Dasar Pengolahan Pangan Hasil Ternak

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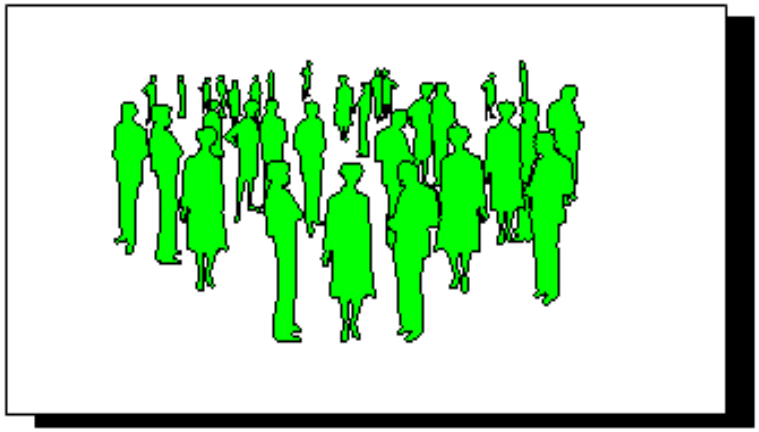
Kandungan nutrisi susu (g/100g) (Wong et al., 1988)

	Cow	Dairy Sheep	Water Buffalo	Goat
Fat	3.9	7.2	7.4	4.5
Total Protein	3.3	4.6	3.8	3.2
Casein	2.6	3.9	3.2	2.6
Whey	0.7	0.7	0.6	0.6
Lactose	4.6	4.8	4.8	4.3
Ash	0.7	0.9	0.8	0.8
Total solids	12.5	17.5	16.83	12.8

Microorganisms are very small



World population is

5.5 BILLION

i.e. 5 500 000 000

1 cup

of yoghurt contains

22 *X* this number!

i.e. 120 000 000 000

separate living

organisms.

Microorganisms classified by their significance

- Pathogenic organisms
- Spoilage organisms
- Useful organisms

Spoilage microorganisms

- **Bacteria**
- **Yeasts**
- **Moulds**

Kerusakan Susu Segar dan Olahan

Sources of Food
Contamination e.g RAW MILK

Sumber Kontaminasi Susu Segar

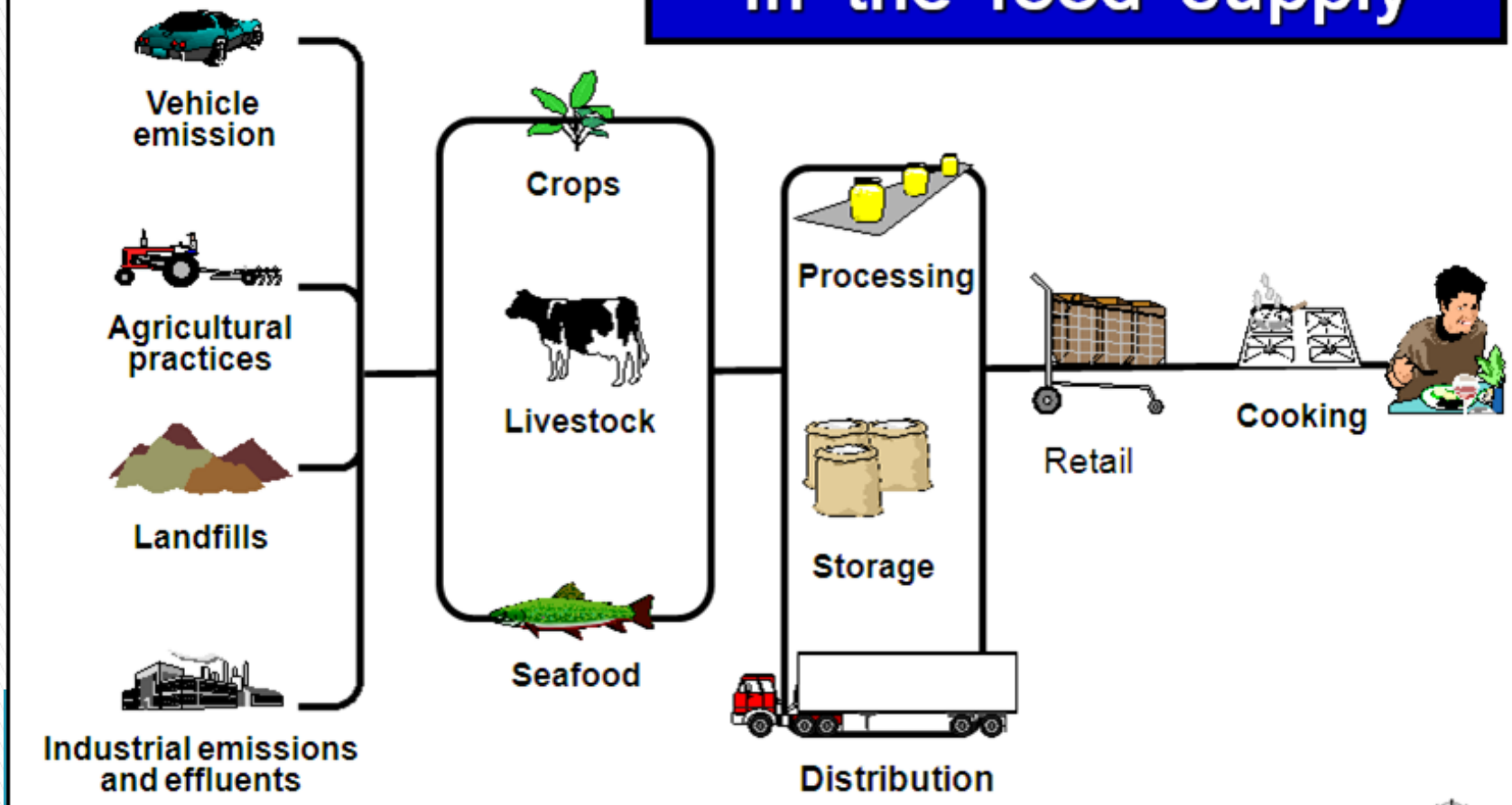
Contamination from diseased udder

- ***Brucella abortus***
- ***Mycobacterium bovis***
- ***Pyogenic streptococci***
- ***Corynebacterium diptheriae***
- ***Bacillus anthracis***
- ***Listeria monocytogenes***
- ***Staphylococcus aureus***
- ***Escherichia coli***
- ***rickettsia Coxiella burnetii***

Contamination from equipment

- unsterile milking utensils
  major source of bacteria in milk
- 80-90% of all high counts traced back to this source.
- Streptococci
- Enterobacteria
- Psychrotrophs
- *Bacillus* spp.
- Thermoduric

Where hazards arise in the food supply



Dangerous microorganisms

Foodborne diseases

- **Bacteria**
- **Moulds**
- **Viruses**
- **Parasites**

Major viruses causing foodborne disease

- Hepatitis A and E viruses
- Small round structured viruses (e.g. Norwalk agent)
- Rotavirus
- Polio virus

Some toxigenic moulds causing foodborne disease

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

(Main sources - fruits, nuts and grains)

Major parasites causing foodborne disease

- *Anisakis*
- *Ascaris*
- *Clonorchis sinensis*
- *Cryptosporidium*
- *Cyclospora cayetanensis*
- *Diphyllobothrium*
- *Echinococcus*
- *Entamoeba histolytica*
- *Fasciola hepatica*
- *Giardia*
- *Opisthorchis felineus*
- *Opisthorchis viverrini*
- *Sarcosporidium*
- *Taenia*
- *Toxoplasma*
- *Trichinella*

Food borne disease

- any disease caused or transmitted by food

Food borne Intoxication

- ingestion of a pre-formed toxin

Food borne Infection

- ingestion of live organisms which subsequently invade the host

MICROBIAL "FOOD POISONING"

Two major types

1. Foodborne intoxications.

   The microorganisms makes a toxin in the food, and then the toxin is consumed.

2. Foodborne infections.

   The causative microorganisms are ingested and then grow within the body and cause damage.

Foodborne intoxications

- viable cells may not be present
- quicker onset time (if preformed toxin)
- often short duration (unless toxin produced in body)
- no fever (usually)

What is a toxin ?

A poison found in some animals and plants and microorganisms

Botulinum toxin is formed when *C. botulinum grows* - it is a PROTEIN

Approximately 500g is enough to kill the human race !

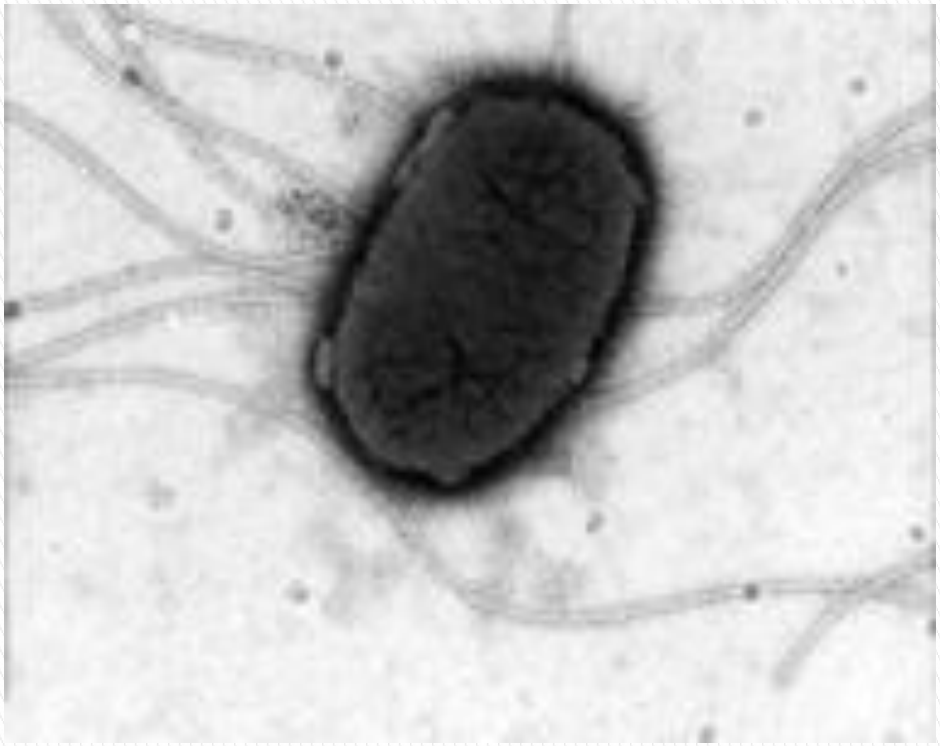
Toxins

- exotoxin = extracellular protein toxin
- endotoxin = lipid A portion of Gram-negative outer membrane.
- enterotoxin = toxin that acts on gastrointestinal tract, producing typical food poisoning symptoms

Foodborne infections

- viable cells consumed
- relatively long onset time for symptoms
- relatively long duration
- fever a common symptom (body's response)

Salmonella



- Penyebab utama penyakit terbawa pangan
- Identifikasi berbasis serologi ada 2400 serovars
- *S. enteritica* ada 7 subspesies dengan subspesies I penyebab utama penyakit (*Enteritidis, Typhimurium, Choleraesuis, Dublin, Gallinarum, Pullonarum*)

Salmonella

2200 different serotypes

200 of which cause foodborne disease in Europe in any one year

70% cases caused by *S. enteritidis* and *S. typhimurium*

Serotypes split into subtypes called *phage-types* (PT)

Salmonella

Gram negative motile rods, facultative anaerobe,

2400 serotypes

e.g S. typhimurium; enteriditis, typhi

Infective dose: 1 - 10^6 type host/Salmonella

Sources: widespread occurrence intestinal tract of animals (poultry, cattle, swine, insects, pests)

polluted water

soil

Raw food materials likely to be contaminated by *Salmonella*

- Poultry
- Meat
- Milk
- Eggs
- Vegetables
- Shellfish
- Spices and herbs
- Untreated water

Shigella

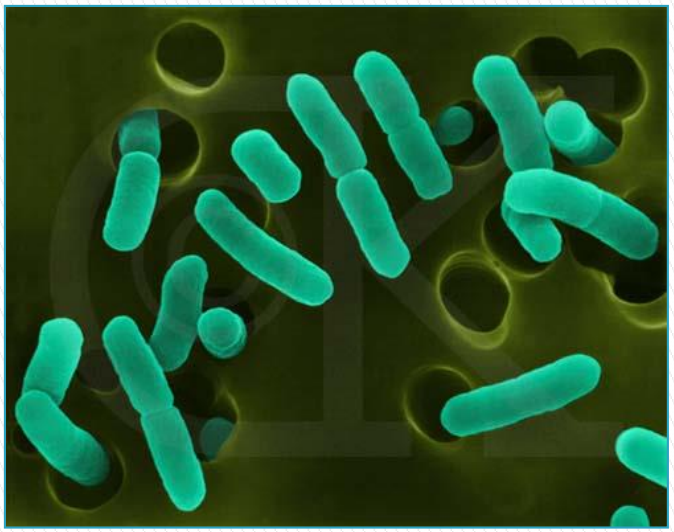
- *S. flexneri,*
  S. boydii,
  S. sonnei,
  S. dysenteriae
  - bacillary dysentery
  - shigellosis
    - bloody feces
    - intestinal pain

- *Shigellosis*
- Within 2-3 days
- Epithelial cell damage
- Man only "reservoir"
- Mostly observed on young children
- Transmitted by adult food handlers (unwashed hands, etc)

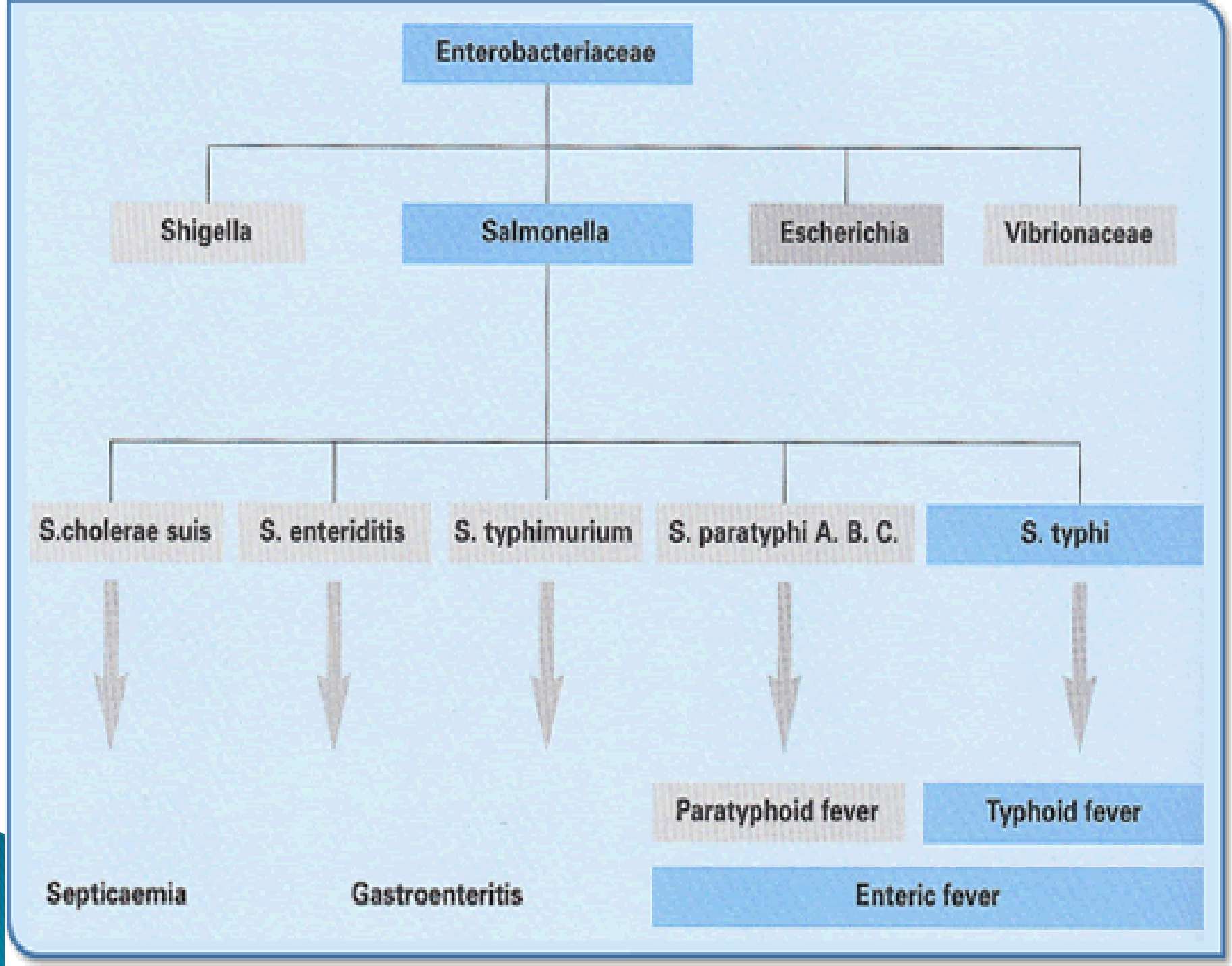
Eschericia coli

- *E. coli and Shigella*

1. Genetically indistiguishable
2. Many similarities in diseases



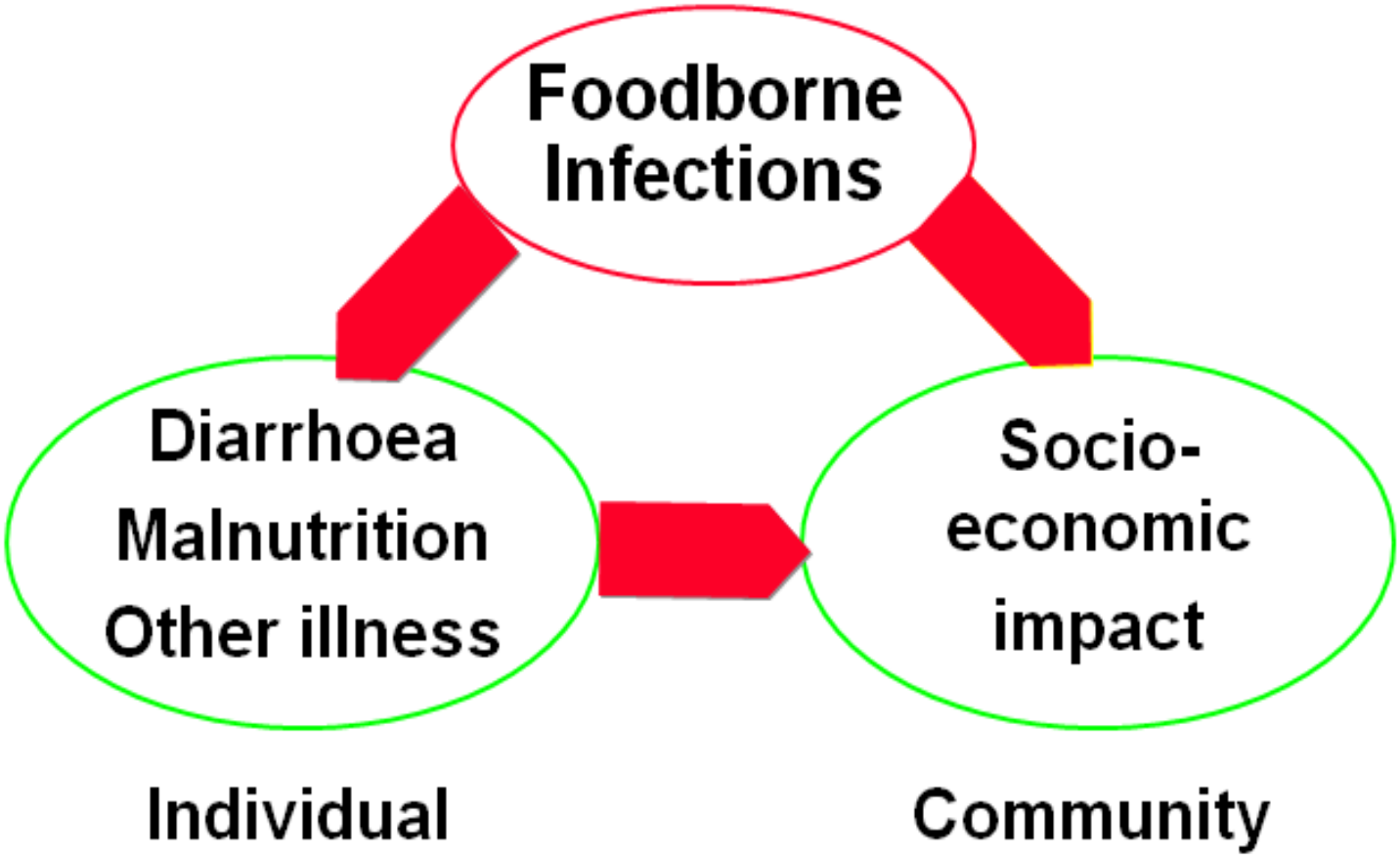
1. Enteropathogenic *E. coli* (EPEC)
1. Enterotoxigenic *E. coli* (ETEC)
1. Enteroinvasive *E. coli* (EIEC)
1. Enterohemorragic *E. coli* (EHEC)


Enterobacteriaceae
Shigella
Salmonella
Escherichia
Vibrionaceae
S.cholerae suis
S. enteriditis
S. typhimurium
S. paratyphi A. B. C.
S. typhi
Paratyphoid fever
Typhoid fever
Septicaemia
Gastroenteritis
Enteric fever

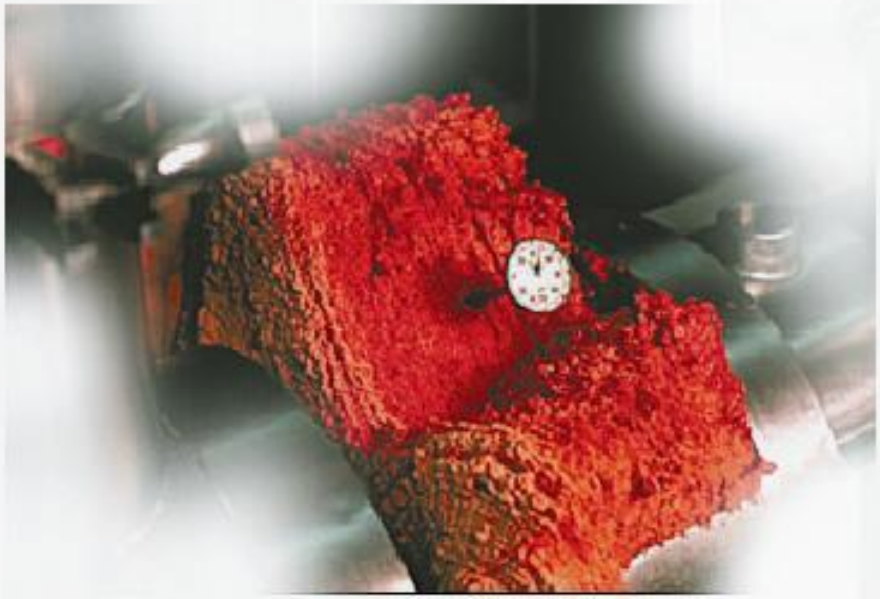
Mycotoxins

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

Consequences of foodborne infections



To Put Things in Perspective

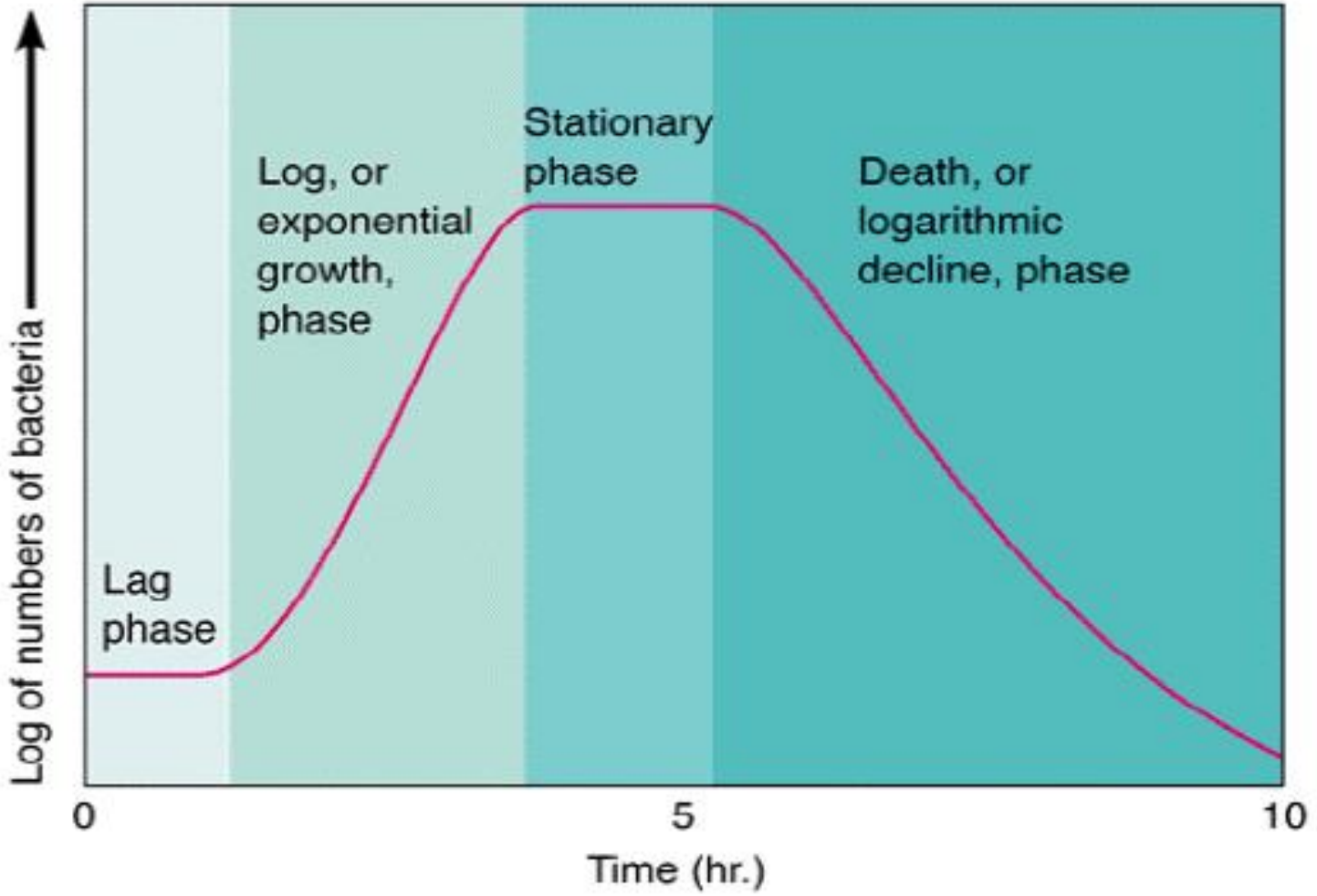


- Microbial pathogens in food cause an estimated 76 million cases of human illness annually in the United States
- 325,000 hospitalized
- 5,000 deaths

Penanganan Bahan Pangan

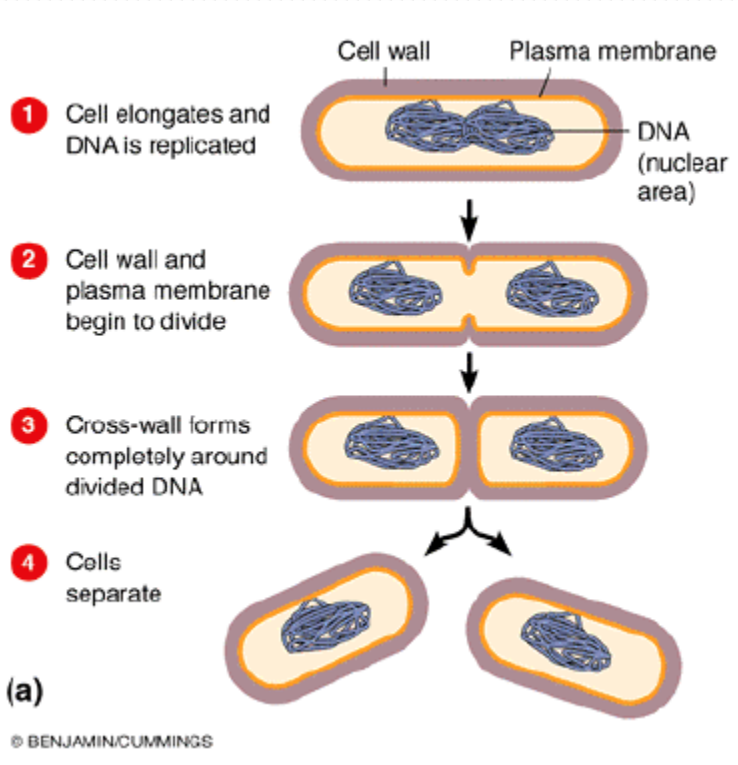
- Pendinginan (penyimpanan suhu kulkas)
- Pemanasan (susu UHT, susu Sterilisasi)
- Pengasaman/fermentasi (yoghurt, susu asam, yakult, kefir, keju)
- Pengeringan (susu bubuk)
- Pemanisan (susu kental manis)

Empat (4) Phase Pertumbuhan Bakteri

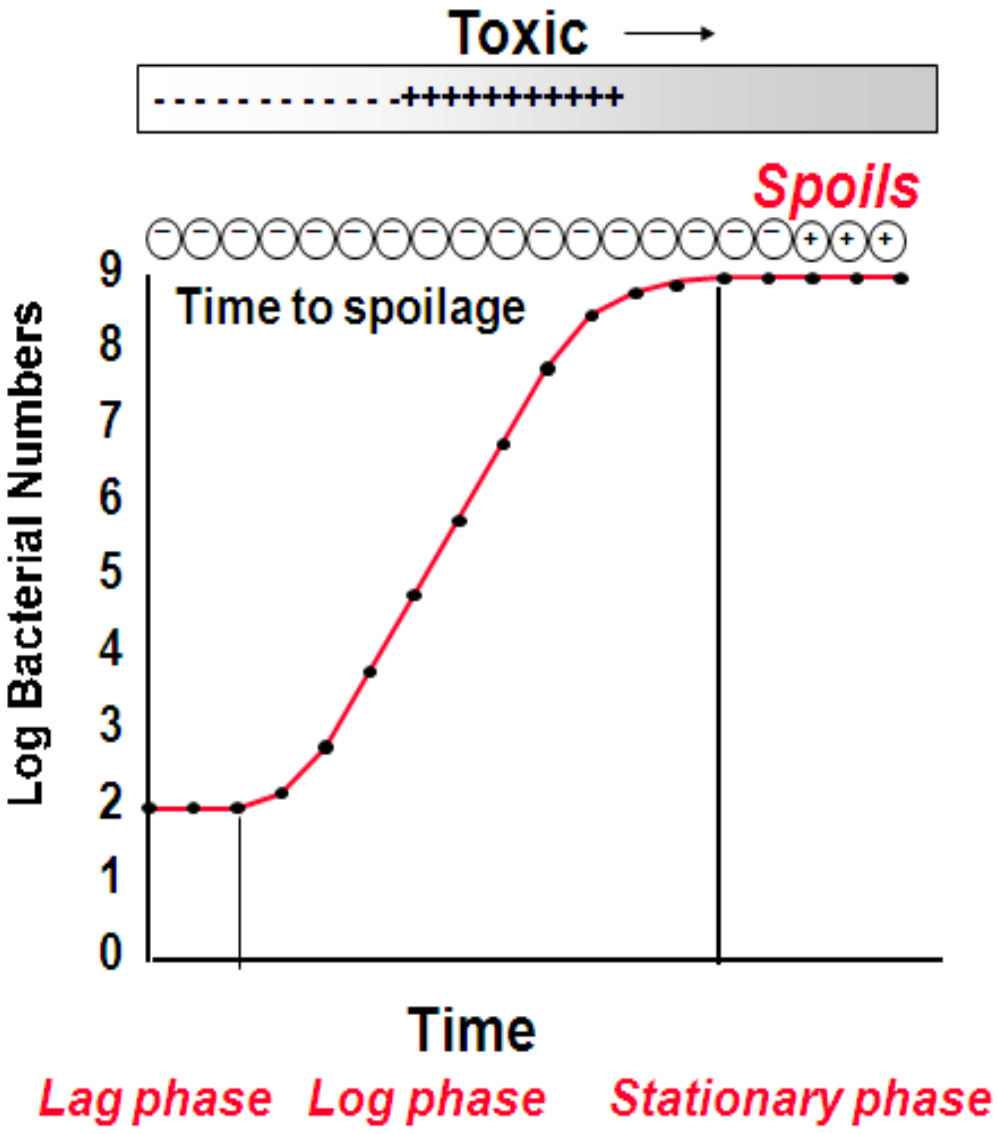


Pertumbuhan Bakteri

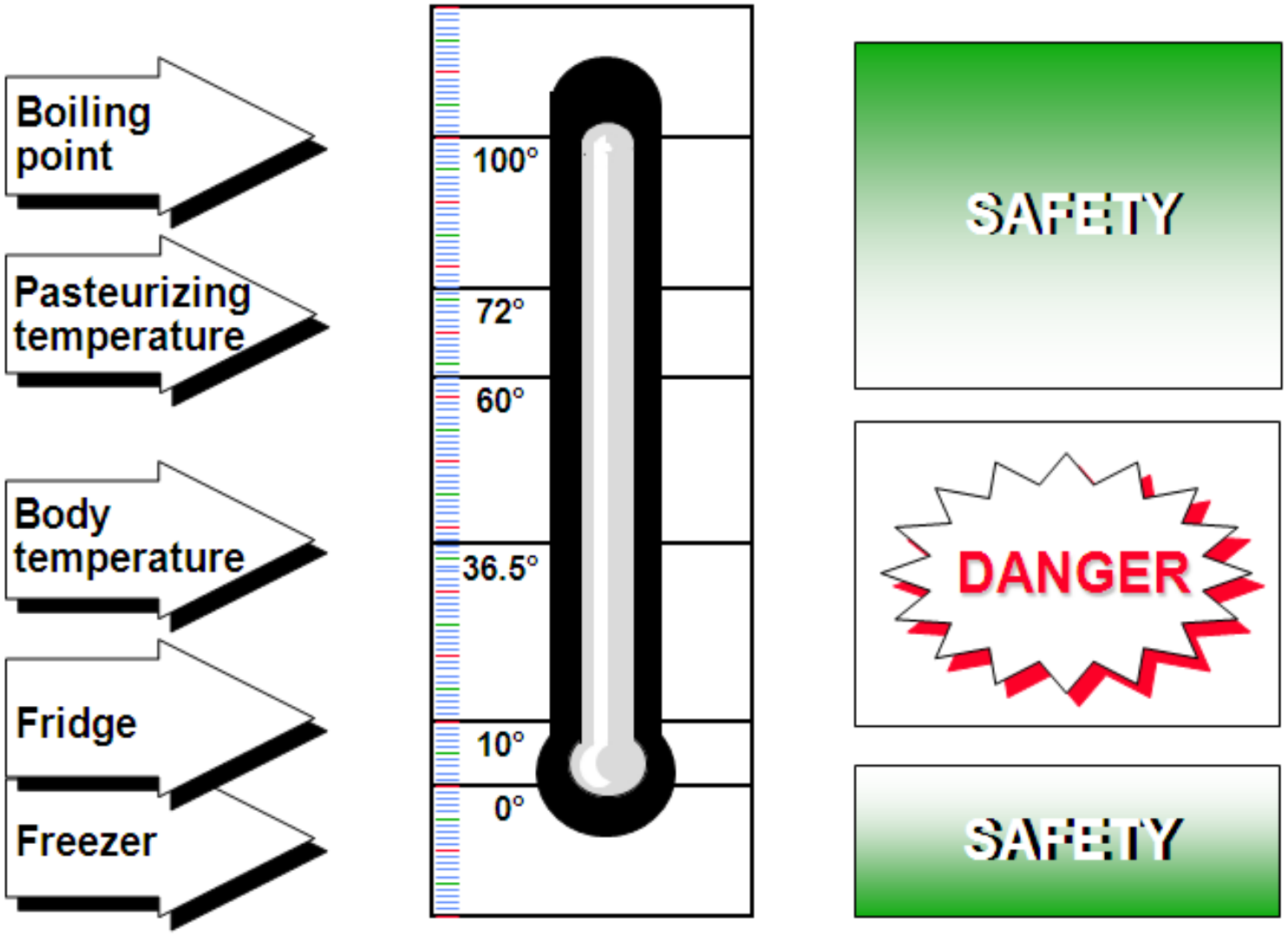
- Lebih mengacu pada Jumlah Sel bukan Ukuran Sel
- Bakteri tumbuh dan membelah dengan *binary fission* (pembelahan menjadi dua bagian) dan merupakan proses yang simpel



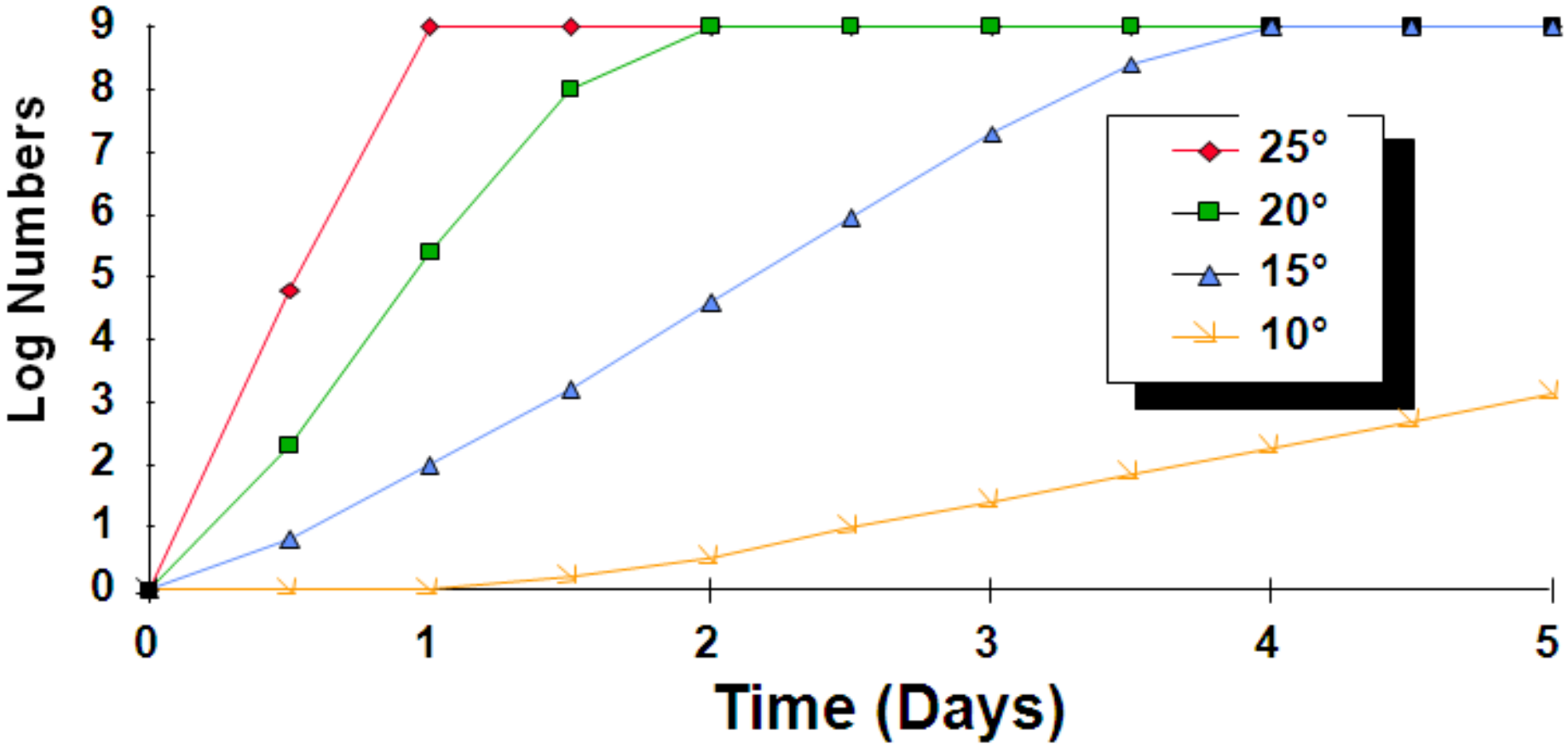
Bacterial growth curve



Prevention of foodborne disease



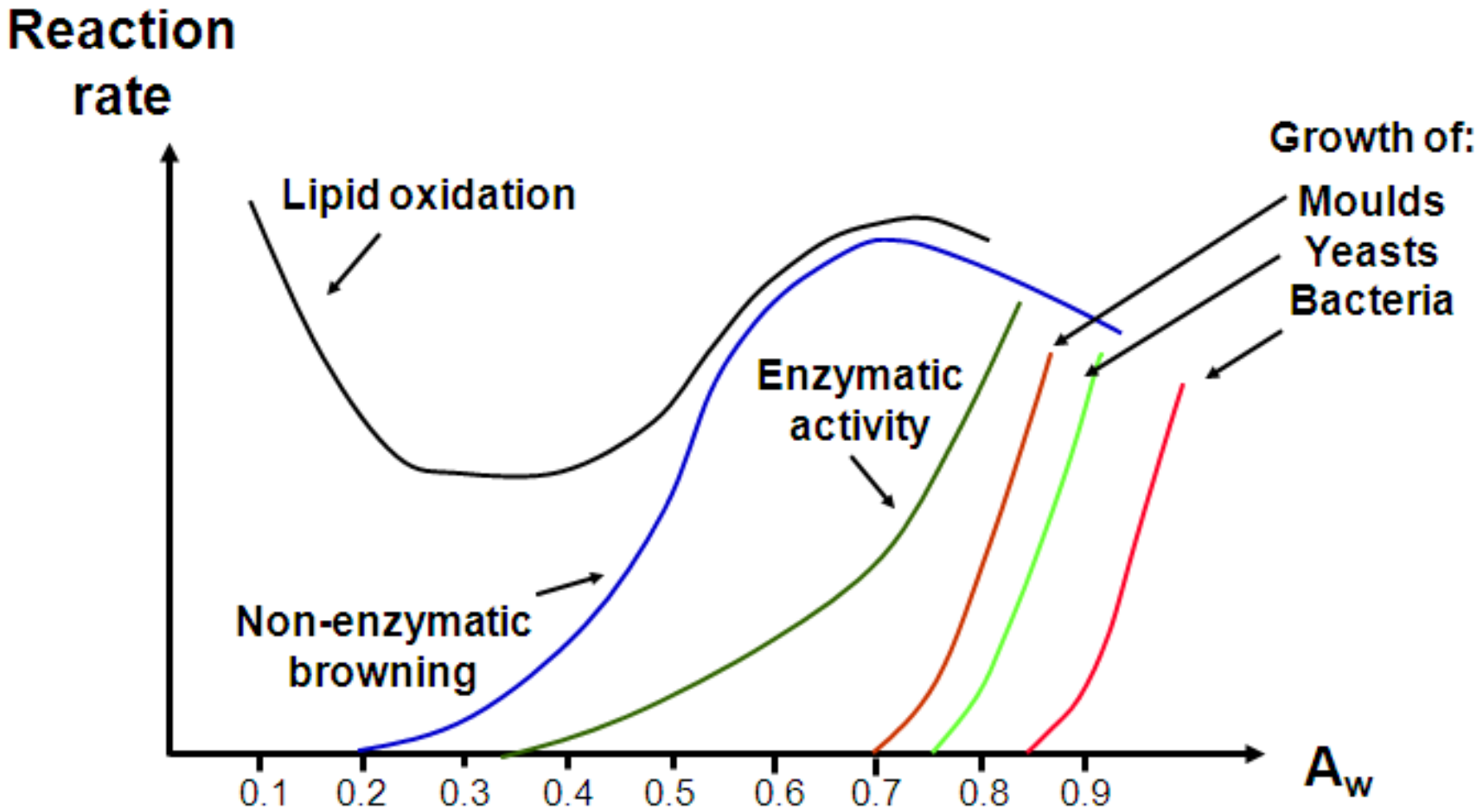
Growth of *S. typhimurium* at different temperatures



Pasteurization schemes

- **Low temperature:**
  - 63° C for 30 min
- **High temperature:**
  - 72° C for 15 sec
- **Ultra-high temperature:**
  - 135° C for 1 sec

Water activity



Minimum levels of a_w permitting growth (at near optimum temperatures)

Moulds	*Aspergillus chevalieri*	0.71
	Aspergillus ochraceus	0.78
	Aspergillus flavus	0.80
	Penicillium verrucosum	0.79
	Fusarium moniliforme	0.87
Yeasts	*Saccharomyces rouxii*	0.62
	Saccharomyces cerevisiae	0.90
Bacteria	*Bacillus cereus*	0.92
	Clostridium botulinum (proteolytic)	0.93
	Clostridium botulinum (non-proteolytic)	0.97
	Escherichia coli	0.93
	Salmonella	0.95
	Staphylococcus aureus	0.83

Water activity

a_w can be reduced by :

- Removing water (drying)
- Decreasing availability of water by crystalization (freezing)
- Decreasing availability by binding water with water binding agents e.g. salt, sugar

Concentration of NaCl and glucose at various a_w values (at 25°C)

a_w	% w / w NaCl	% w / w Glucose
1.00	0.00	0.00
0.99	1.74	8.90
0.98	3.43	15.74
0.96	6.57	28.51
0.94	9.38	37.83
0.92	11.90	43.72
0.90	14.18	48.54
0.88	16.28	53.05
0.86	18.18	58.45

Pemanasan dan penambahan Gula

- **Evaporated Milk**
  Proses pemanasan cukup membantu mematikan mikrobia perusak / patogen pangan

- **Sweetened Condensed Milk**
  Proses penambahan gula (sukrosa) meningkatkan tekanan osmotik sehingga menghambat mikrobia tumbuh

pH

Acidification

- *addition of vinegar*

Fermentation

- *organic acid*
- *competitive exclusion*
- *antimicrobial agents*