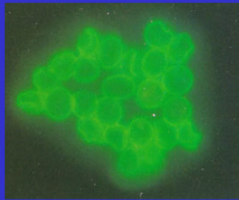


Ecology of Disease

Weekly theme: WATER
Lecture: Contamination



Prof Peter O'Donoghue

1

CONTAMINATION

According to the Oxford dictionary:

contaminate, v.t. pollute, infect. So **contamina'tion** n. (also, in literary criticism, the blending of two plays, tales, etc., into one). [f.L *contaminare*]

2

CONTAMINANTS

ABIOTIC

- phenolic compounds
- benzoates
- hydrocarbons
- surfactants
- pesticides
- humic substances
- lignin
- heavy metals
- organic enrichment

toxic/mutagenic/carcinogenic/teratogenic

3

CONTAMINANTS

BIOTIC

- viruses
 - DNA/RNA
 - virus-like particles
- bacteria
 - aerobic/anaerobic
 - spore forming/non-spore forming
 - cyanobacteria (blue-green algae)
[Annie, Fannie, Mike, Noddy]
- algae
 - green/golden-brown/red/brown
- fungi
 - water molds/yeasts
 - wood rotting fungi
 - fungi imperfecti

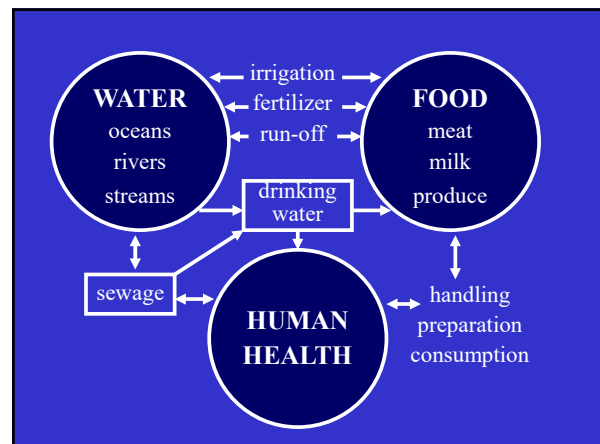
4

CONTAMINANTS

BIOTIC

- protozoa
 - flagellates (*Giardia*)
 - amoebae (*Entamoeba*, *Naegleria*)
 - ciliates (*Balantidium*)
 - sporozoa (*Isospora*, *Cyclospora*, *Cryptosporidium*)
 - microspora (*Enterocytozoon*, *Encephalitozoon*)
- helminths
 - nematodes (*Ascaris*, *Trichuris*)
 - cestodes (*Taenia*, *Echinococcus*)
 - flukes (*Schistosoma*, *Fasciola*)

5



6

Major sources of contamination

- human waste (sewage)
- animal waste (agricultural runoff)
- domestic waste (effluent)
- industrial waste (effluent)
- contaminate drinking water
- contaminate food (washing/preparation)

7

Contamination

depends on:

- host distribution and abundance
- pathogen distribution and abundance
- proliferative potential
- standard of sanitation
- waste disposal
- water treatment
- agricultural practices

8

Human/animal waste

Exemplars: Cestodes (tapeworms)

Taenia (human tapeworm) cysticercosis
Echinococcus (dog tapeworm) hydatid disease



adult stages
enteric
benign



larval stages
tissues
space-occupying
lesions

9

Taenia - adult tapeworm in gut



10

Taenia saginata
"beef" tapeworm



scolex

Taenia solium
"pork" tapeworm



proglottid

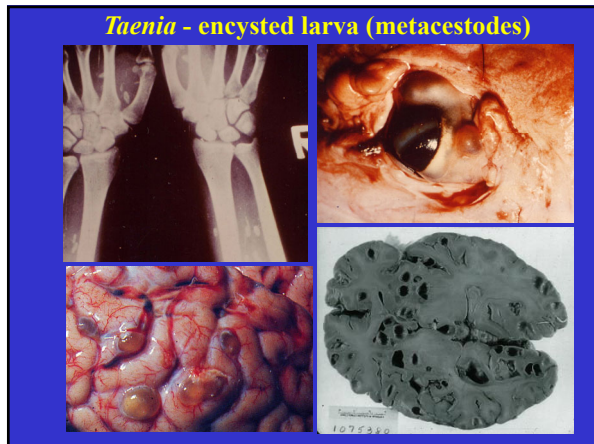


11

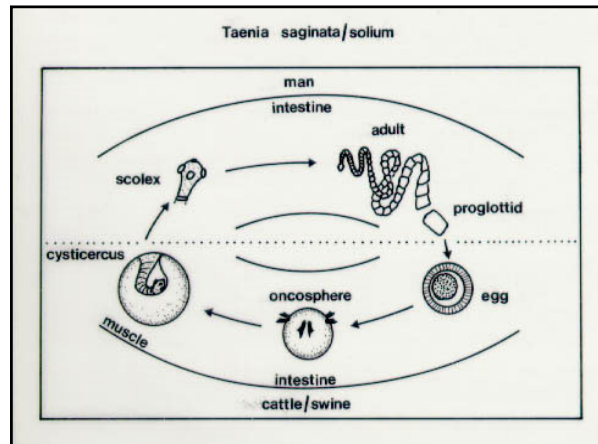
Taenia - eggs voided in human faeces



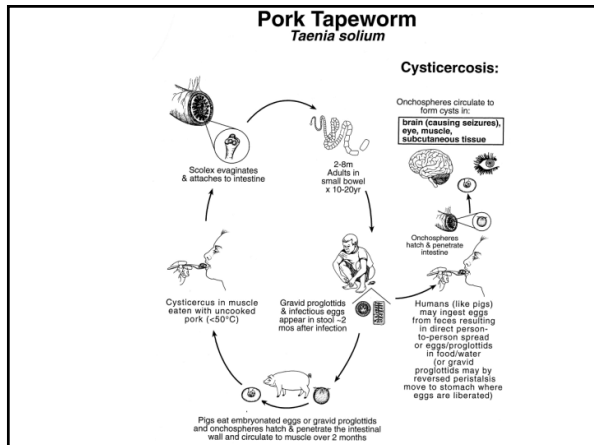
12



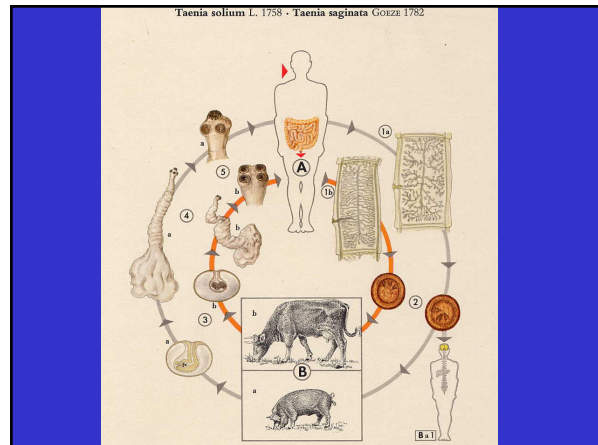
13



14



15



16

Source of contamination

- human waste (sewage)
- human faeces contain eggs infective to animals (exception: *T. solium* eggs infective to humans) which develop encysted larval (metacystode) stages
- precludes use of sewage as fertilizer

17

German experience (barn dairies)

- partly treated sewage used to fertilize pastures
- increase in cysticerci in cattle
- increase in tapeworms in humans consuming raw/rare meat and smallgoods

Dutch experience (market gardens)

- sewage used to fertilize vegetable crops
- increase in cysticerci in humans consuming contaminated vegetables

Irian Jaya experience (gift pigs)

- severe burns in villagers due to seizures induced by cerebral cysticerci (*T. solium*)

18

Sewage fertilizers

- sewage prohibited for use as fertilizer in agriculture and horticulture (only used in cut-flower industry)
- many countries now re-examining regulations due to technological innovations in processing (composting, microbial degradation, thermal sterilization, biosolid extraction)

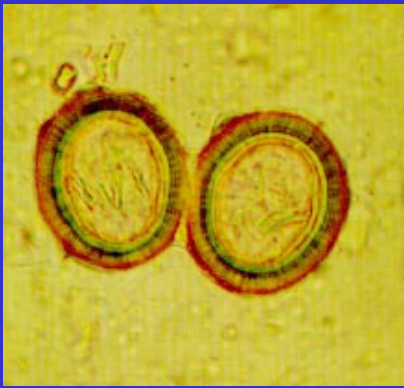
19

Echinococcus granulosus (dog tapeworm)



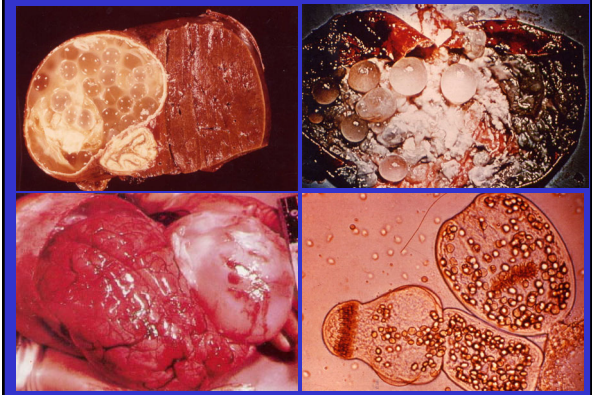
20

Echinococcus granulosus - eggs in faeces

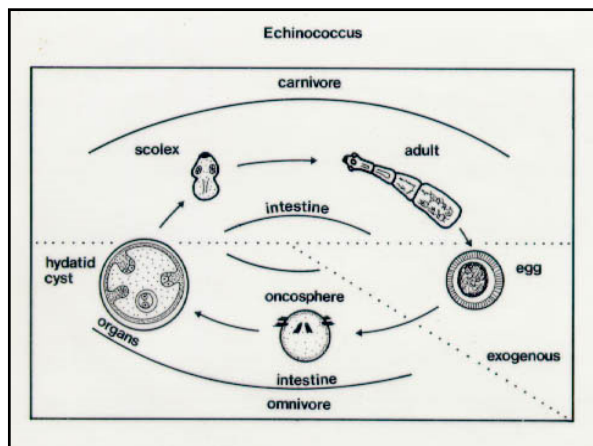


21

Hydatid cysts

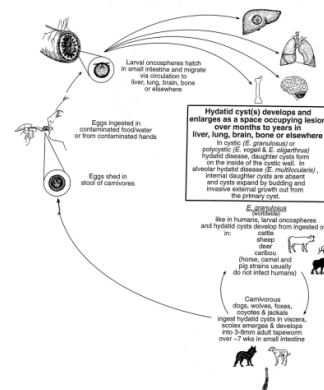


22



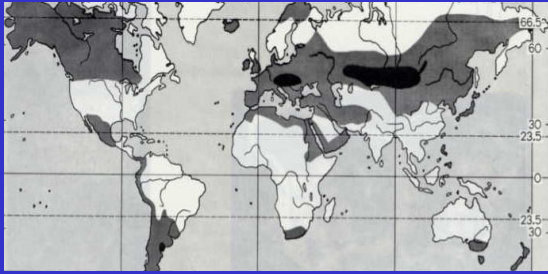
23

Echinococcal Disease



24

DISTRIBUTION



E. multilocularis *E. granulosus*

25

Source of contamination

- animal waste
- dog faeces contain eggs infective to humans and animals which develop encysted larval (metacestode) stages
- mandates faecal disposal
- strict pet-child hygiene

26

Hydatid eradication campaign

New Zealand + Tasmania

- target infections in domestic dogs
- use anthelmintics to purge dogs
CAUTION: destroy voided faeces
- prevent re-infection
 - delete offal from diet
 - destroy carcasses in field
 - curb hunting behaviour
- shoot wild dogs
 - problems with dingo/macropod sylvatic cycle
- vaccination? (CSIRO success)

27

Lesson learnt

- ensure water supplies are not contaminated by faecal waste (limit contact between the two)



28

Lesson learnt

- do not use faecal material to fertilize fodder for stock or food for humans (alternatively, develop effective decontamination procedures)



29



Major sources of contamination

- human waste (sewage)
- animal waste (agricultural runoff)
- domestic waste (effluent)
- industrial waste (effluent)
- contaminate drinking water
- contaminate food (irrigation, washing/preparation)

30