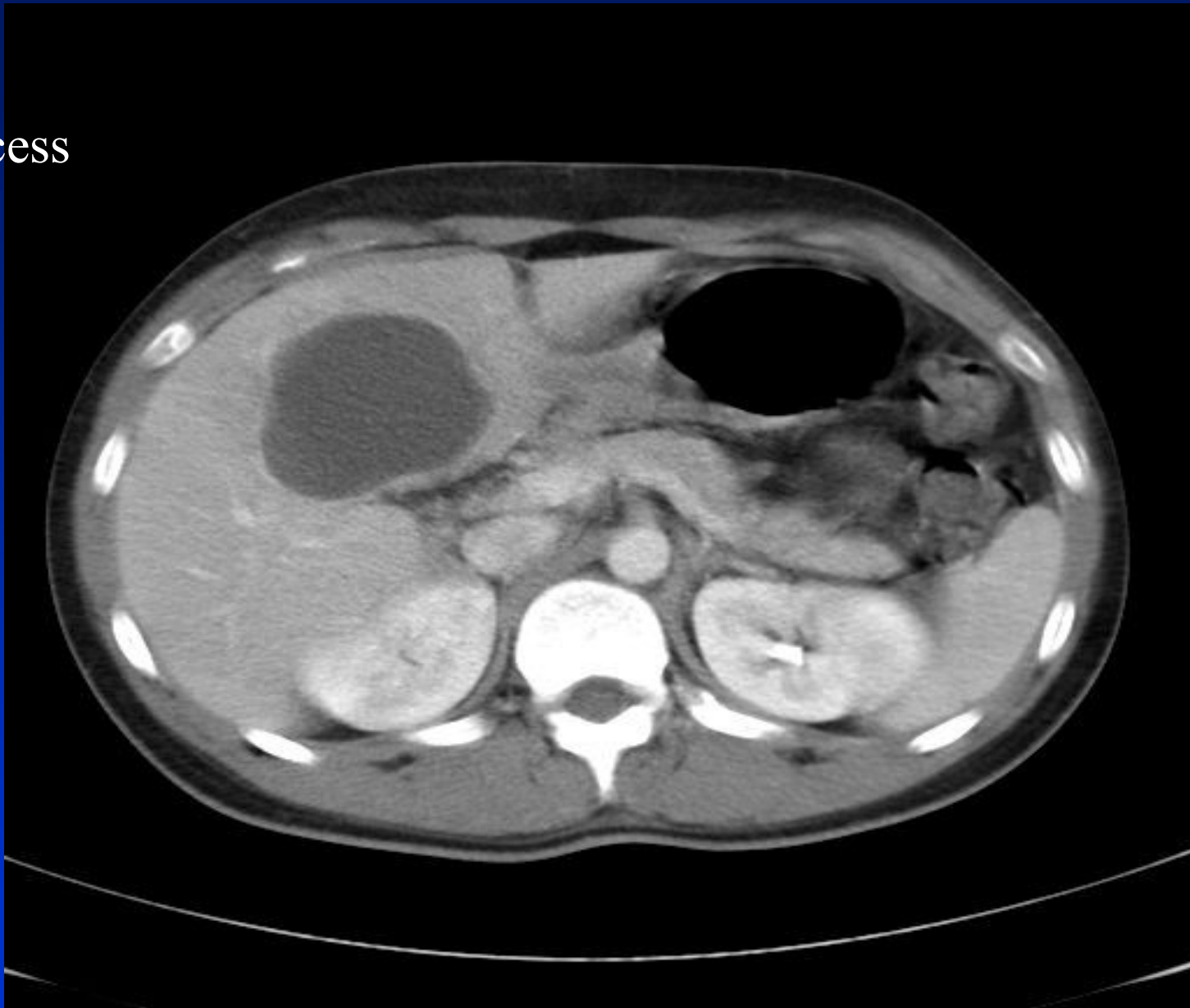
Entamoeba histolytica



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

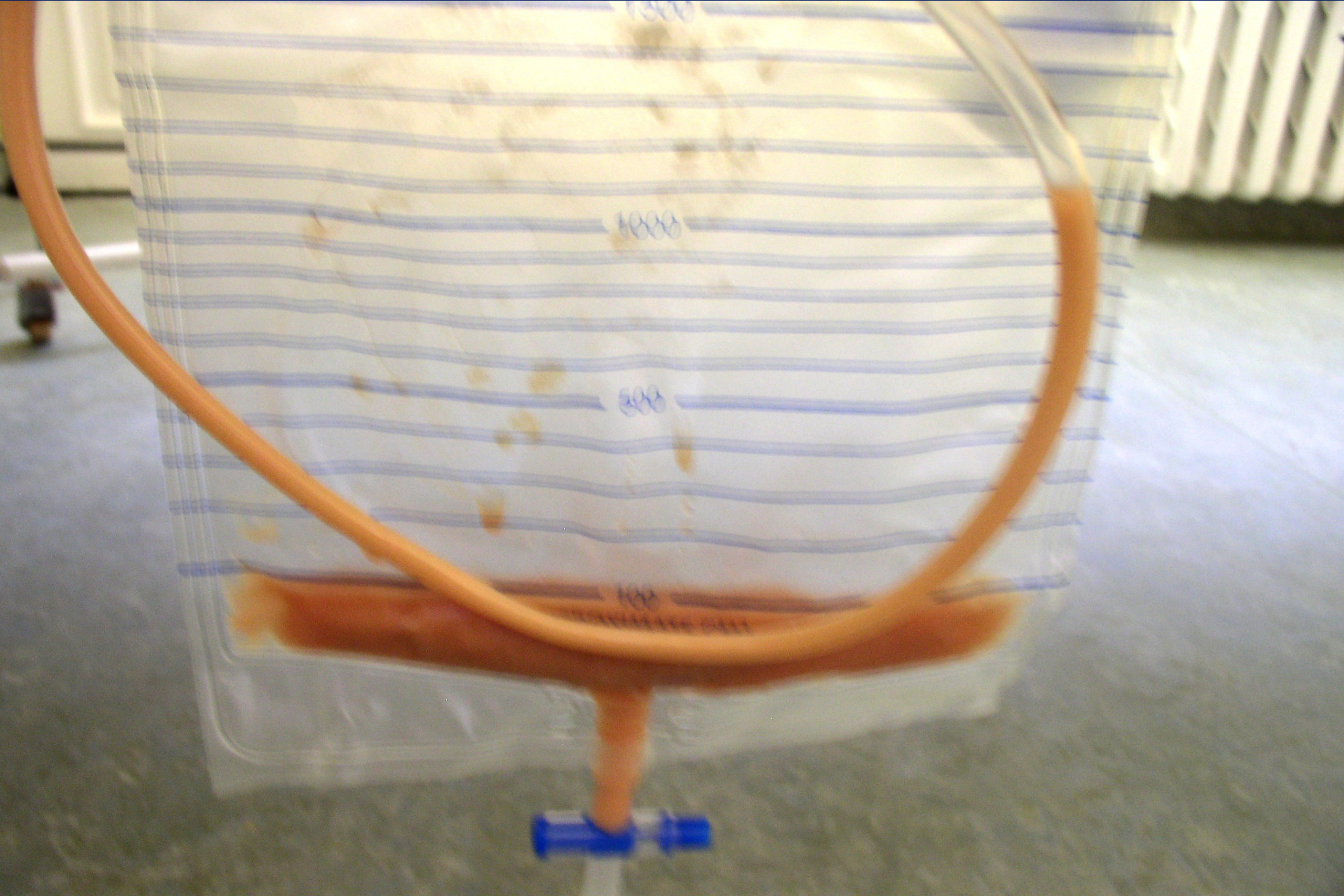
ATL



+ 4.23cm
x 2.98cm

US - day 5





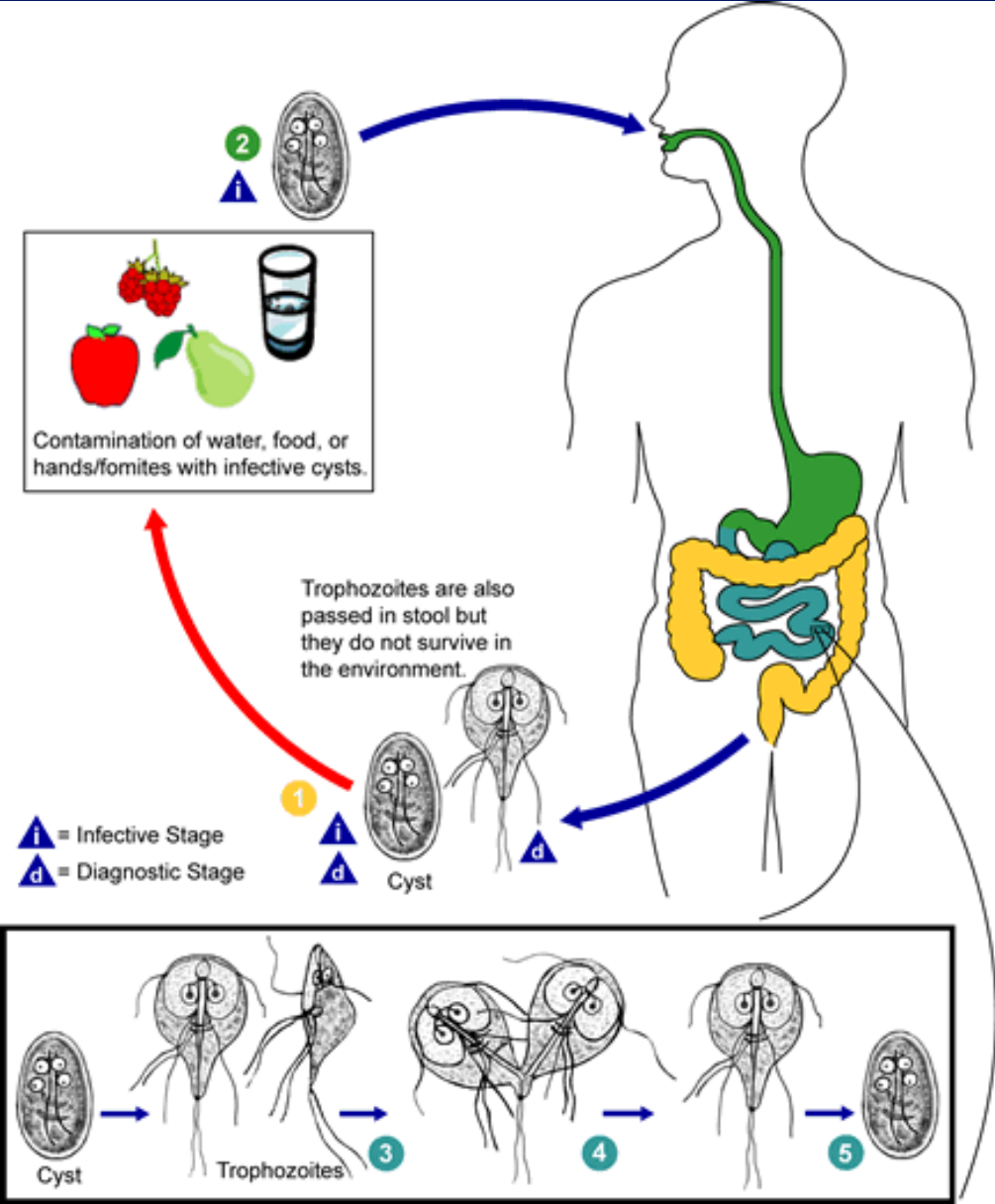


Amebic abscess –
transcutaneous puncture

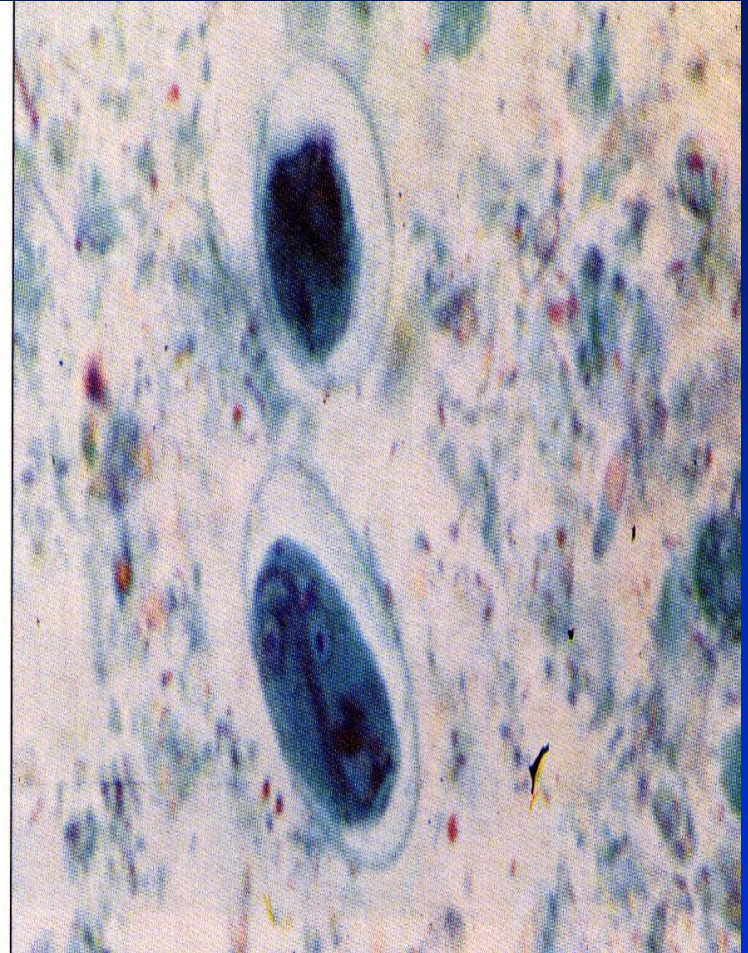


Lambliasis, girardiasis

*Lamblia, Giardia
intestinalis*



Lamblasis
microskopy



Lamblasis
scan



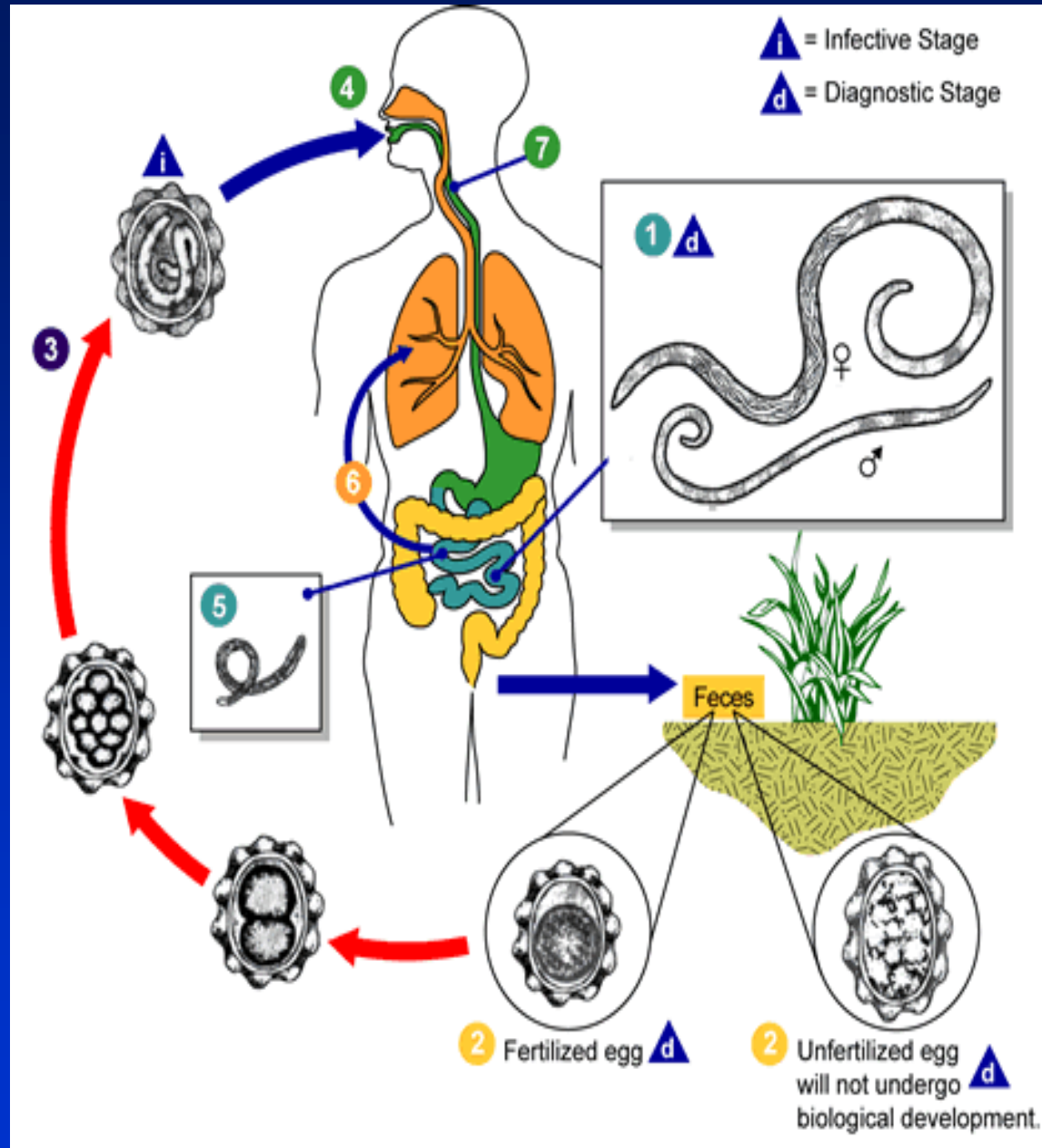
Helmintic GI infections

- Roundworms (Nematodes) - ascariasis, enterobiosis=oxyuriasis, trichuriasis
- Tapeworms (Cestodes) - teniosis, diphylobotriosis, hymenolepsiosis, echinococcosis, alveococcosis
- Flukes (Trematodes) - schistosomosis

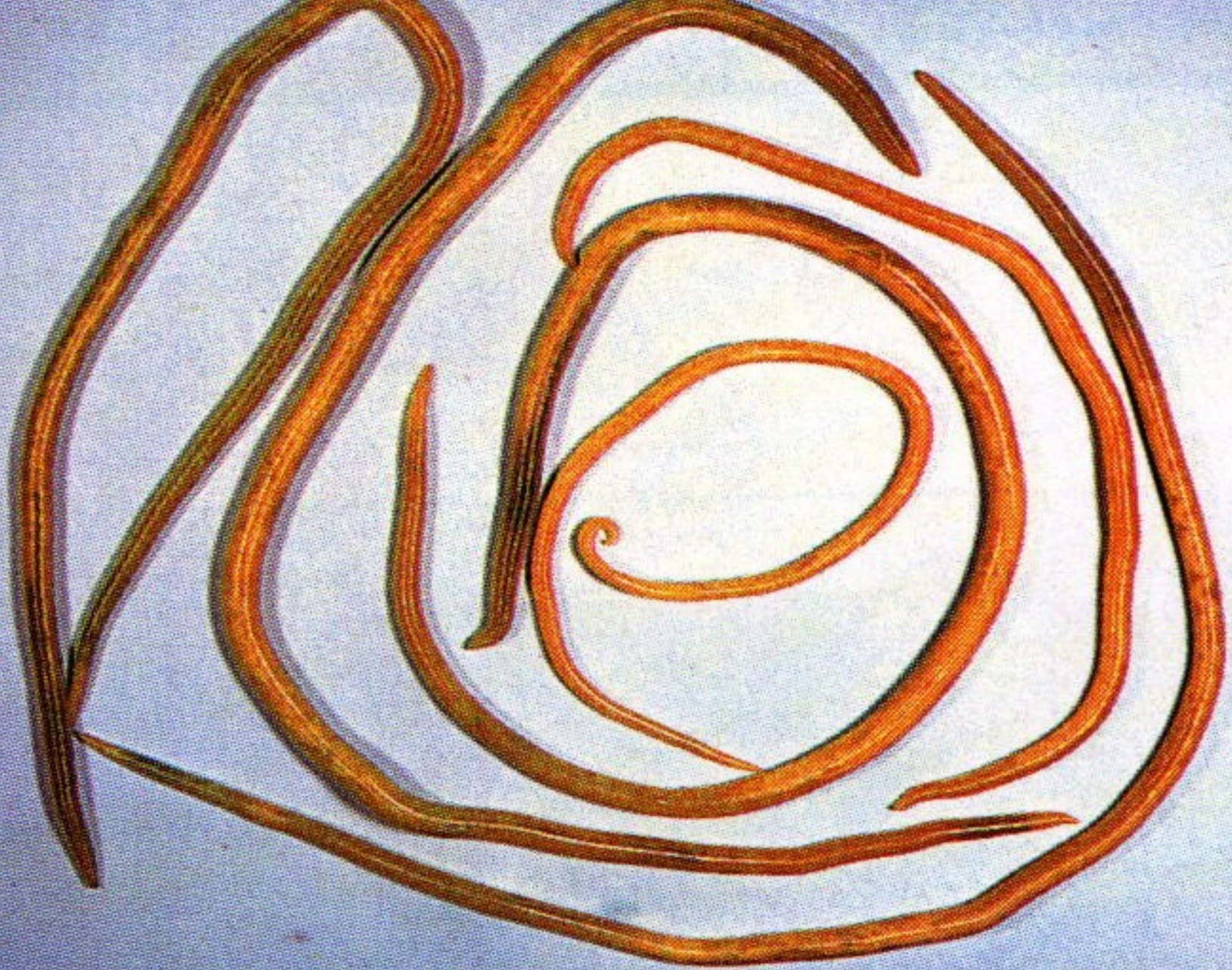
Roundworms (Nematodes)

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

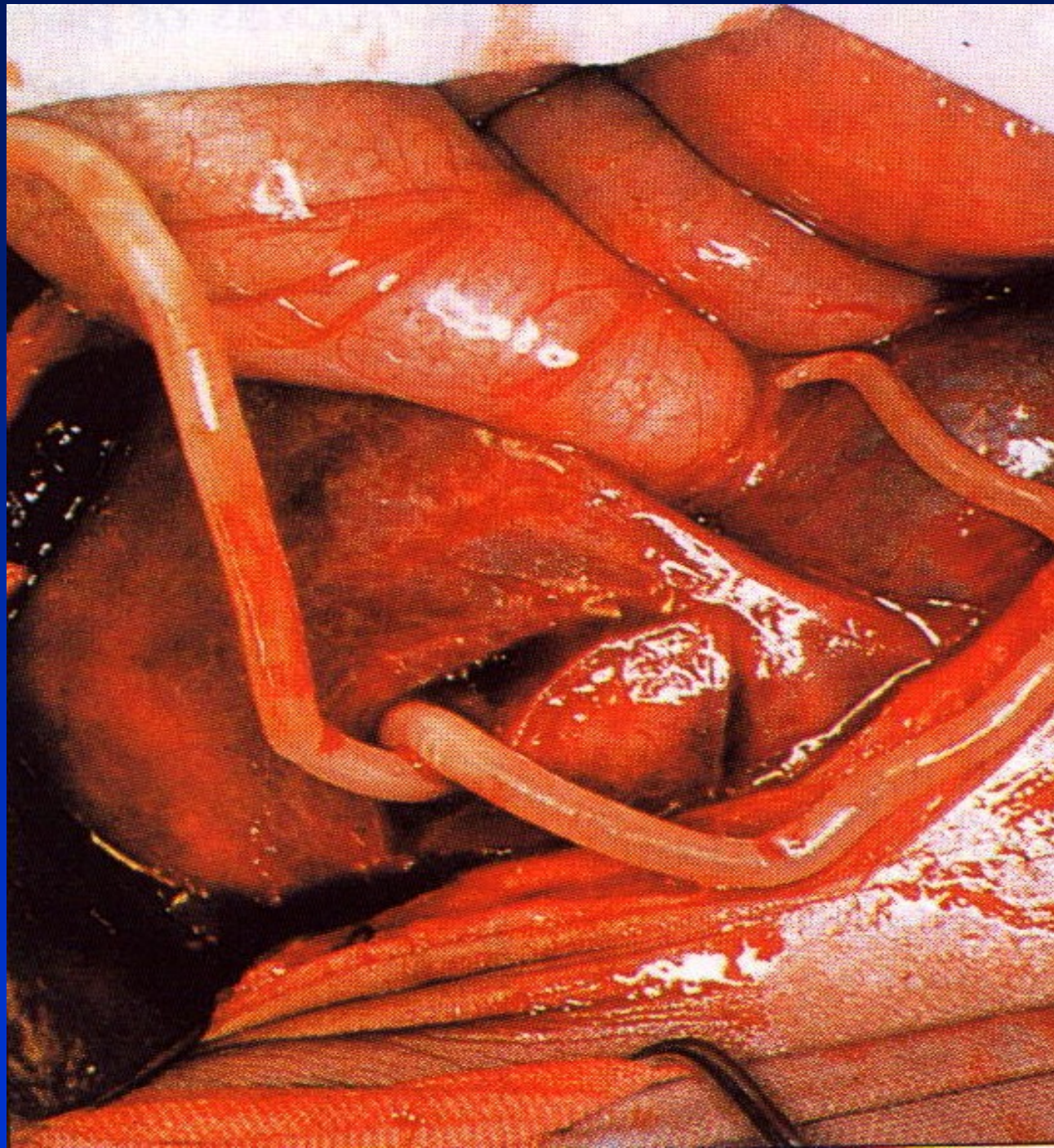
Ascariasis



Ascaris lumbricoides

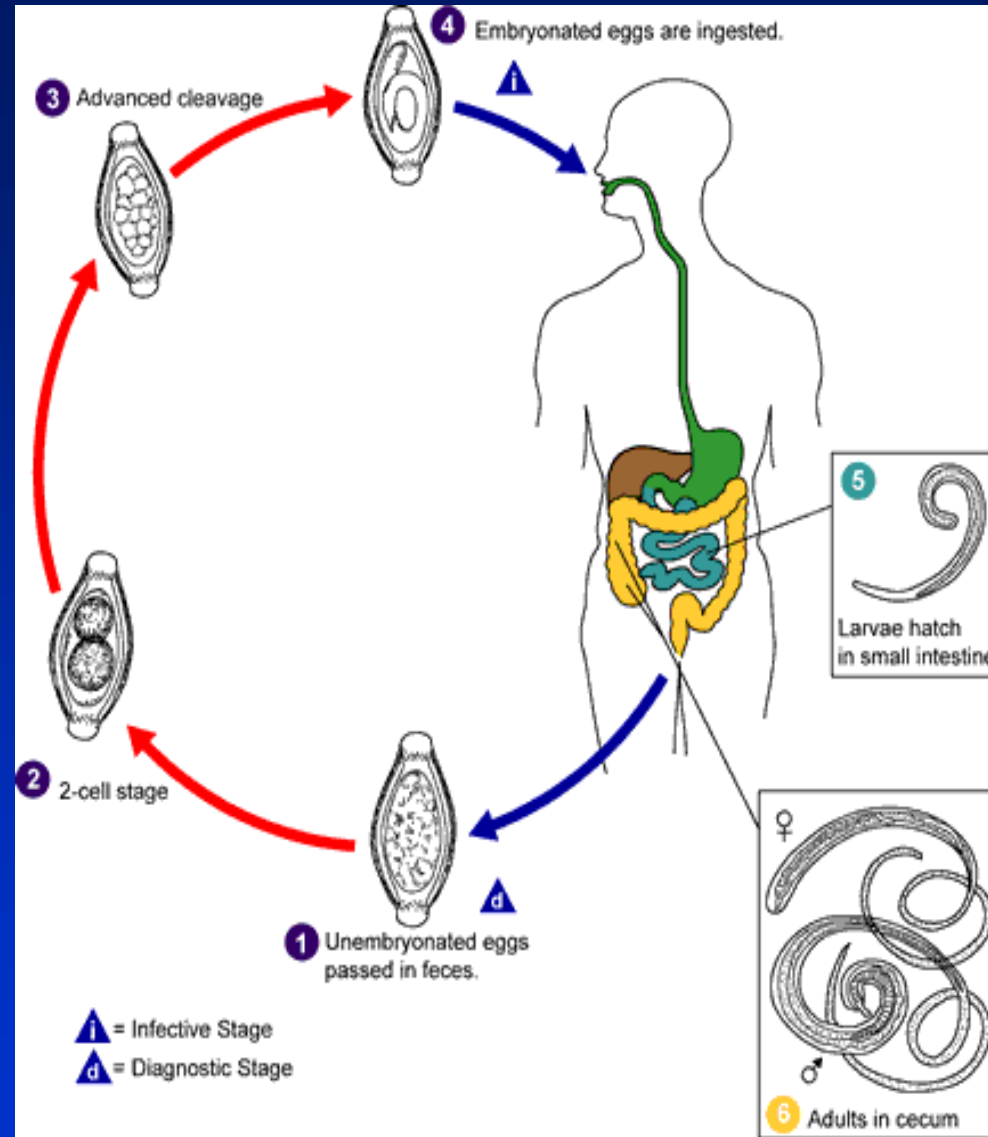




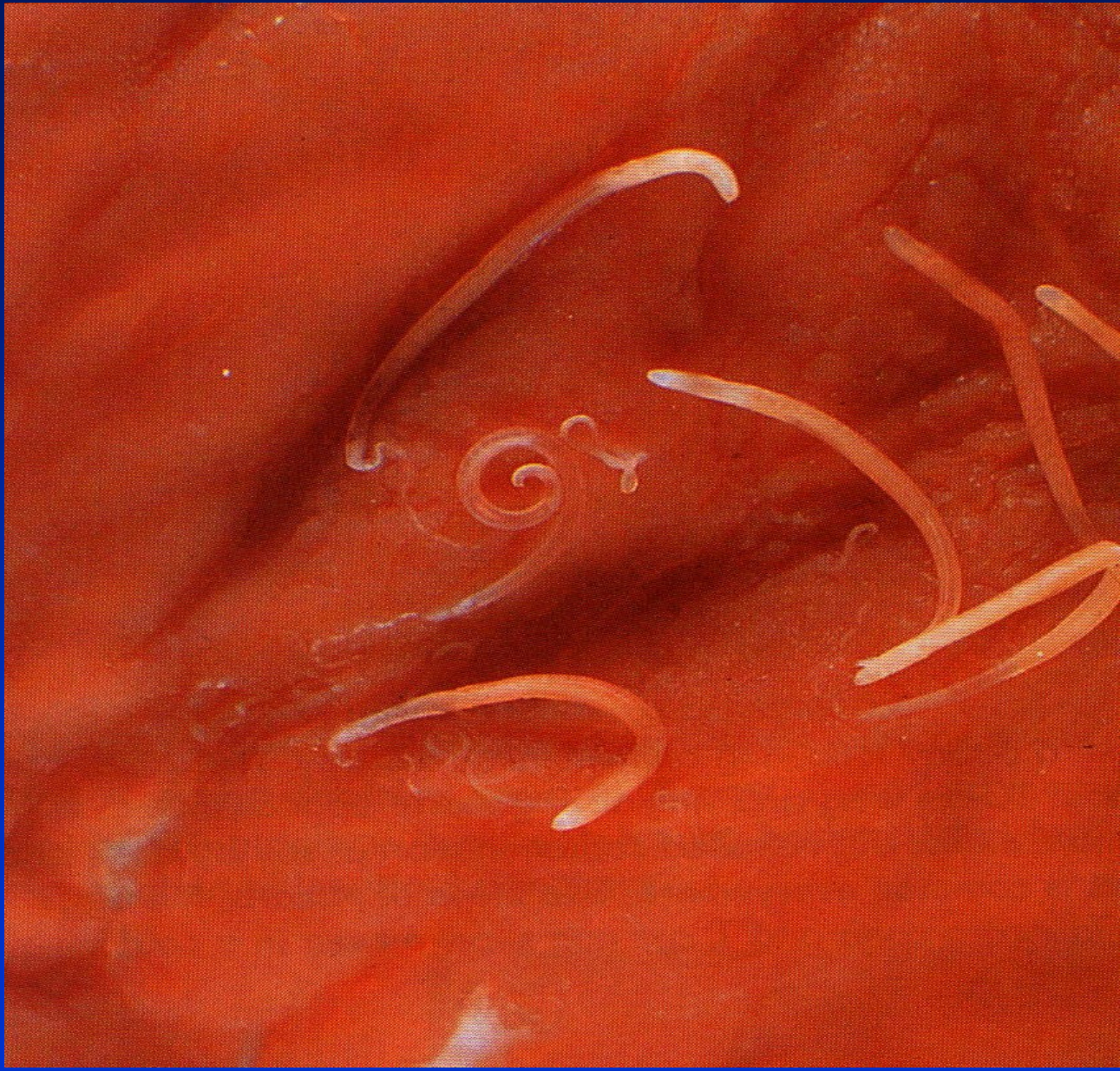


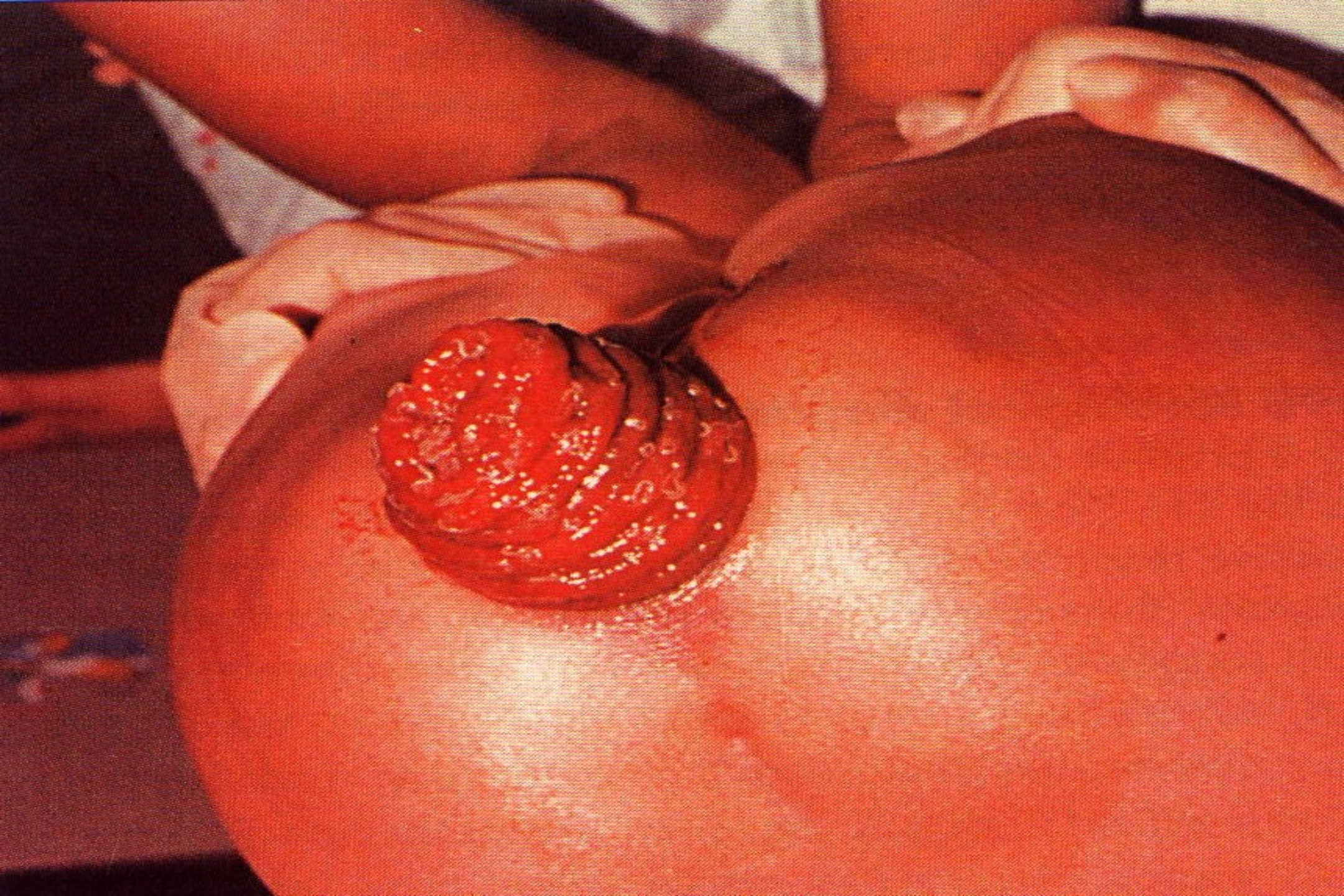


Trichuriasis

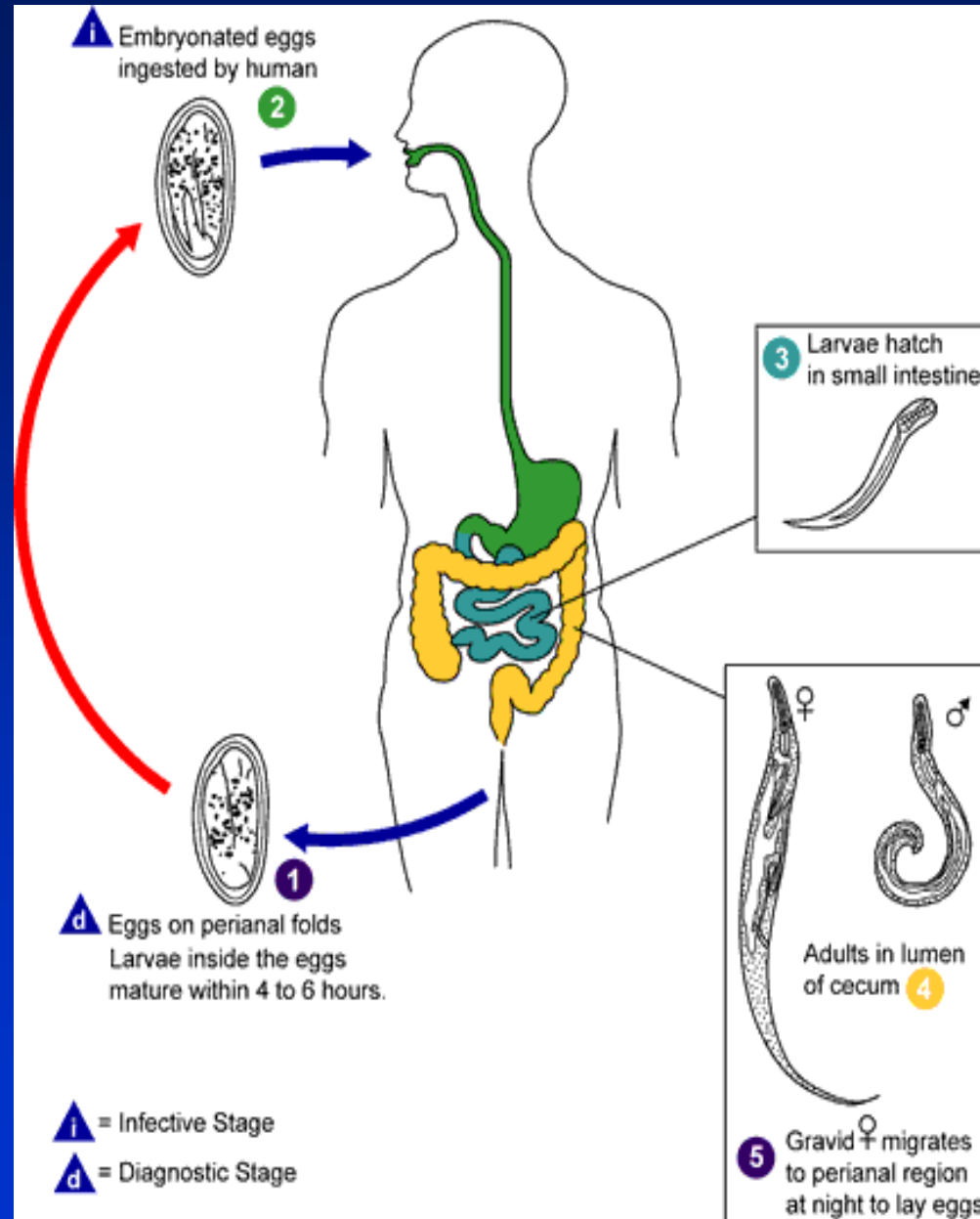


Trichuris trichiura



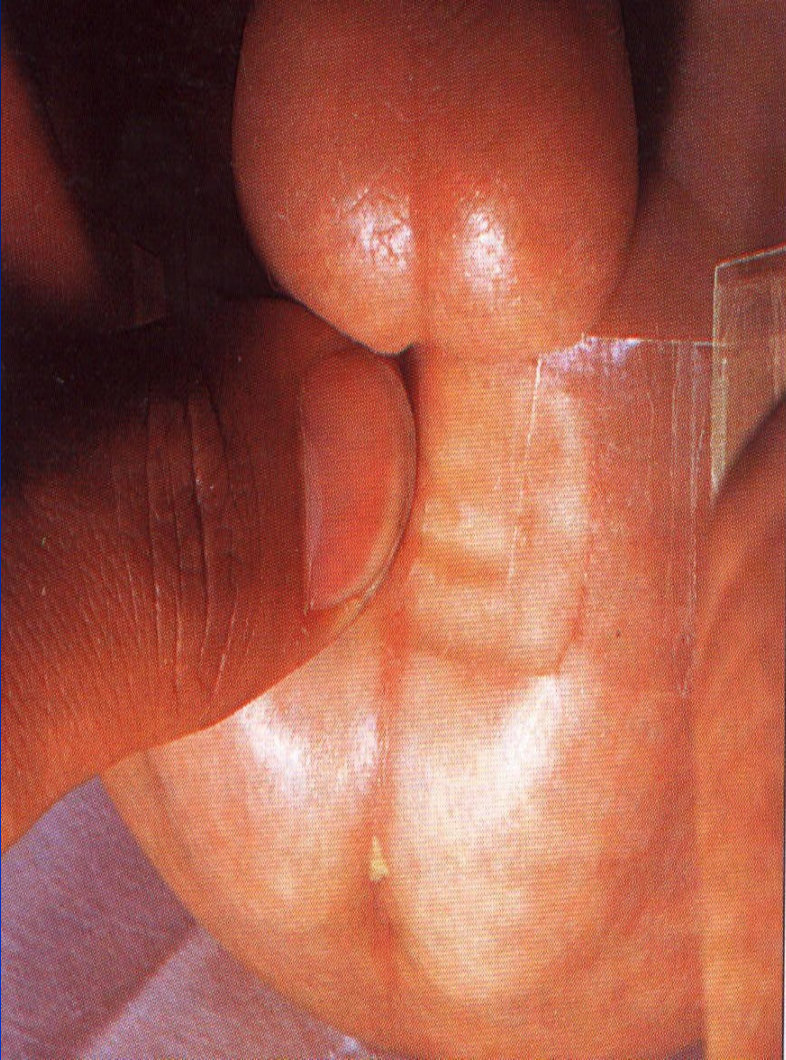


Enterobiosis, oxyuriasis



*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

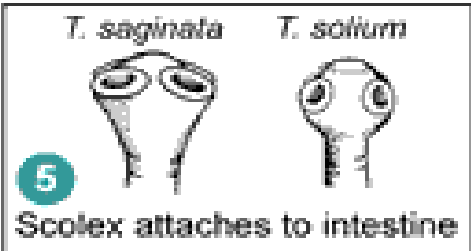
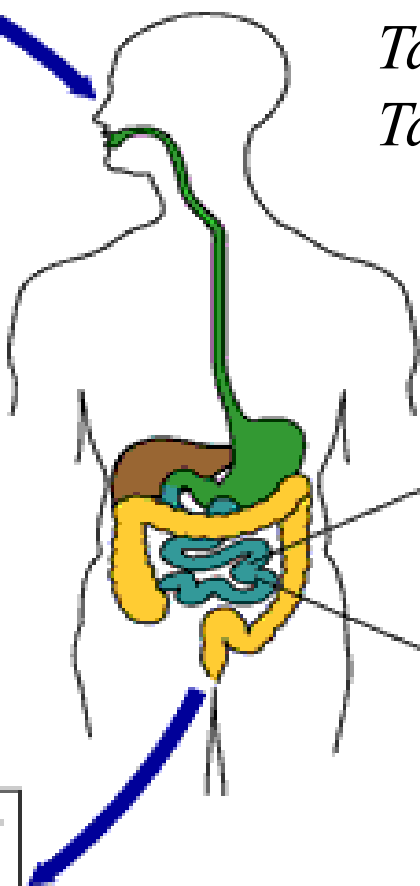
- *Echinococcus granulosus*
- *Echinococcus (Alveococcus) multilocularis*

i Oncospheres develop into cysticerci in muscle



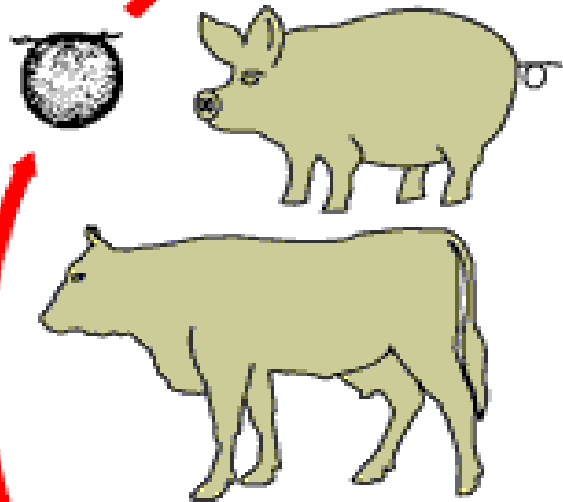
4 Humans infected by ingesting raw or undercooked infected meat

Taenia saginata
Taenia solium



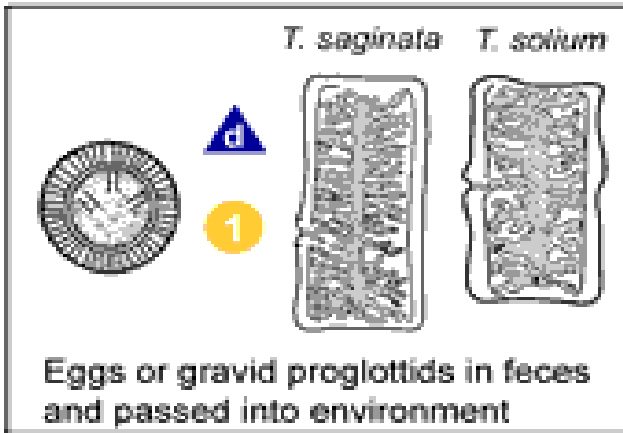
Oncospheres hatch, penetrate intestinal wall, and circulate to musculature

3



2

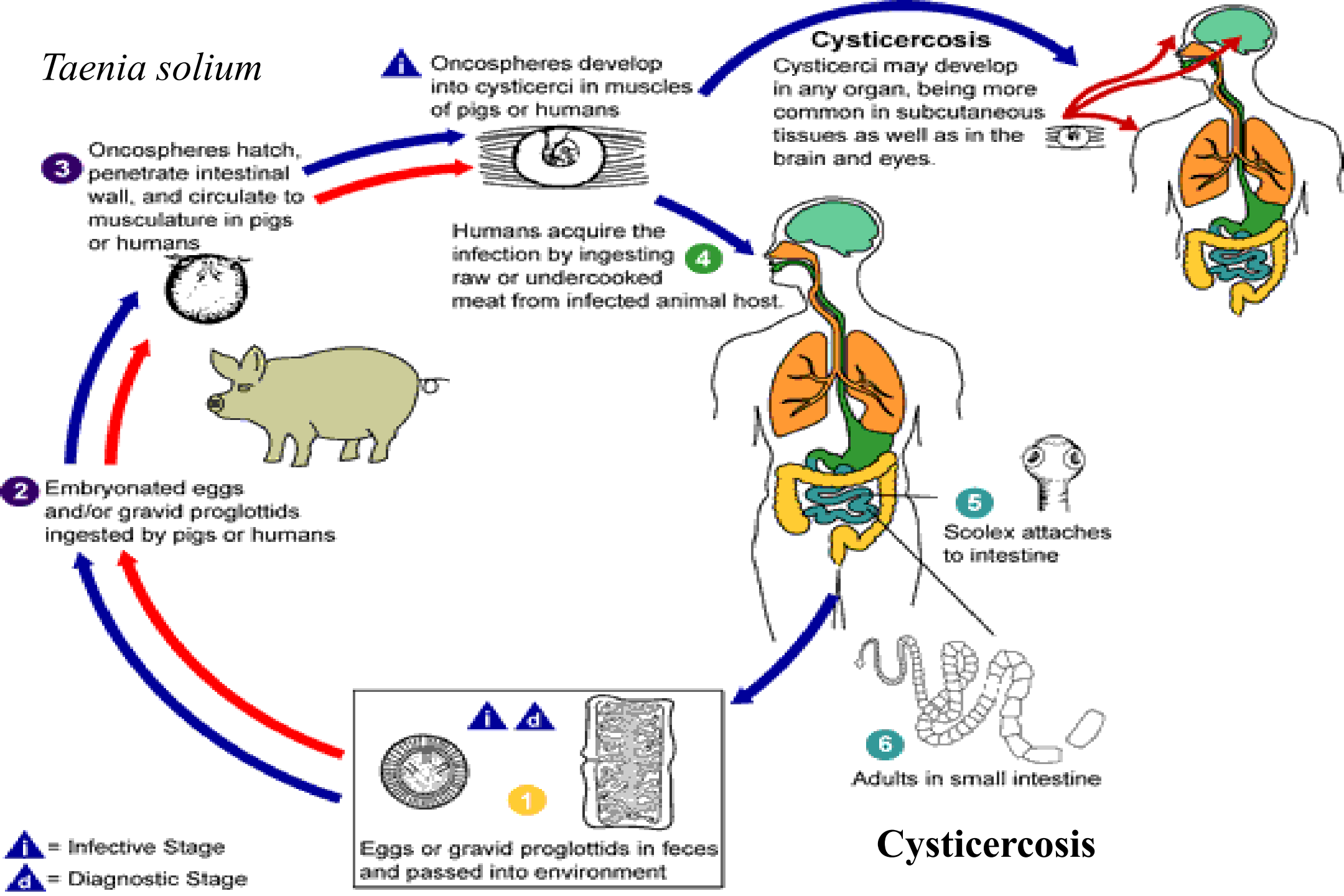
Cattle (*T. saginata*) and pigs (*T. solium*) become infected by ingesting vegetation contaminated by eggs or gravid proglottids



i = Infective Stage
d = Diagnostic Stage

Taeniosis

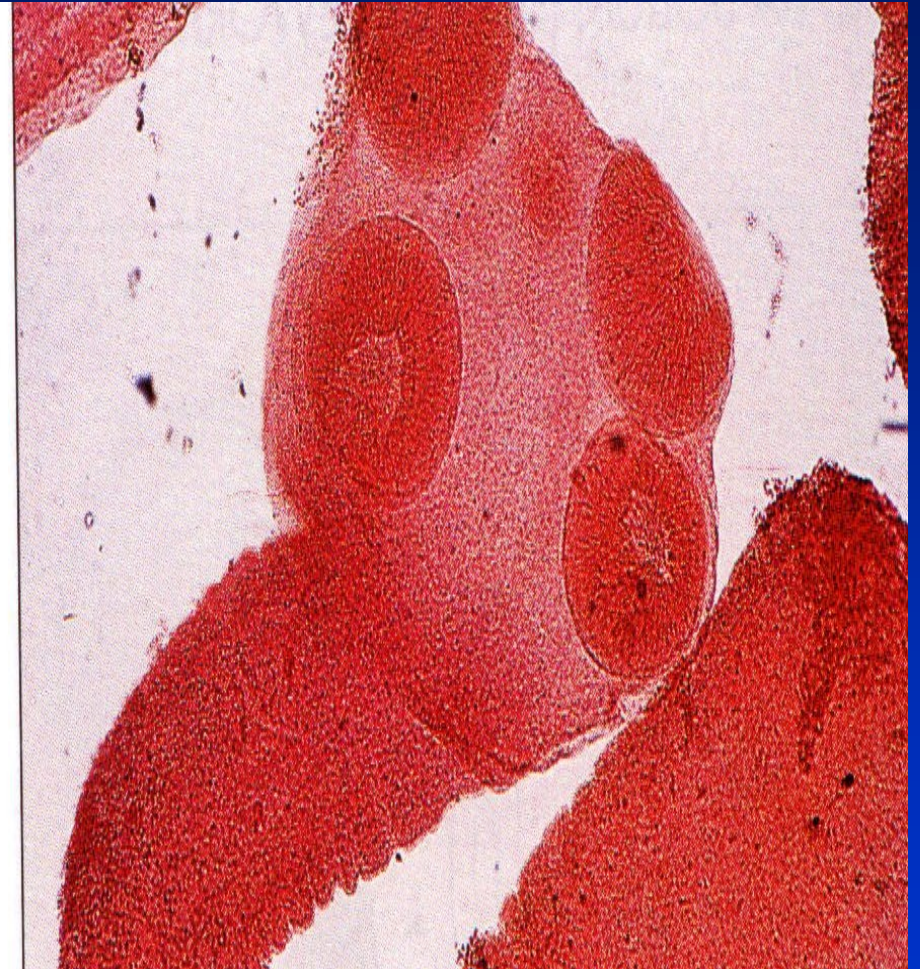
Taenia solium



Taenia solium



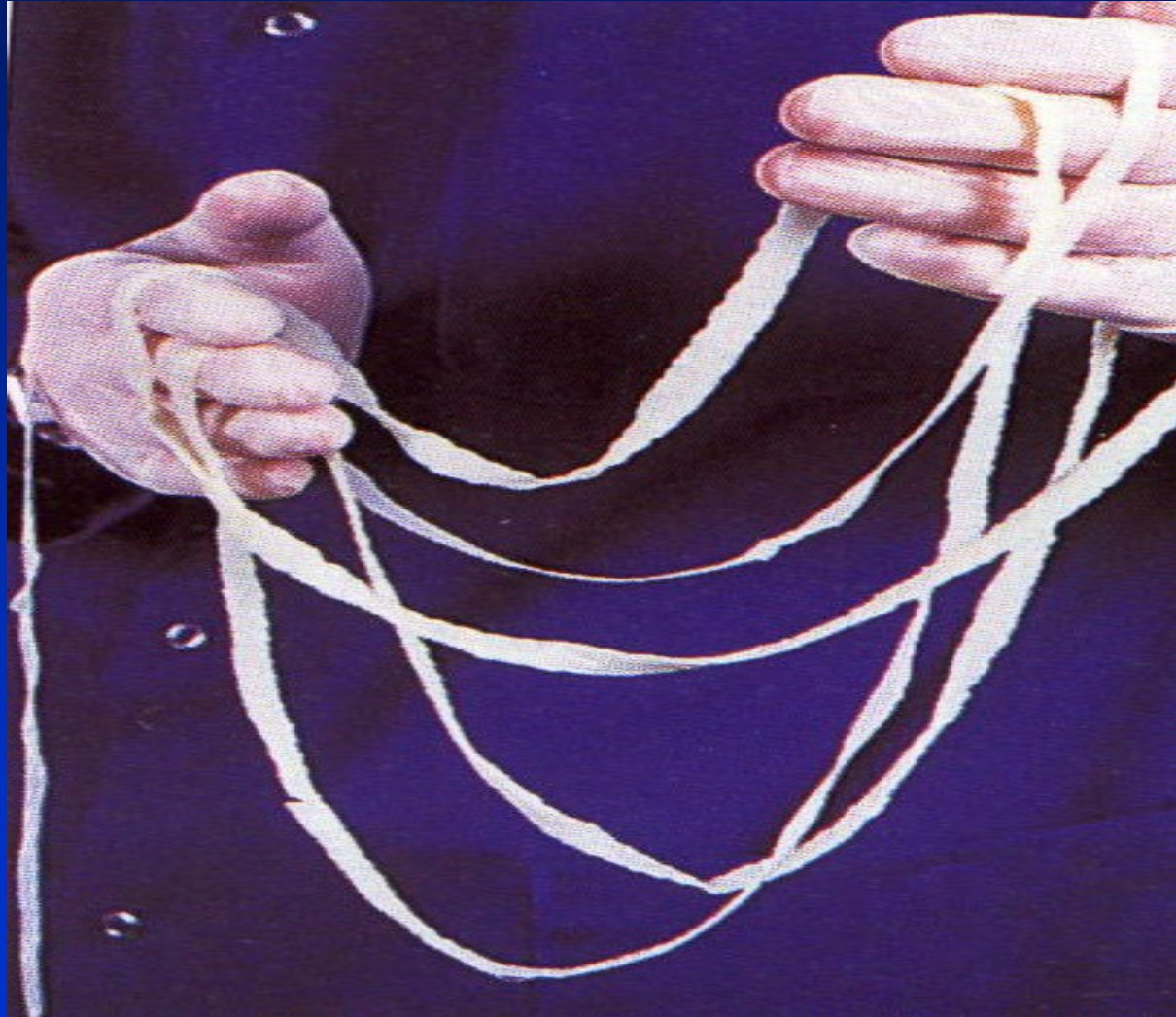
Taenia saginata



Taenia solium



Taenia saginata



Cysticercosis (pig)

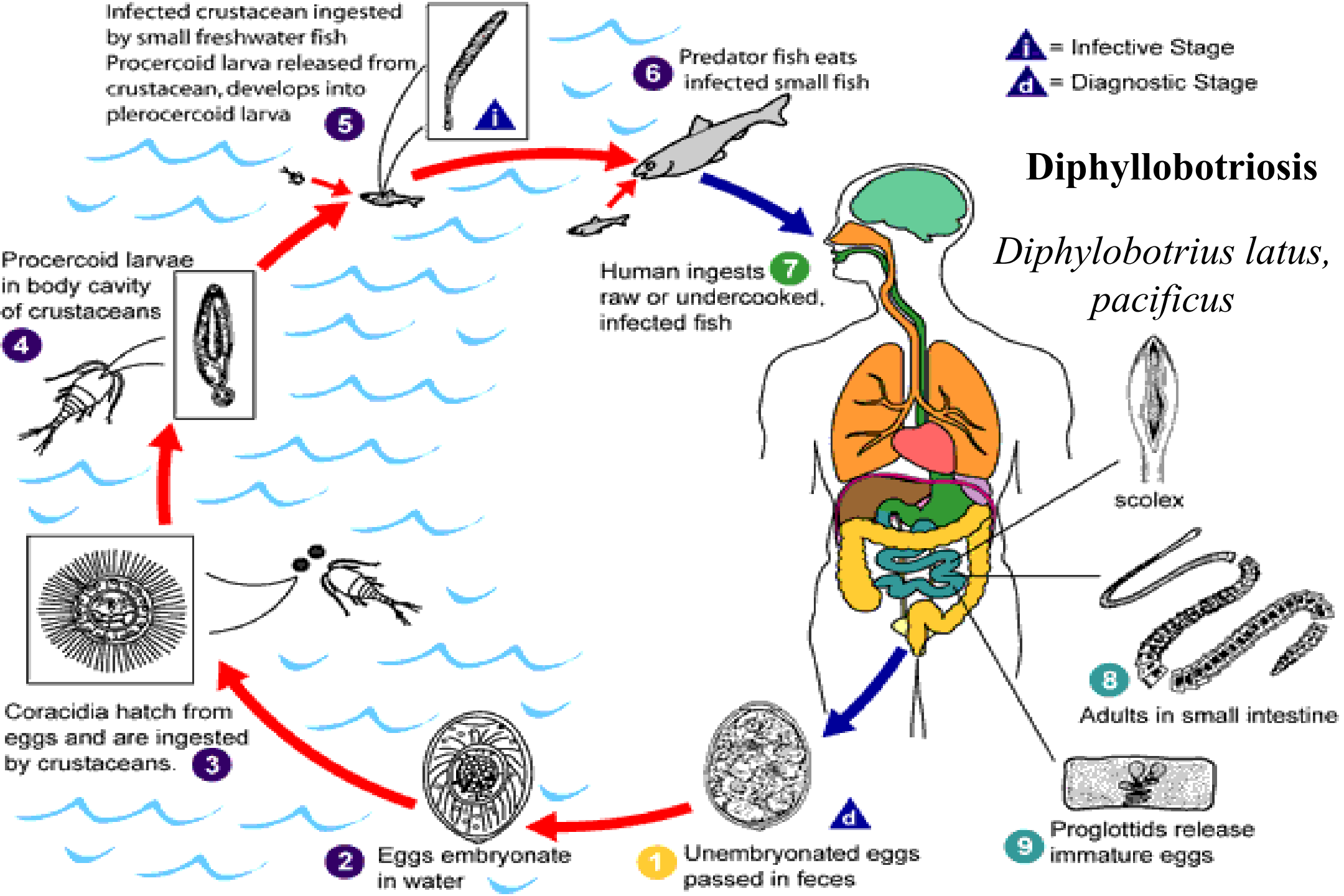


Cysticercosis (man)

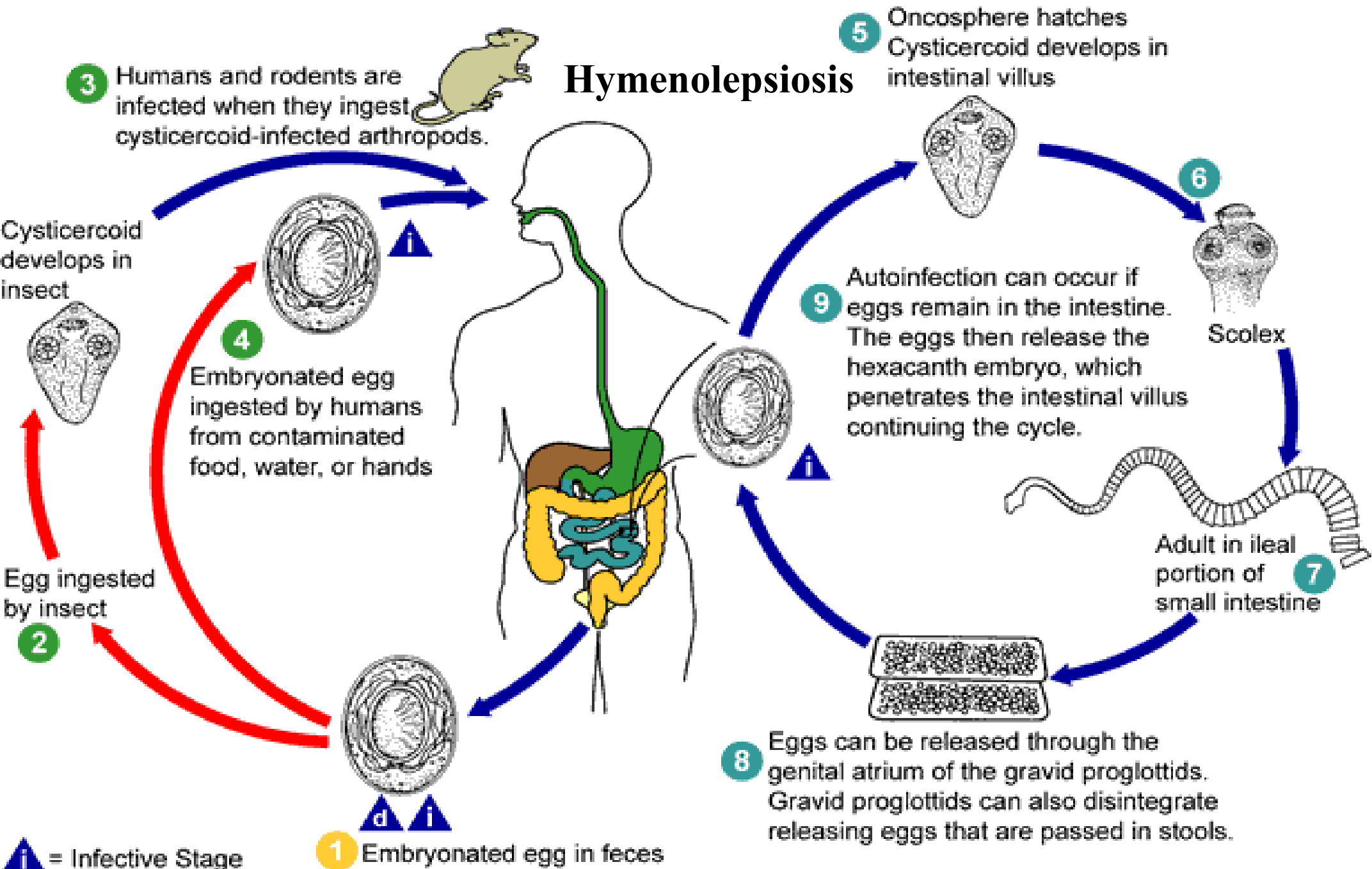


Cysticercosis (cow)





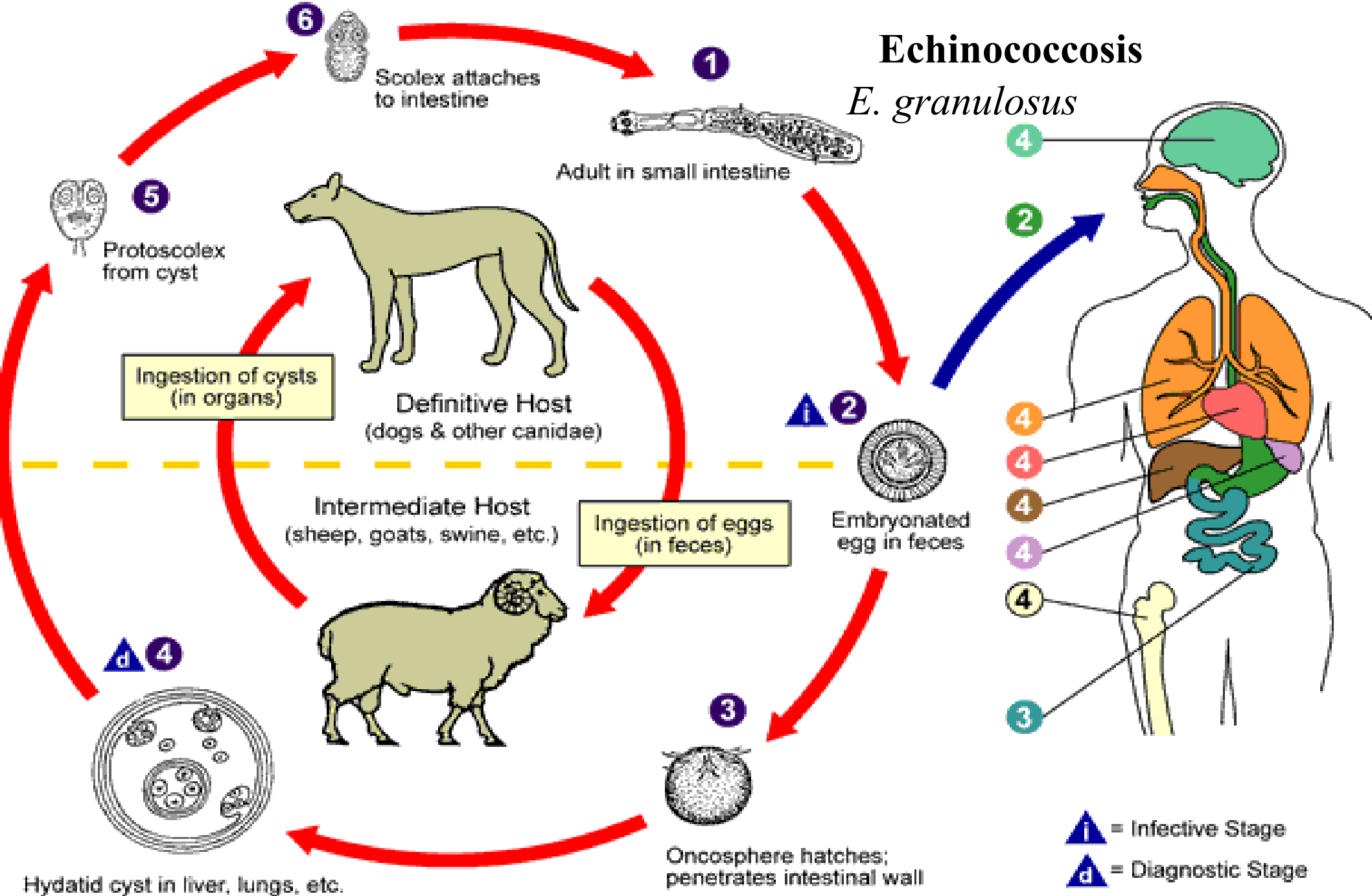
Hymenolepsis



Hymenolepsis nana

Echinococcosis

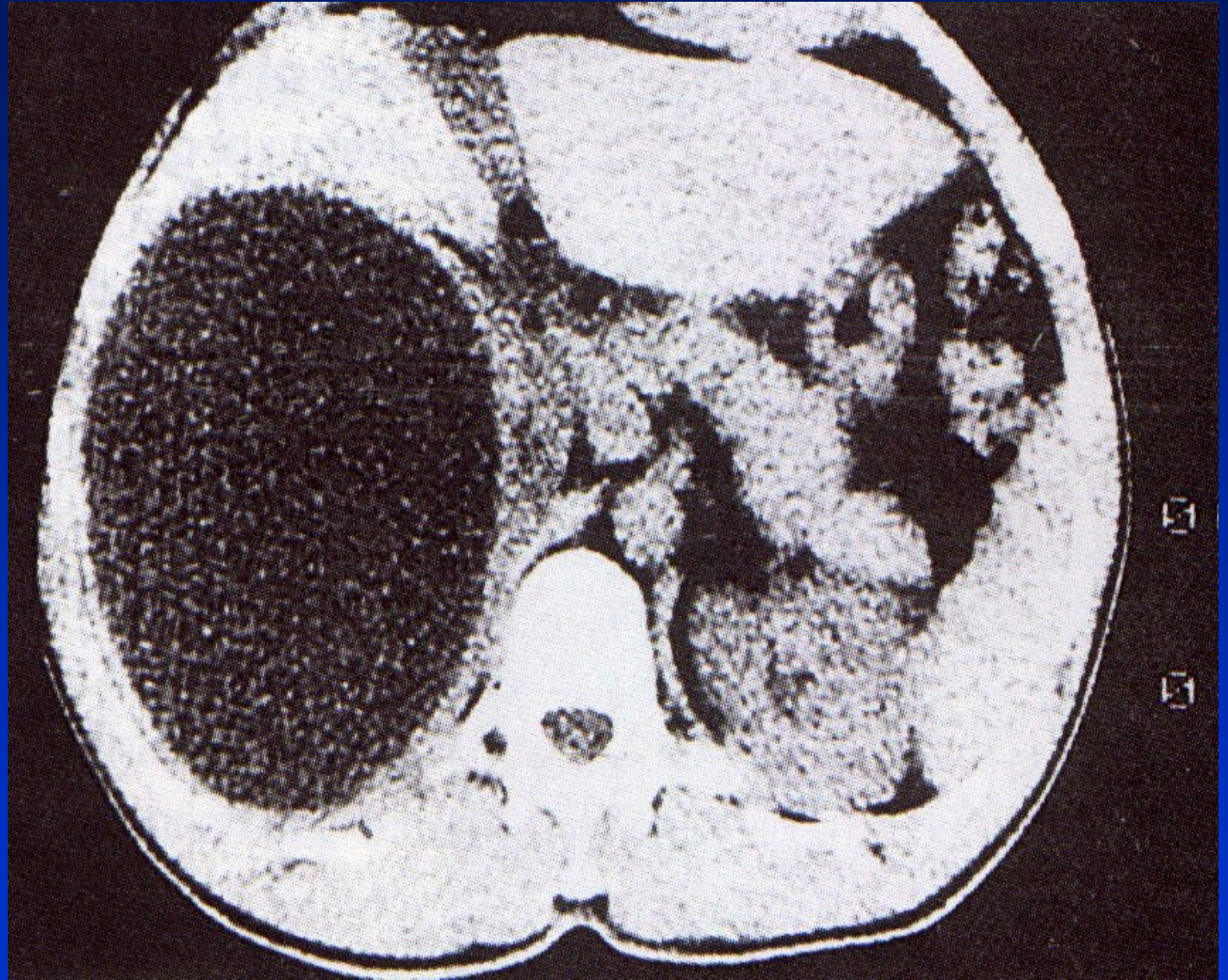
E. granulosus



Echinococcus
granulosus
(dog)



Echinococcus granulosus – liver cysts
(man)



*Echinococcus
granulosus* – liver cysts
(man)

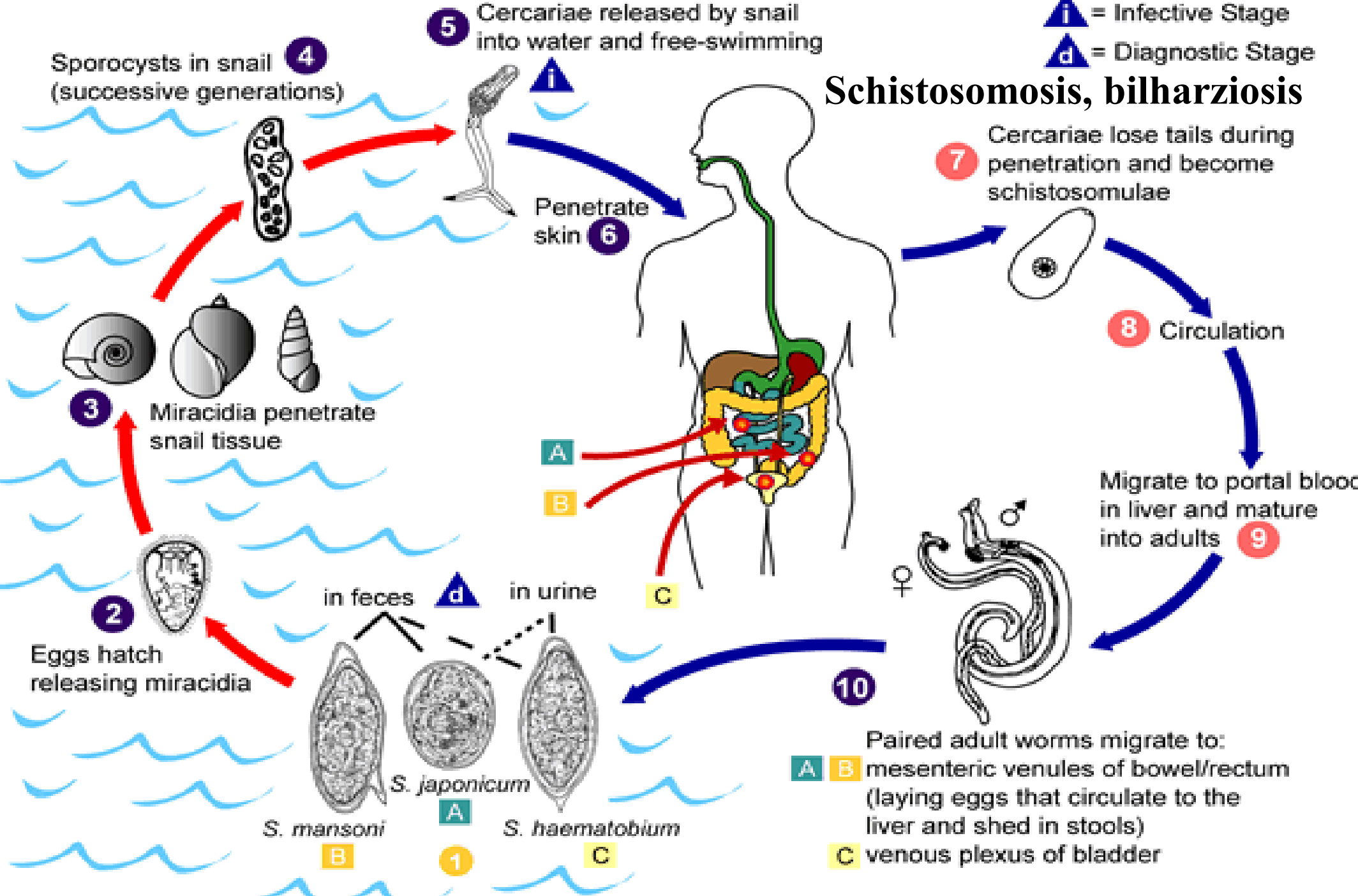


Flukes (Trematodes)

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

i = Infective Stage
d = Diagnostic Stage

Schistosomosis, bilharziosis

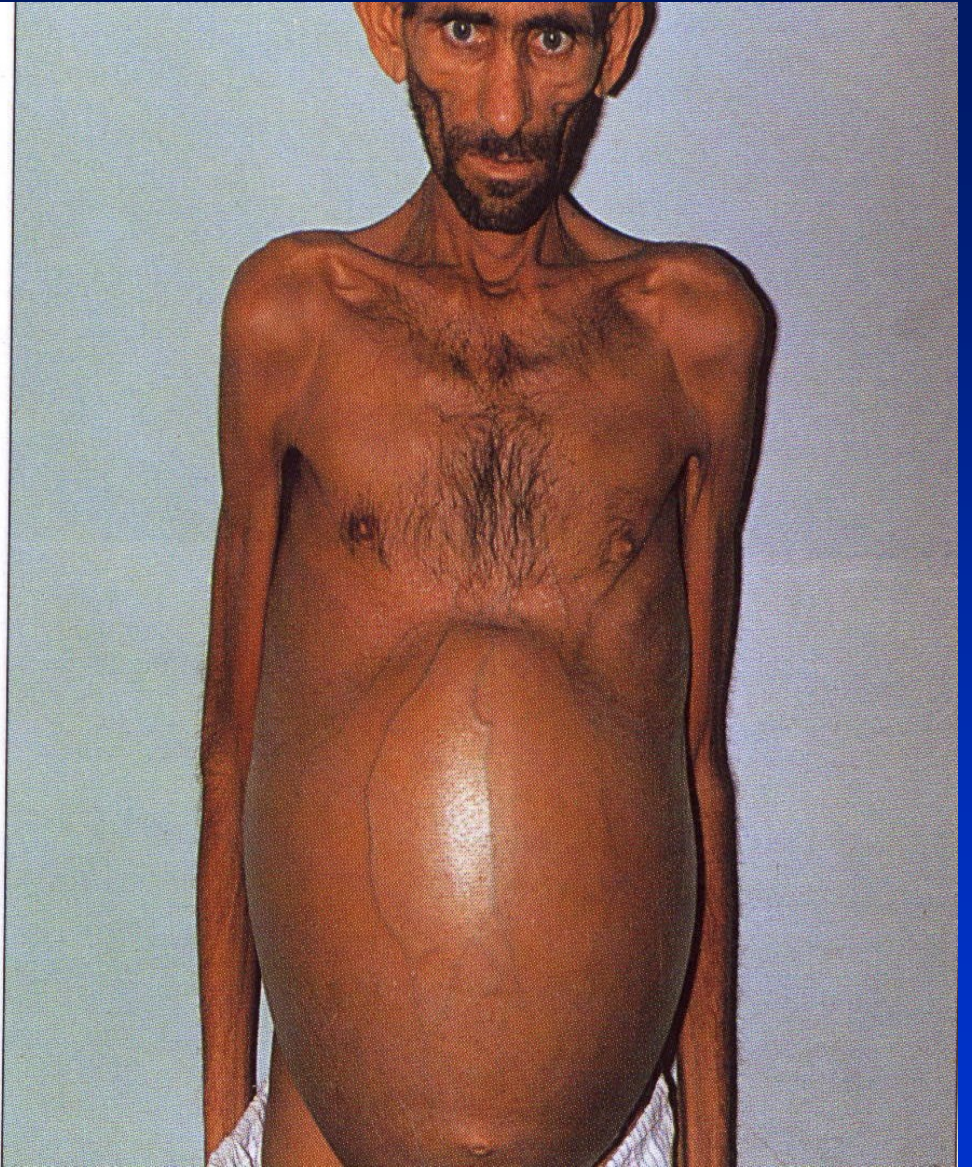
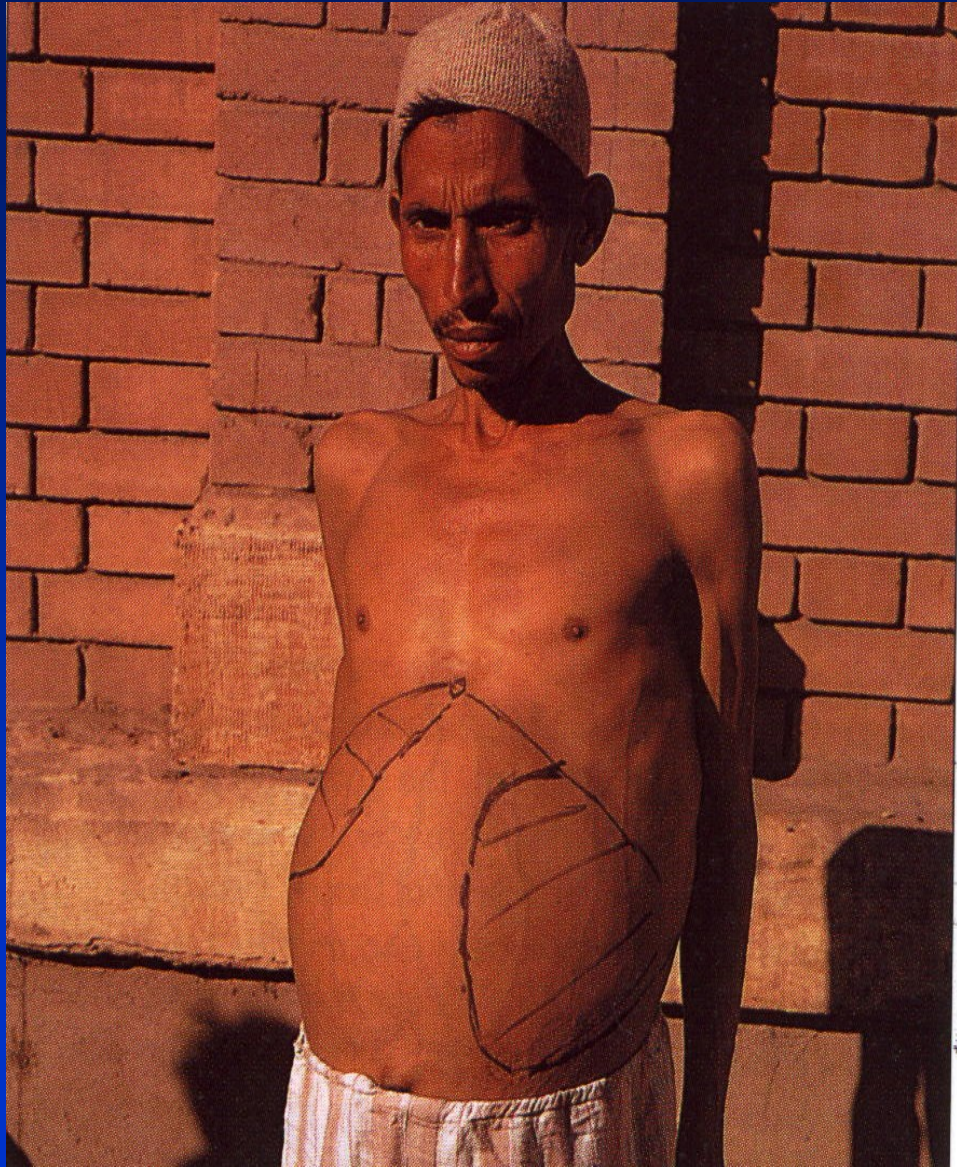


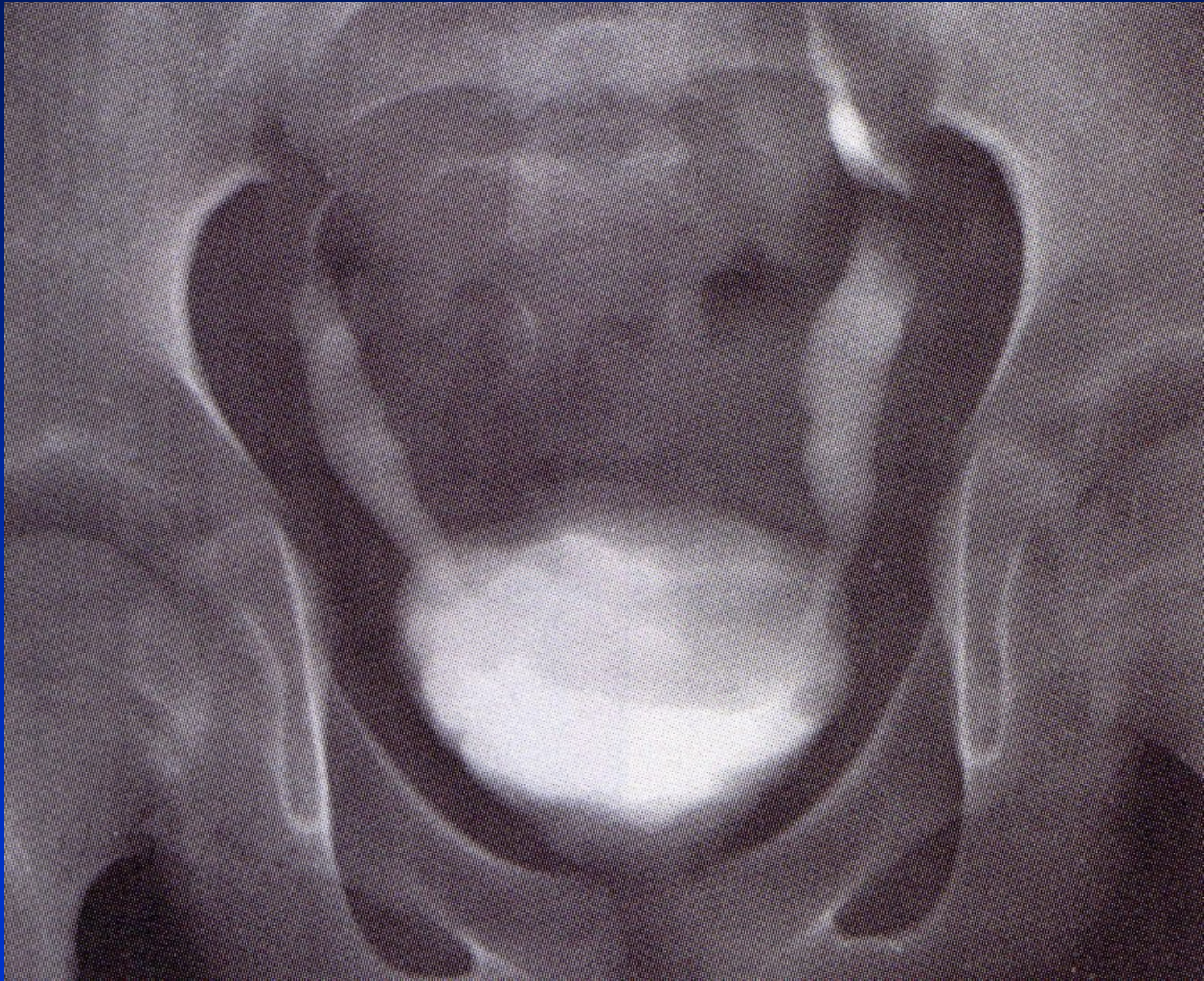












Fungal GI infections

- 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!

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