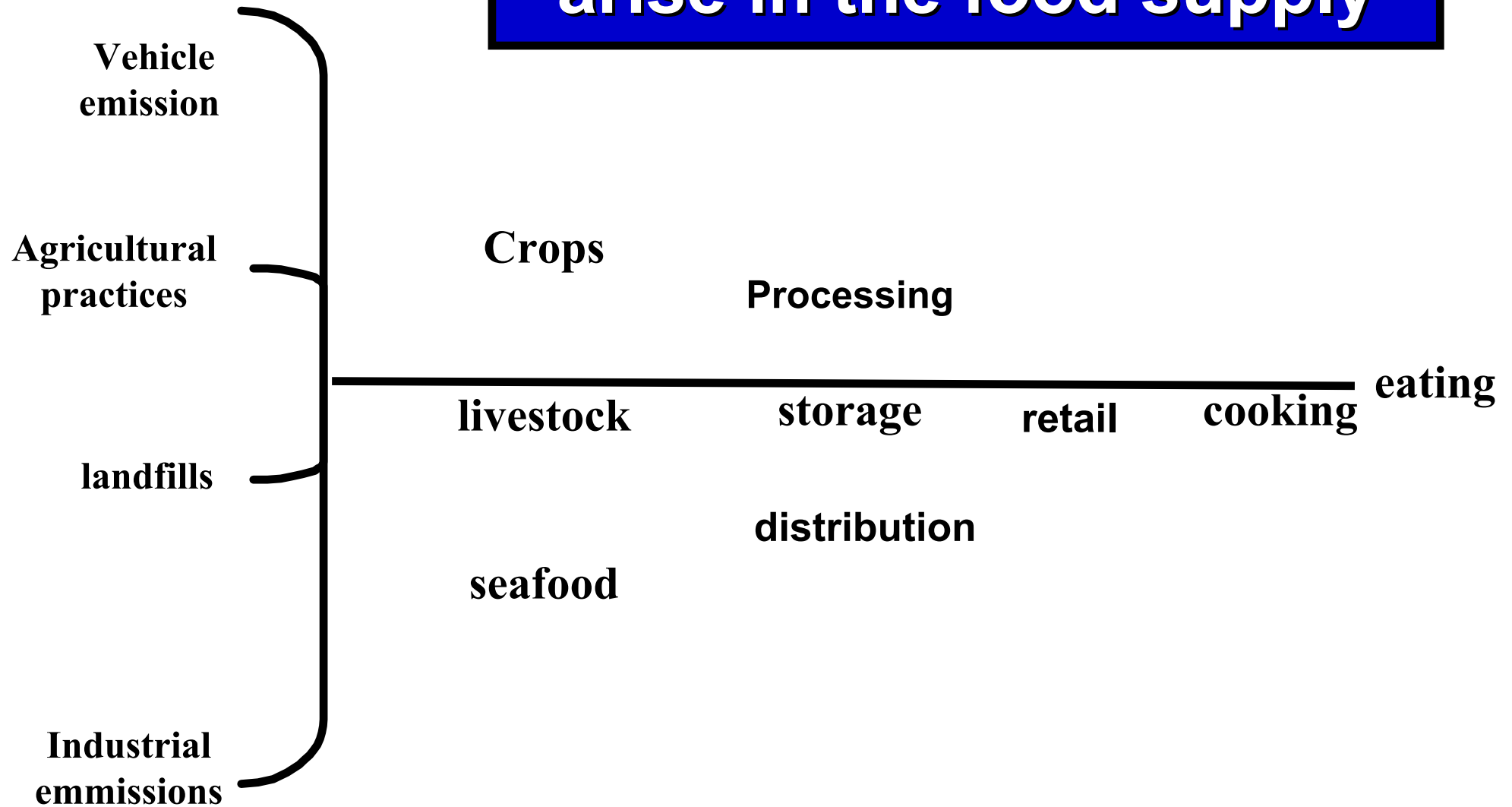


Module 02 - lecture 03

Hazards in raw material

Where hazards arise in the food supply

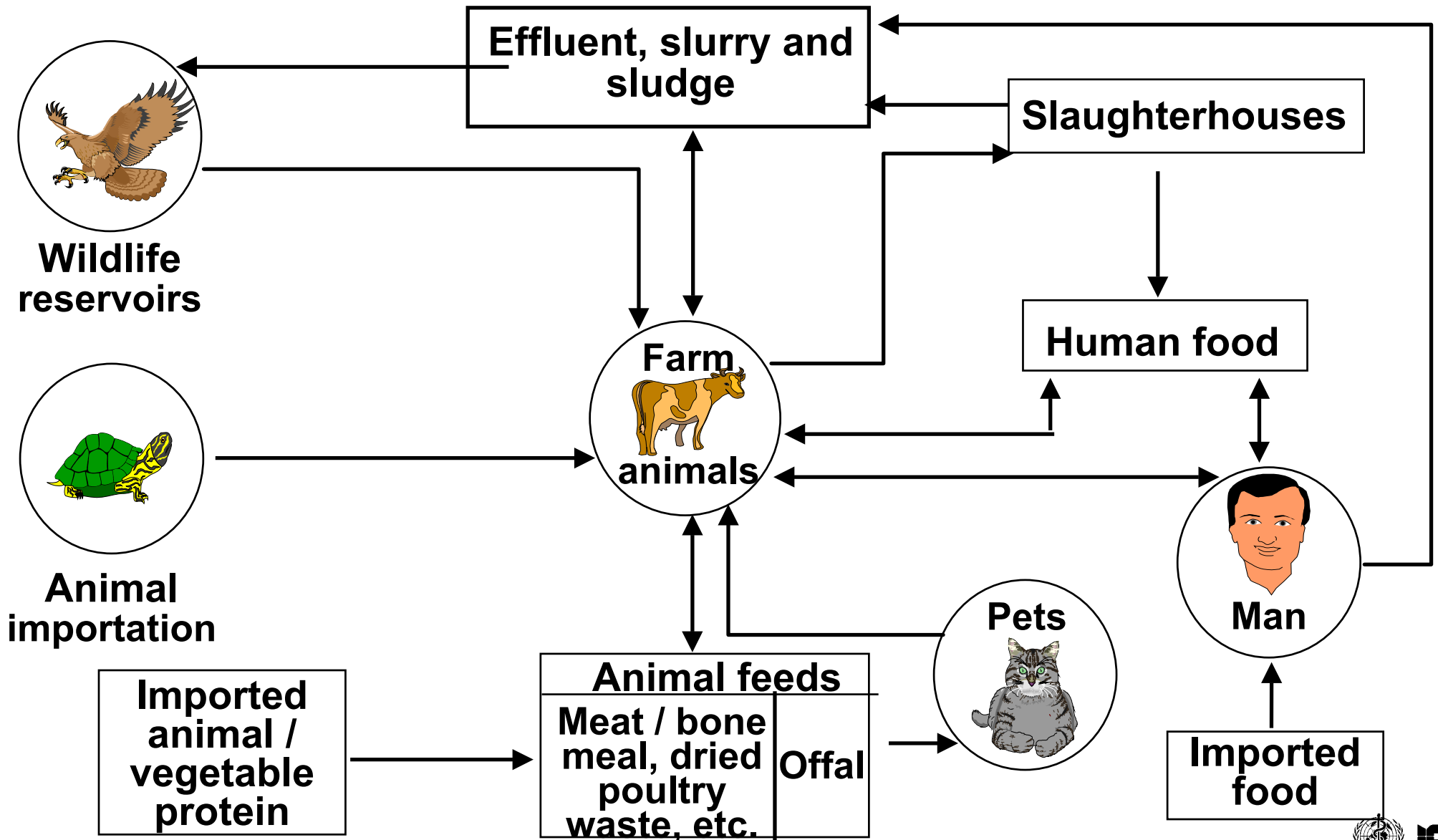


Microbial ecology

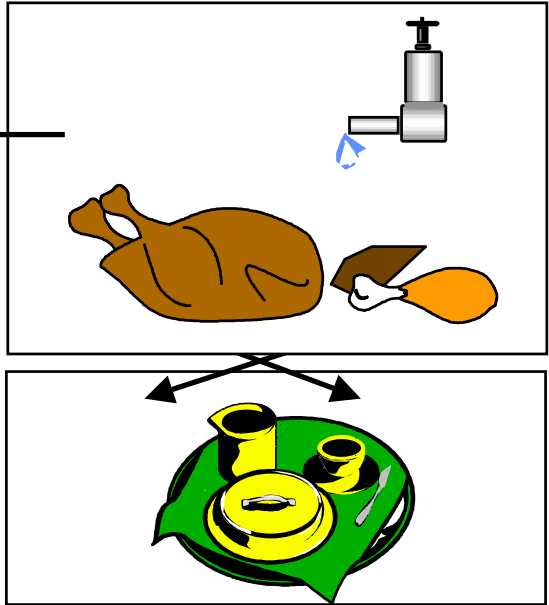
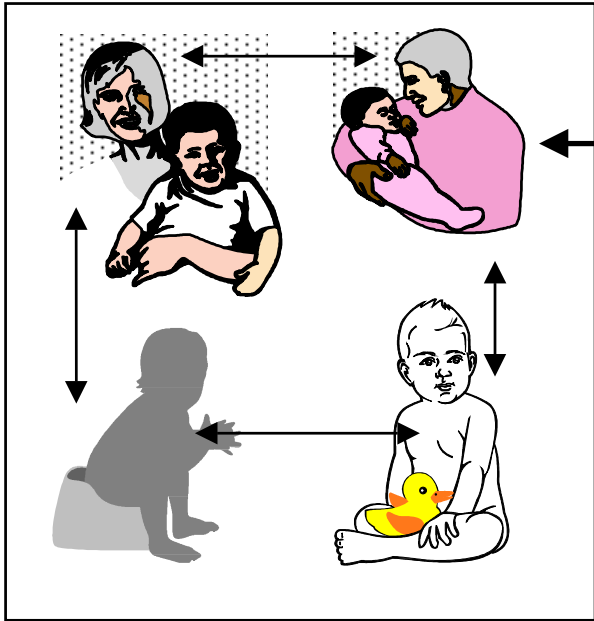
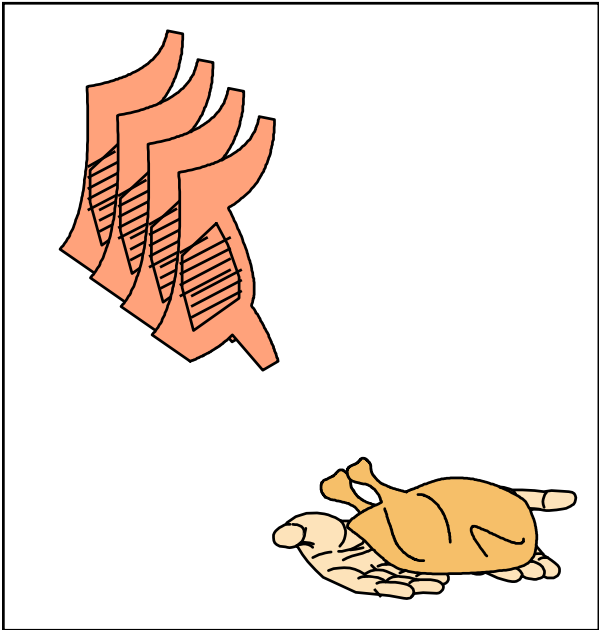
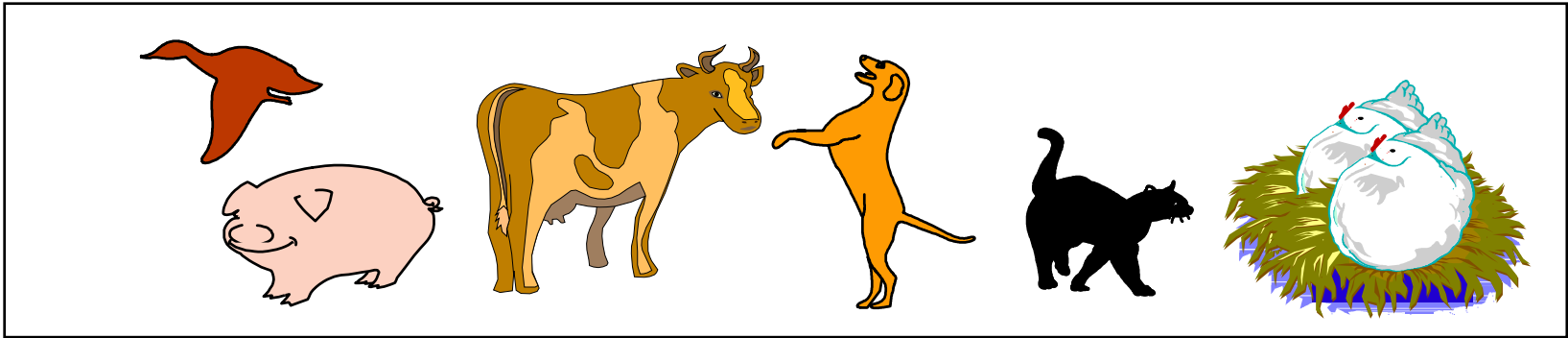
Microbes are everywhere:

- **Air**
- **Water**
- **Food**
- **Soil**
- **Humans**
(e.g. gut, nose, skin)
- **Surfaces**

The *Salmonella* (non typhi) cycle



Transmission of *Campylobacter*



Raw materials will have a normal flora

- **Meat**
- **Poultry**
- **Fish and shellfish**
- **Cereals and pulses**
- **Milk**
- **Egg products**
- **Vegetables, fruits and nuts**
- **Spices**
- **Oils and fats**
- **Water**

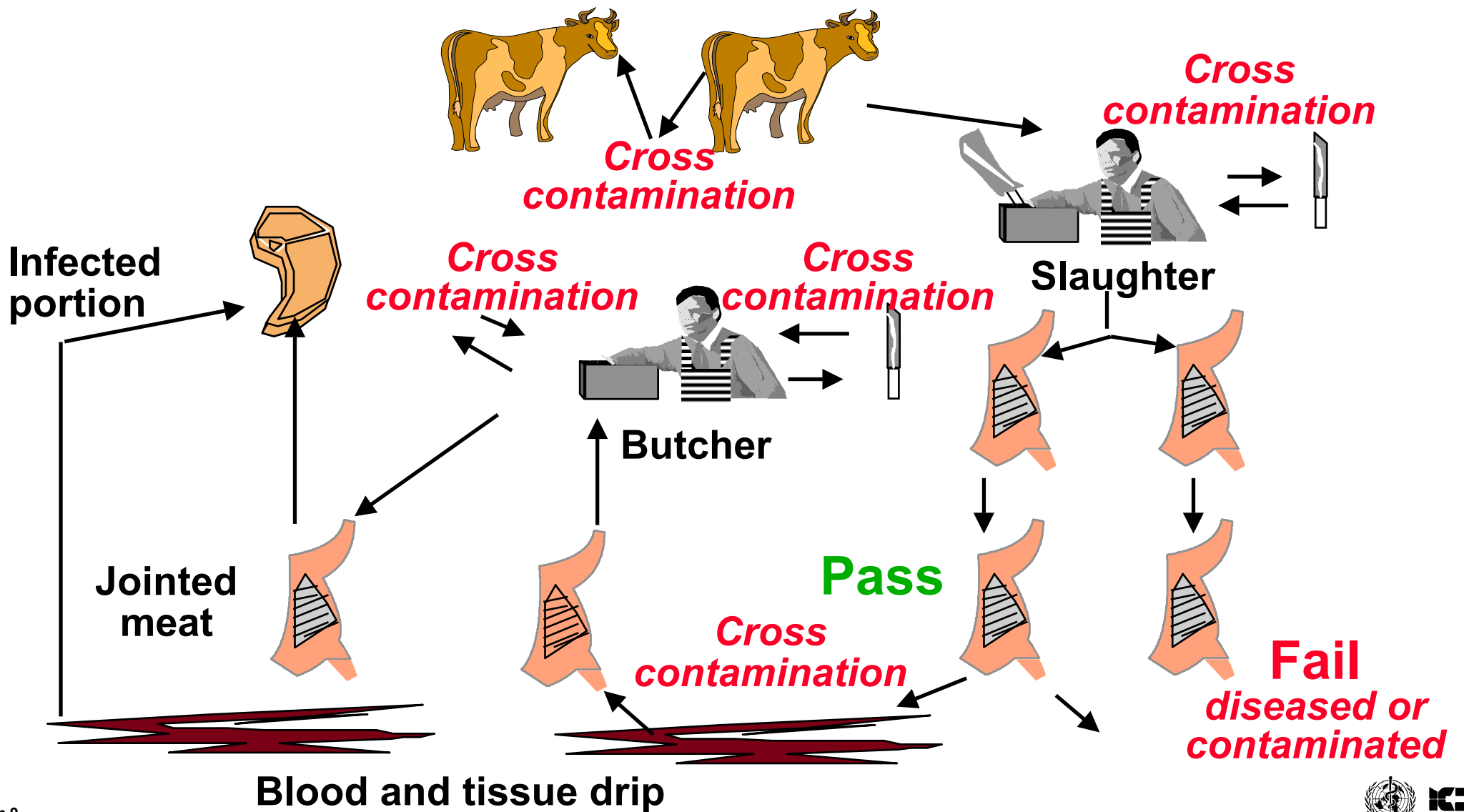
Importance of raw materials

- **Meat and meat products**
- **Poultry and poultry products**
- **Fish and shellfish**
- **Milk**
- **Eggs and egg products**
- **Vegetables, fruits and nuts**
- **Cereals and pulses**
- **Spices**
- **Oils and fats**
- **Water**

Potential hazards in meat and meat products

- ***Salmonella***
- ***Staphylococcus aureus***
- ***Yersinia enterocolitica***
- ***Clostridium perfringens***
- ***Clostridium botulinum***
- **Pathogenic *Escherichia coli***
- ***Listeria monocytogenes***
- **Parasites**

The contamination chain for meat



Hazards in milk

- *Mycobacterium*
- *Brucella*
- *Salmonella*
- *L. monocytogenes*
- *E. coli*
- *S. aureus*
- *Bacillus*
- *Clostridium*
- *Campylobacter*

Hazards in poultry and poultry products

- *Salmonella*
- *Campylobacter*
- *C. perfringens*
- *S. aureus*
- *Y. enterocolitica*
- *L. monocytogenes*

Hazards in eggs and egg products

Salmonella !

Hazards in fish and shellfish

Bacteria

- ◆ *Clostridium botulinum* type E
- ◆ *Vibrio parahaemolyticus*
- ◆ *Vibrio vulnificus*
- ◆ *Vibrio cholerae*
- ◆ *Listeria monocytogenes*

Parasites

Viruses

- ◆ *Hepatitis A virus*
- ◆ *Norwalk virus*

Hazards in vegetables, fruits and nuts

Bacteria

- ◆ *Salmonella*
- ◆ *Shigella*
- ◆ *Vibrio cholerae*
- ◆ *Listeria monocytogenes*
- ◆ *Enterotoxigenic E. coli*
- ◆ *Clostridium botulinum*

Hepatitis A and other enteric viruses

Parasites

Moulds

Hazards in spices

- *C. perfringens*
- *B. cereus*
- *Salmonella*
- Moulds

Hazards in cereals

- **Moulds**
- ***Salmonella***
- ***B. cereus***

Hazards in oils and fats

- **Toxic adulterants**
- **Chemical contaminants**

Ecology of foodborne pathogens

Key messages

Some originate from animals

- *Salmonella*
- *Campylobacter*
- *E. coli*

Some come from plants and soil

- Moulds
- *B. cereus*
- *C. botulinum*

Some originate in the sea

- *V. parahaemolyticus*
- *C. botulinum* Type E
- *V. cholerae*

Some originate from man

- Viruses
- *S. typhi*
- *S. aureus*
- *Shigella*

Mycotoxins

<i>Mycotoxin</i>	<i>Source</i>	<i>Associated Food</i>
Aflatoxins	<i>Aspergillus flavus</i> and <i>A. parasiticus</i>	Corn, peanuts, tree nuts, milk
Trichothecenes	Mainly <i>Fusarium</i>	Cereals and other foods
Ochratoxin A	<i>Penicillium verrucosum</i> <i>A. ochraceus</i>	Wheat, barley, corn
Ergot alkaloids	<i>Claviceps purpurea</i>	Rye, barley, wheat
Fumonisin	<i>Fusarium moniliforme</i>	Corn
Patulin	<i>P. expansum</i>	Apples, pears
Zearalenone	<i>Fusarium</i> spp.	Cereals, oil, starch

Inherent plant food toxicants

Toxicant

Oxalates

Glycoalkaloids

Cyanoglycosides

Phytohaemagglutinin

Various carcinogens

Associated Food

Rhubarb, tea, cocoa, spinach, beet

Green potato

Lima bean, cassava

Red kidney beans and other beans

Spices and herbs

Physical hazards in foods

- **Bone particles**
- **Stones**
- **Insect fragments**
- **Metal**
- **Meat, Poultry, Fish**
- **Dried fruits**
- **Cereals**
- **Mechanically harvested materials**

Key messages

- **Raw materials -- ingredients, packaging material, water -- may be sources of hazards**
- **Knowledge concerning the likelihood of the presence of hazards in raw materials is the basis of any HACCP system**
- **This knowledge is used to identify potential hazards and decide whether they need to be controlled**