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 2008-2018

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Campylobacter	20 175	20 371	21 164	18 811	18 412	18 389	20 903	21 102	24291	24508	23780
Salmonella	11 009	10 805	8 622	8 752	10 507	10 280	13 633	12 739	11912	11779	11359
Shigella	229	178	450	164	266	257	92	88	70	168	145
Bacterial other	3 305	3 178	3 343	4 607	5 168	5 797	6 763	8 146	7563	7371	8116
Viral	6 639	6 066	8 517	9 955	6 877	7 778	9 438	18 858	9491	9986	9694
Food poisoning	84	106	100	381	14	203	177	793	127	3	237

Gastrointestinal infections

- bacterial
- viral
- parasitic

Bacterial GI infections

- transmission of pathogenic microbs
  - zoonosis
  - human

- food-poisoning

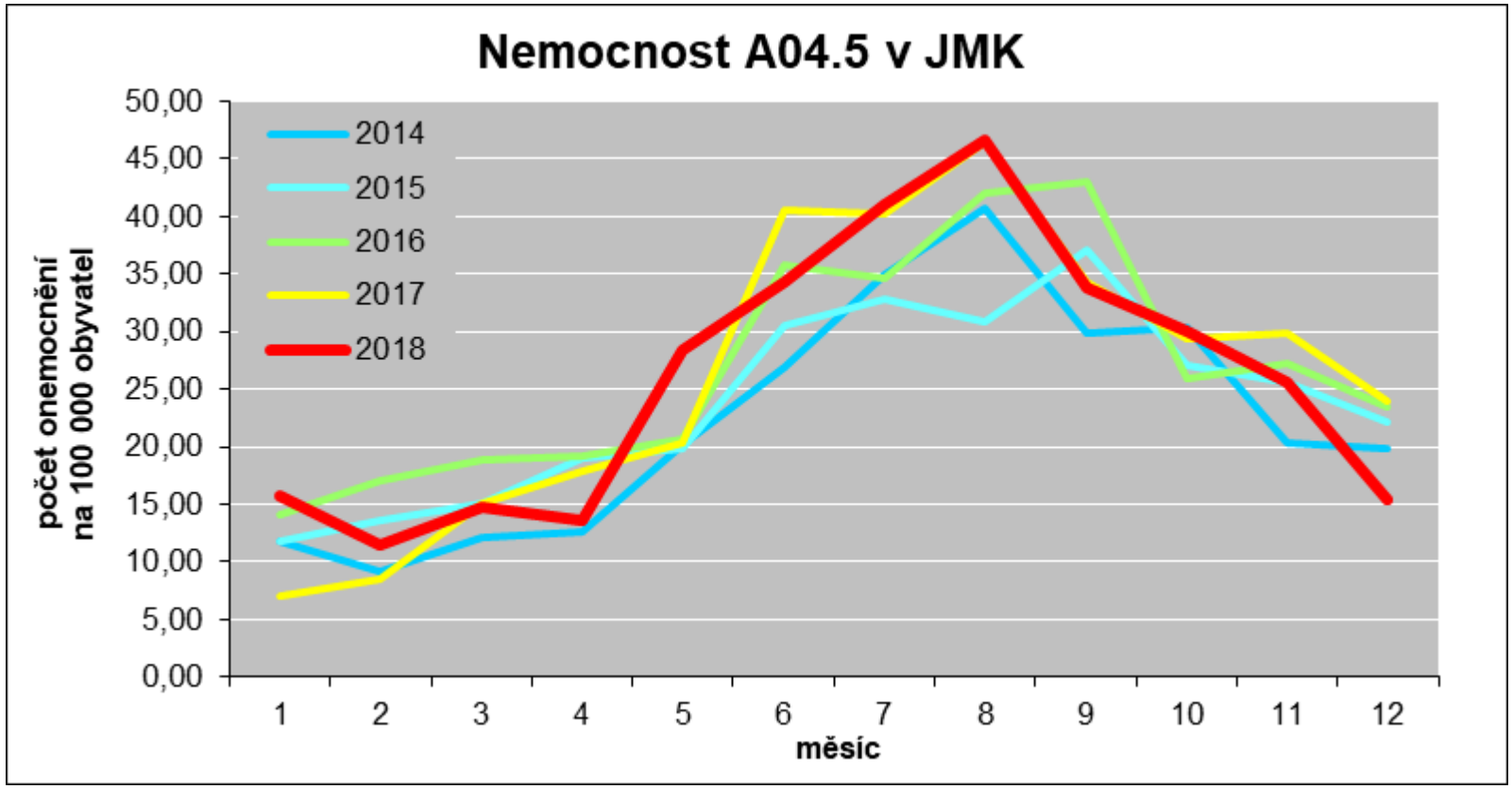
Zoonosis

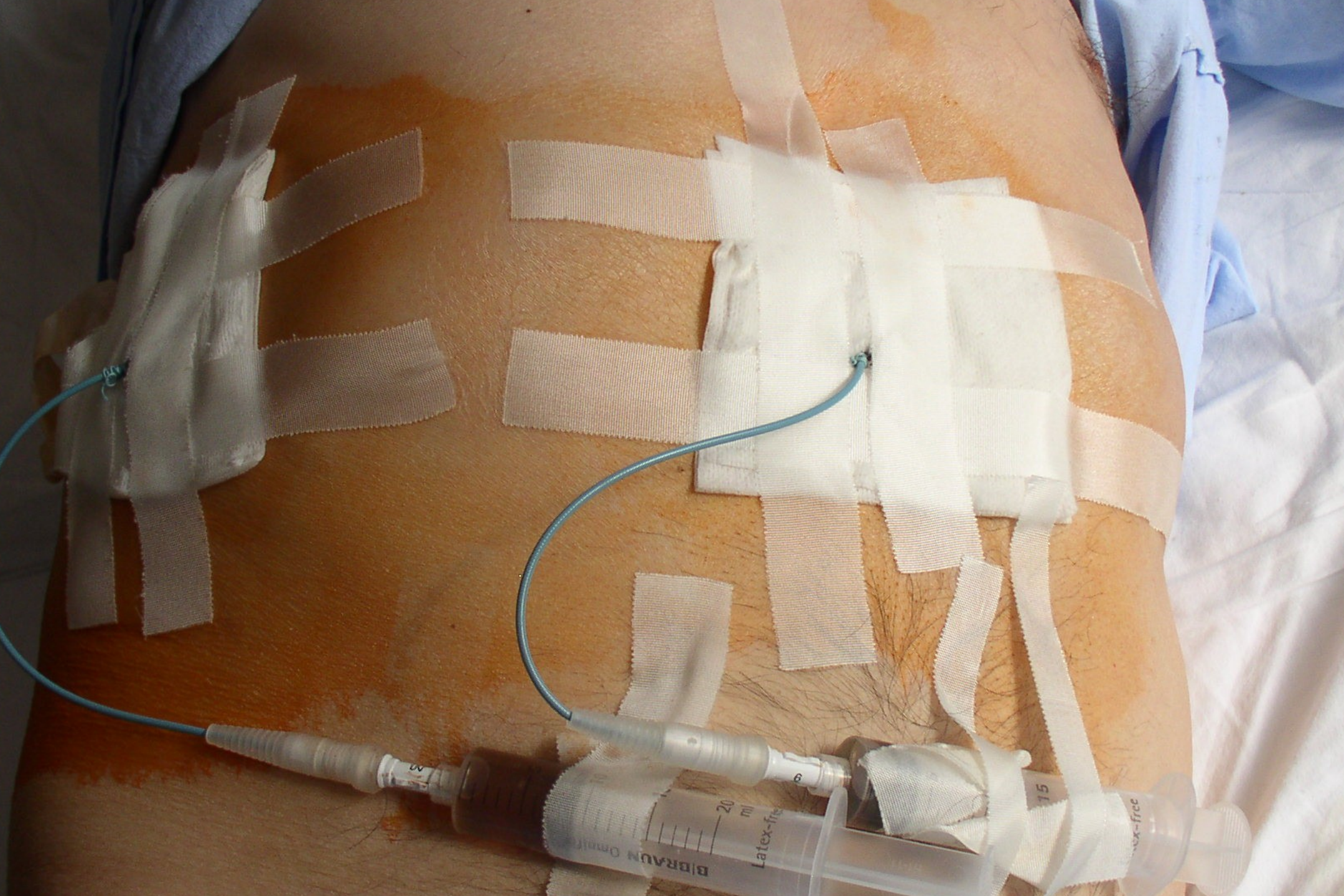
- salmonellosis (*S.* Enteritidis)
- campylobacteriosis (*C. jejuni*)
- yersiniosis (*Y. enterocolitica)*
- EHEC (*E. coli*)

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 2014-2018



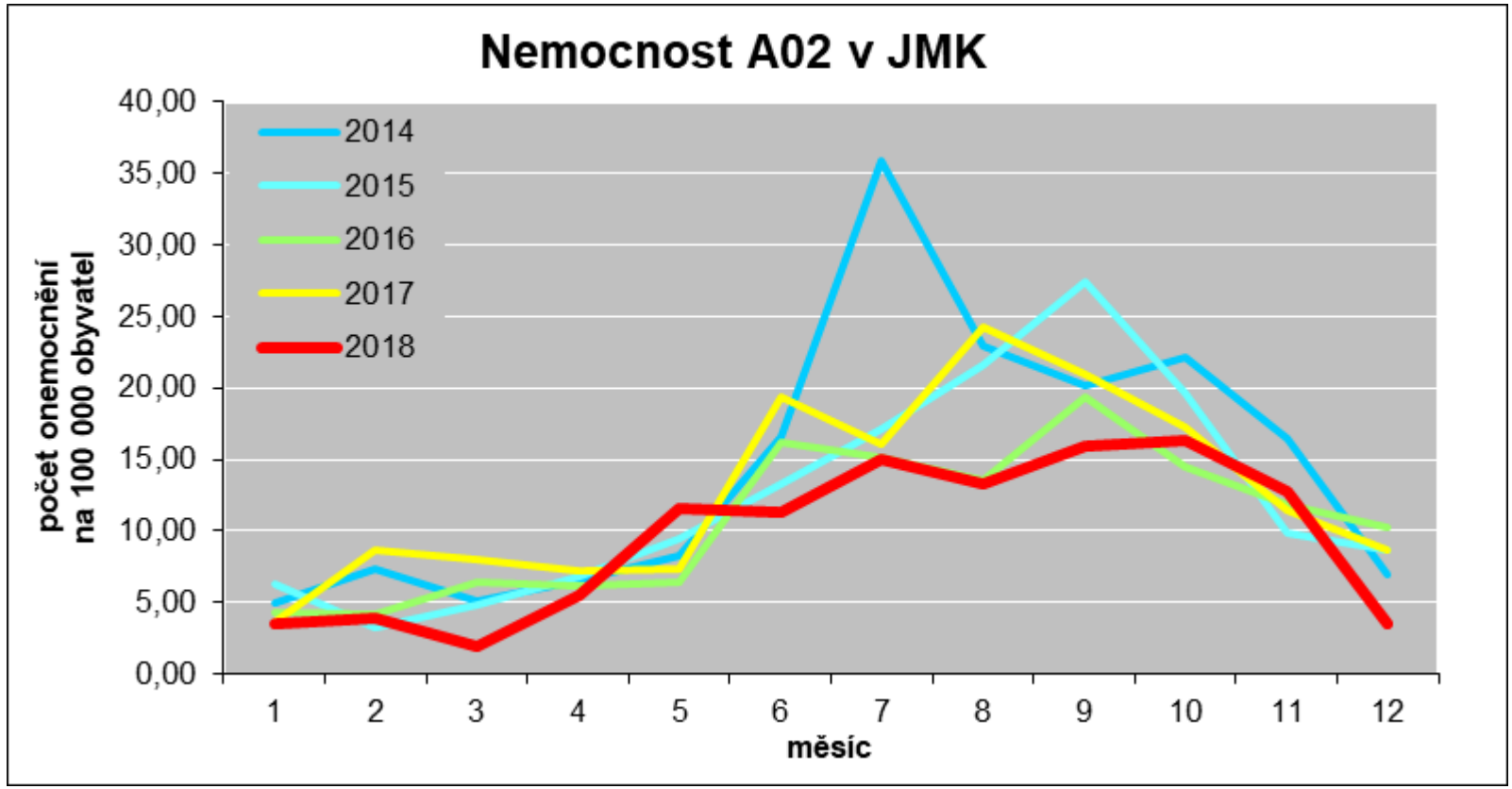

B|BRAUN
Latex-free


ANA
05496

Salmonellosis

- the second most common zoonosis in CR and most European countries
- at present in CR minimally 90 % cases caused by *S.* Enteritis, 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 2014-2018



Yersiniosis

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

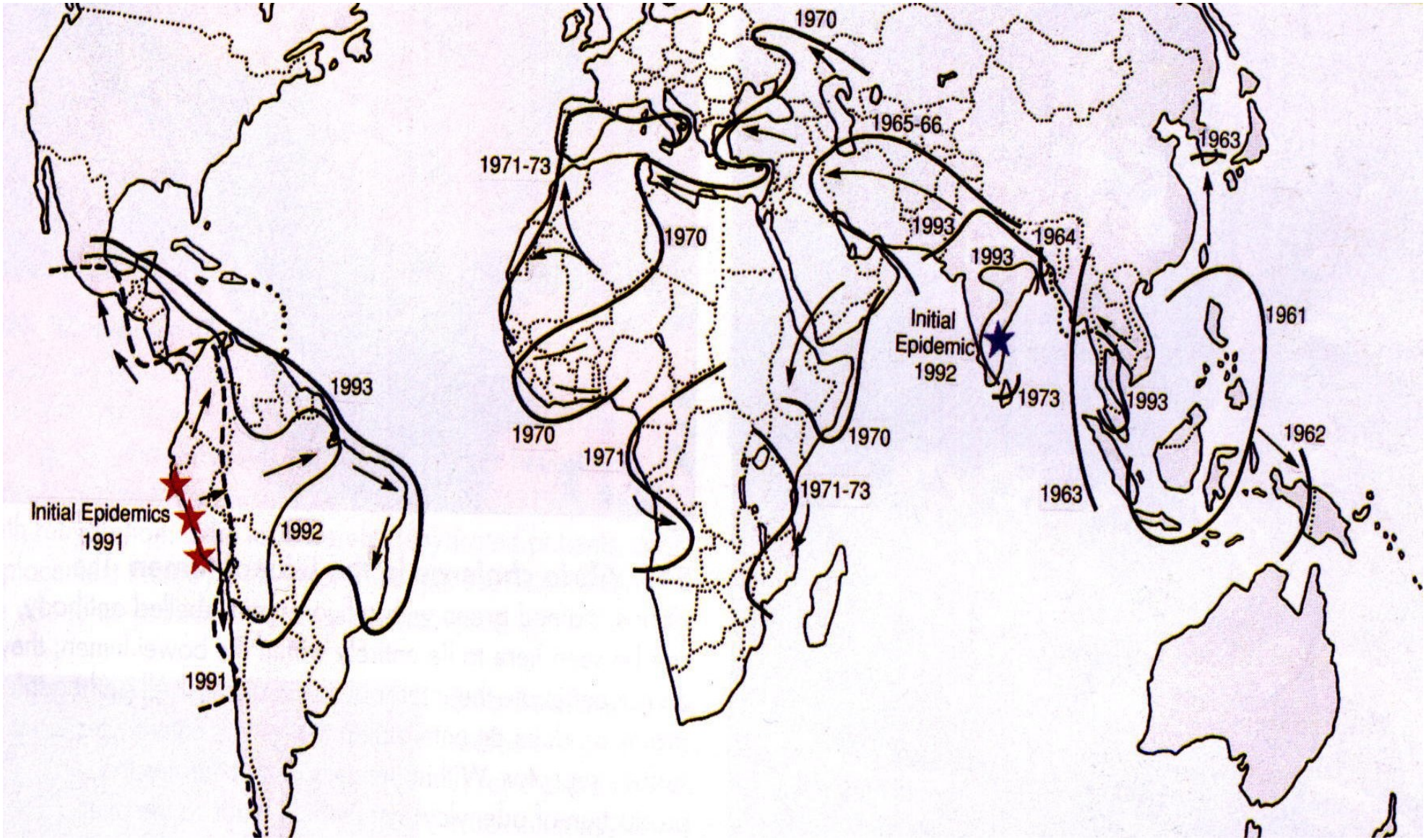
Human bacterial infections

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

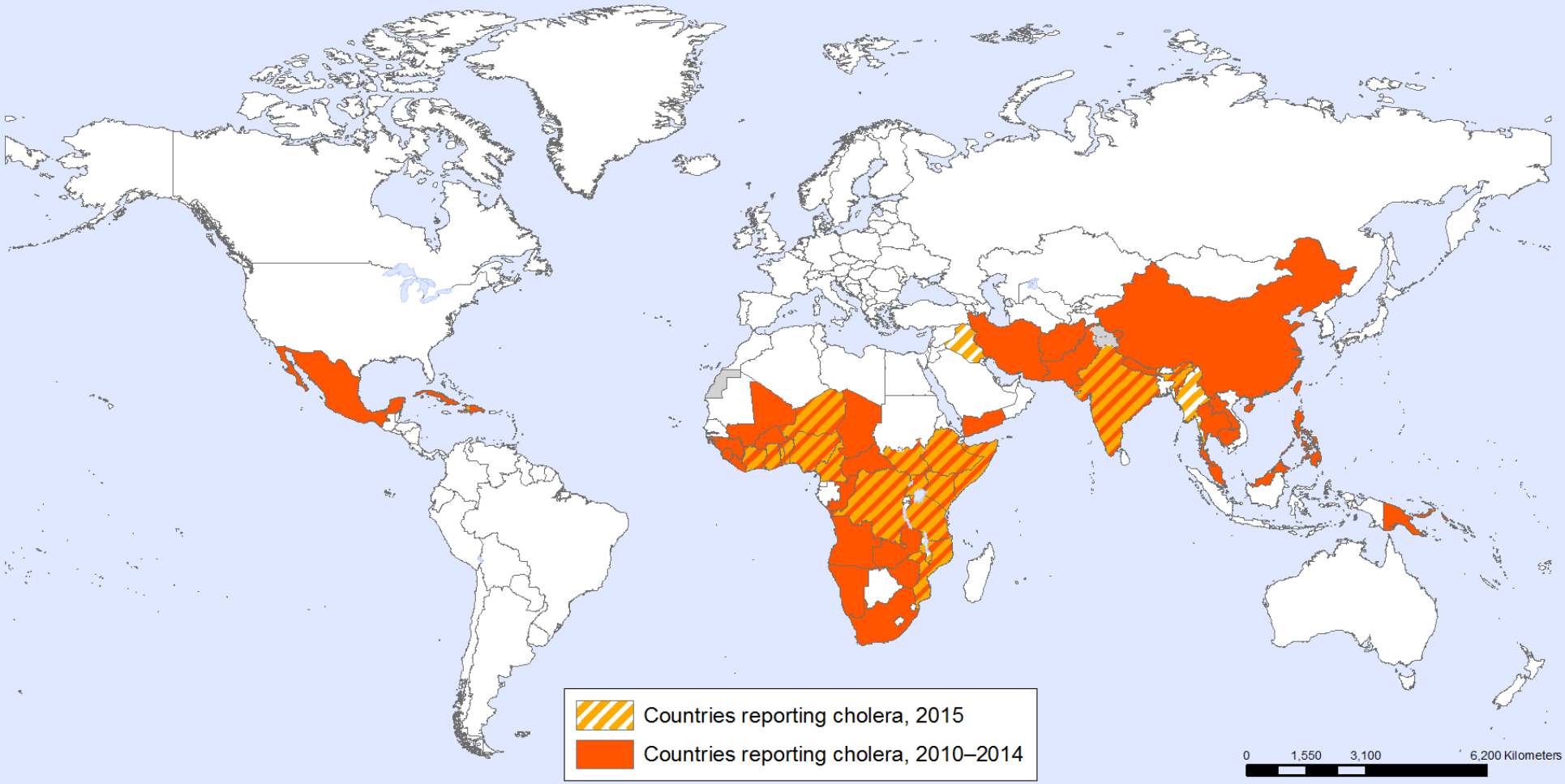
Cholera

- 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

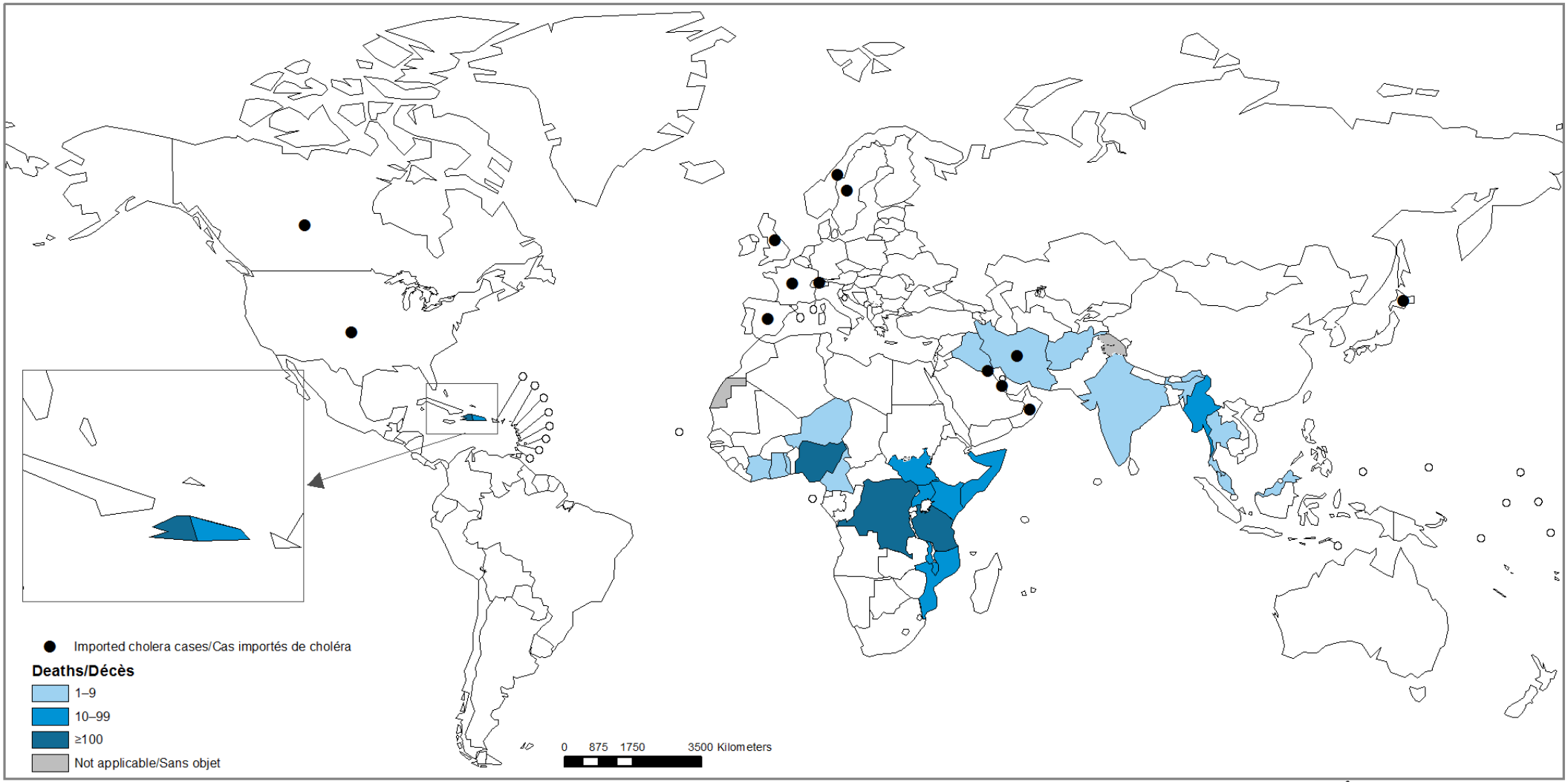


The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers 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

World Health Organization

Countries reporting cholera deaths and imported cases in 2015
Pays ayant déclaré des décès dus au choléra et des cas importés en 2015



Data Source: Control of Epidemic Diseases Unit
World Health Organization

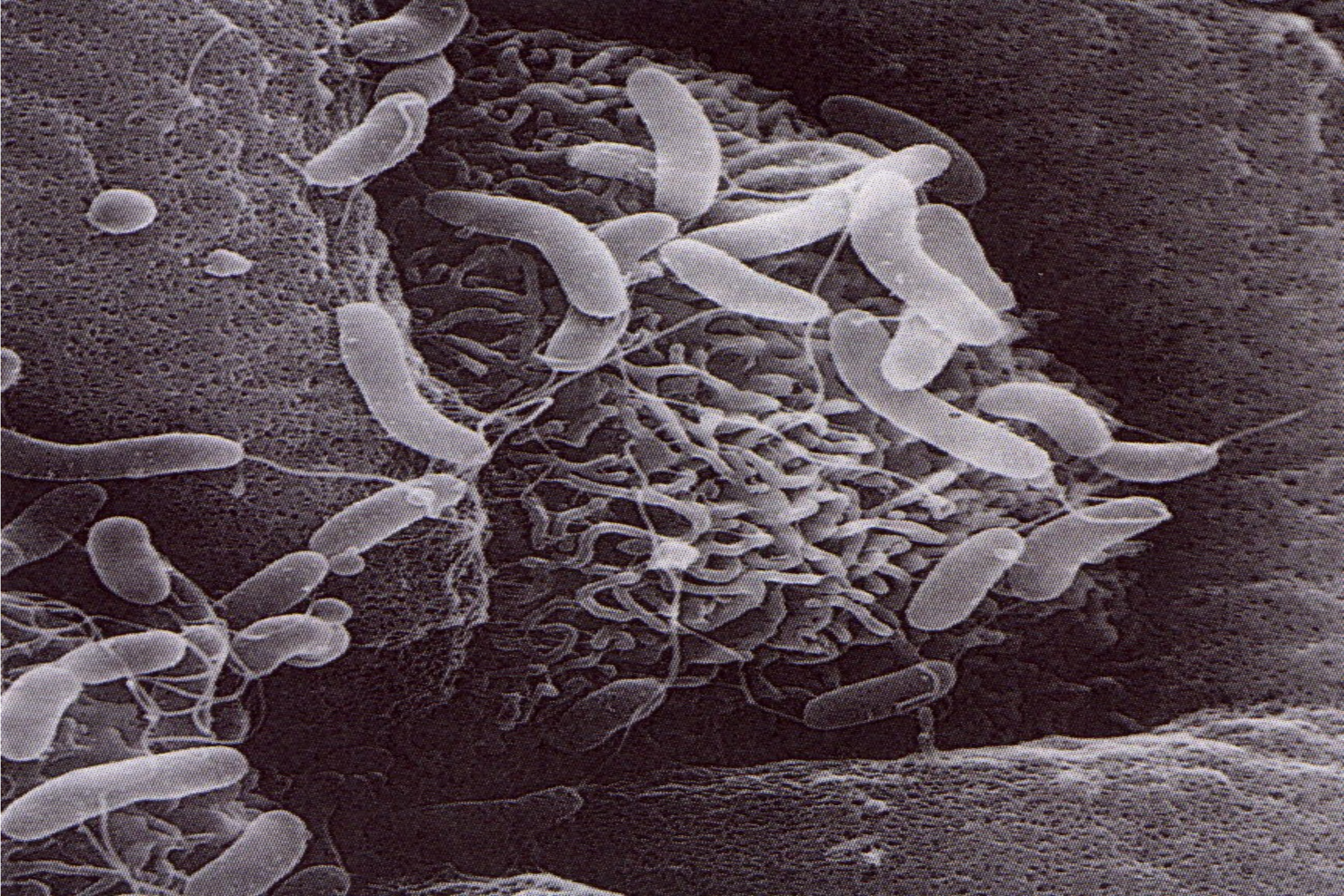
Map Production: Information Evidence and Research (IER)
World Health Organization

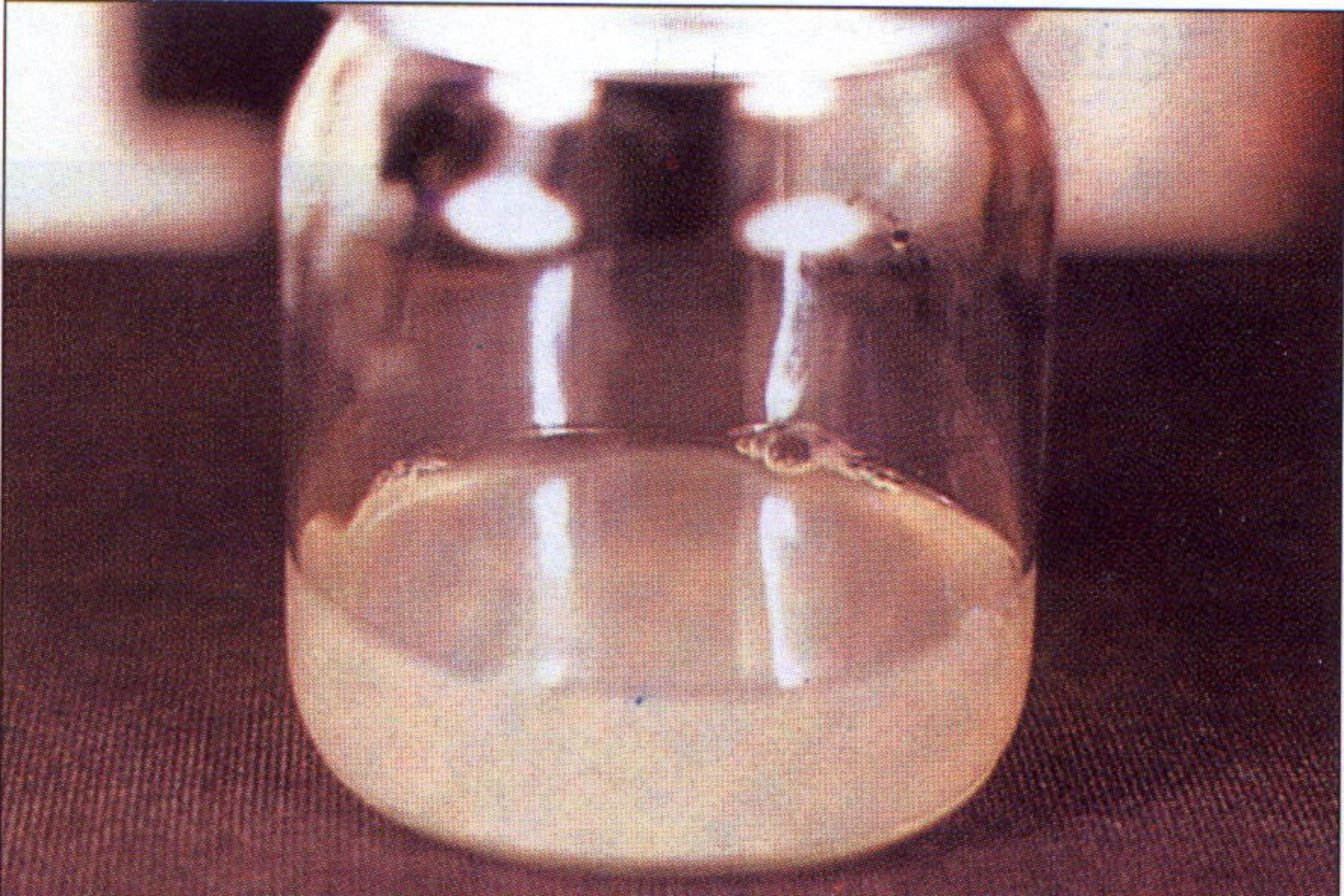
World Health Organization

Organisation mondiale de la Santé

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, doxicycline, chloramphenicol)
- vaccination available (combinated 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

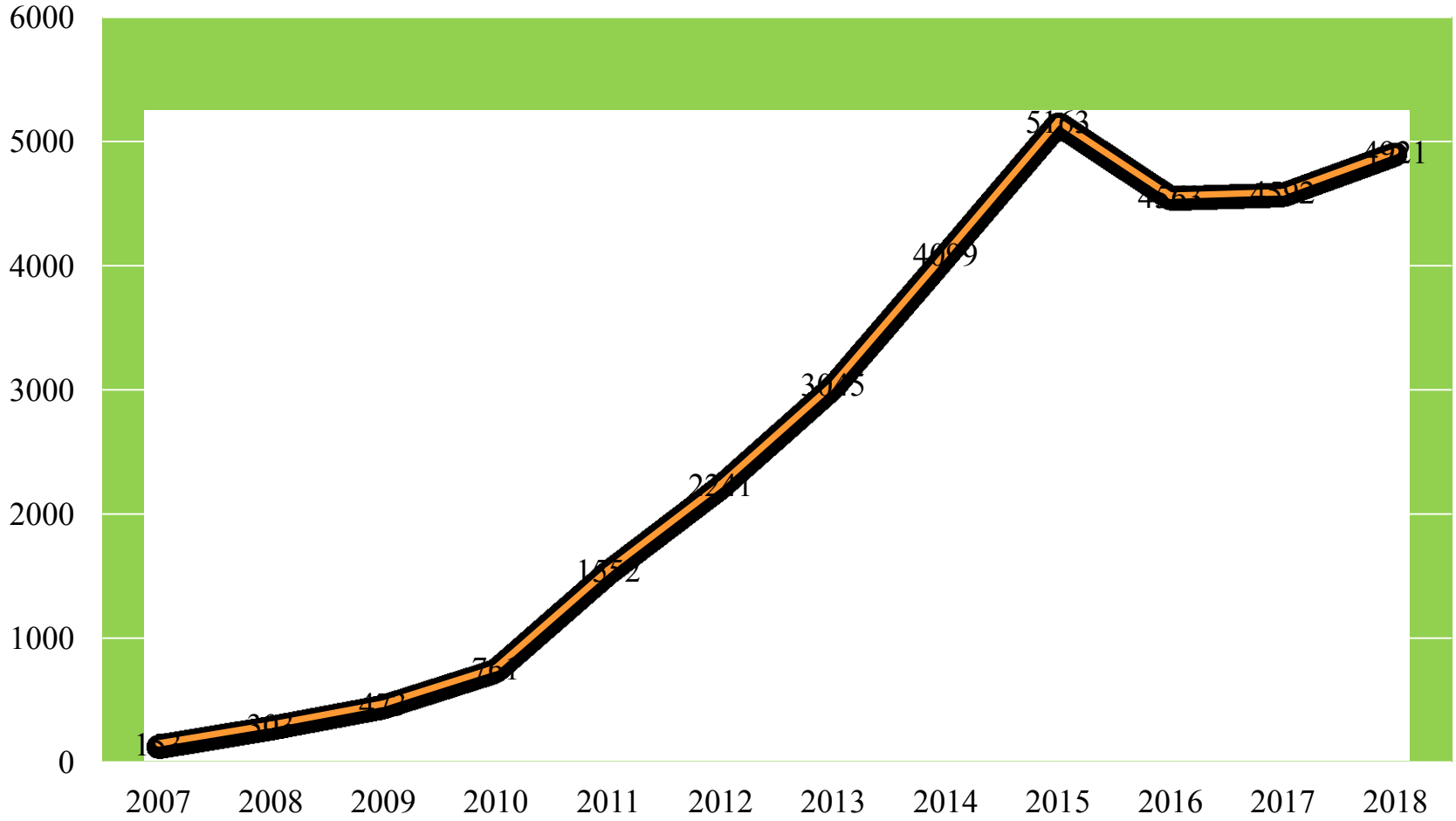
E. coli enterocolitis

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

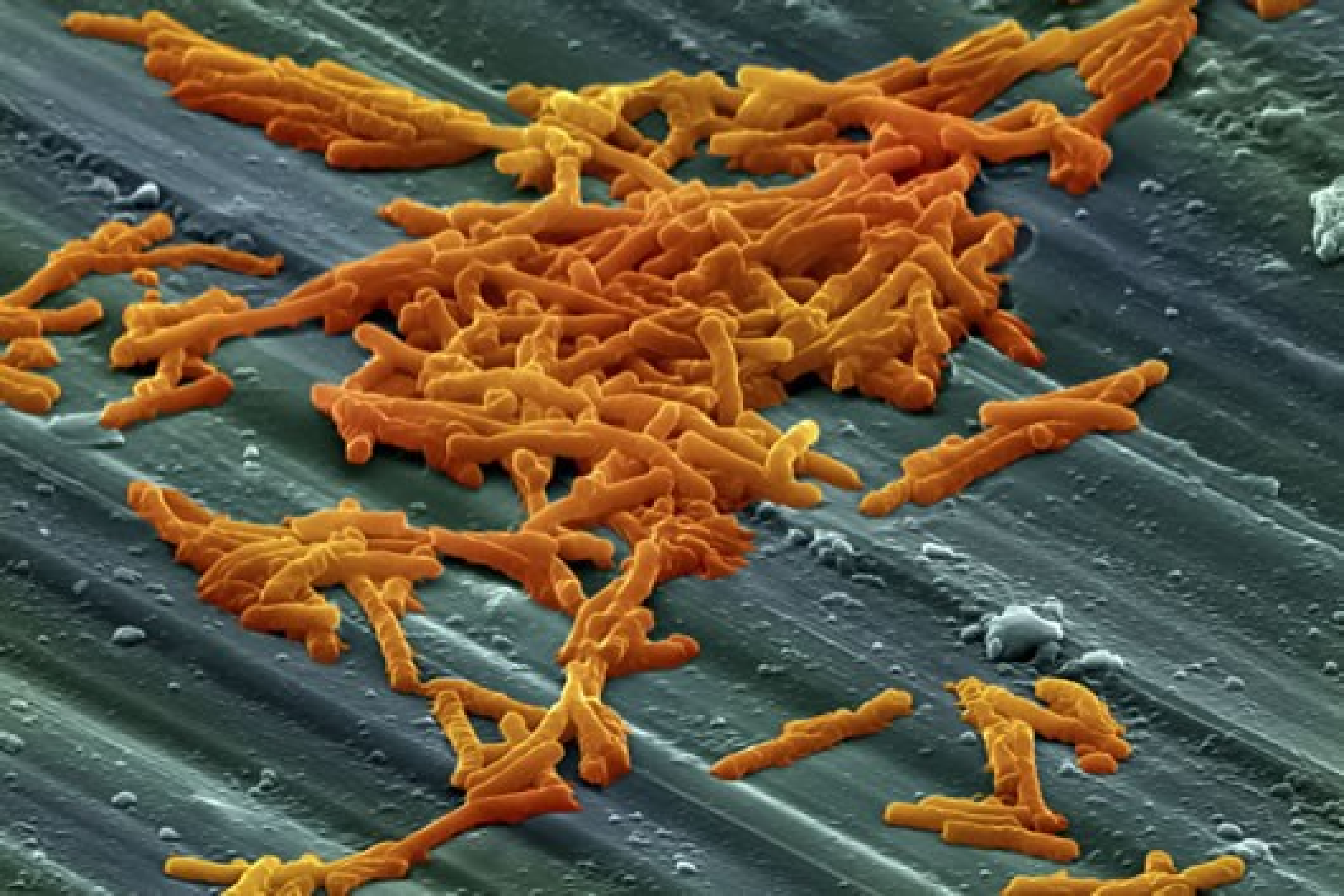
Clostridium difficile infection (CDI)

- *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)

CDI in CR 2007-2018

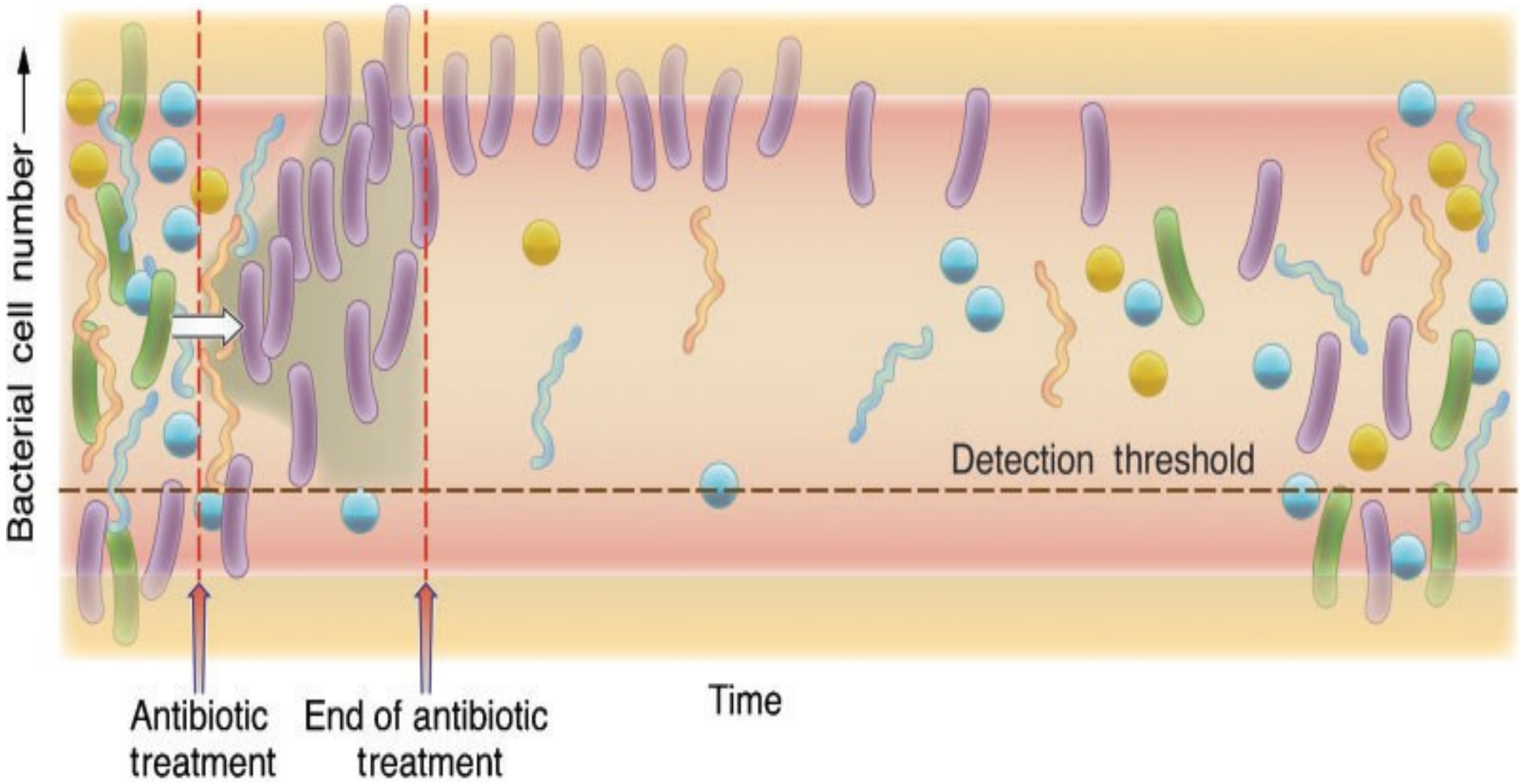


Source: Epidat



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, comorbities, IS
- function of GI tract – peristalsis, only parenteral nutrition, disturbances of mucous immunity


Bacterial cell number
Detection threshold
Antibiotic treatment
End of antibiotic treatment
Time

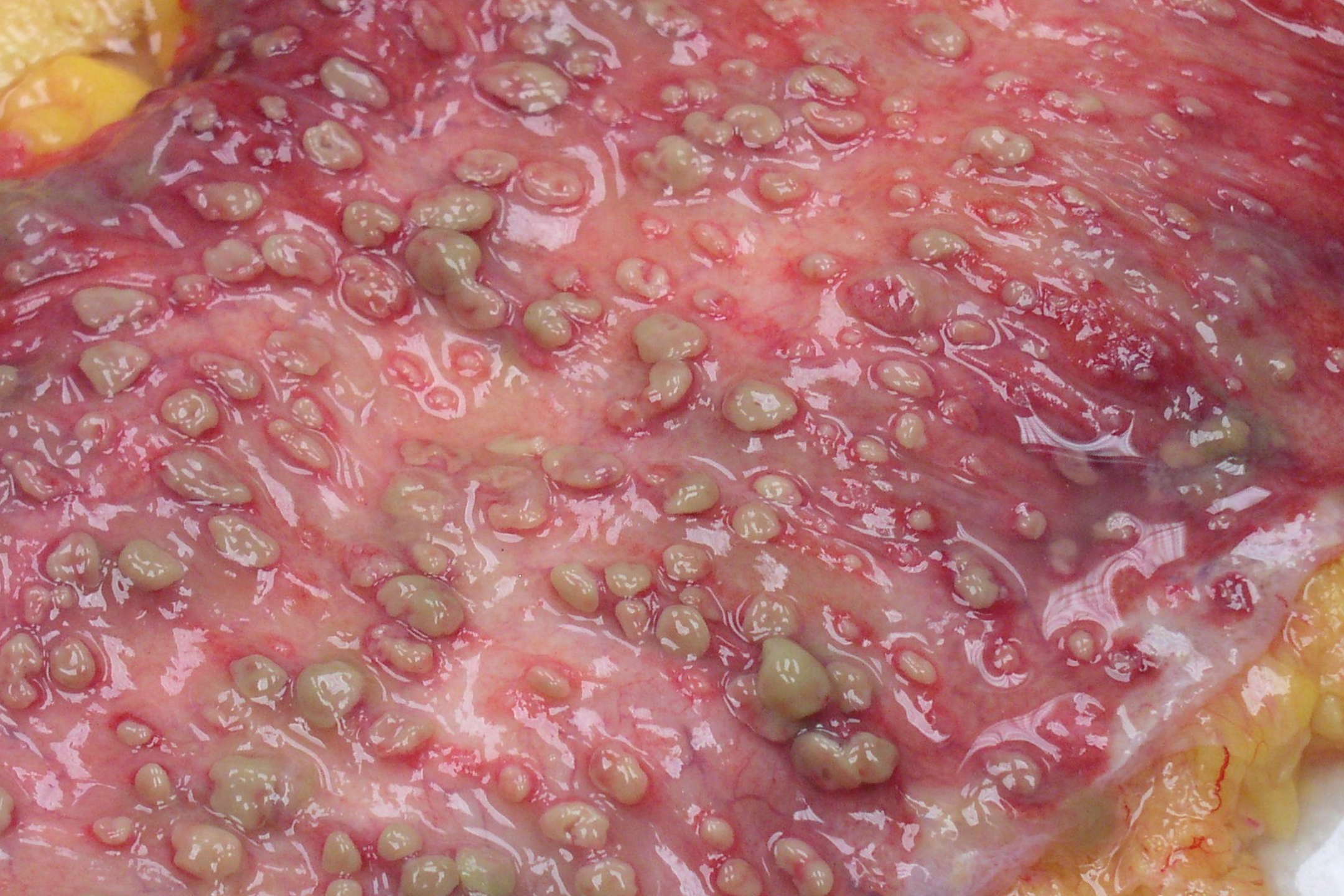
CDI – clinical forms

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)

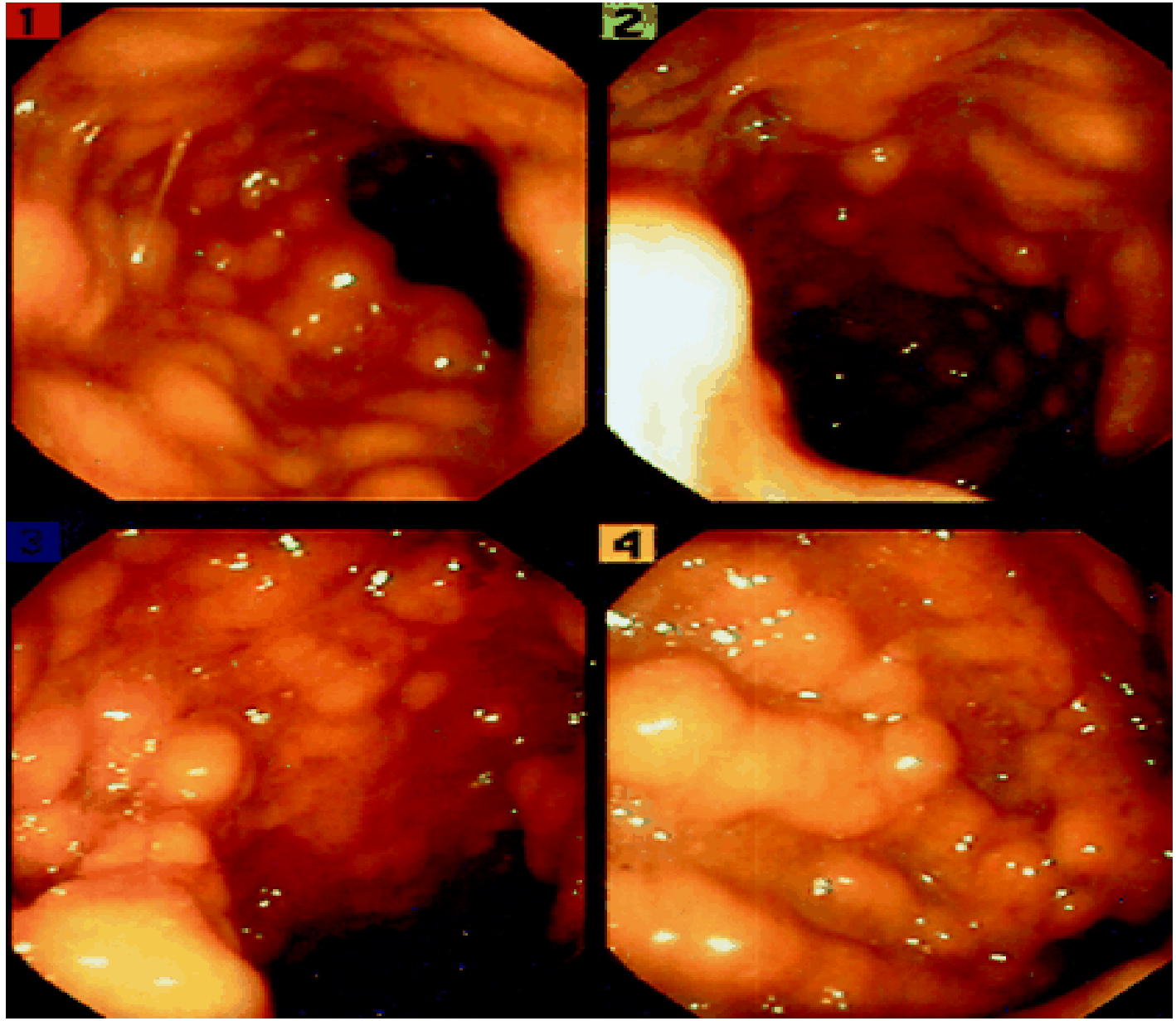
c) pseudomembranous colitis - PMC (sepsis, leucocytosis, abdominal pain, and bloody stool)

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


1
2
3
4

CDI therapy

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

Food poisining

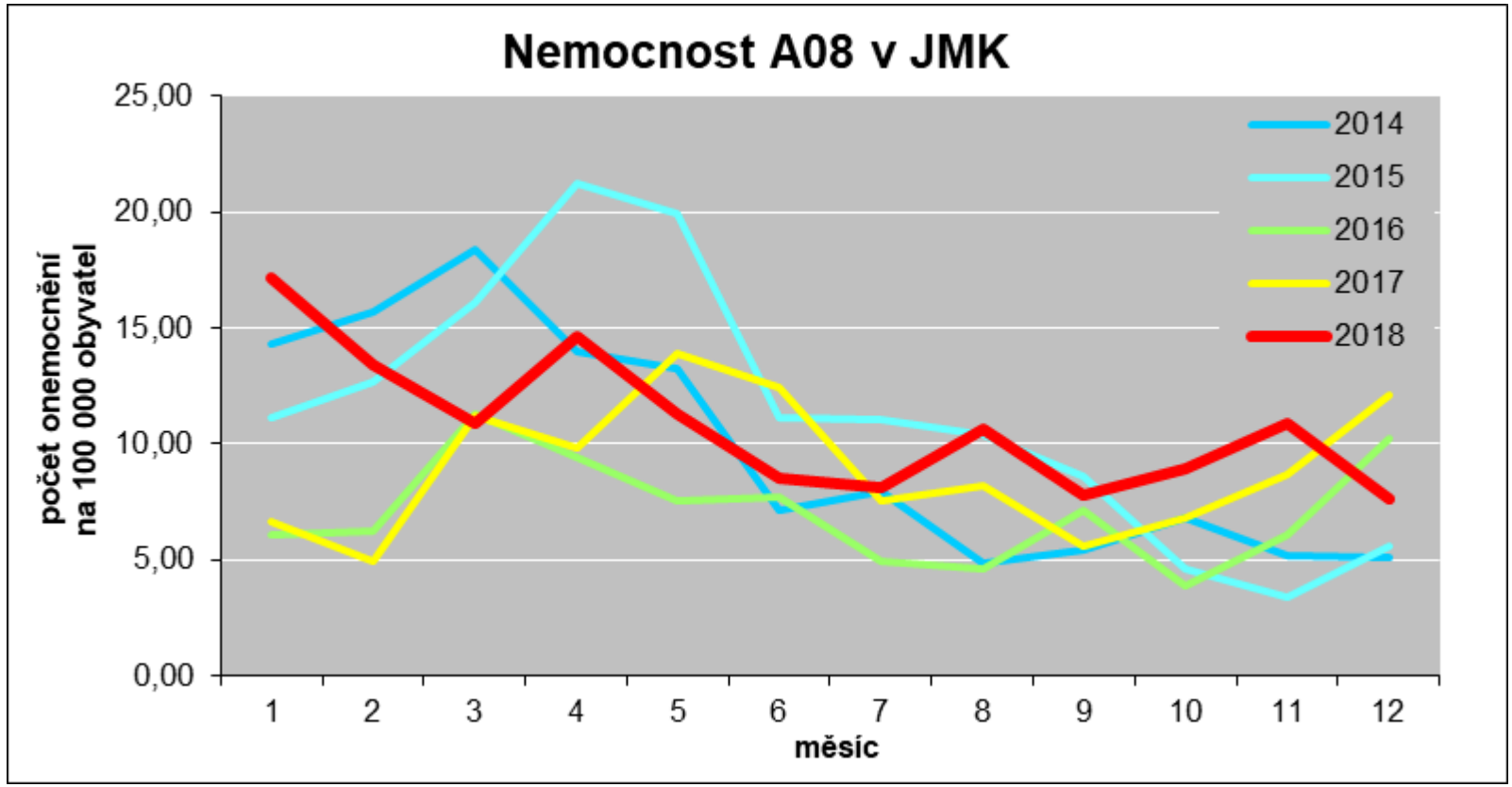
- with short incubation period (1-6 hours)-termostabile toxins – nausea, vomiting
- *Staphylococcus aureus*
- *Bacillus cereus*
- with long incubation period (6-18 hours)- termolabile toxins - diarrhea
- *Bacillus cereus*
- *Clostridium perfringens* A
- absence of fever, outbreaks
- rehydration, diet

Viral gastroenteritis

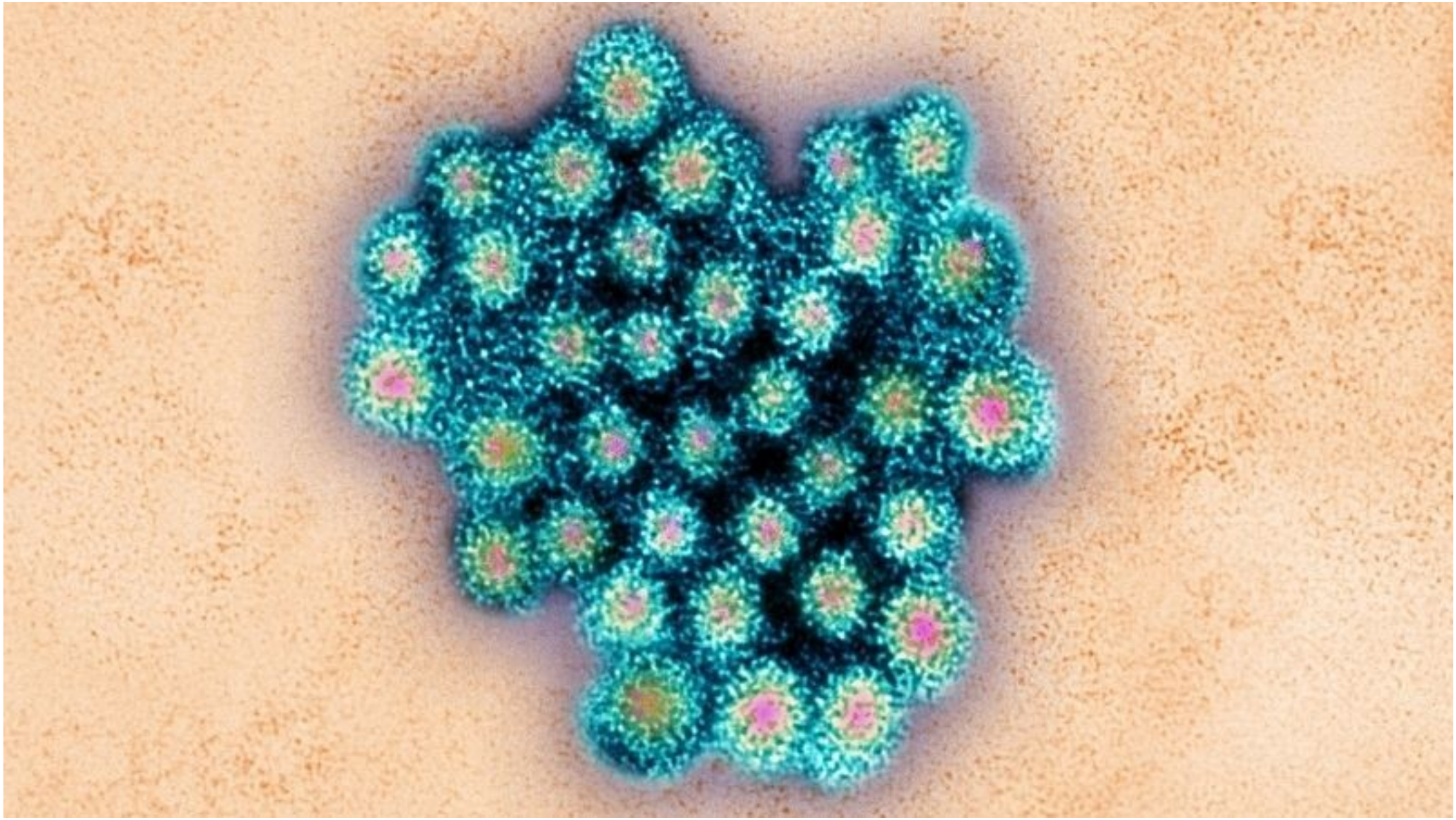
- noroviruses (Norwalk, Norwalk-like virus) – older children, adults
- rotaviruses (small children- 6-24 months, seniors) – fecal-oral, air-borne infection, vaccine available
- adenoviruses
- astroviruses
- coronaviruses

- symptomatic therapy

Viral GI infections in Southern Moravia 2014-2018



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

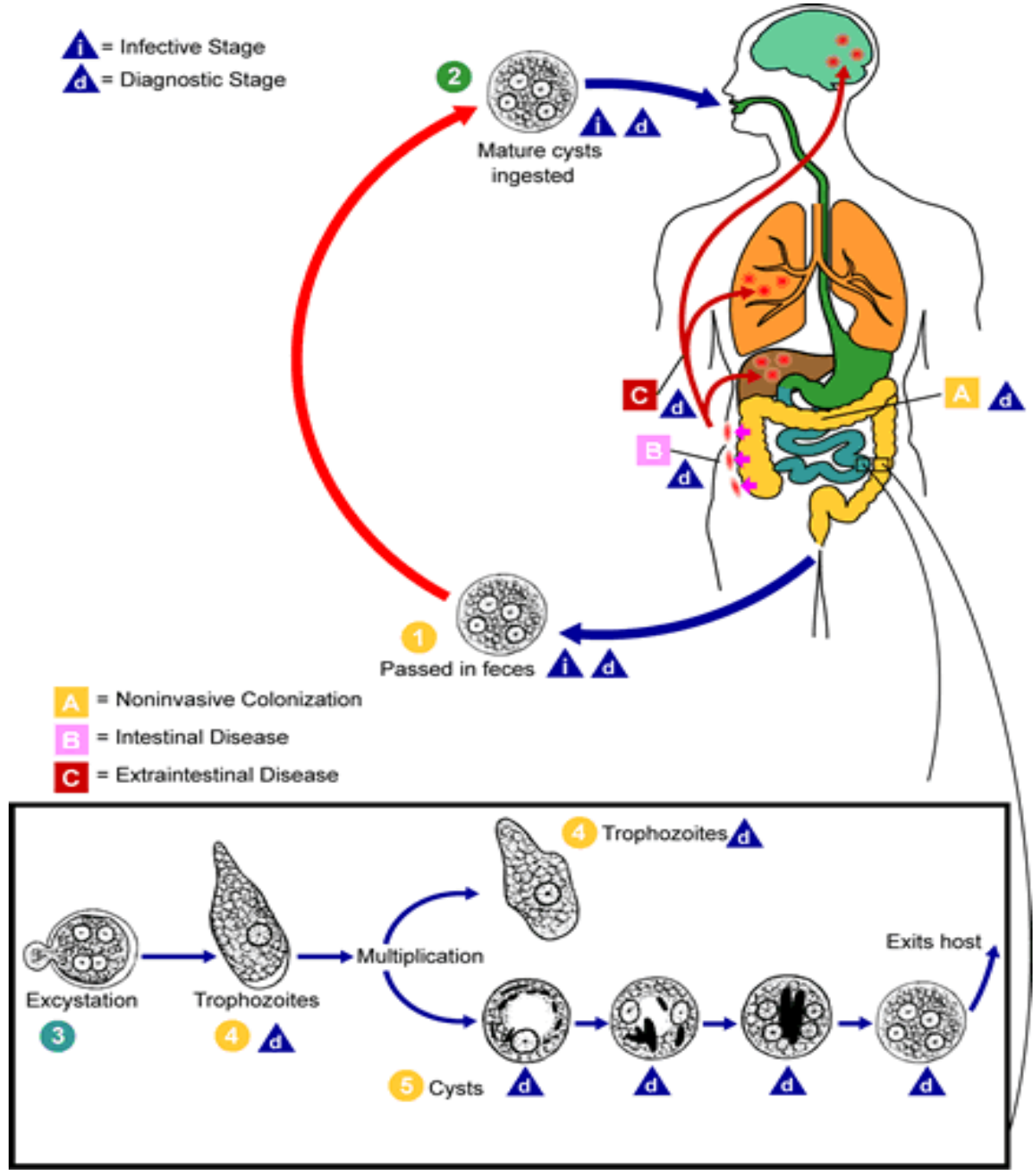
Parasitic infection of GI tract

- protozoal
- helmintic
- fungal

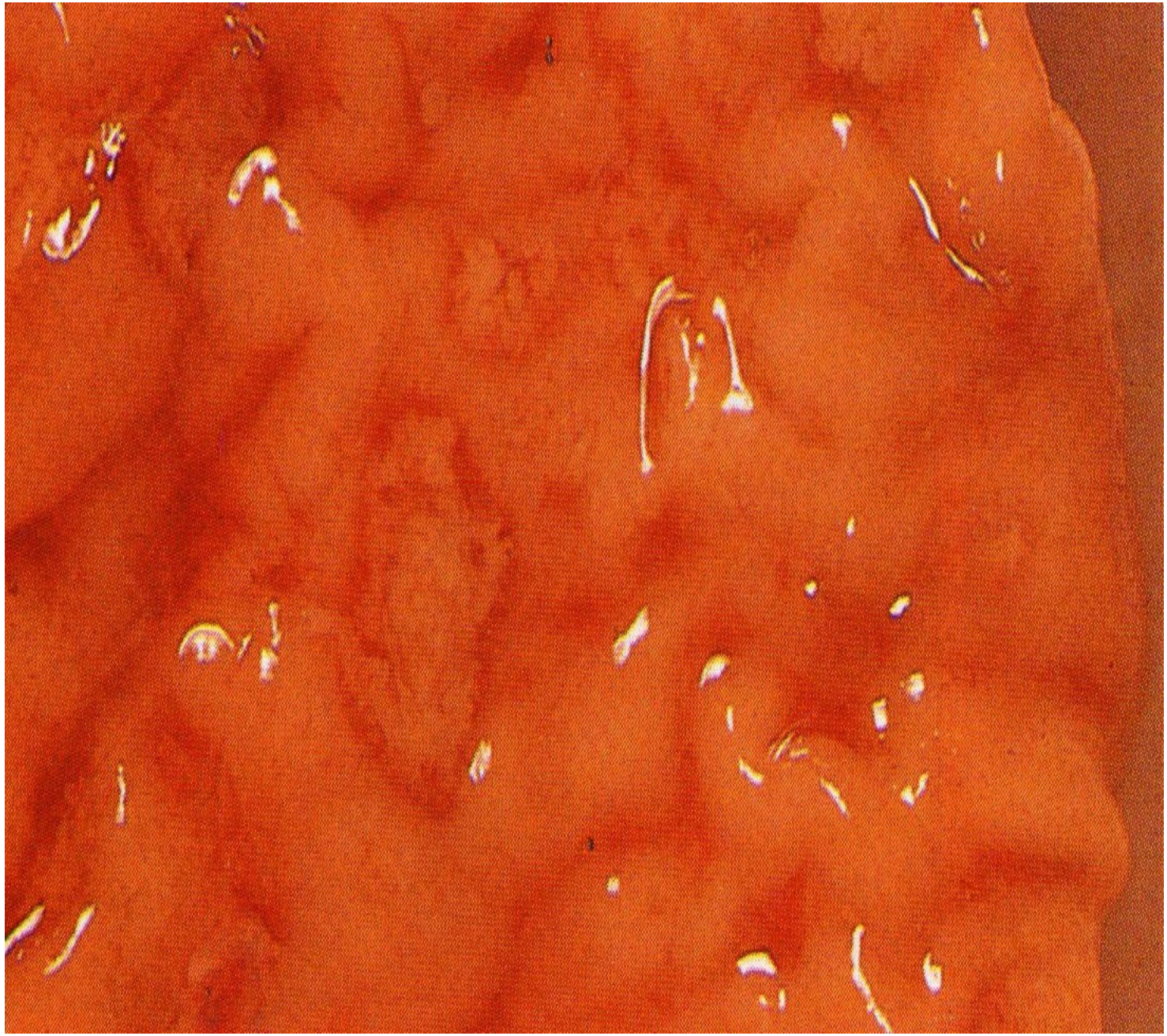
Protozoal infections

- Human
- Amebiasis (*Entamoeba histolytica*)
- Lambliasis = girardiasis (*L., G. intestinalis*)
- Zoonotic
- cryptosporidiosis (*Cryptosporidium parvum*)
- isosporosis (*Isospora belli*)
- microsporidiosis (*Enterocytozoon bineusi*)
- cyclosporosis (*Cyclospora cayetanensis*)

Amebiasis


i = Infective Stage
d = Diagnostic Stage
2
Mature cysts ingested
C
A
B
1
Passed in feces
A = Noninvasive Colonization
B = Intestinal Disease
C = Extraintestinal Disease
4 Trophozoites
Multiplication
Exits host
Excystation
3
Trophozoites
4
5 Cysts

Amebic colitis



Amebic abscess

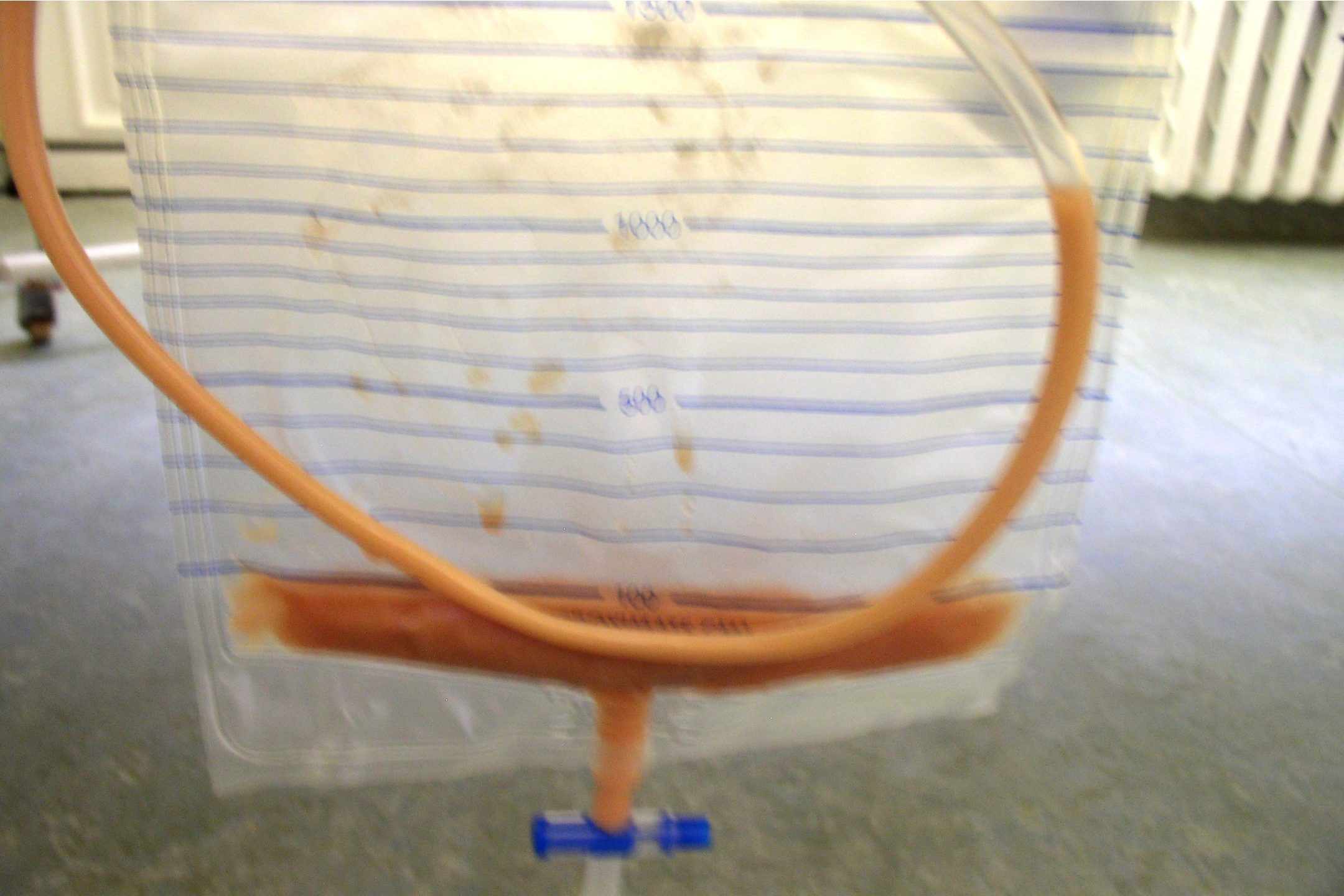
CT – day 0

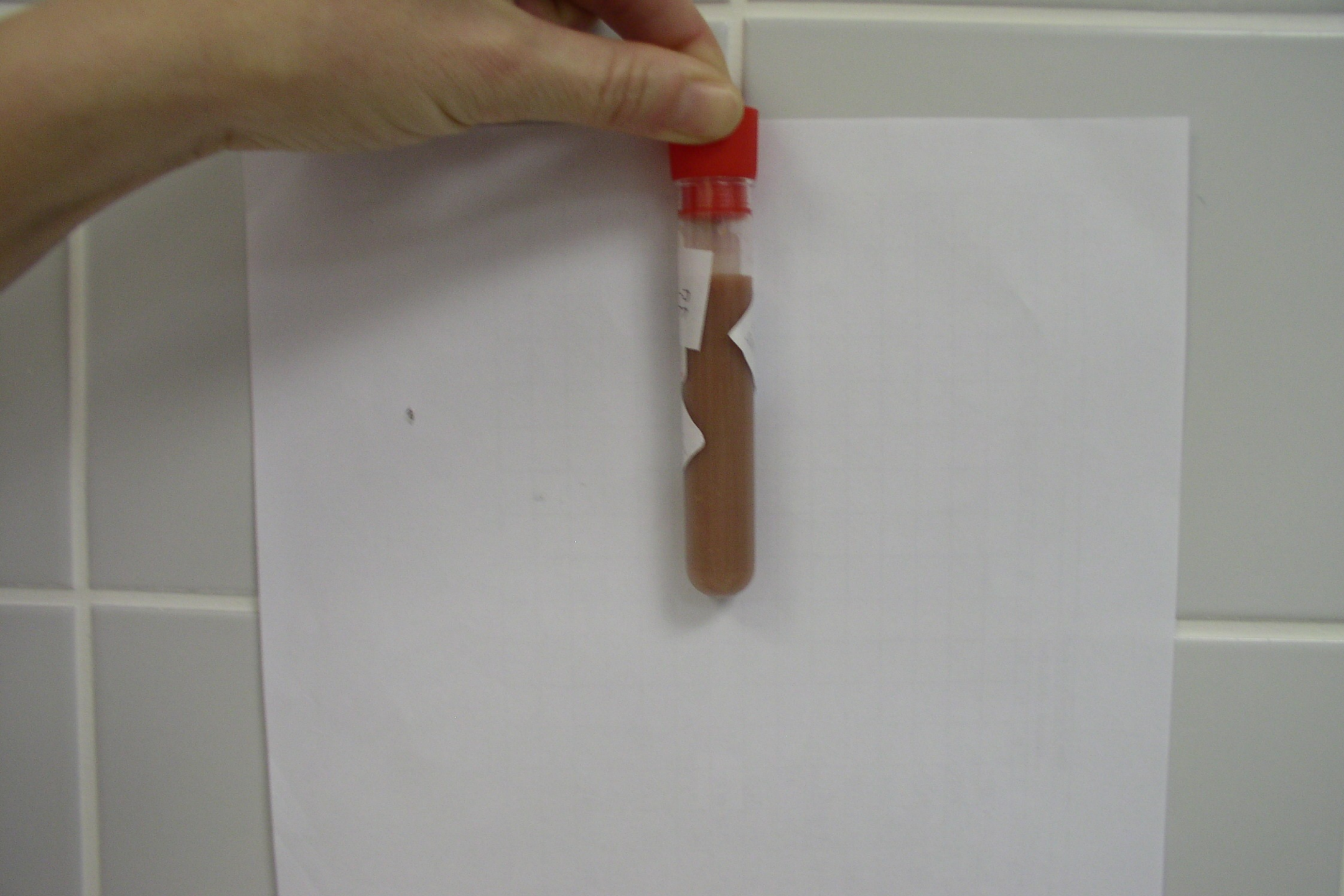
Amebic abscess

CT – drainage of 2 abscesses – day 2


5000
FN Brno RDG klinika
C5-2 Abd/General
12:11:11
Fr #235 16.6cm
Map 3
150dB/C3
Persist Med
Fr Rate Med
2D Opt:Gen
ATL
D X
5.76cm
US – day 0

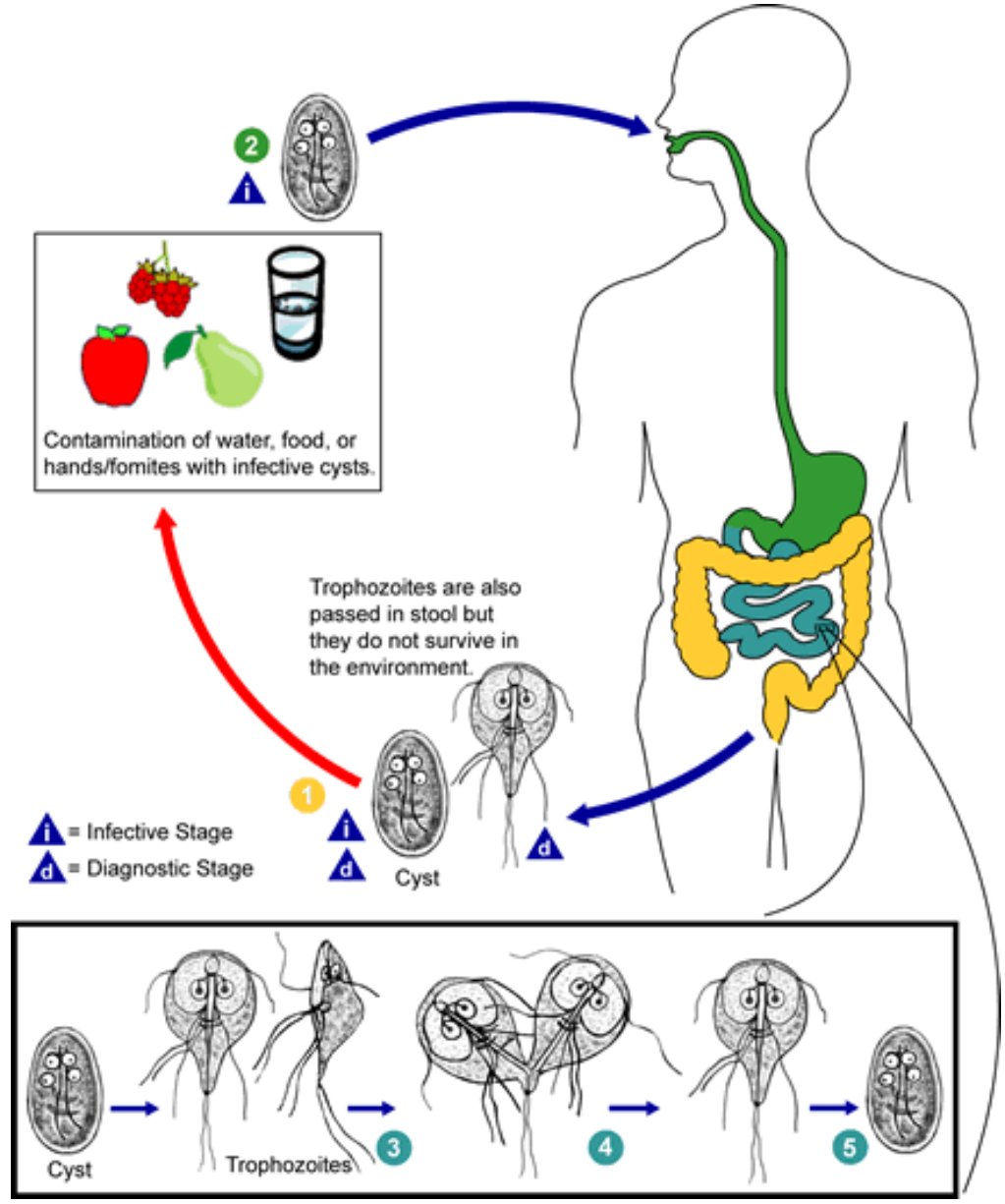

FN Brno RDG klinika
C5-2 Abd/General
09:57:25
Fr #48
13.8cm
Map 3
150dB/C3
Persist Med
Fr Rate Med
2D Opt:Gen
ATL
4.23cm
2.98cm
US – day 5



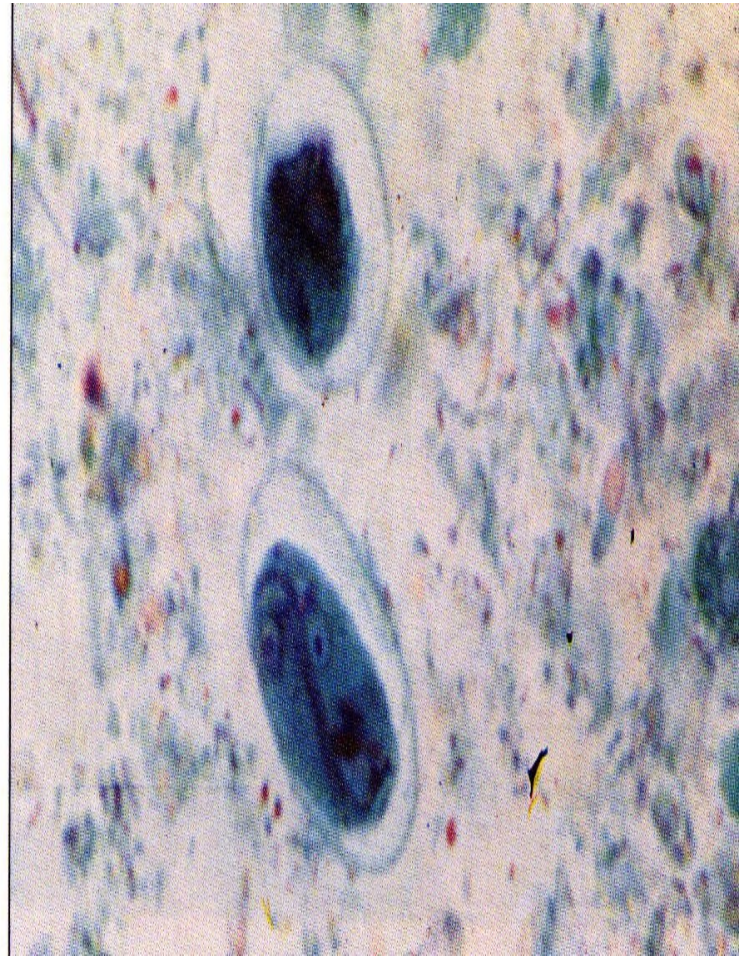


Amebic abscess –
transcutaneus punction

Lambliasis, girardiasis



Lambliasis microscopy



Lambliasis scan

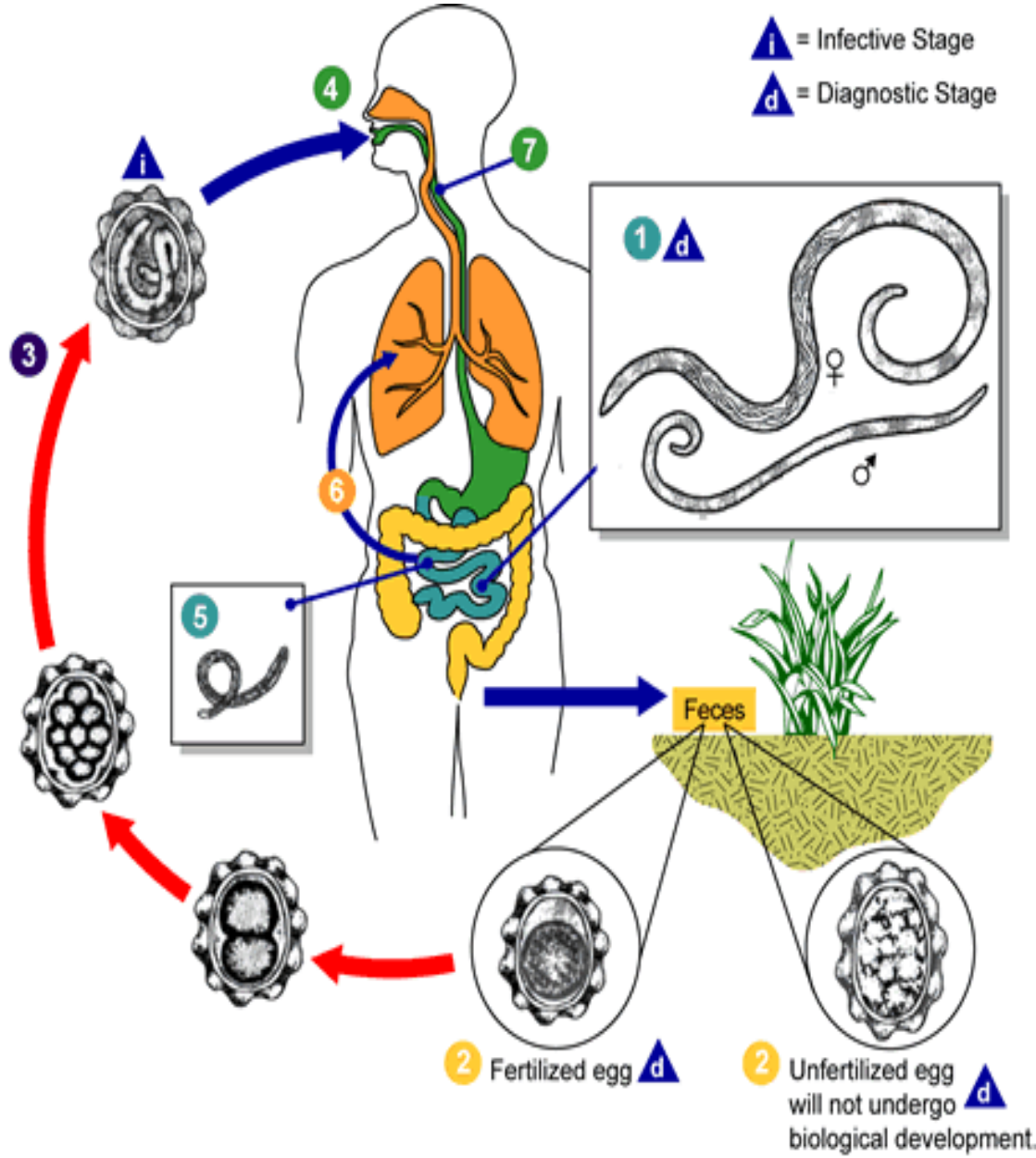
Helmintic GI infections

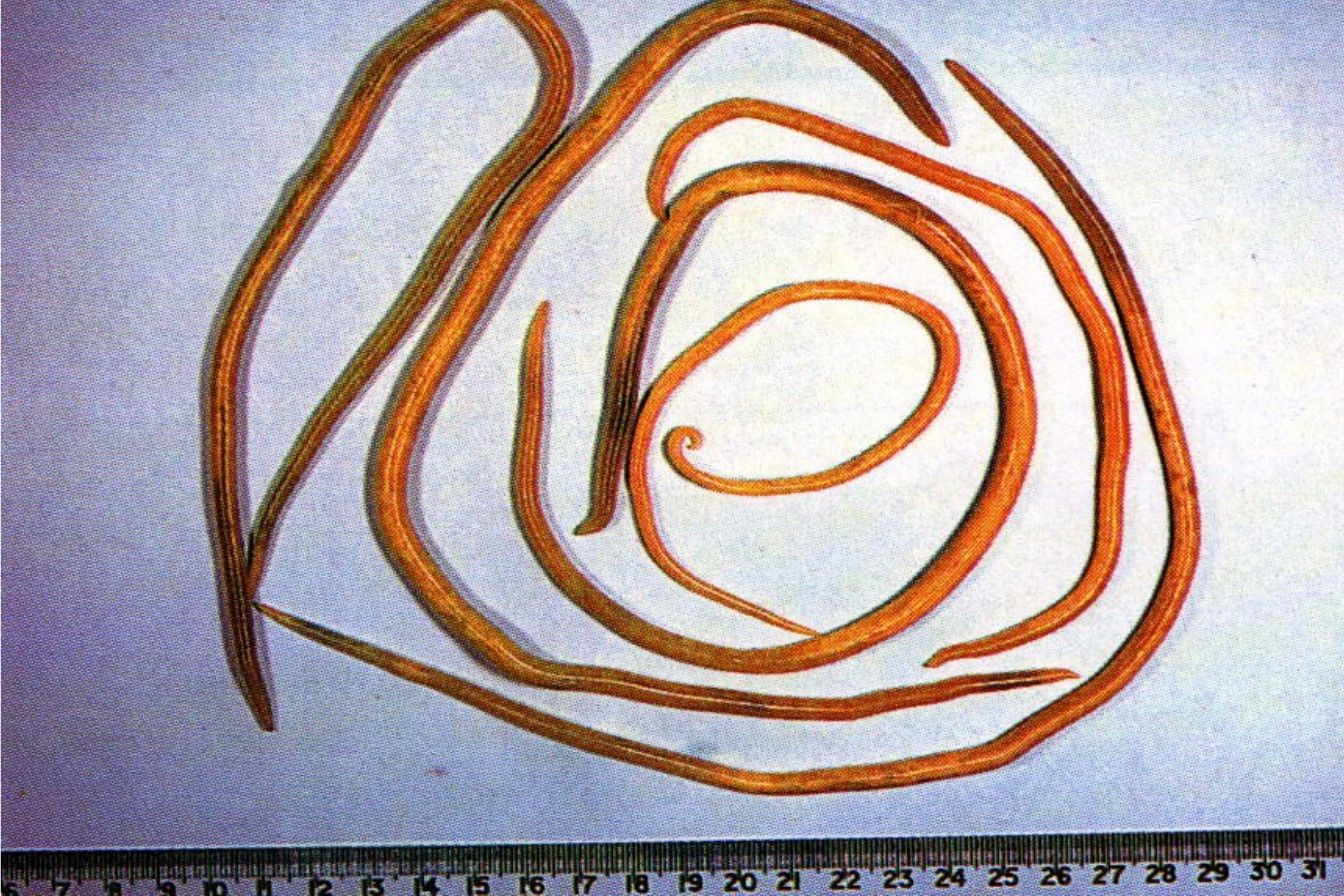
- Roundworms (Nematodes) - ascariosis, enterobiosis=oxyuriosis, trichuriosis
- Tapeworms (Cestodes) - teniosis, diphylobotriosis, hymenolepsiosis, echinococcosis, alveococcosis
- Flukes (Trematodes) - schistosomosis

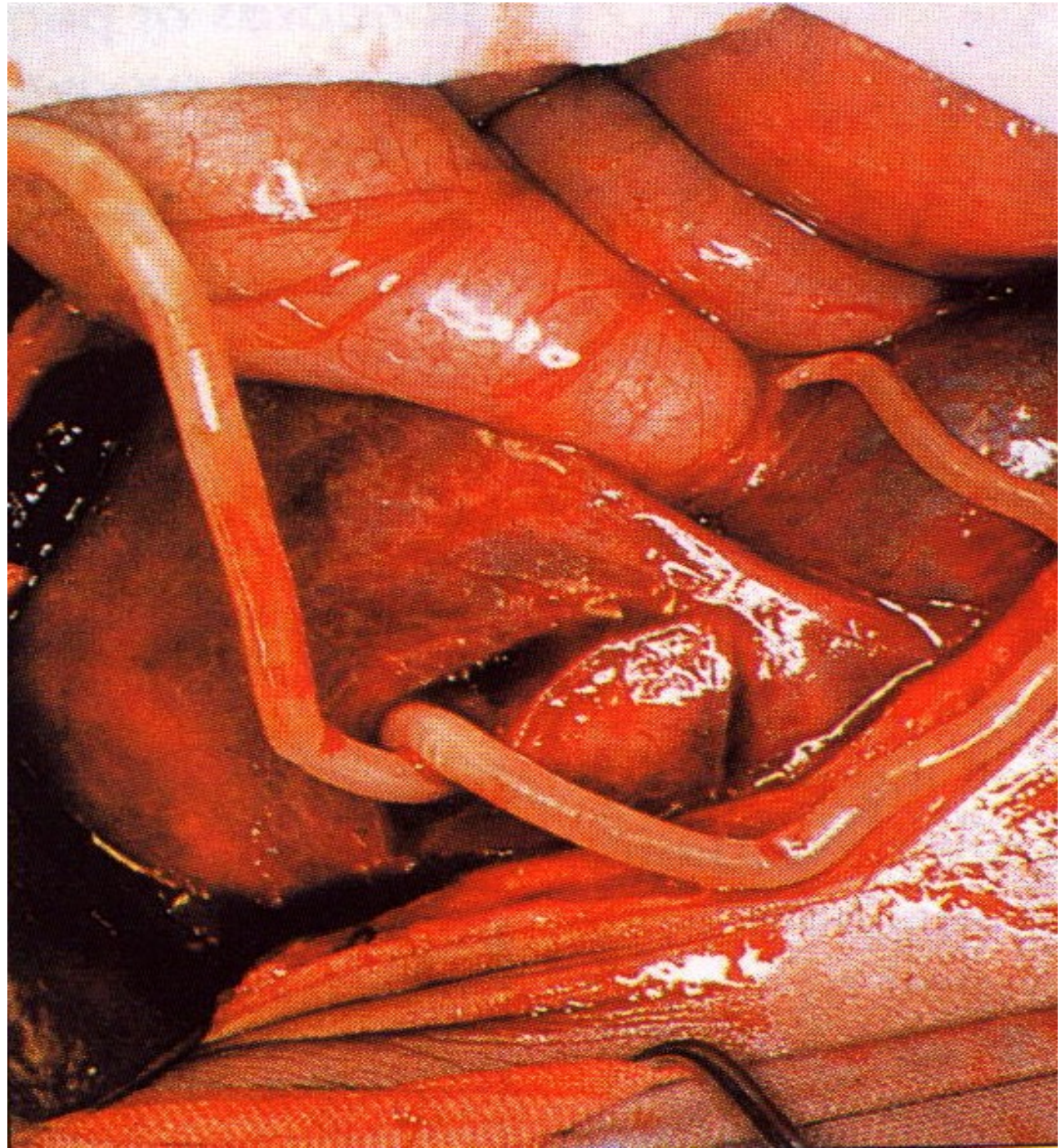
Roundworms (Nematodes)

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

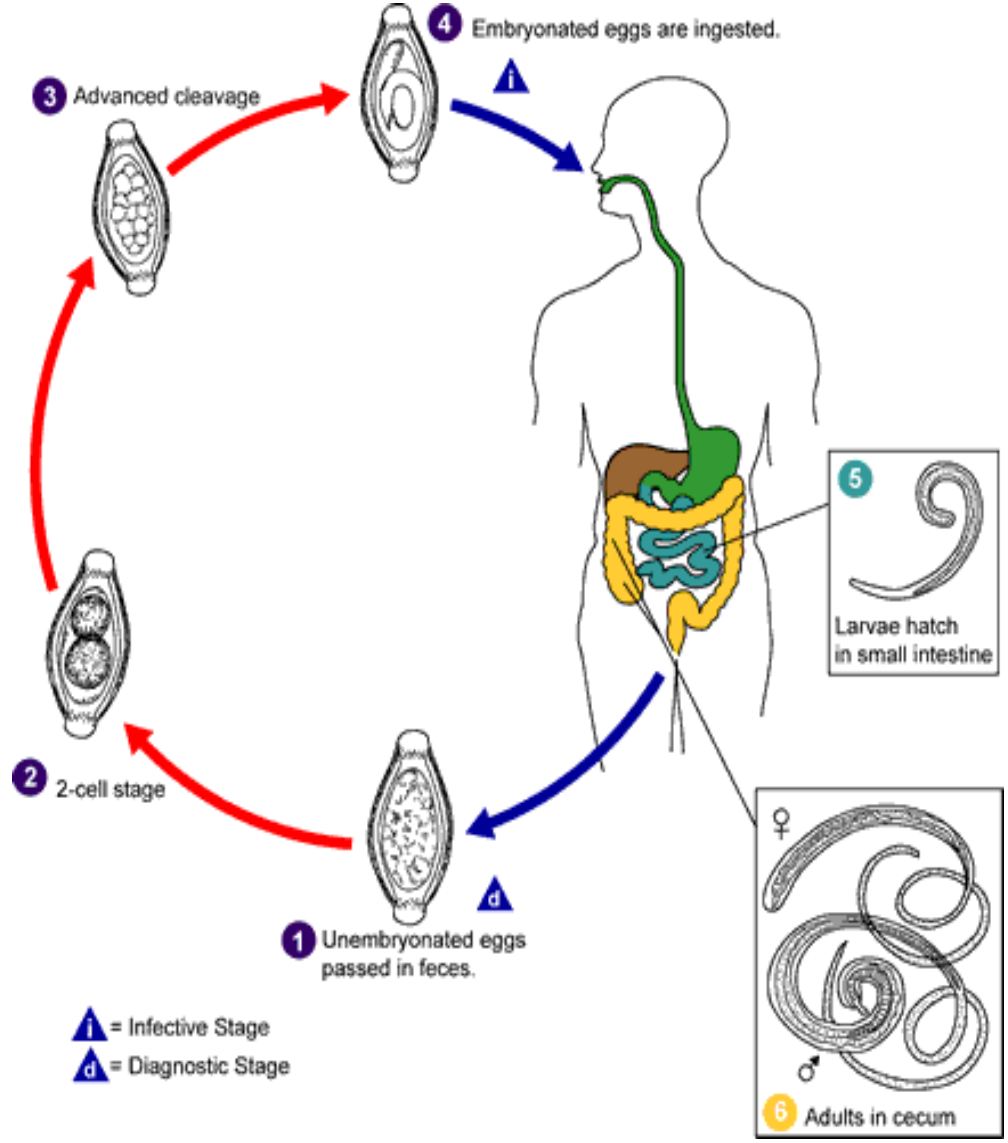
Ascariosis

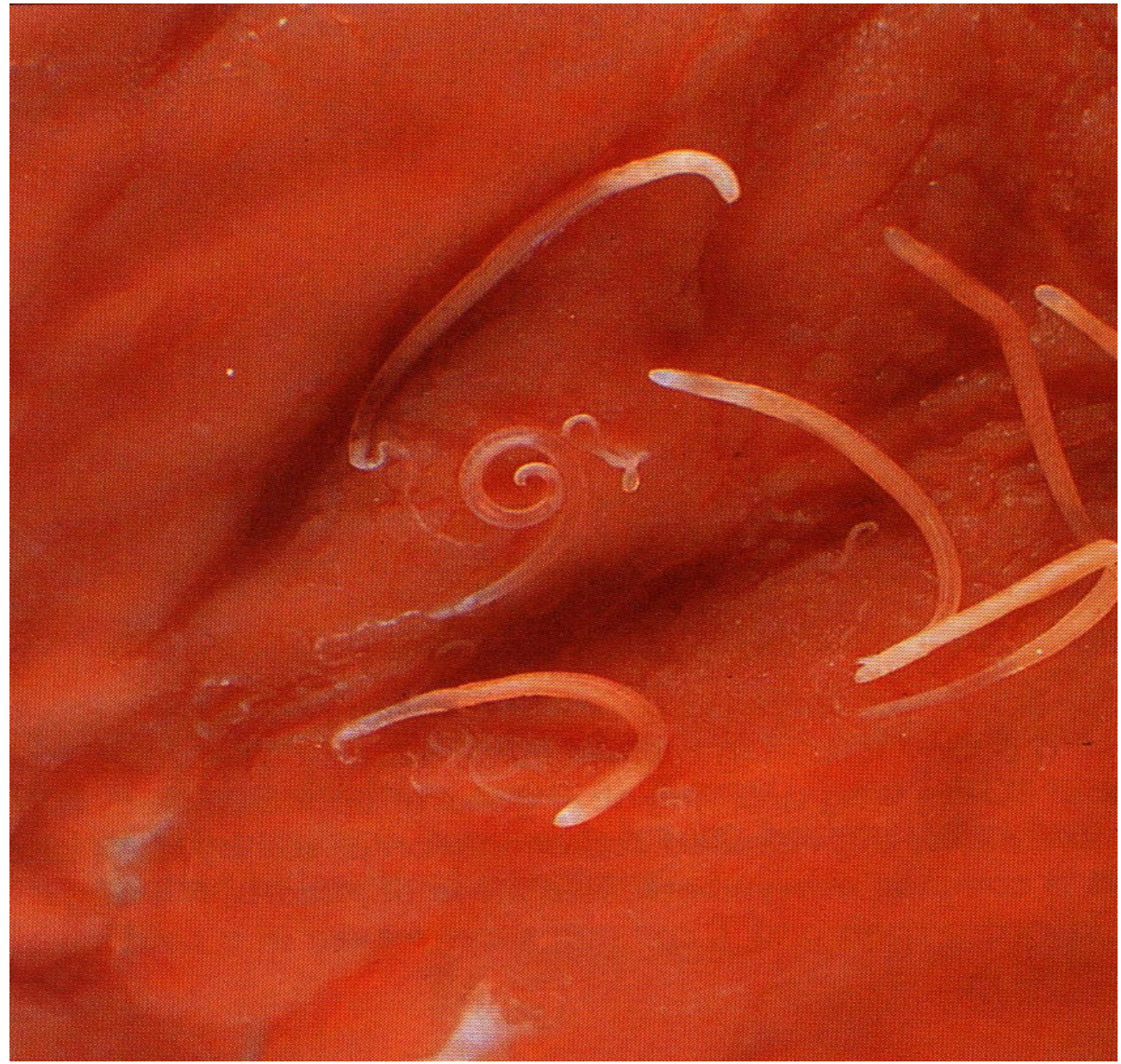

i = Infective Stage
d = Diagnostic Stage
1 d
♀
♂
2 Fertilized egg d
2 Unfertilized egg d
will not undergo
biological development.
Feces

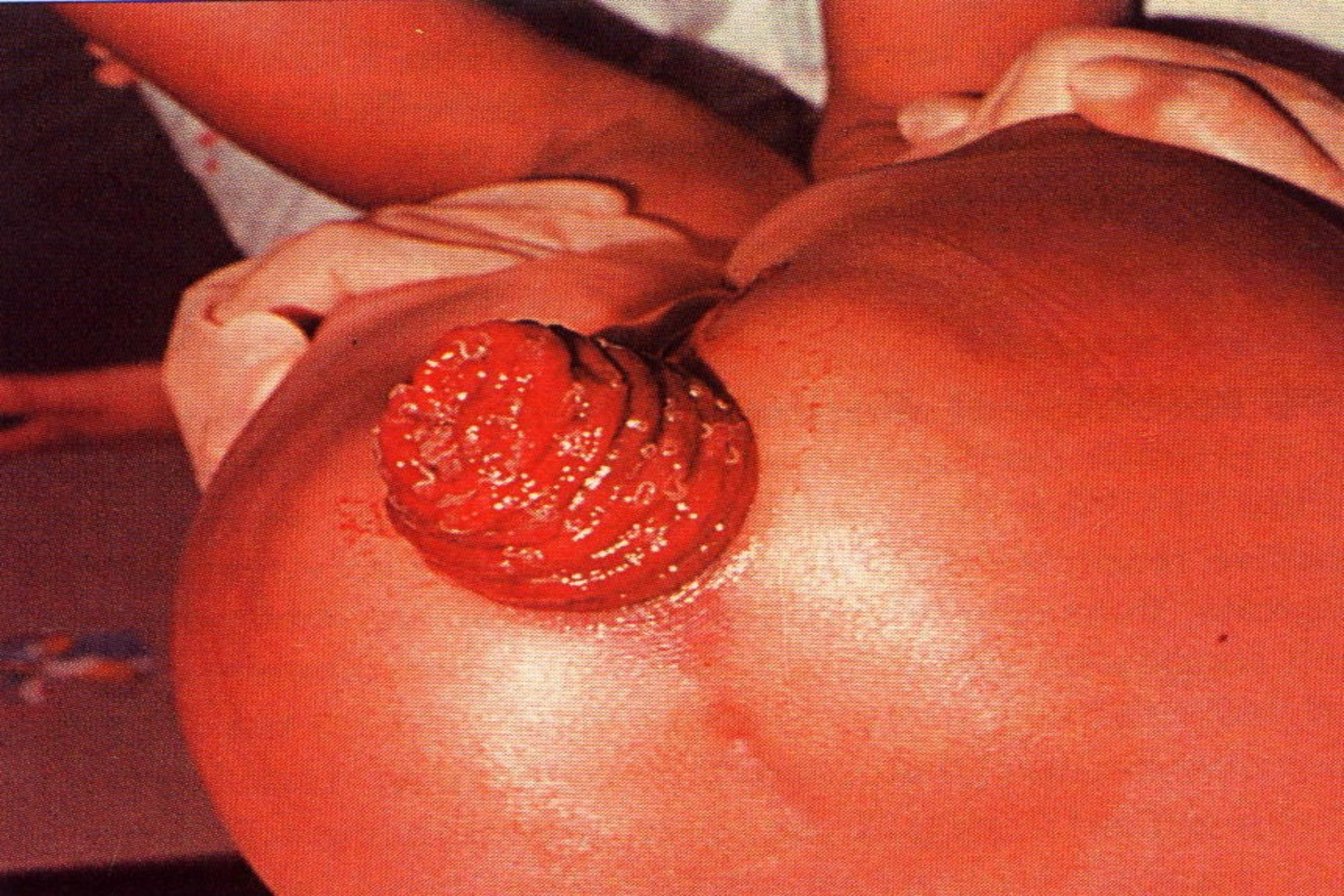




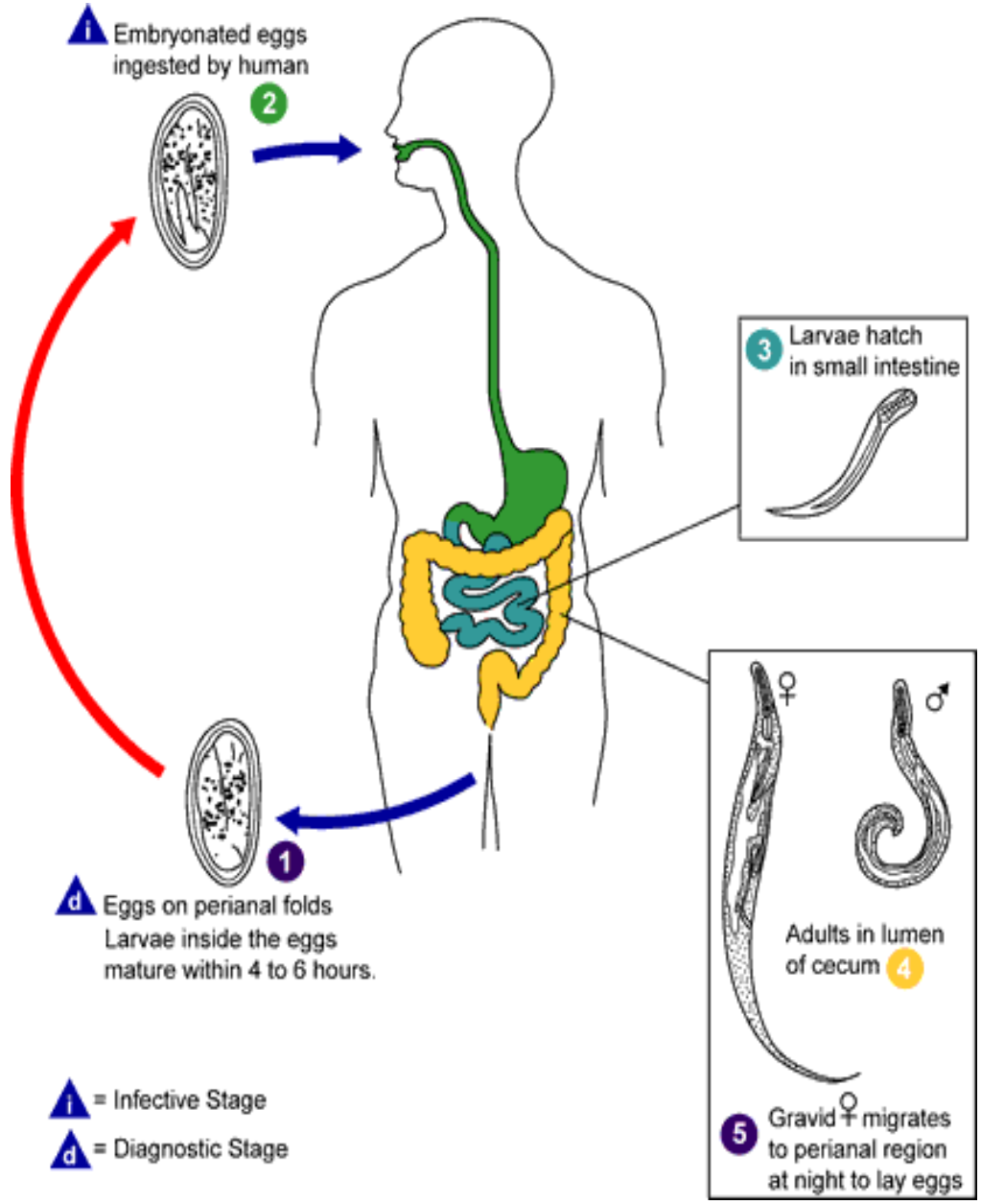
Trichuriosis



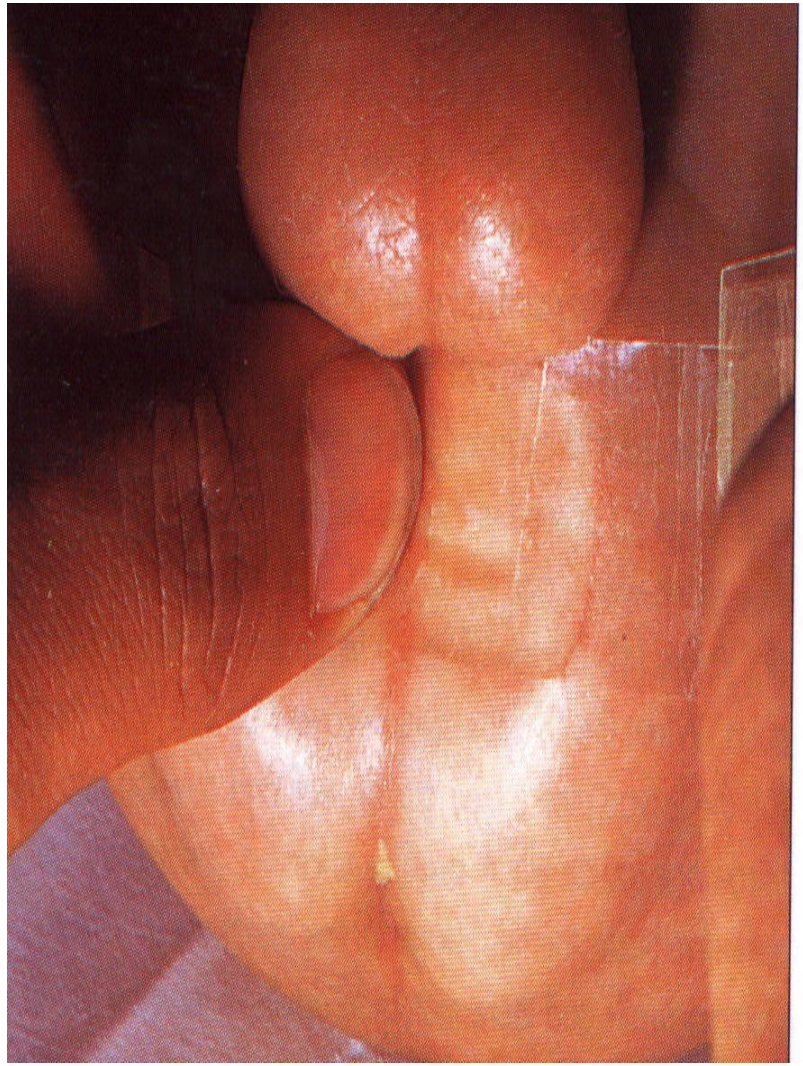


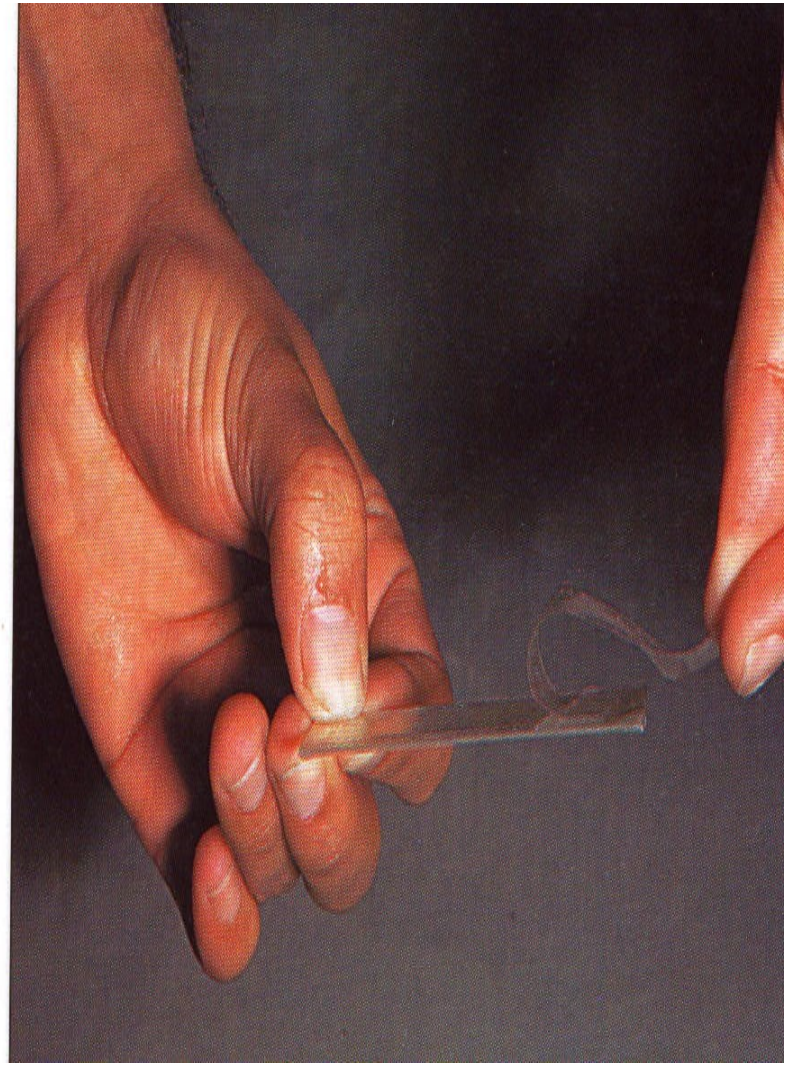


Enterobiosis, oxyuriosis



Enterobios oxyuriosis

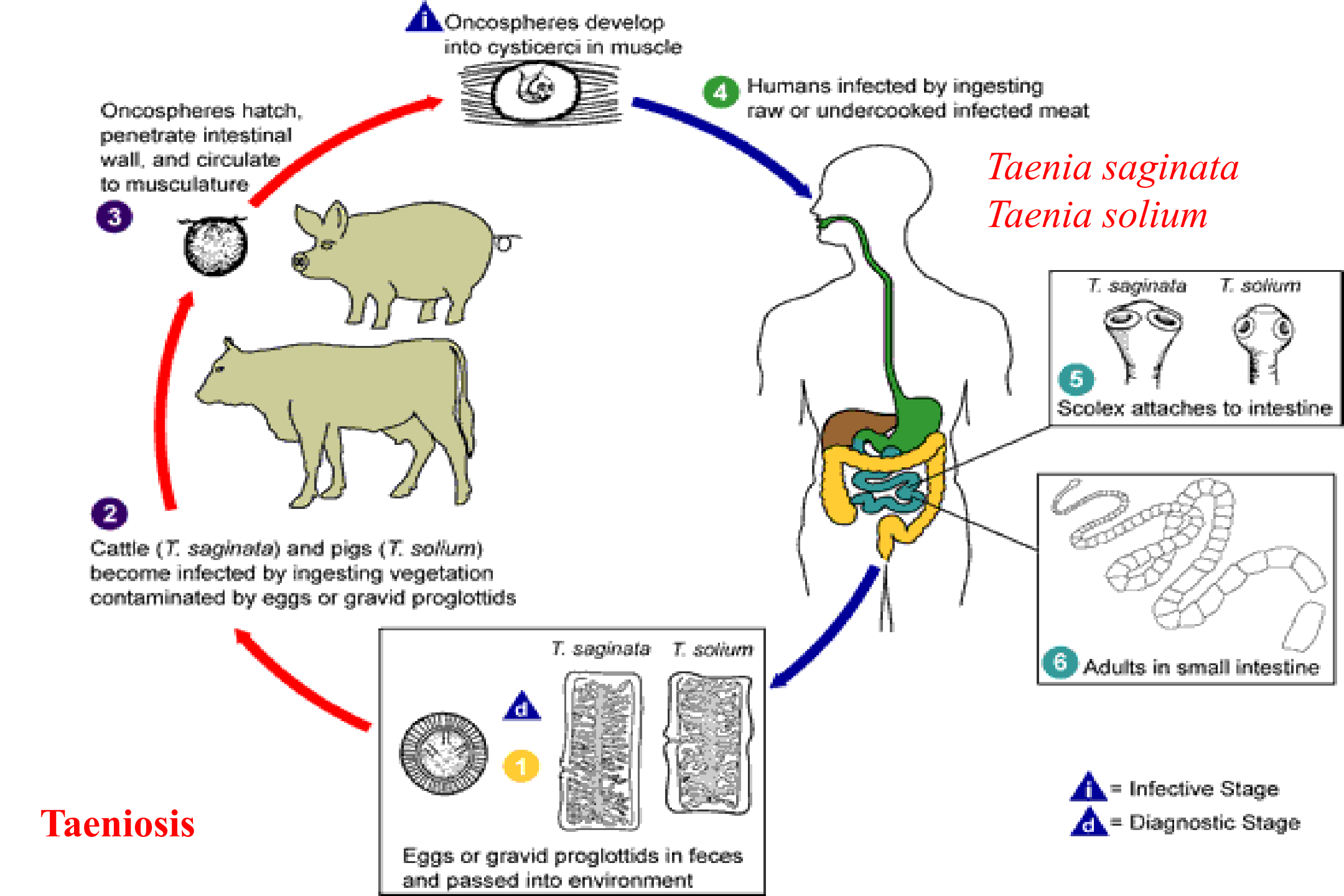




Tapeworms (Cestodes)

- Man as final host
- *Taenia saginata*
- *Taenia solium*
- *Diphyllobotrium latum*, *D. pacificum*
- *Hymenolepsis nana*

- Animal as final host
- *Echinococcus granulosus*
- *Echinococcus (Alveococcus) multilocularis*

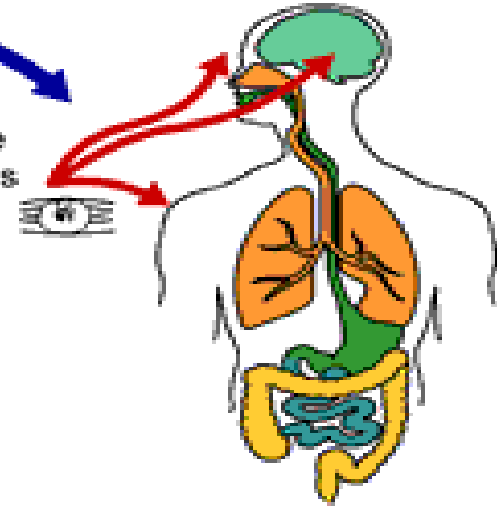

i Oncospheres develop into cysticerci in muscle
4 Humans infected by ingesting raw or undercooked infected meat
Oncospheres hatch, penetrate intestinal wall, and circulate to musculature
3
Taenia saginata
Taenia solium
T. saginata
T. solium
5 Scolex attaches to intestine
2 Cattle (T. saginata) and pigs (T. solium) become infected by ingesting vegetation contaminated by eggs or gravid proglottids
6 Adults in small intestine
T. saginata
T. solium
d
1
Eggs or gravid proglottids in feces and passed into environment
i = Infective Stage
d = Diagnostic Stage
Taeniosis

Taenia solium

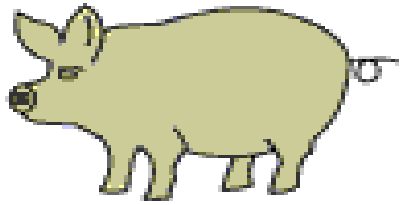
i Oncospheres develop into cysticerci in muscles of pigs or humans

Cysticercosis

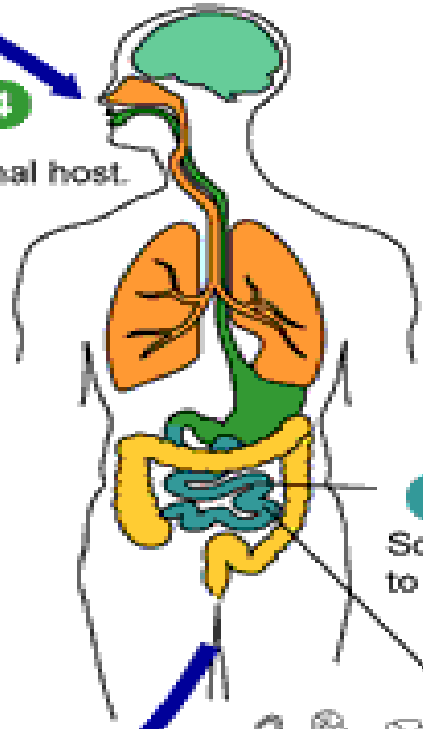
Cysticerci may develop in any organ, being more common in subcutaneous tissues as well as in the brain and eyes.



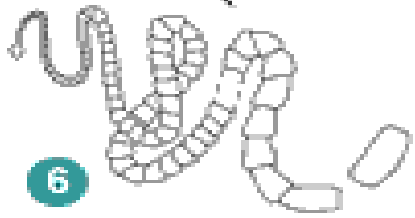
3 Oncospheres hatch, penetrate intestinal wall, and circulate to musculature in pigs or humans



Humans acquire the infection by ingesting raw or undercooked meat from infected animal host. 4



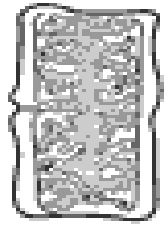
5 Scolex attaches to intestine



6 Adults in small intestine

2 Embryonated eggs and/or gravid proglottids ingested by pigs or humans

i d



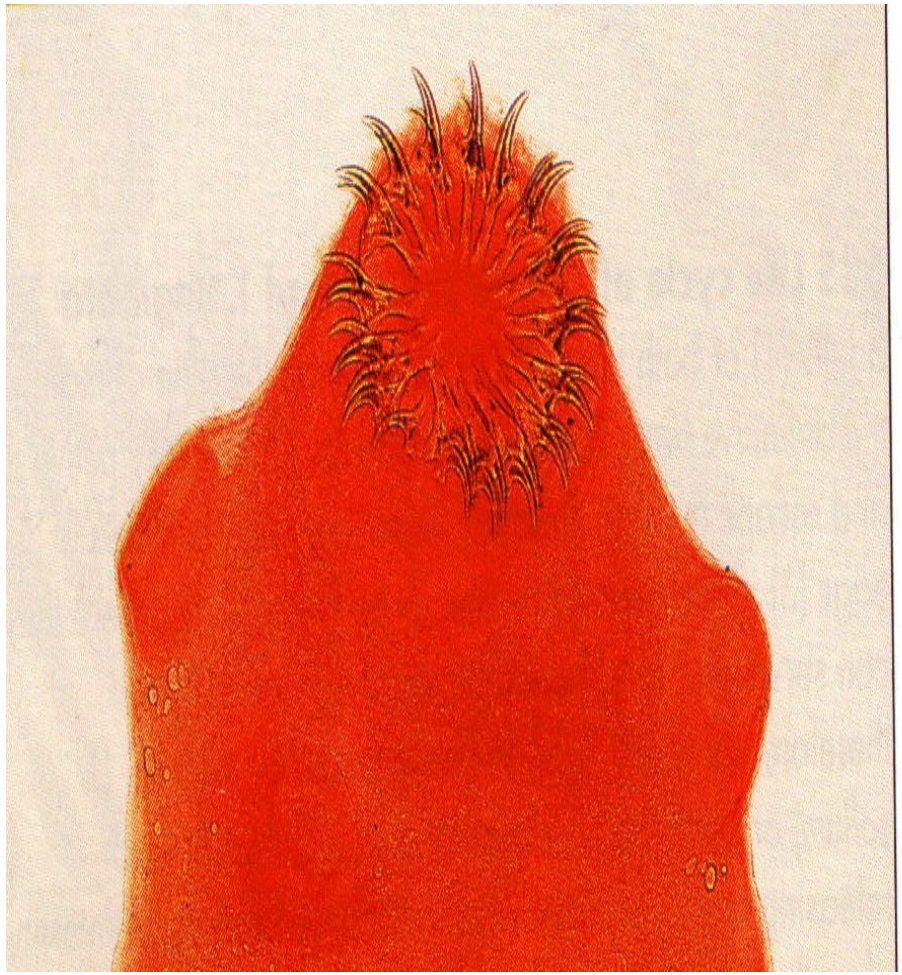
1 Eggs or gravid proglottids in feces and passed into environment

i = Infective Stage

d = Diagnostic Stage

Cysticercosis

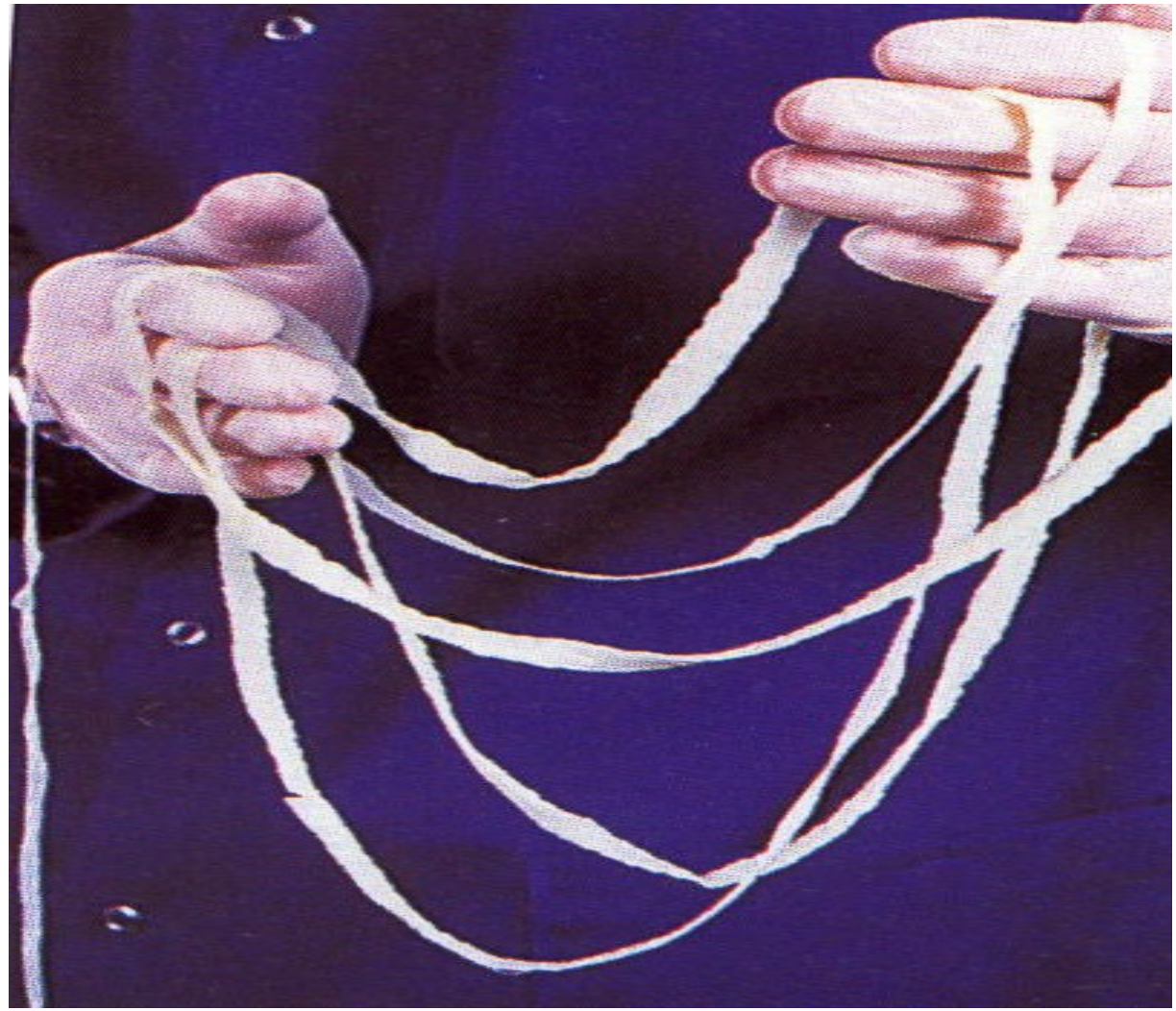
Taenia solium



Taenia saginata

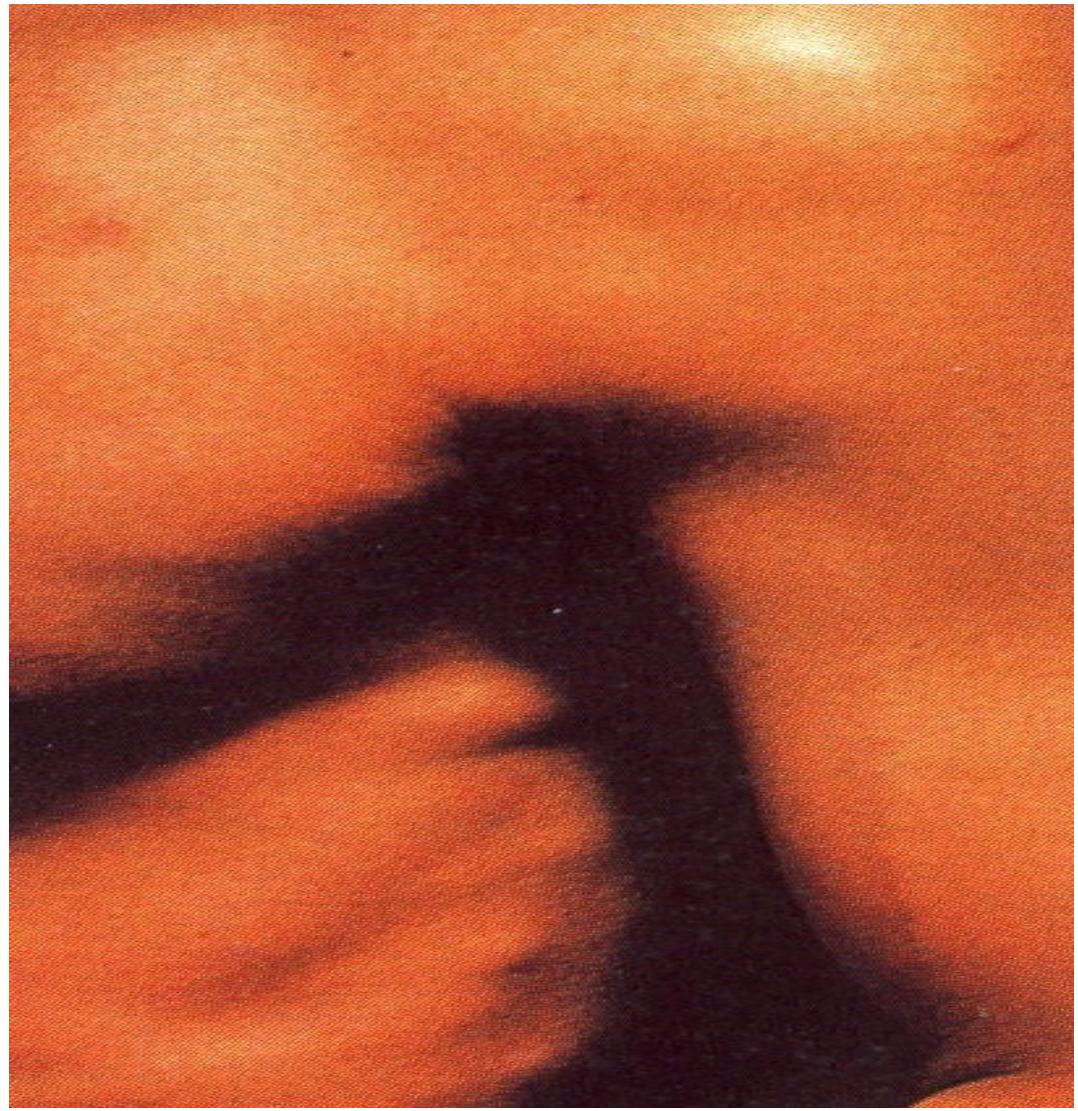
Taenia solium

Taenia saginata

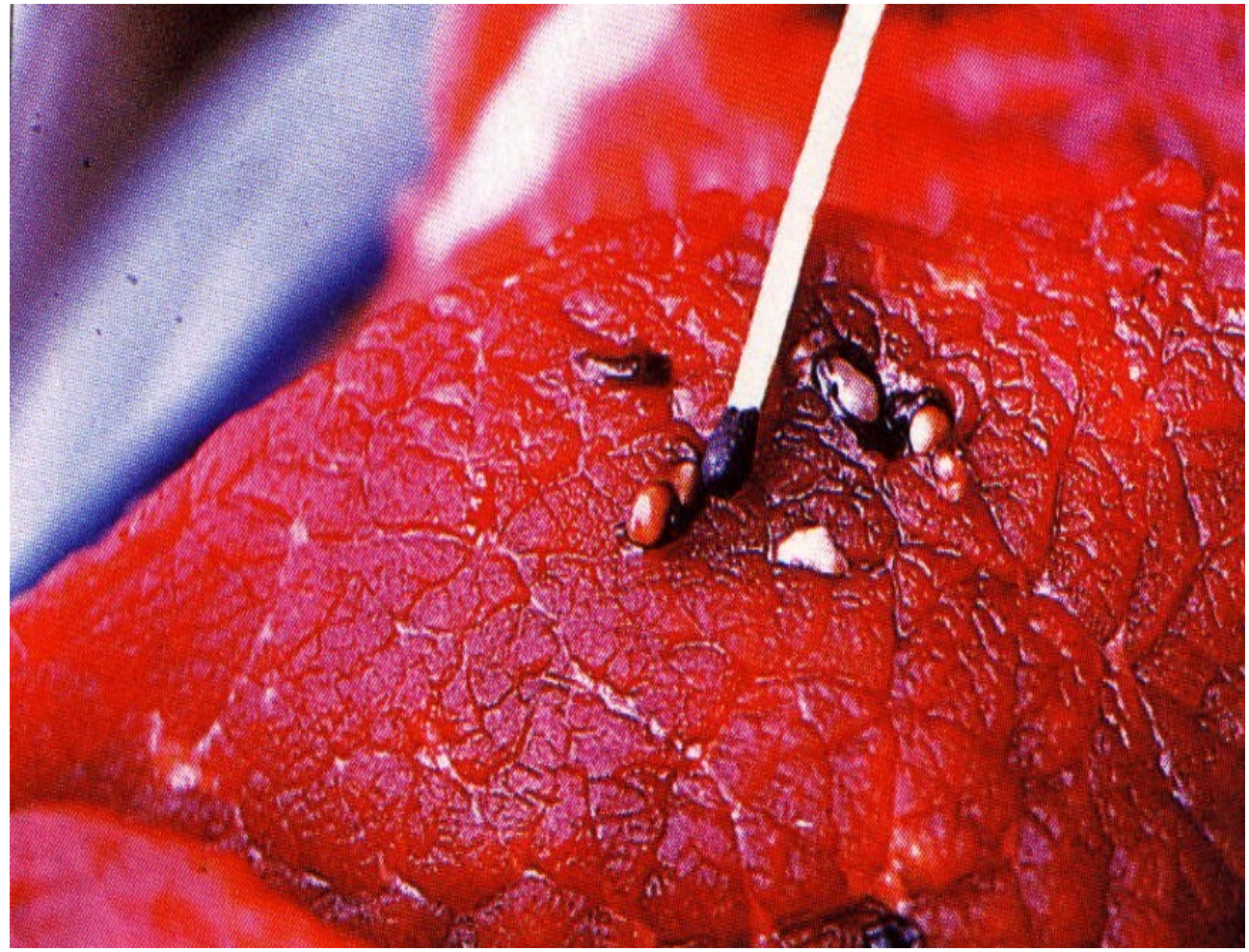


Cysticercosis (pig)

Cysticercosis (man)

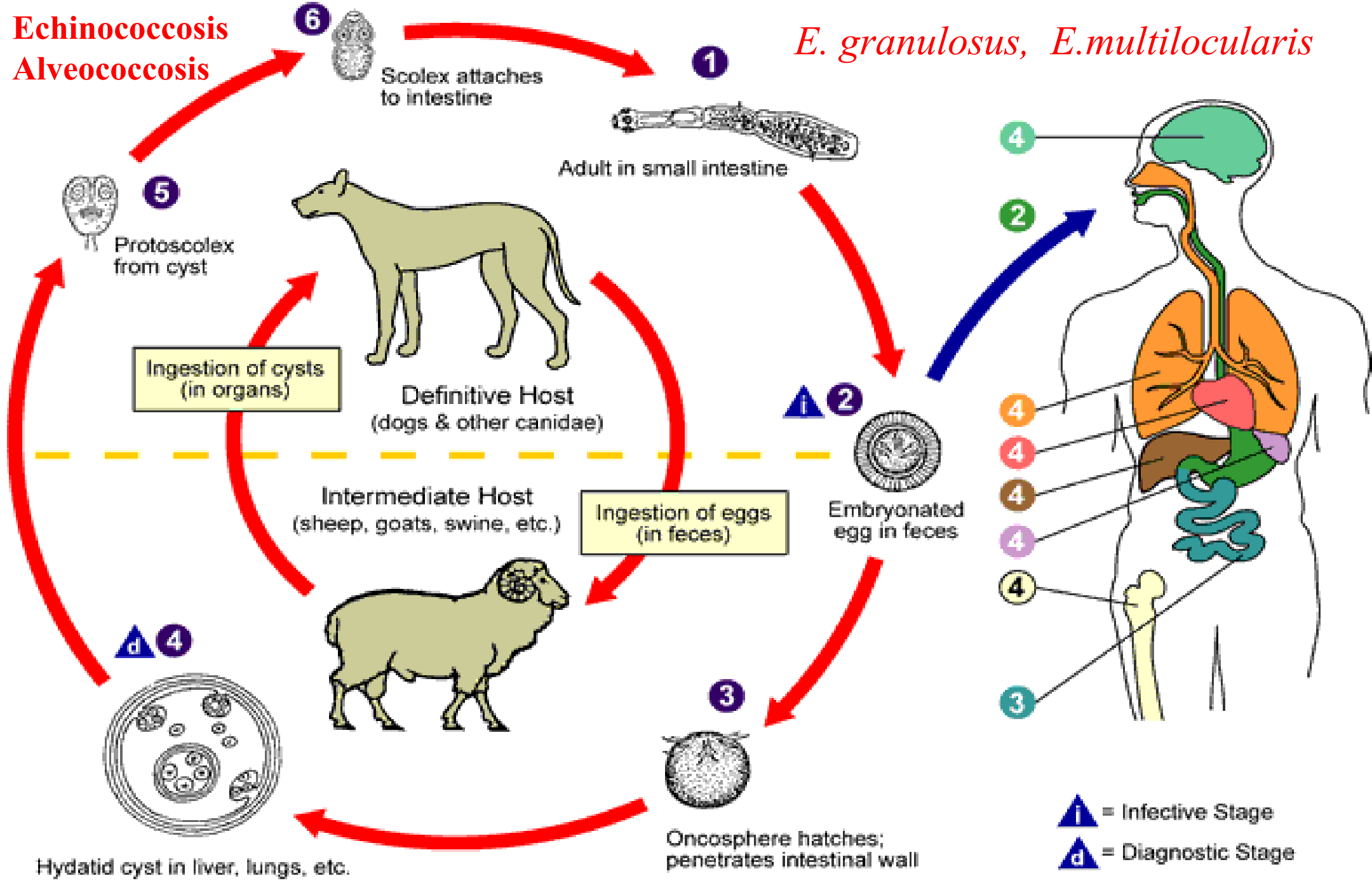


Cysticercosis (cow)



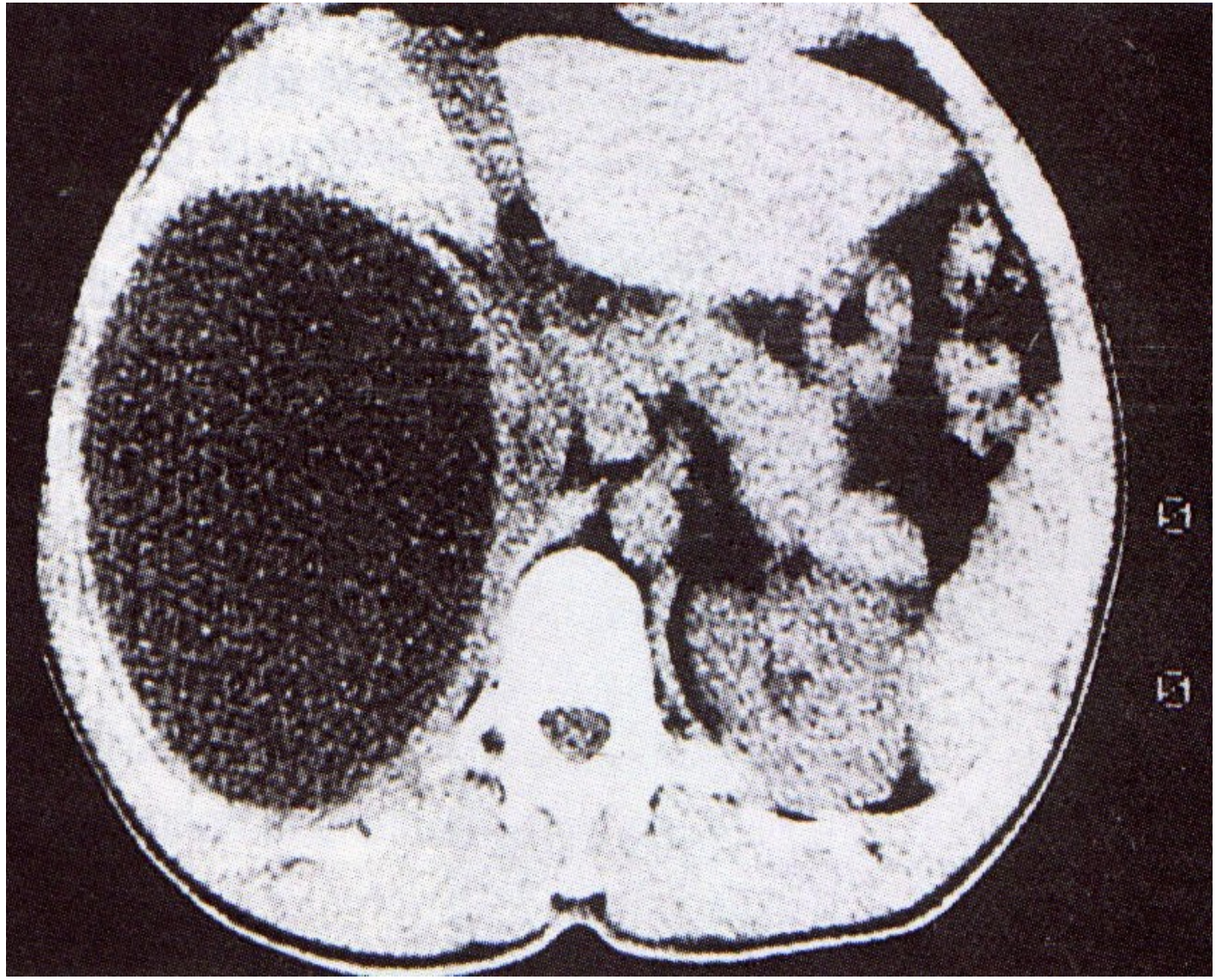
Echinococcosis
Alveococcosis

E. granulosus, E.multilocularis



Echinococcus granulosus (dog)

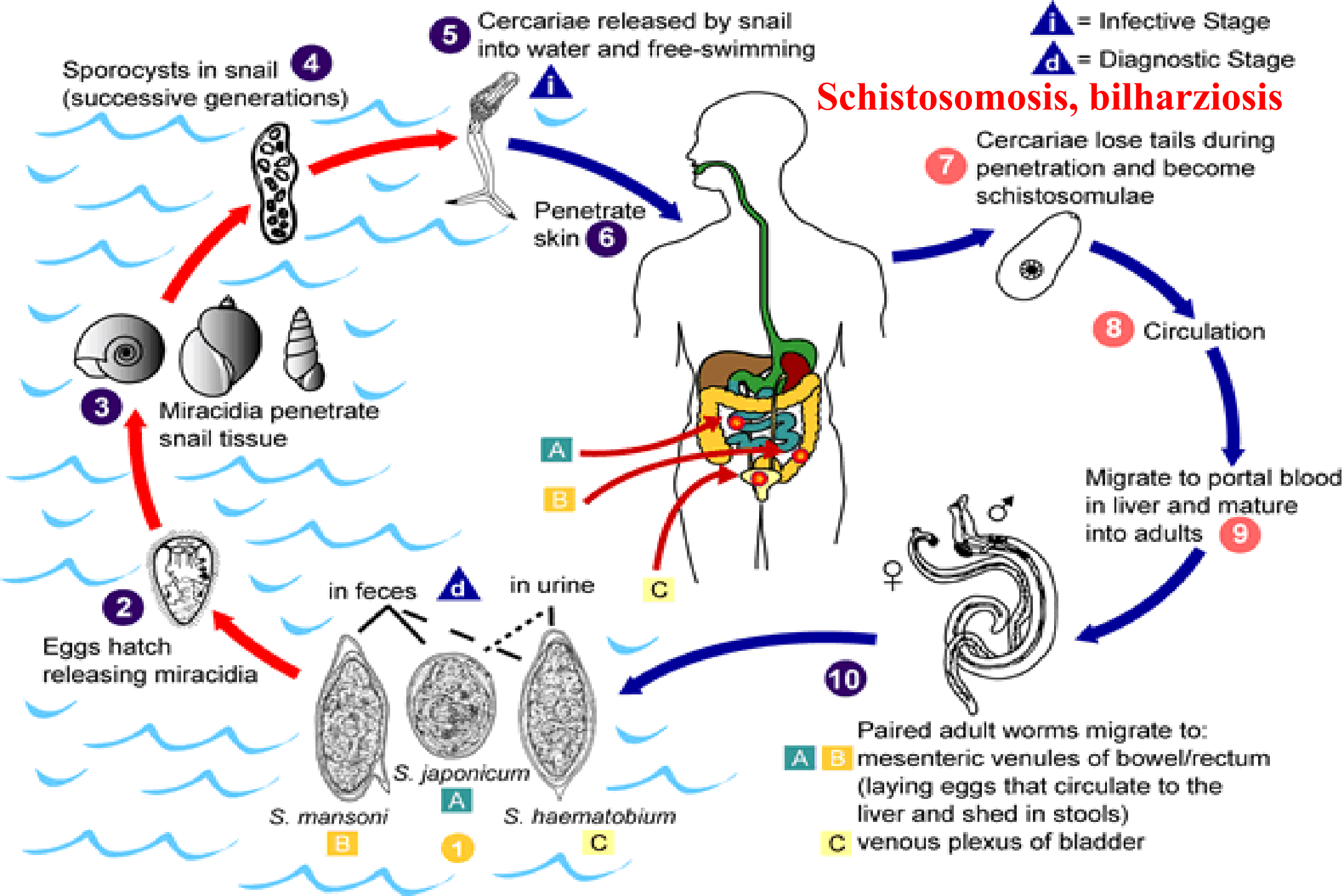
Echinococcus granulosus – liver cysts (man)



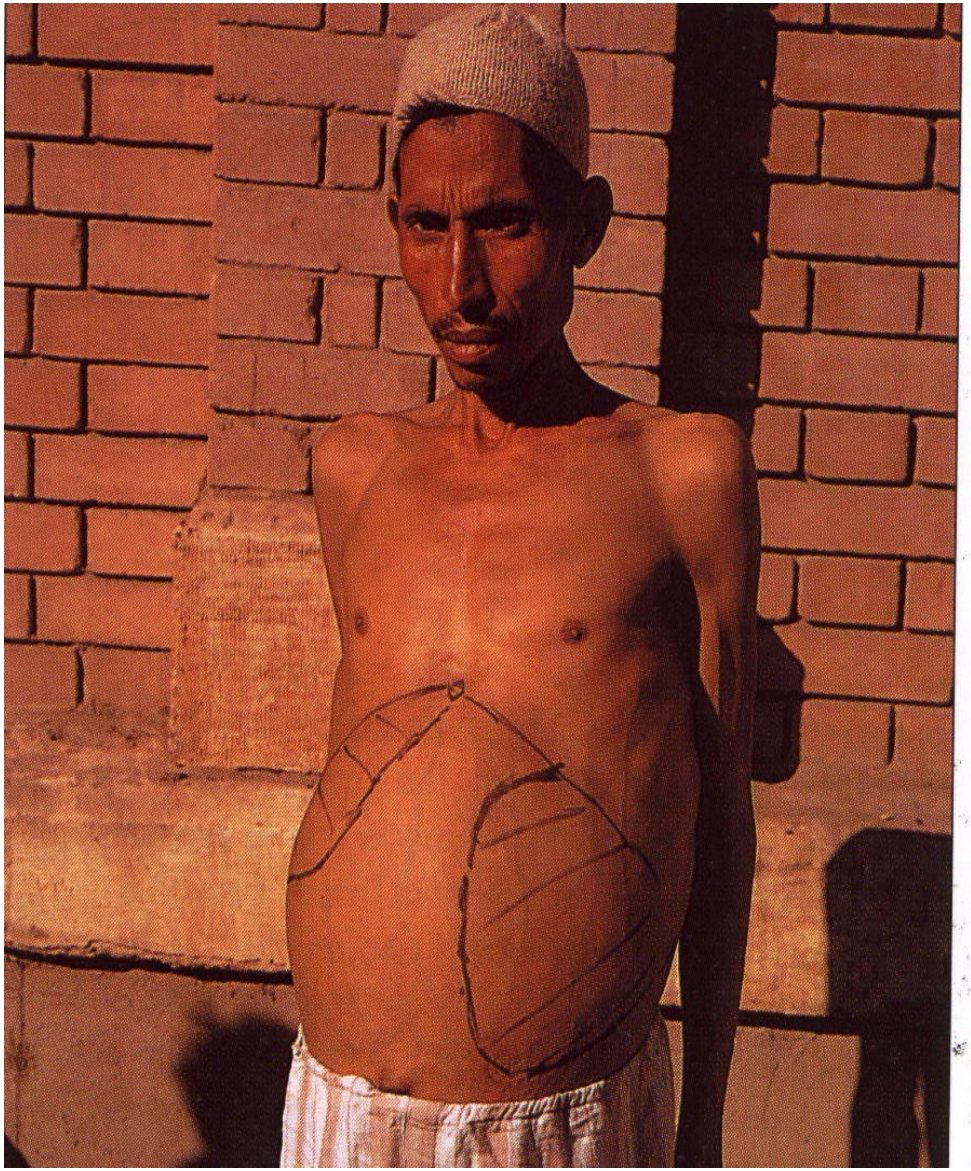
Echinococcus granulosus – liver cysts (man)

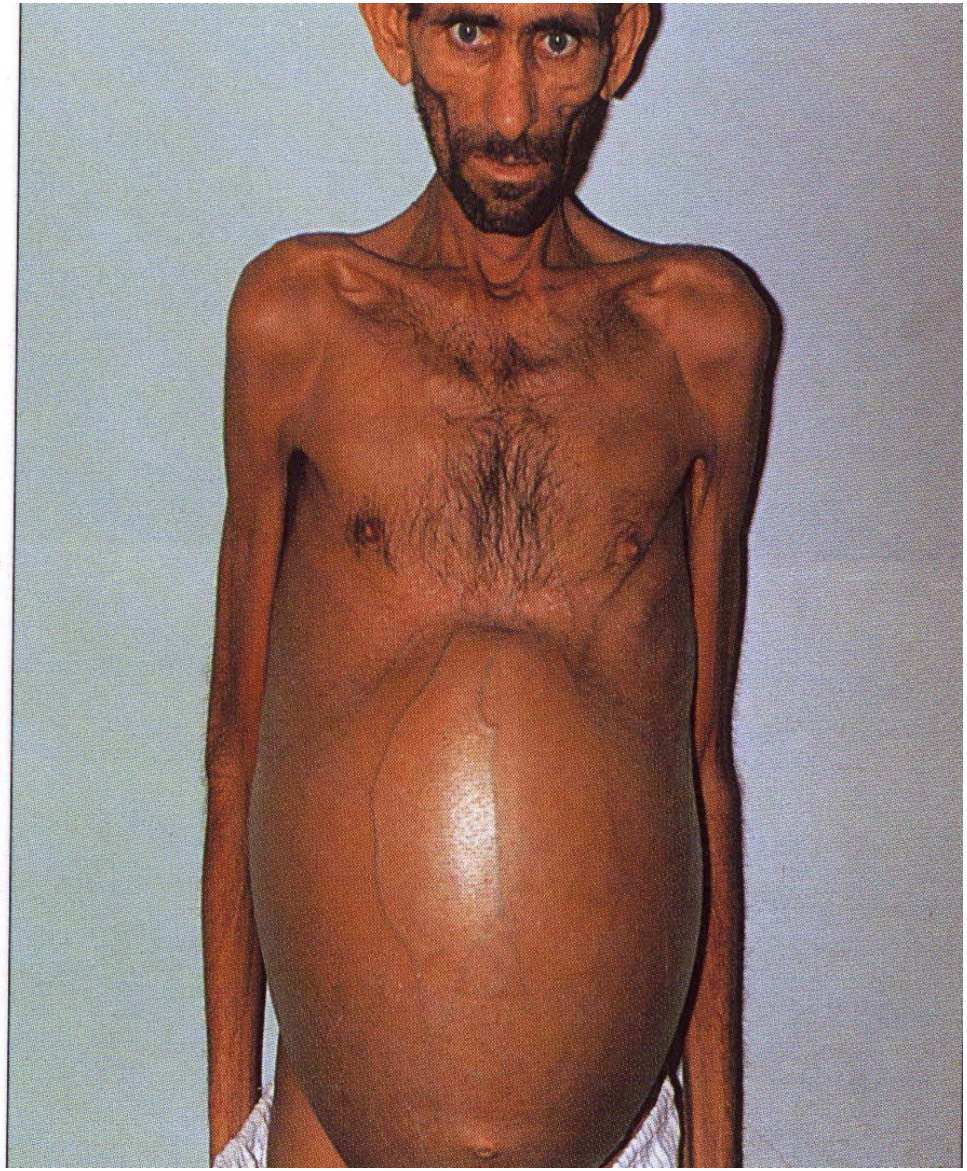
Flukes (Trematodes)

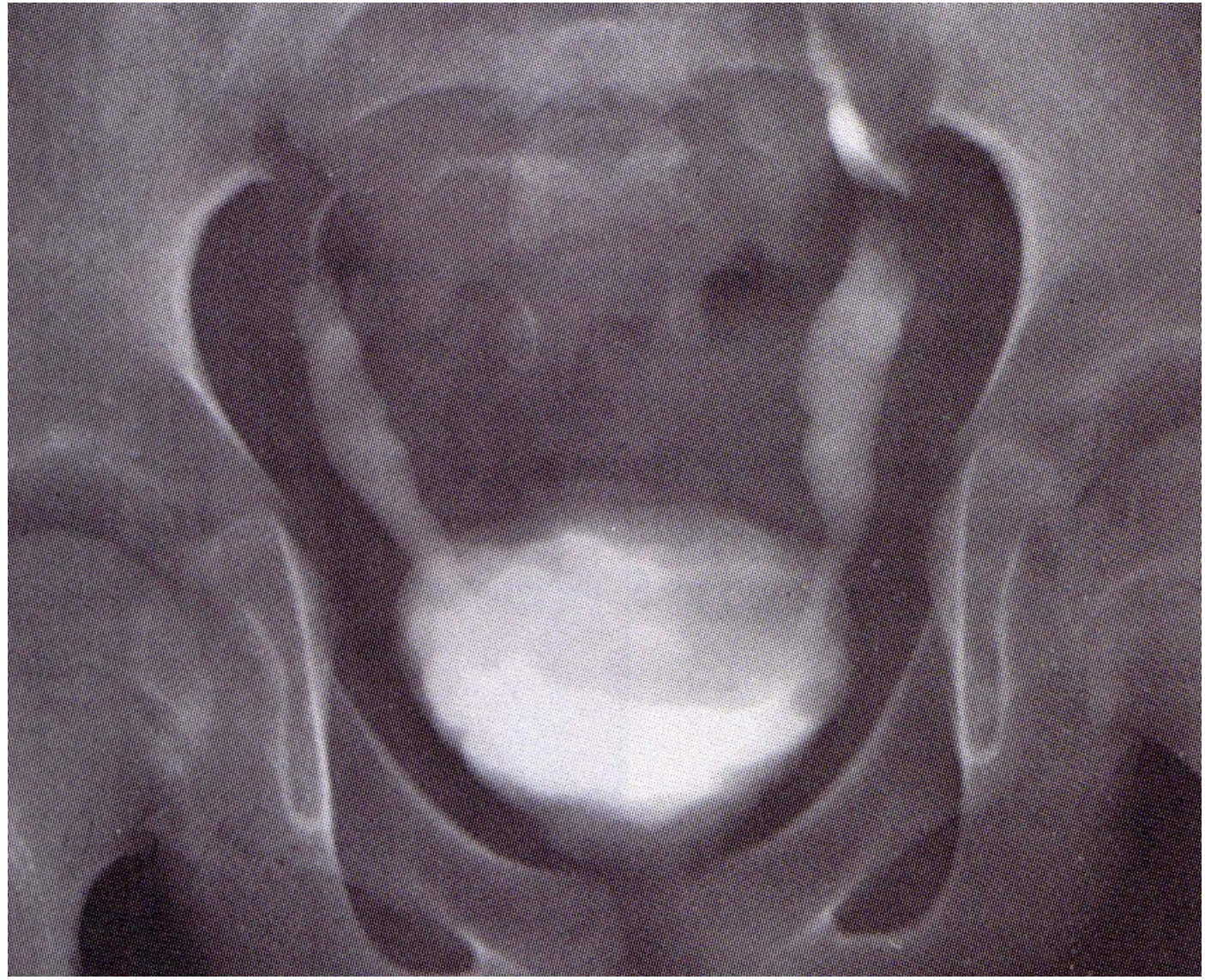
- schistosomiasis (bilharsiasis)
- *S. hematobium*
- *S. intestinalis (mansoni)*
- *S. japonicum*
- *S. mekongi*


i = Infective Stage
d = Diagnostic Stage
Schistosomosis, bilharziosis
1 Sporocysts in snail (successive generations)
2 Cercariae released by snail into water and free-swimming
3 Penetrate skin
4 Cercariae lose tails during penetration and become schistosomulae
5 Circulation
6 Migrate to portal blood in liver and mature into adults
7 Paired adult worms migrate to:
A B mesenteric venules of bowel/rectum (laying eggs that circulate to the liver and shed in stools)
C venous plexus of bladder
8 Eggs hatch releasing miracidia
9 Miracidia penetrate snail tissue
10
in feces
in urine
S. japonicum
A
S. mansoni
B
S. haematobium
C


Atlantic Ocean
Pacific Ocean
Indian Ocean
Dominican Republic
Haiti
Puerto Rico
Antigua & Barbuda
Guadeloupe
Martinique
St. Lucia
Caribbean Sea
Venezuela
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*)
- mounth cavity, oesophagus, anorectal
- mostly IS patients
- fluconazol, itraconazol ketoconazol, amphotericin

Thank you for your attention!

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