

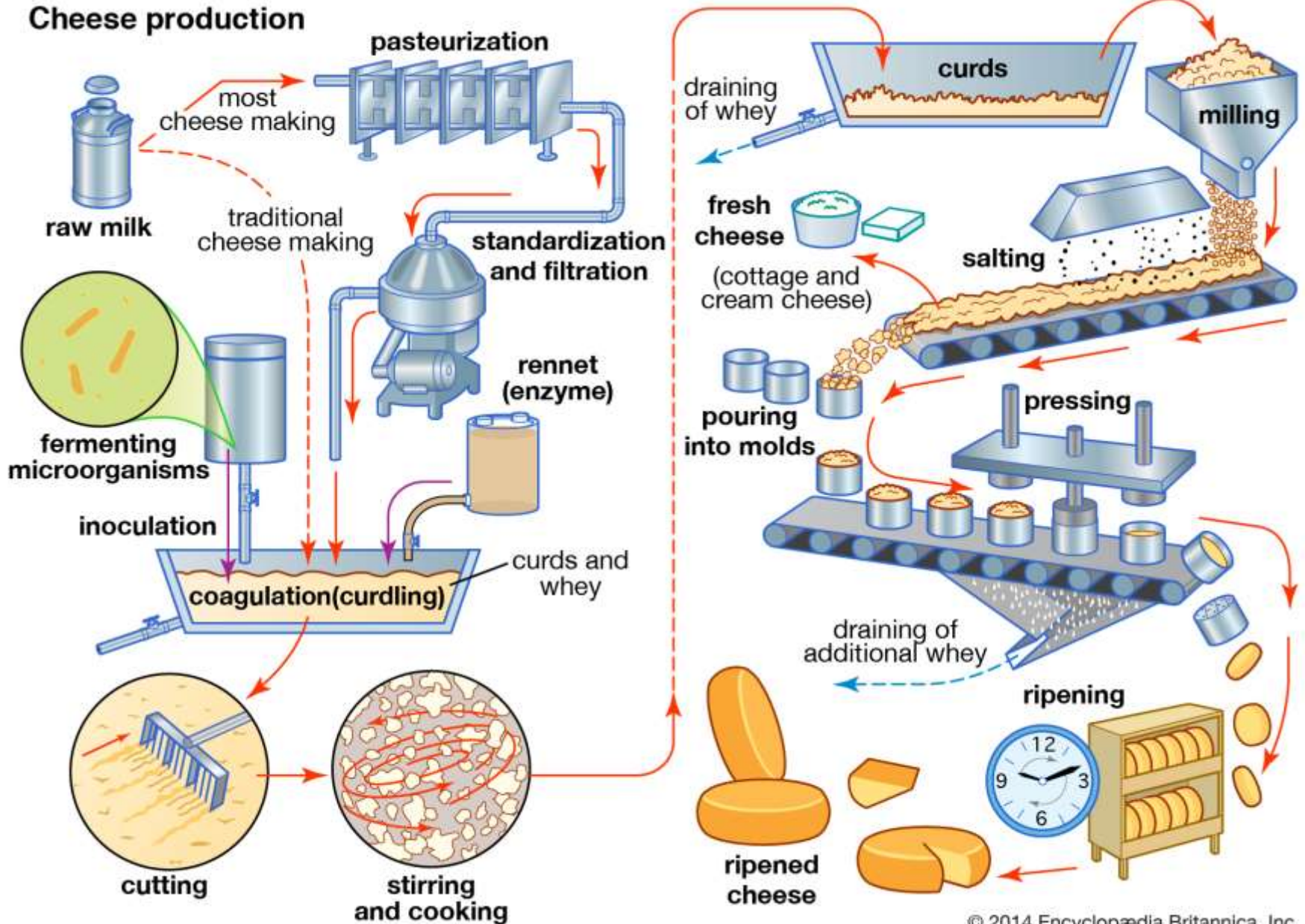
Cheese Starters



Cheese-a traditional product of world...

Product made from curd obtained from milk by coagulating the casein with the help of rennet or similar enzymes in the presence of lactic acid produced by added microorganisms from which part of the moisture has been removed by cutting, cooking and/or pressing which has been pressed in a mould and then ripened by holding it for sometime at suitable temperature and humidity.

Process of Cheese making



Classification of cheese

based on moisture content

Very hard (max 34% moisture content)

Hard (max 39% moisture content)

Semi hard (max 39 - 50% moisture content)

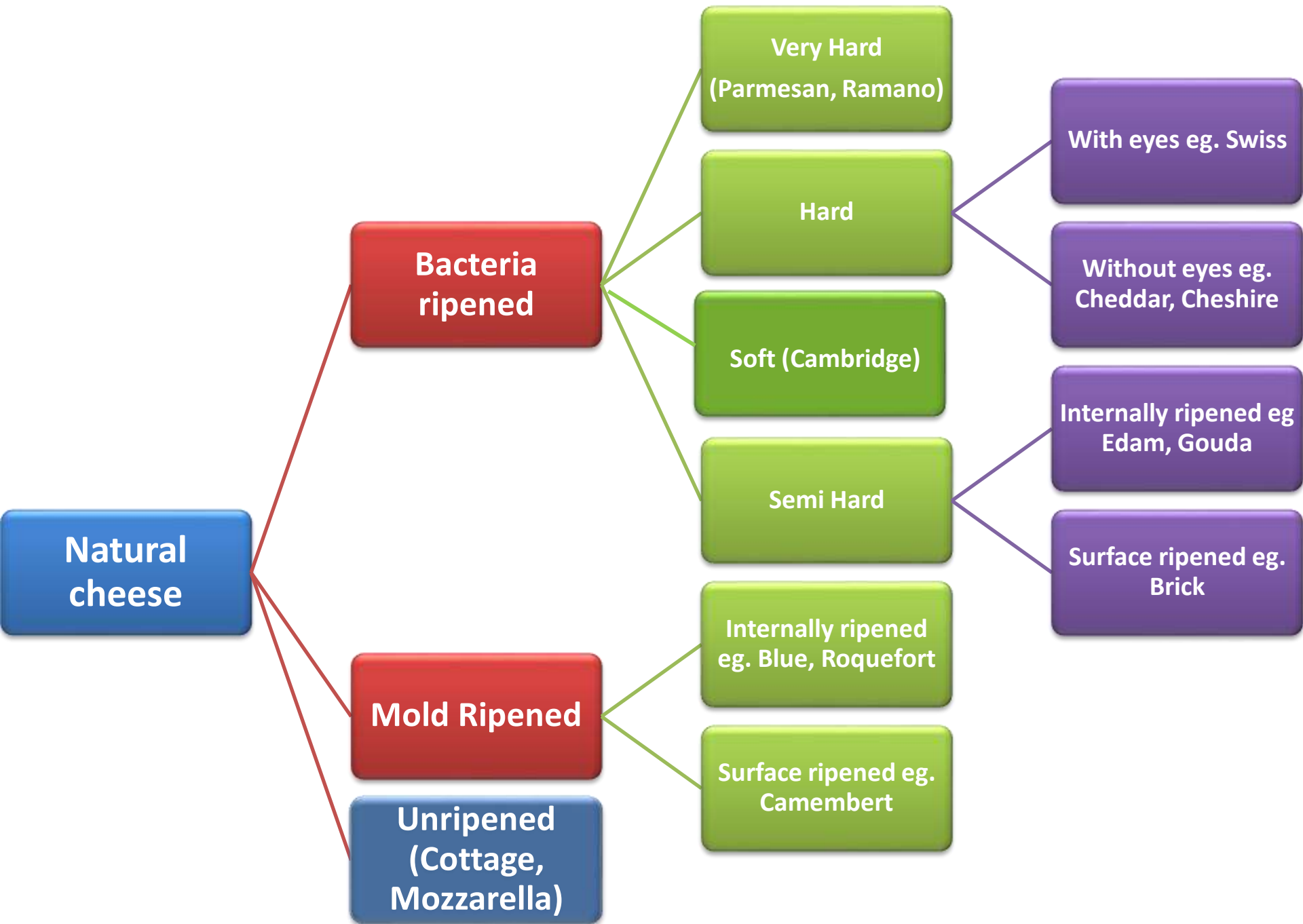
Soft (max 50 - 80% moisture content)

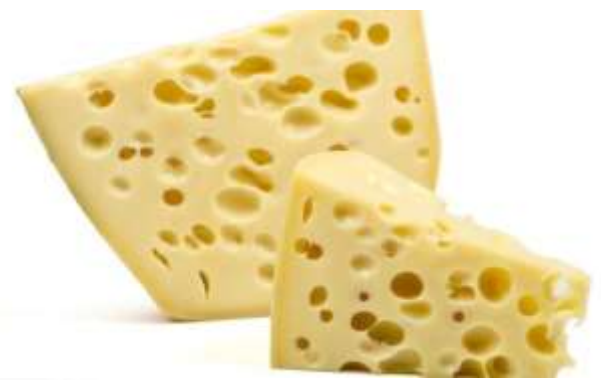
based on mode of ripening

Unripened

Bacteria ripened

Mold ripened

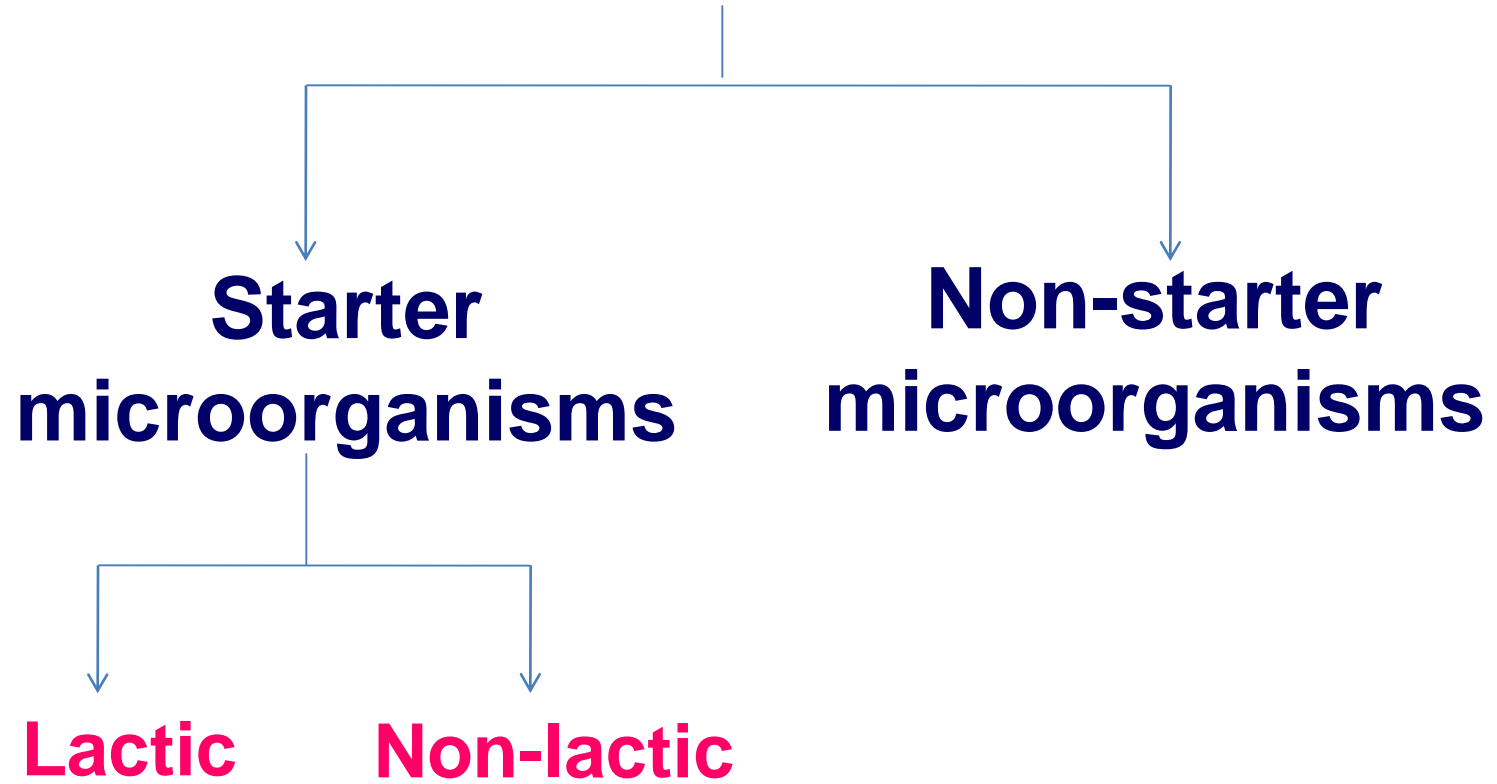




Desirable Properties of Starters

- Two broad class of microorganisms constitute the microflora of cheese
 - Starter microorganisms
 - Non starter microorganisms
- Starter bacteria play important roles in the **acid development** during curd formation.
- Activities of starter bacteria in addition to nonstarter bacteria, molds, yeast, smear flora, etc in specific varieties contribute to **flavor development**.

Microorganisms



Starter microorganisms

Selected microorganisms deliberately added to milk for initiating and carrying out the desired fermentation that in turn controls the appearance, body, texture and flavour characteristics of cheese.

Primary functions of starter

- ❖ **Acid production**
- ❖ **Flavor production due to production of flavour compounds as a result of breakdown of lactose, protein (proteolysis), and fat (lipolysis)..**
- ❖ **Eye formation**
- ❖ **Inhibition of undesirable microorganisms**
- ❖ **Creation of suitable environment for ripening**

Secondary functions

- ❖ **Promotion of milk coagulation by rennet**
- ❖ **Stimulation of curd shrinkage and drainage of whey**
- ❖ **Controlling the elasticity of finished curd**
- ❖ **Promotion of fusion of curd into solid mass**
- ❖ **Controlling the enzymatic changes during ripening**

Classification of cheese starters

Based on function

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graph TD; A[Based on function] --> B[Lactic Starter]; A --> C[Non Lactic Starter];
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Lactic Starter

- *Lactococcus* spp.
- *S. thermophilus*
- Lactobacilli
(Homofermentative)

Non Lactic Starter

- Propionibacteria
(in Swiss cheese)
- *Brevibacterium linens*
(Brick type of cheese)
- *Penicillium roqueforti*
(blue-veined cheese)

Functions of Lactic and Non-lactic starters

Primary lactic starter:

- ❖ Consistent acid development during cheese making.
- ❖ Involved in the degradation of protein and fat during ripening.
- ❖ Biological protection of product (bacteriocin production).

Non-lactic starter: Provide well-defined functions.

- ❖ Gas production in Swiss type cheese (*Propionibacterium shermanii* ssp. *freudenreichii*).
- ❖ Surface coloration by *Brevibacterium linens*.
- ❖ Secondary starters involved in ripening process; contribute in the development of typical flavor of many cheeses e.g. Emmental.

Based on optimum growth temperature

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graph TD; A[Based on optimum growth temperature] --> B[Mesophilic starters (20-30 C)]; A --> C[Thermophilic starters (37-45 C)];
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Mesophilic starters (20-30 C)

- ✓ *L. lactis* subsp. *lactis*
- ✓ *L. lactis* subsp. *cremoris*
- ✓ *Leuconostoc* spp.

Thermophilic starters (37-45 C)

- ✓ *S. thermophilus*
- ✓ *Lb. helveticus*
- ✓ *Lb. bulgaricus*

Composition of Cheese Starters

Cheese variety	Starters used
Cheddar	<i>L. lactis (cit⁺)</i> , <i>L. cremoris</i> , <i>L. diacetylactis</i>
Gouda	<i>L. lactis (cit⁺)</i> , <i>L. cremoris</i> , <i>L. diacetylactis</i> , <i>Leuconostoc spp.</i>
Cottage	<i>L. lactis (cit⁺)</i> , <i>L. cremoris</i> , <i>Leuconostoc spp.</i>
Swiss	<i>S. thermophilus</i> , <i>Lb. helveticus</i> , <i>Propionibacterium shermanii</i>
Brick	<i>L. lactis</i> , <i>L. cremoris</i> , <i>S. thermophilus</i> , <i>Brevibacterium linens</i>
Mozzarella	<i>S. thermophilus</i> , <i>Lb. bulgaricus</i>
Roquefort	<i>L. lactis</i> , <i>Penicillium roqueforti</i>
Camembert	<i>L. lactis</i> , <i>Penicillium camemberti</i>

Non-starter microorganisms

(adventitious microflora/Non-starter lactic acid bacteria (NSLAB))

This group refers to microorganisms which are not added deliberately by manufacture but gain access to the cheese vat accidentally during different stages of cheese making

Non-Starter Cultures

Type of Microorganism	Role
Lactobacilli	Constitute a major part of nonstarter bacteria in Cheddar cheese
Pediococci	Flavour production
Gram negative rods	Produce enzymes for flavour production
Coryneform bacteria	Cheddar cheese flavour development
Yeasts	Contribute to synergistic growth of starter organism by increasing pH and releasing vitamins

Adjunct cultures

- ❖ To offer consumers safe and consistent cheeses with high organoleptic properties in reasonable ripening time, new technologies such as “adjunct cultures” came into existence.
- ❖ Adjunct cultures can be defined as selected strains of cheese related microorganisms that are added to the cheese milk to improve development of cheese sensory quality.
- ❖ Accelerate cheese ripening, which may allow substantial cost savings to the cheese industry.