

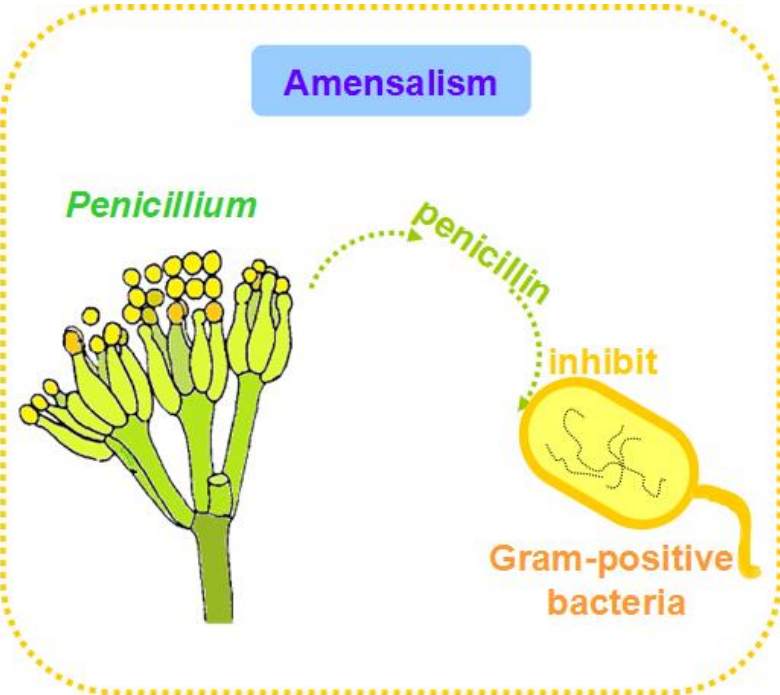
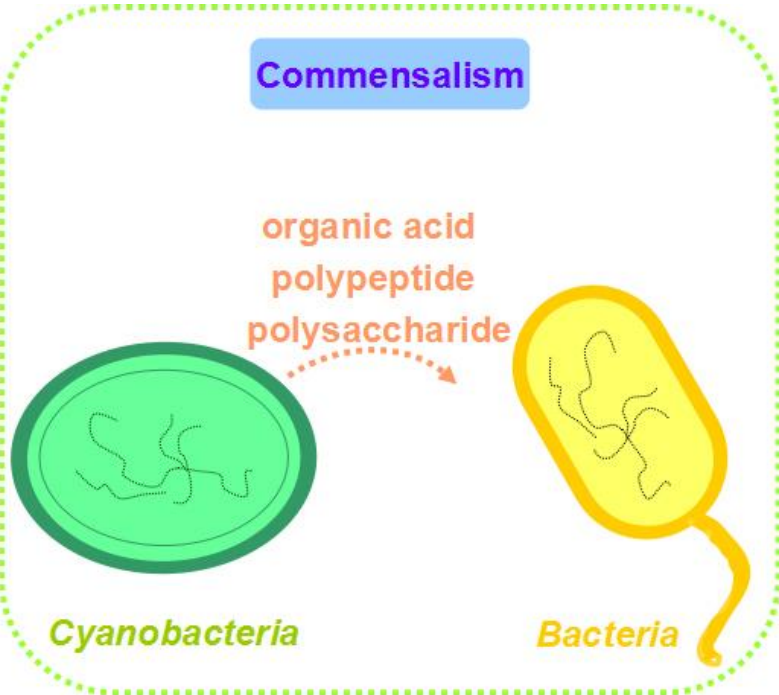
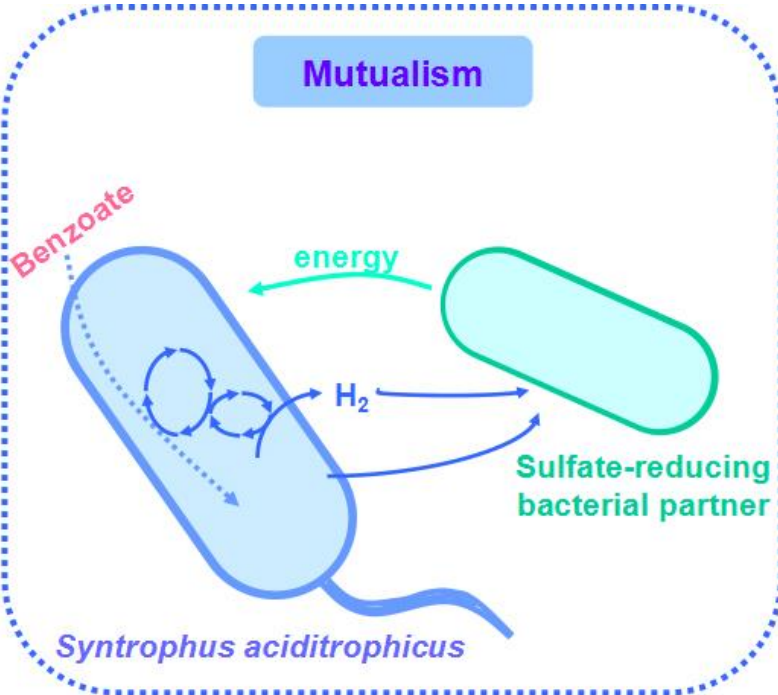
*MIXED MICROBIAL POPULATIONS IN
APPLICATION AND NATURAL
SYSTEMS
MODULE 6*

- Microbes have played an integral role in the evolution & operation of biosphere
- Primitive algae capable of increasing the oxygen level by about 1%
- mixed microbial population can grow in air, soil, bodies of water and inside higher organisms. Like
 1. the symbioses with ruminant animals such as cattle, sheep, goat etc. The microbial activity in rumen is decomposition of cellulose and other complex carbohydrates of plant material into simpler substances which can be absorbed by blood stream.
 2. The natural flora of microorganisms which inhabit the human body
 3. Dental plaque consists of several microorganisms.
 4. Production of wine and beer by fermenting fruits and grains.

Mechanism of mixed microbial interaction

1. Mutualistic interaction:
2. Competitive interaction:
3. Amensalistic interaction:
4. Prey-predatory interaction:

EXAMPLE



EXAMPLE

Nutrient acquisition mutualisms



Rhizobium nodules
(Bacteria)

- The plant (legumes) supplies energy to the bacteria from photosynthesis
- The bacteria 'fix' nitrogen for the plant (convert atmospheric N_2 gas to ammonium (NH_4^+) in the nodules
- Economically very important

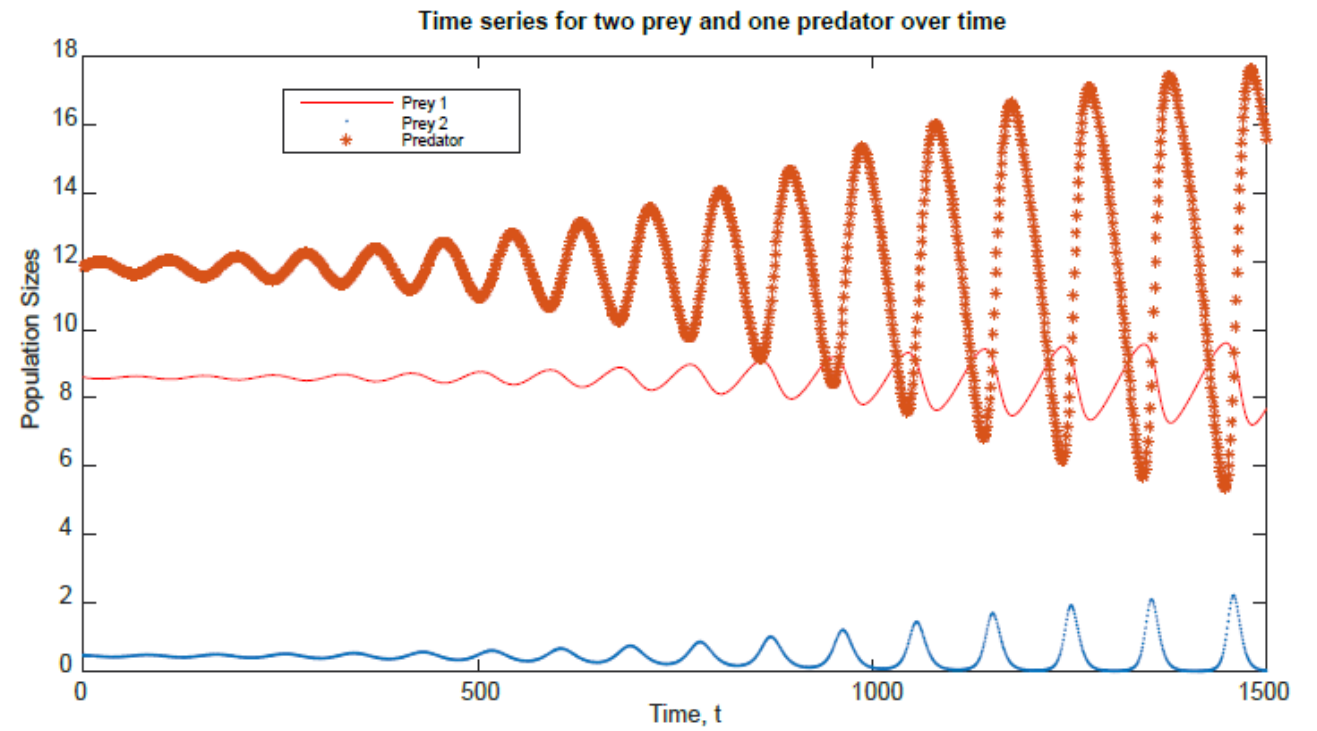
EXAMPLE

Roles

- Predators and prey – consumers (predators) that kill and eat other animals (prey)

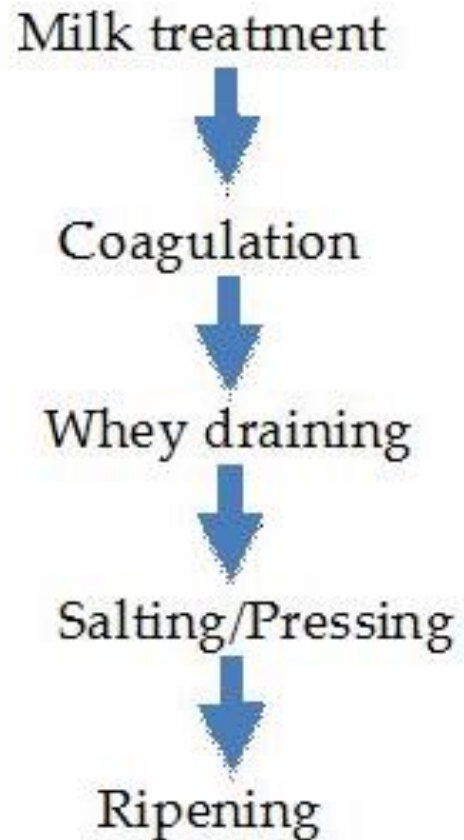


- Lions and zebras – other examples?



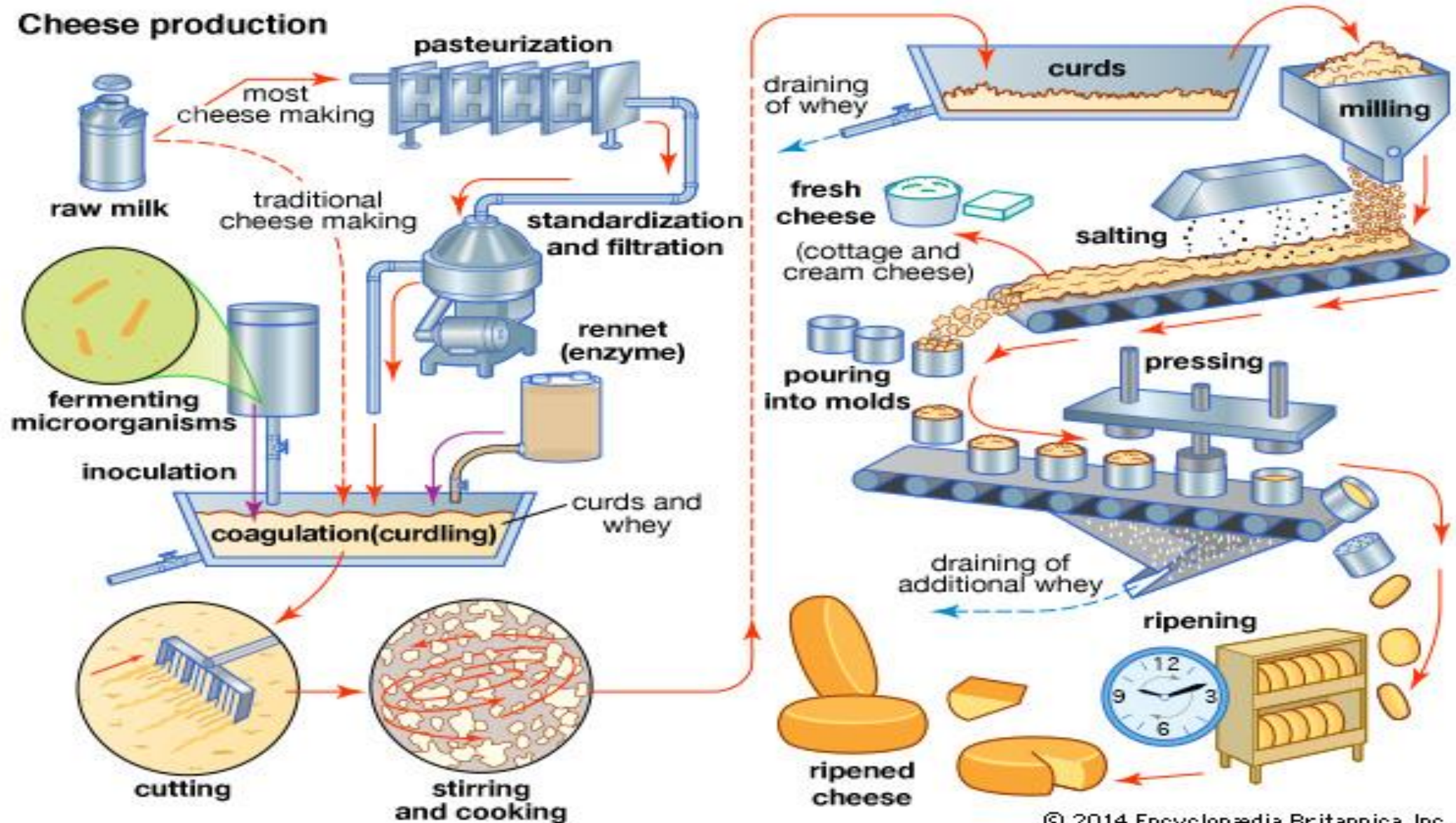
Well-defined mixed population in Cheese production

- Steps of cheese production

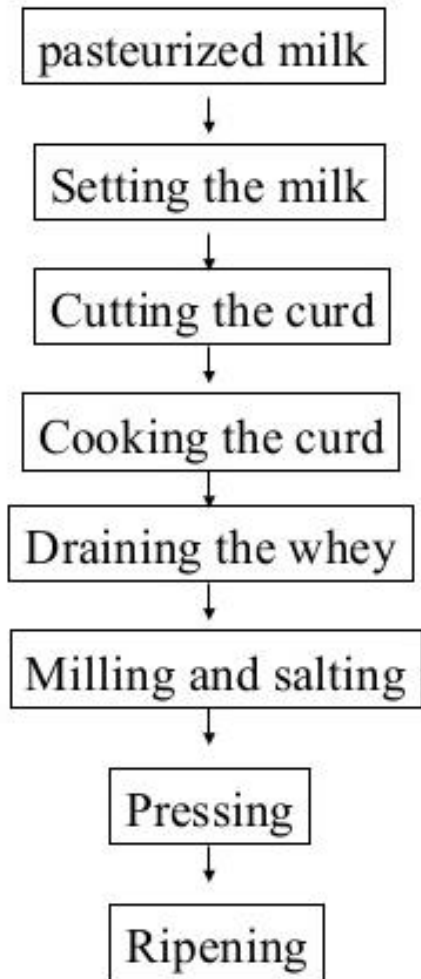


cheese production

Cheese production



Cheddar Cheese Making Process



- Inoculation of pasteurized fresh milk with appropriate **lactic acid** producing microorganism.
- The resulting aqueous curd is drained of liquid (whey) and allowed to ripen by the action of **bacteria or mold**.
- Hard curd cheese (enzyme mixture of rennet) is added to the slightly acidic inoculated milk.
- A rubberlike curd formed and cut into pieces
- After two time milling, salting, draining and pressing into molds cheese are ready for curing
- In curing due to slow anaerobic action the lipids and proteins to produce lactic, butaric and acetic acid and increases the age of cheese.

Few more application of well-defined mixed population

1. Use of Lactobacillus with yeast to reduce the pH in whiskey manufacturing. This also increases the flavour and aroma
2. Used of yeast and lactic acid bacterium in ginger-beer production
3. Dual fermentation: formation of L-lysine from glycerol with α,ϵ -diaminopimelic acid (DAP) as an intermediate. The DAP is accumulated using an E.coli to yield L-lysine.
4. Faster production of β -carotene with different mating type microorganism