

**Module 01    Lecture 02**

**The nature of microorganisms  
and parasites**

# Microorganisms classified by their significance

- **pathogenic organisms**
- **spoilage organisms**
- **useful organisms**

# Dangerous microorganisms and parasites

## *Foodborne diseases*

- ◆ **bacteria**
- ◆ **moulds**
- ◆ **viruses**
- ◆ **parasites**

# Major bacteria causing foodborne disease

*Aeromonas* spp.

*Bacillus cereus*

*Brucella* spp.

*Campylobacter jejuni*

*Clostridium botulinum*

*Clostridium perfringens*

*Escherichia coli*

*Listeria monocytogenes*

*Mycobacterium bovis*

*Salmonella* spp.

*Shigella* spp.

*Staphylococcus aureus*

*Vibrio cholerae*

*Vibrio parahaemolyticus*

*Vibrio vulnificus*

*Yersinia enterocolitica*

# Spoilage microorganisms

- **bacteria**
- **yeasts**
- **moulds**

# Food products made with useful microorganisms

- **fermented meats**
- **yoghurt**
- **cheese**
- **beer**
- **leavened bread**
- **soy sauce**
- **fermented soybean (tofu)**

# Useful microorganisms

## *Lactic acid bacteria (LAB)*

➤ These ferment carbohydrates into organic acids which inhibit

- ◆ *Salmonella*
- ◆ *Staphylococcus*
- ◆ *Listeria*
- ◆ *Clostridium*
- ◆ *E. coli*

*LAB are found in*

- ◆ Plants
- ◆ Soil
- ◆ Animals
- ◆ Human Gut

# Microorganisms are very small

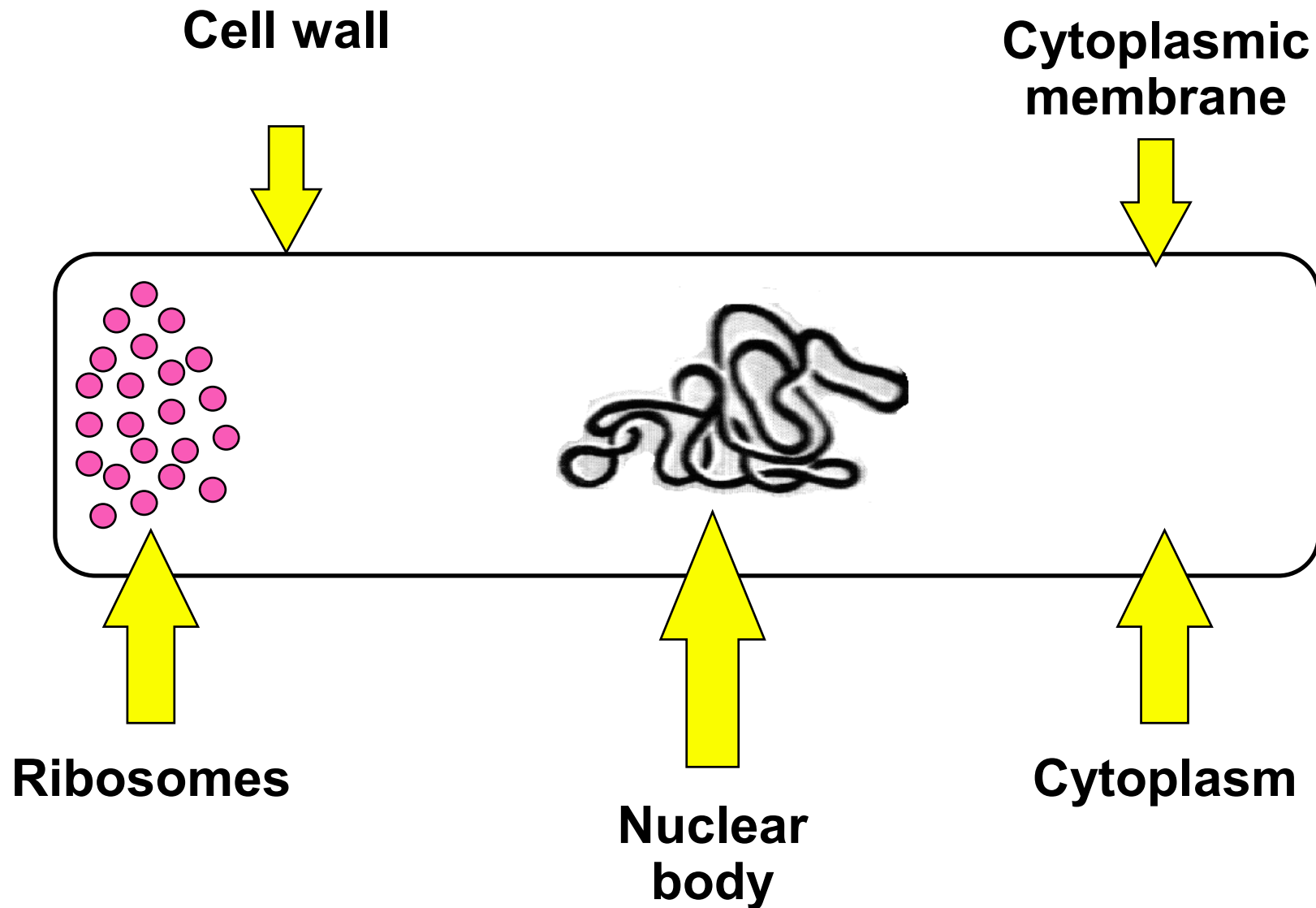


YOGHURT

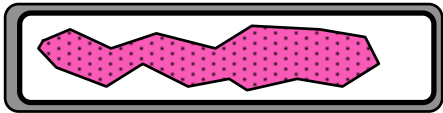
World population is  
**5.9 BILLION**  
i.e. 5 900 000 000

1 cup  
of yoghurt contains  
**20 X** this number!  
i.e. **120 000 000 000**  
separate living  
organisms.

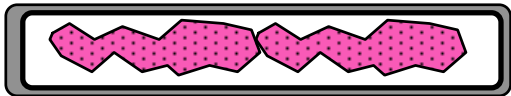
# Microorganisms are very small



# Bacterial division



1



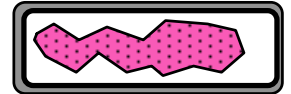
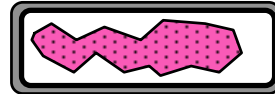
2



3

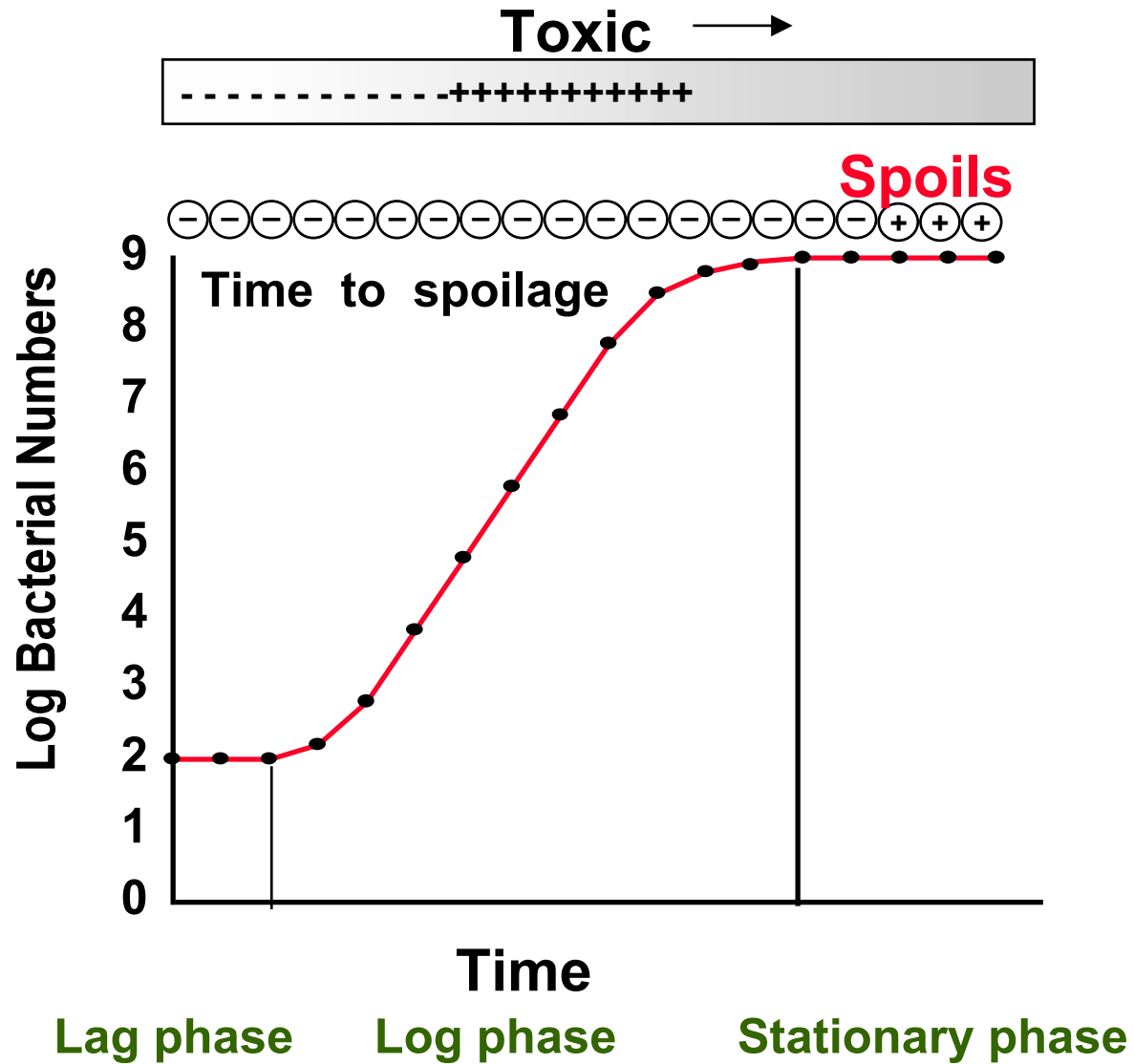


4



5

# Bacterial growth curve



# Phases of bacterial growth

- ***lag phase***  
(short) period of adjustment to environment
- ***logarithmic growth phase***  
growth begins and accelerates to a phase of rapid, constant exponential growth
- ***stationary phase***  
depletion of nutrients and accumulation of toxic metabolic products growth is slowed to a point where cell division and cell death are in balance
- ***death phase***  
population decreases due to death of cells

# Some toxigenic moulds causing foodborne disease

- *Aspergillus* spp.
- *Fusarium* spp.
- *Penicillium* spp.

( *Main sources - fruits, nuts and grains* )

# Major viruses causing foodborne disease

- **Hepatitis A and E viruses**
- **Small Round Structured Viruses  
(e.g. Norwalk agent)**
- **Rotavirus**
- **Polio virus**

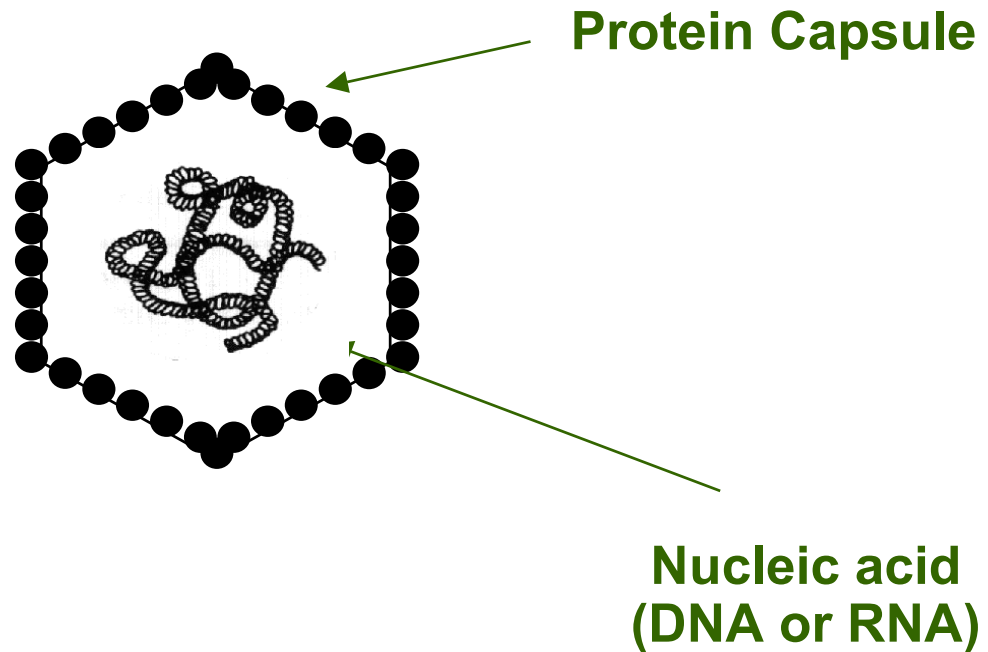
# Virus structure

**Poliovirus**

**Hepatitis-A virus**

**Rotavirus**

**Norwalk-like or  
SRSV**



# Virus levels required for infection and detection

## *infection*

**10 -100 particles / ml**

## *detection*

**$10^5 - 10^6$  particles / g  
(by electron microscopy)**

**$10^4 - 10^5$  particles / g  
(by radioimmunoassay)**

# Examples of peak excretion period of some faecal viruses

<b>SRSV</b>	<b>1 - 3 days</b>
<b>Astrovirus</b>	<b>1 - 4 days</b>
<b>Rotavirus</b>	<b>1 - 7 days</b>
<b>Adenovirus</b>	<b>prolonged</b>
<b>Coronavirus</b>	<b>prolonged</b>
<b>Hepatitis A virus</b>	<b>pre-jaundice</b>

# The human intestines - the source and target of foodborne viruses

## *cause diarrhoea*

- ◆ Small round structured viruses (SRSV)
- ◆ Astrovirus
- ◆ Adenovirus
- ◆ Coronavirus
- ◆ Rotavirus

## *do not cause diarrhoea*

- ◆ Hepatitis A virus
- ◆ Poliovirus
- ◆ Echovirus
- ◆ Coxsackievirus

# Major parasites causing foodborne disease

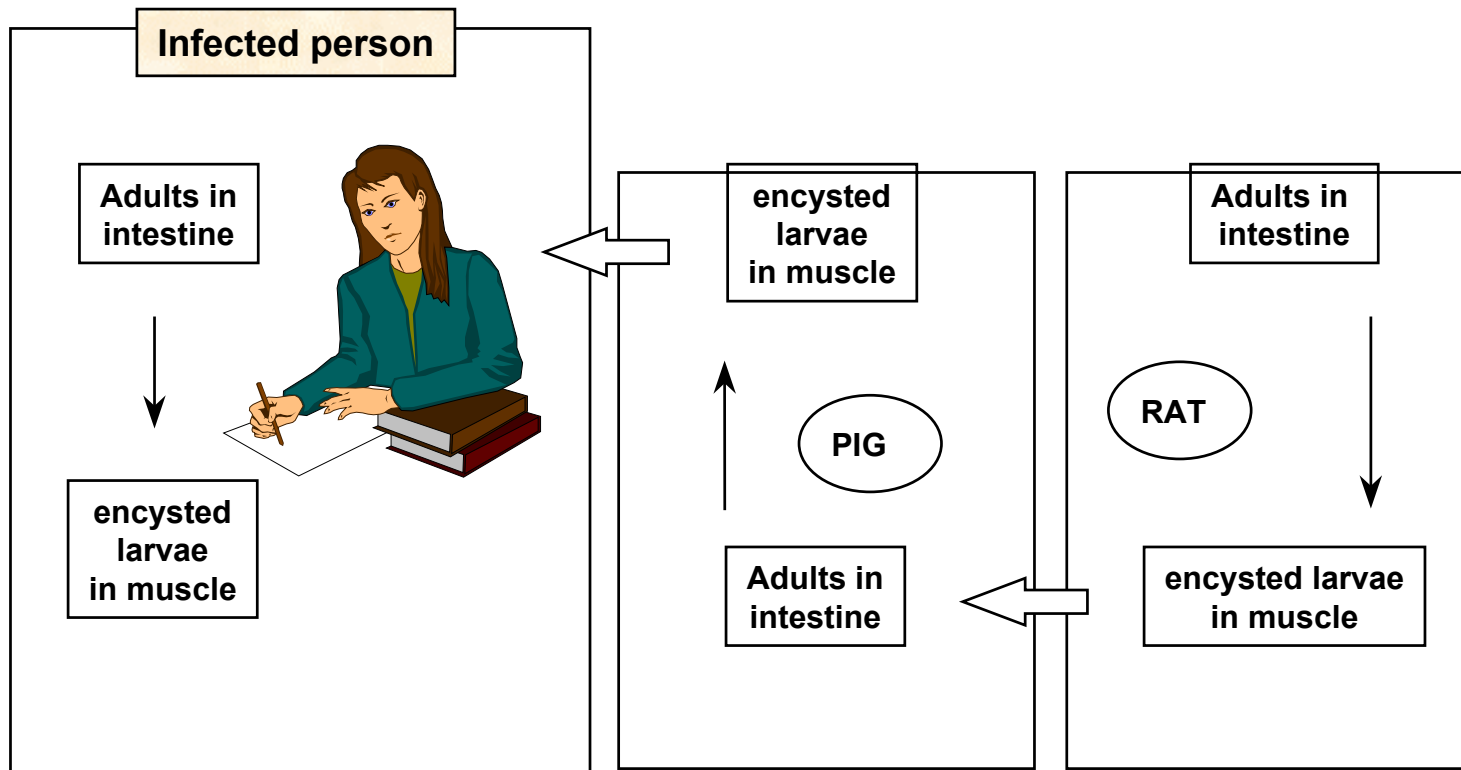
## **Protozoa**

- *Cryptosporidium*
- *Entamoeba histolytica*
- *Giardia*
- *Toxoplasma*

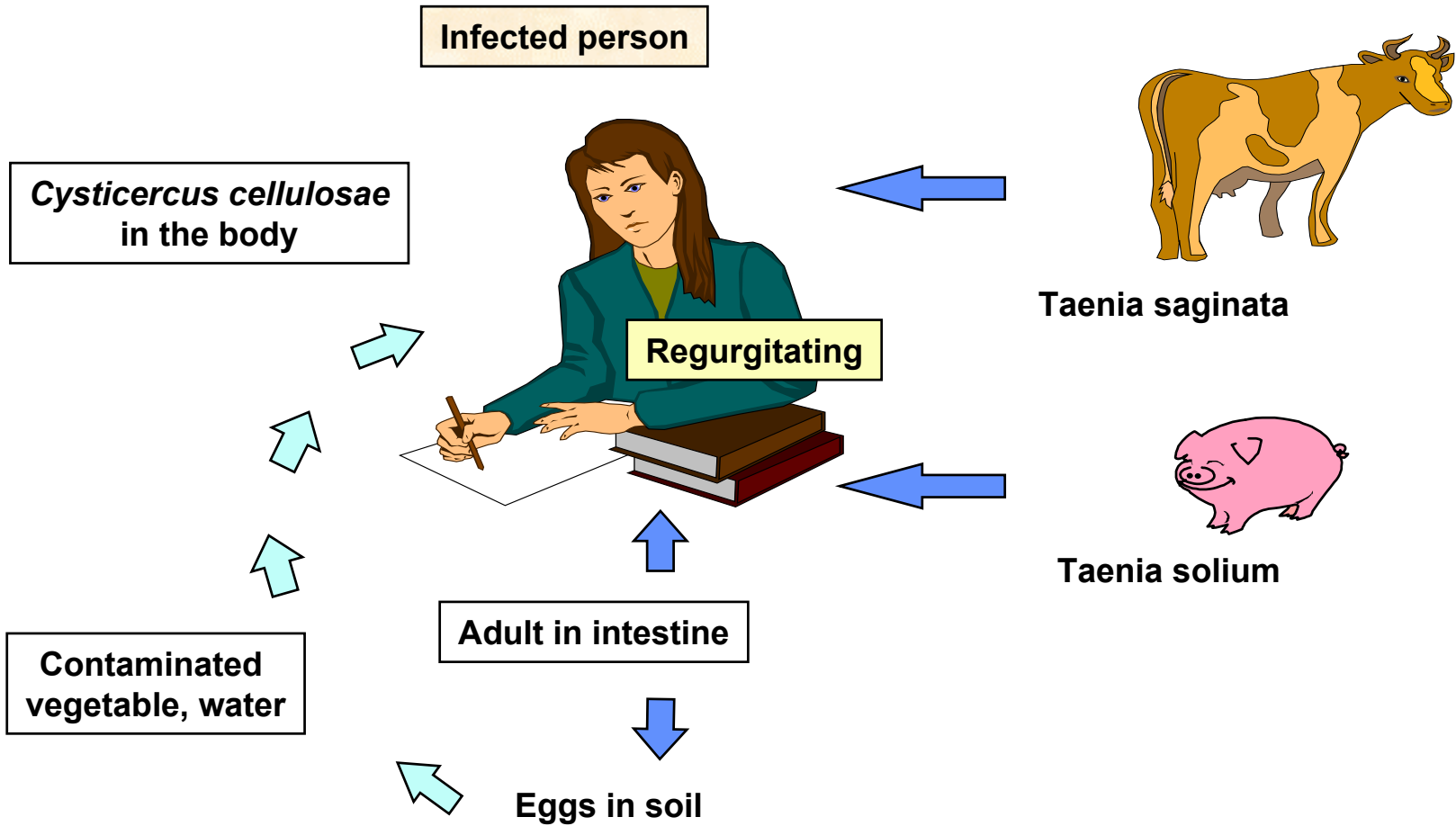
## **Helminths**

- *Angiostrongylus*
- *Anisakis*
- *Ascaris*
- *Capillaria*
- *Gnathostoma*
- *Trichinella*
- *Fasciola*
- *Fasciolopsis*
- *Haplorchis*
- *Opisthorchis*
- *Paragonimus*
- *Cysticercus cellulosae*

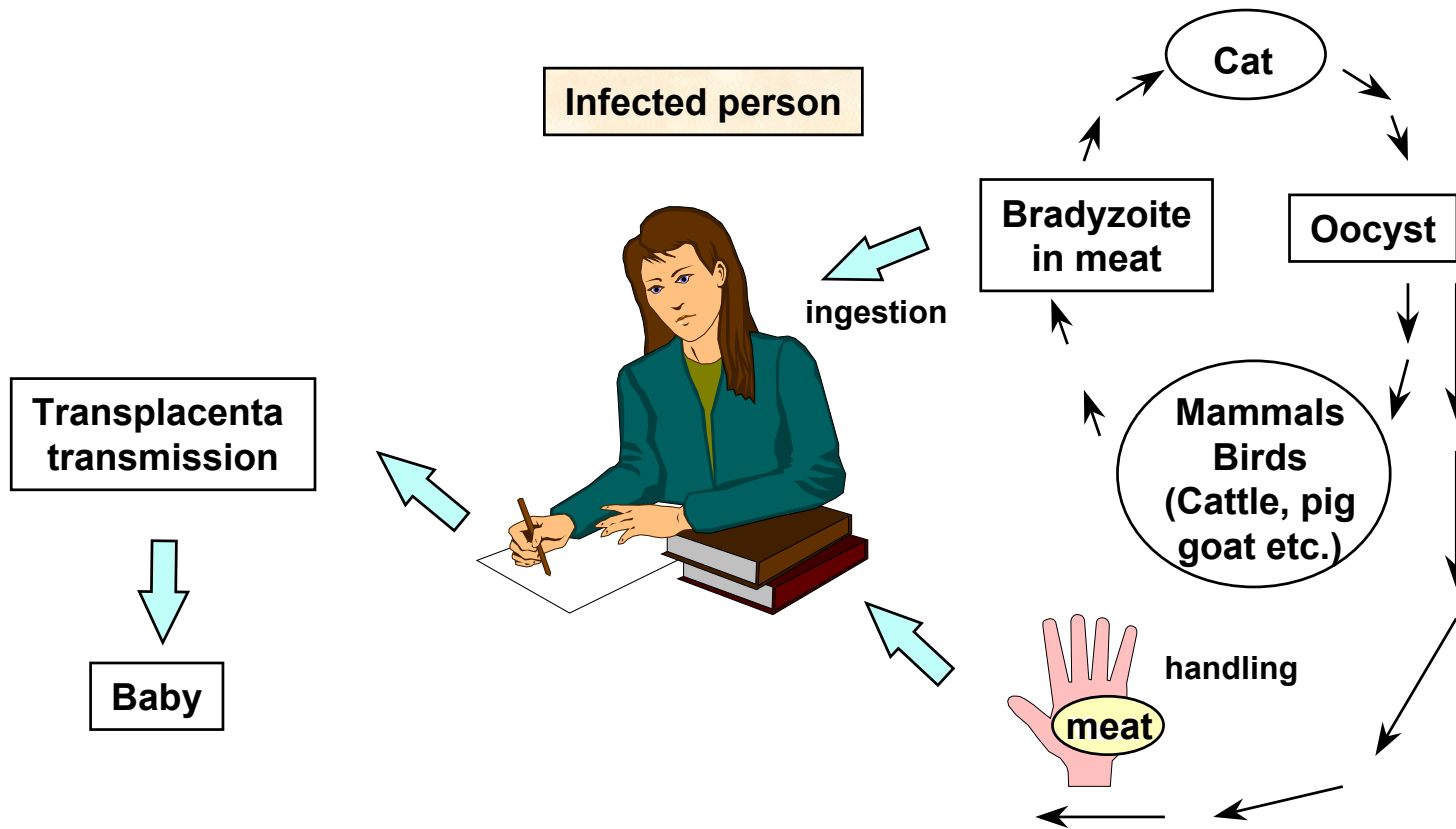
# Transmission of trichinellosis



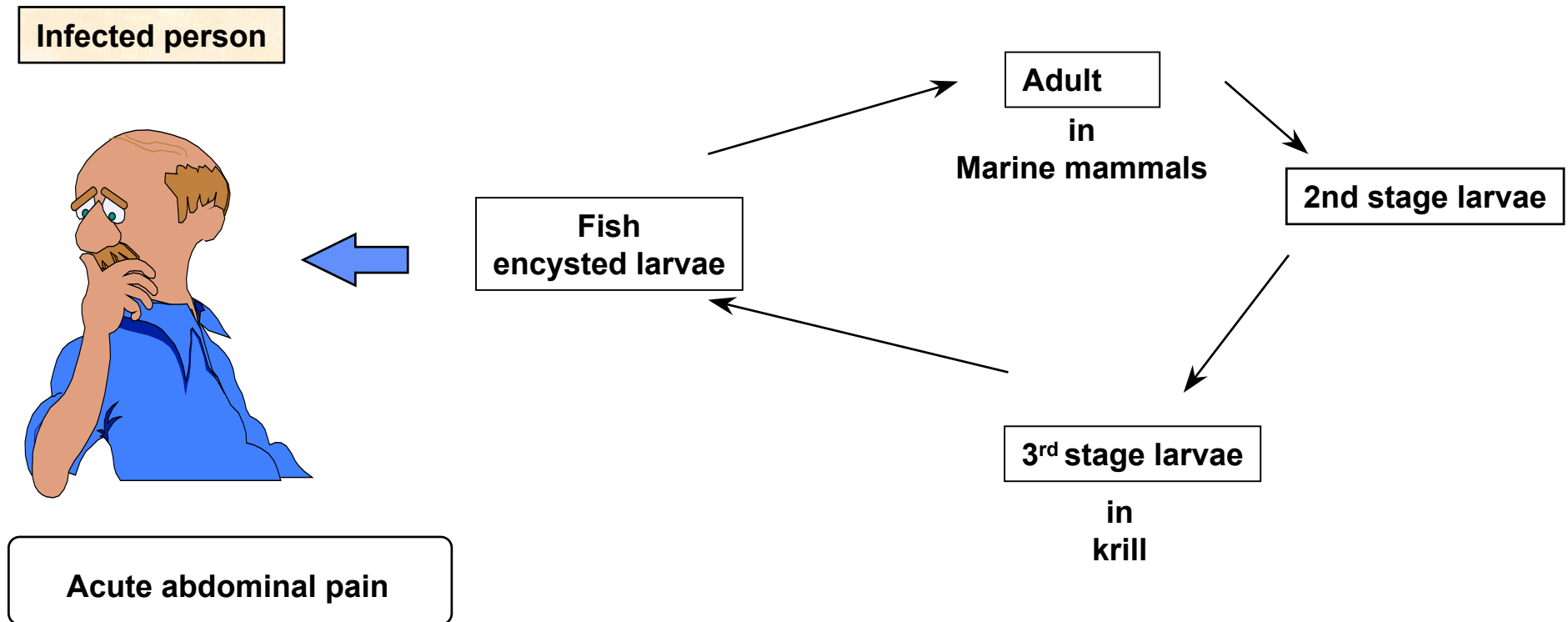
# Transmission of cysticercosis



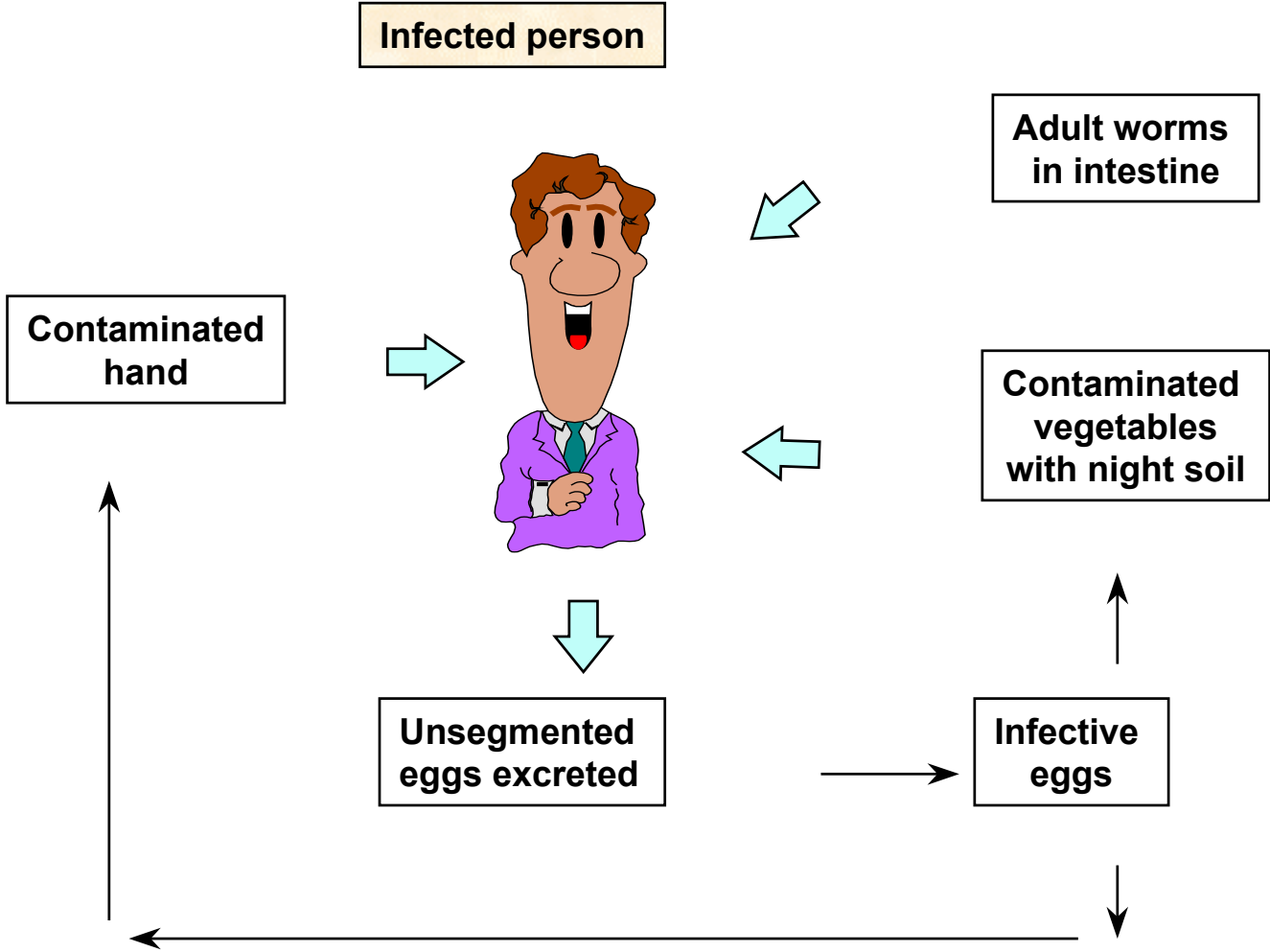
# Transmission of toxoplasmosis



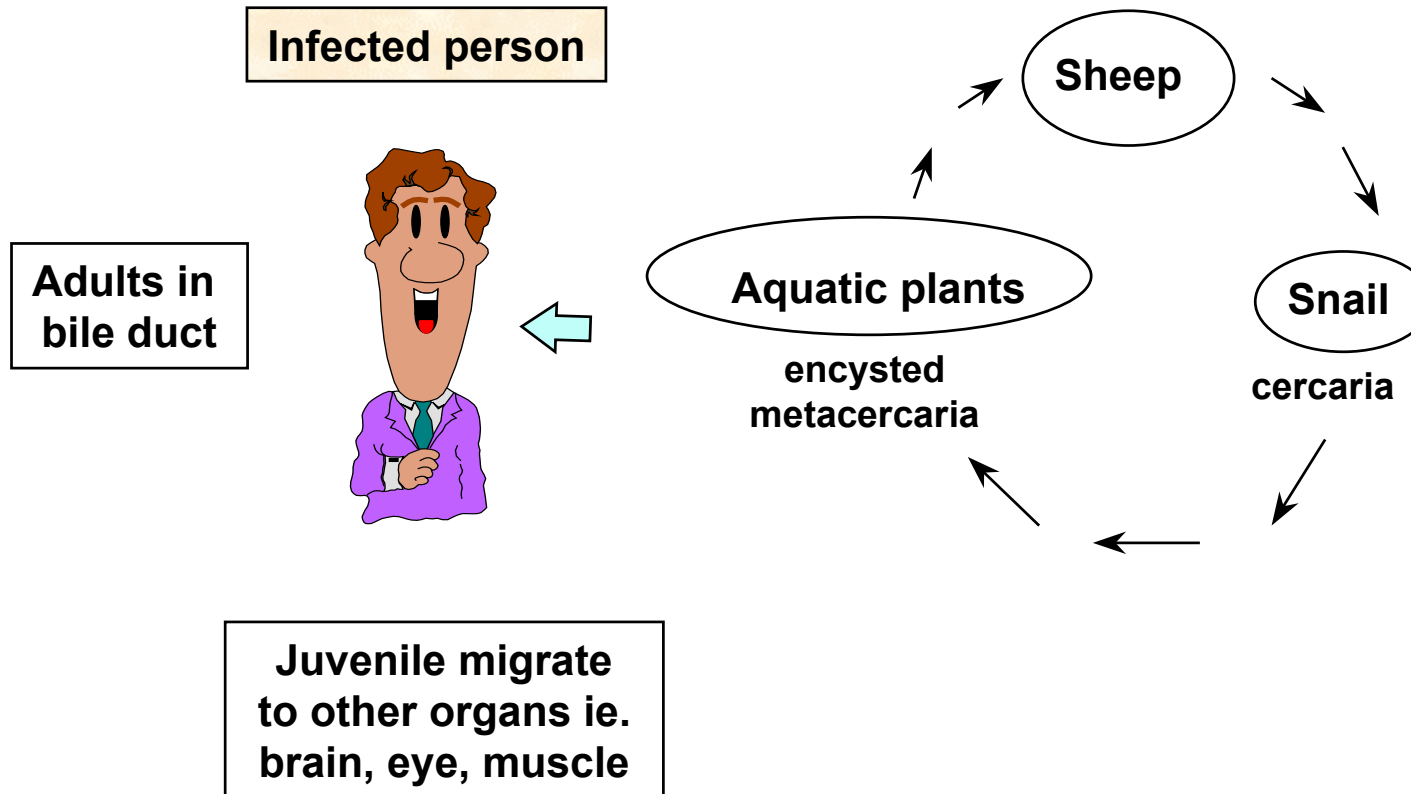
# Transmission of anisakiasis



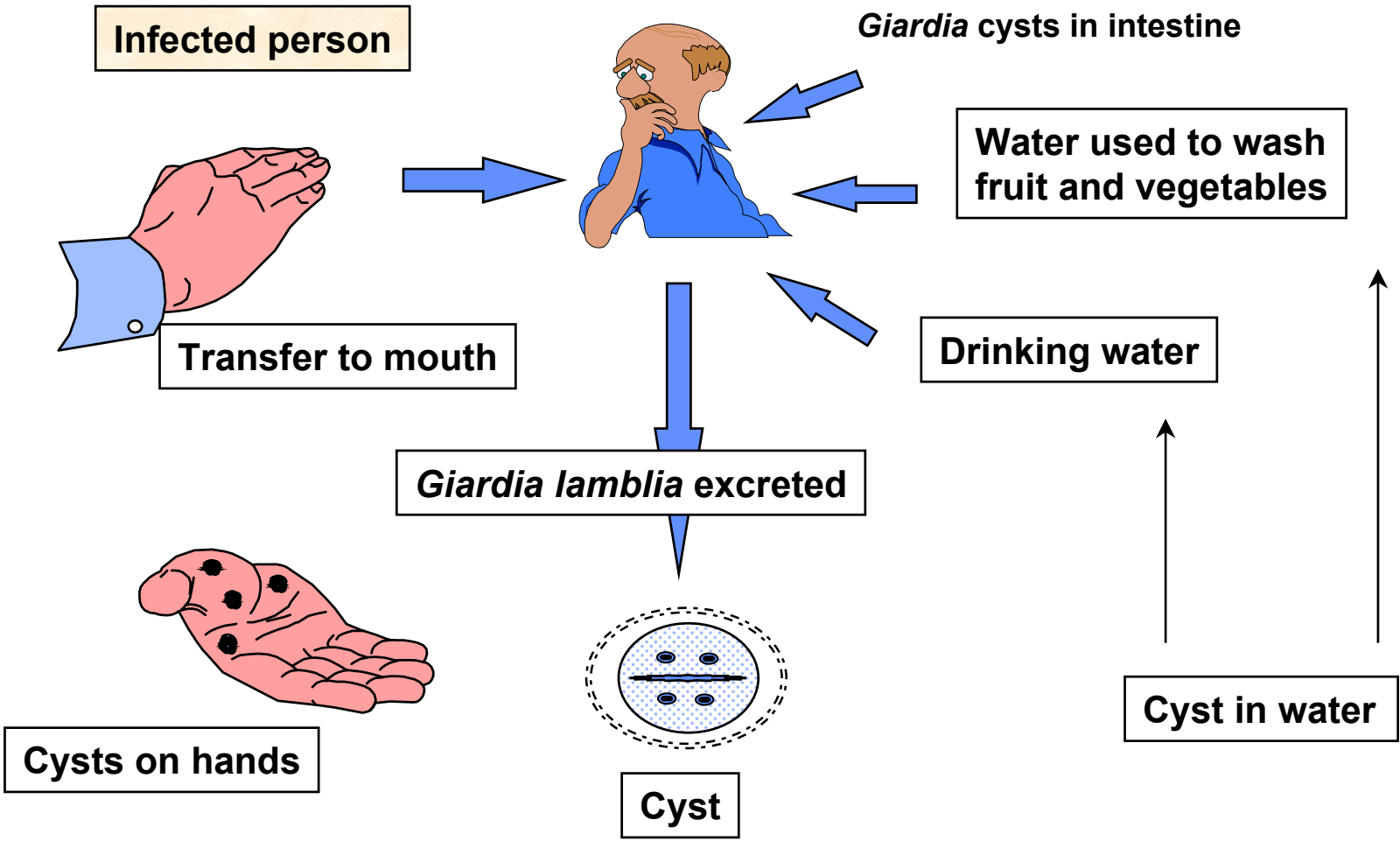
# Transmission of ascariasis



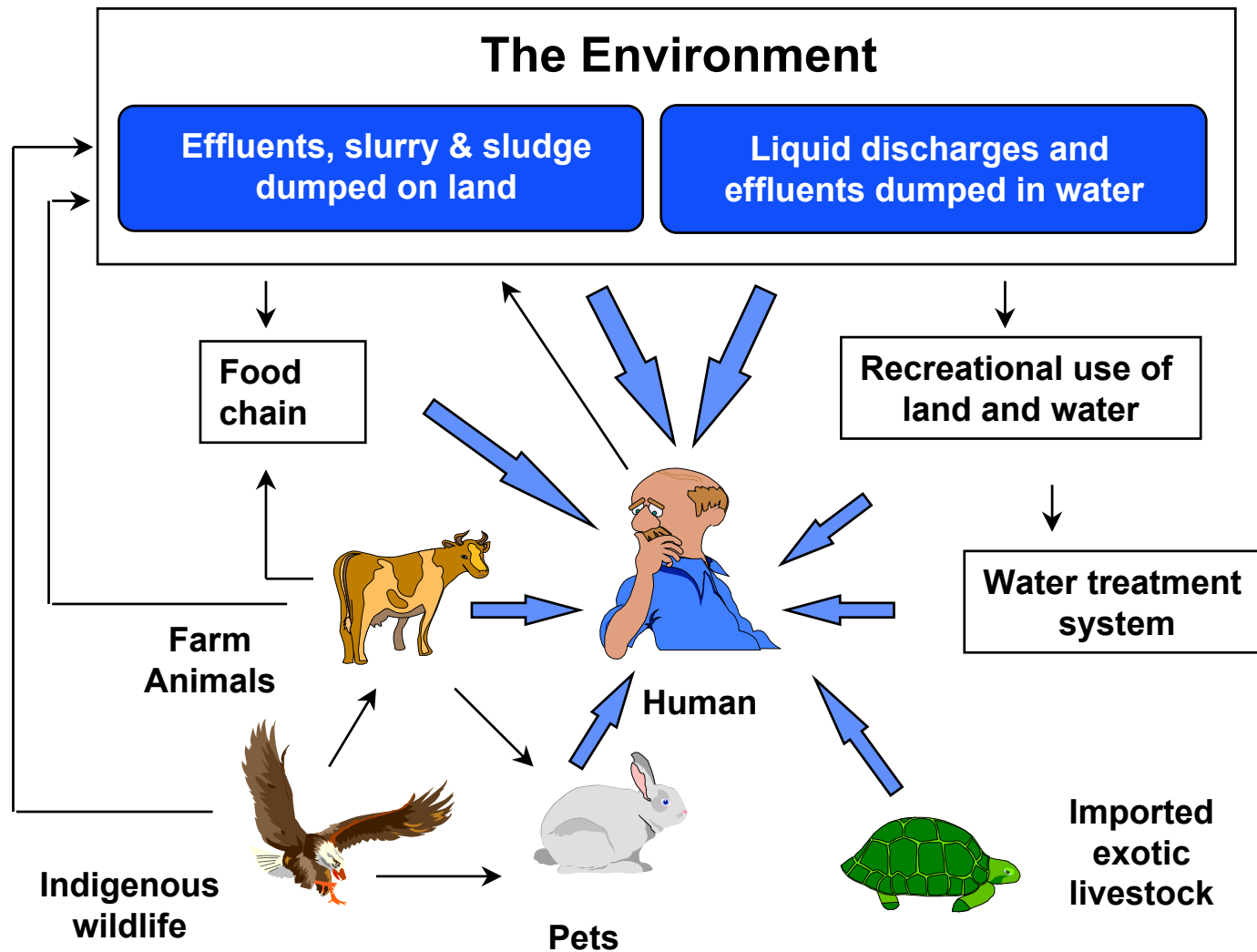
# Transmission of fascioliasis



# Transmission of giardiasis



# Transmission of *cryptosporidium*



# **Nature of bacteria, moulds, viruses and parasites - Key messages (1)**

- foodborne diseases are caused by bacteria, moulds, viruses, and parasites**
- certain microorganisms are of greater significance than others for humans**
- bacteria and moulds multiply on foods and may produce toxins**
- understanding the factors controlling growth of microorganisms allows us to control them in food**

# Nature of bacteria, moulds, viruses and parasites - Key messages (2)

- **bacteria may be harmful *or* useful**
- **bacteria, yeasts and moulds can be used to preserve foods**
- **lactic acid bacteria secrete lactic and other organic acids**
- **organic acids inhibit pathogens in food and in the gut**
- **viruses and parasites do not grow in food**