

# Cheese Starters

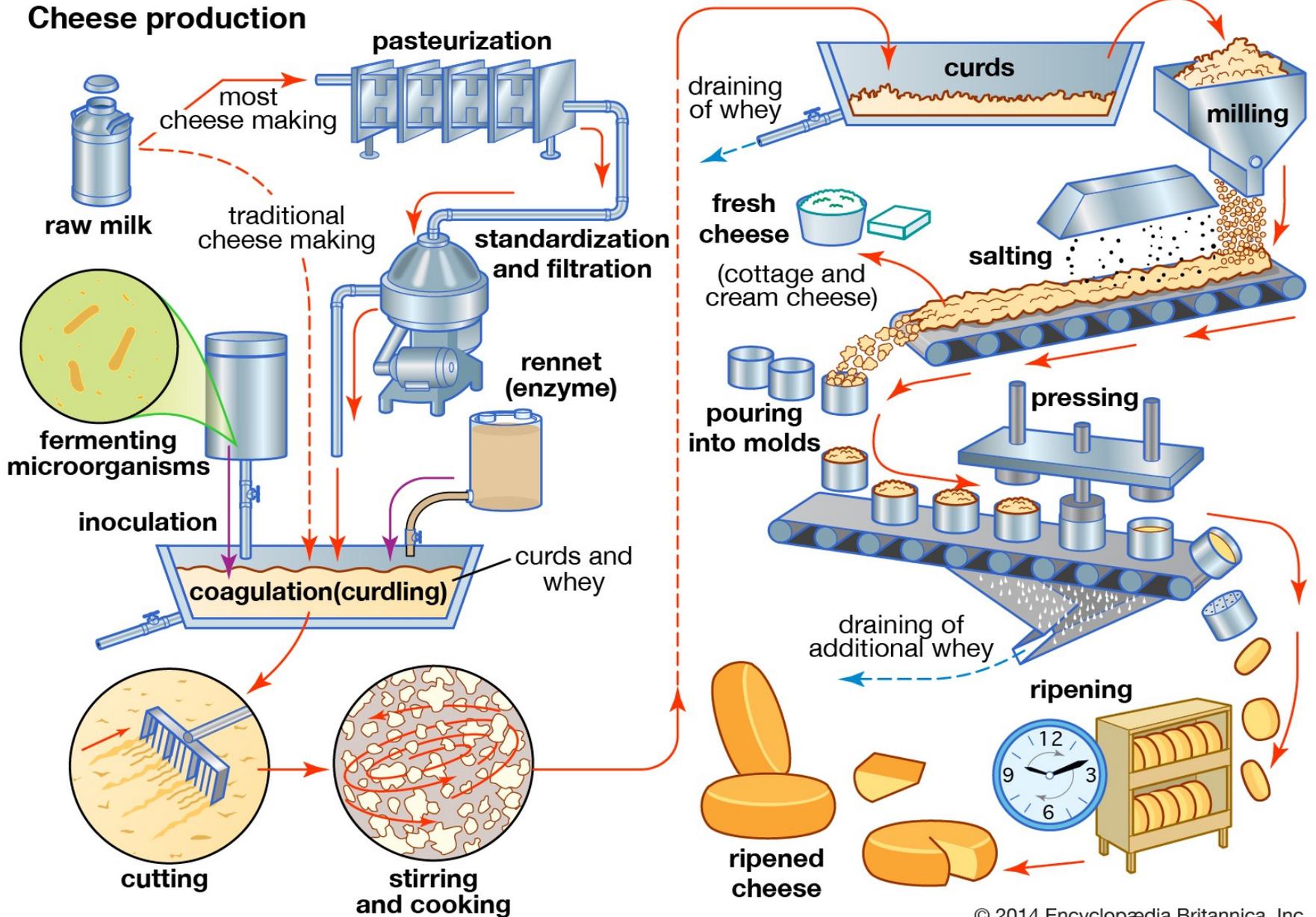


# **Cheese-a traditional product of world**

**A product made from the 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 or adventitious 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.**

- **Cheese is essentially a microbial fermentation of milk by selected lactic acid bacteria whose major function is to produce lactic acid from lactose, which, in turn, causes the pH of the curd to decrease.**
- **The final pH after manufacture ranges from 4.6 to 5.3, depending on the buffering capacity of the curd.**
- **A reduction in the moisture content of the milk (dehydration) also occurs during cheese-making from an initial value of ~88%, in the case of cows' milk, to 55 %.**

# The 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)**

## Natural cheese

### Bacteria ripened

Very Hard  
(Parmesan, Ramano)

Hard

With eyes eg. Swiss

Without eyes eg. Cheddar, Cheshire  
Soft (Cambridge)

Semi Hard

Internally ripened eg Edam, Gouda

Surface ripened eg. Brick

### Mold Ripened

Internally ripened eg. Blue, Roquefort

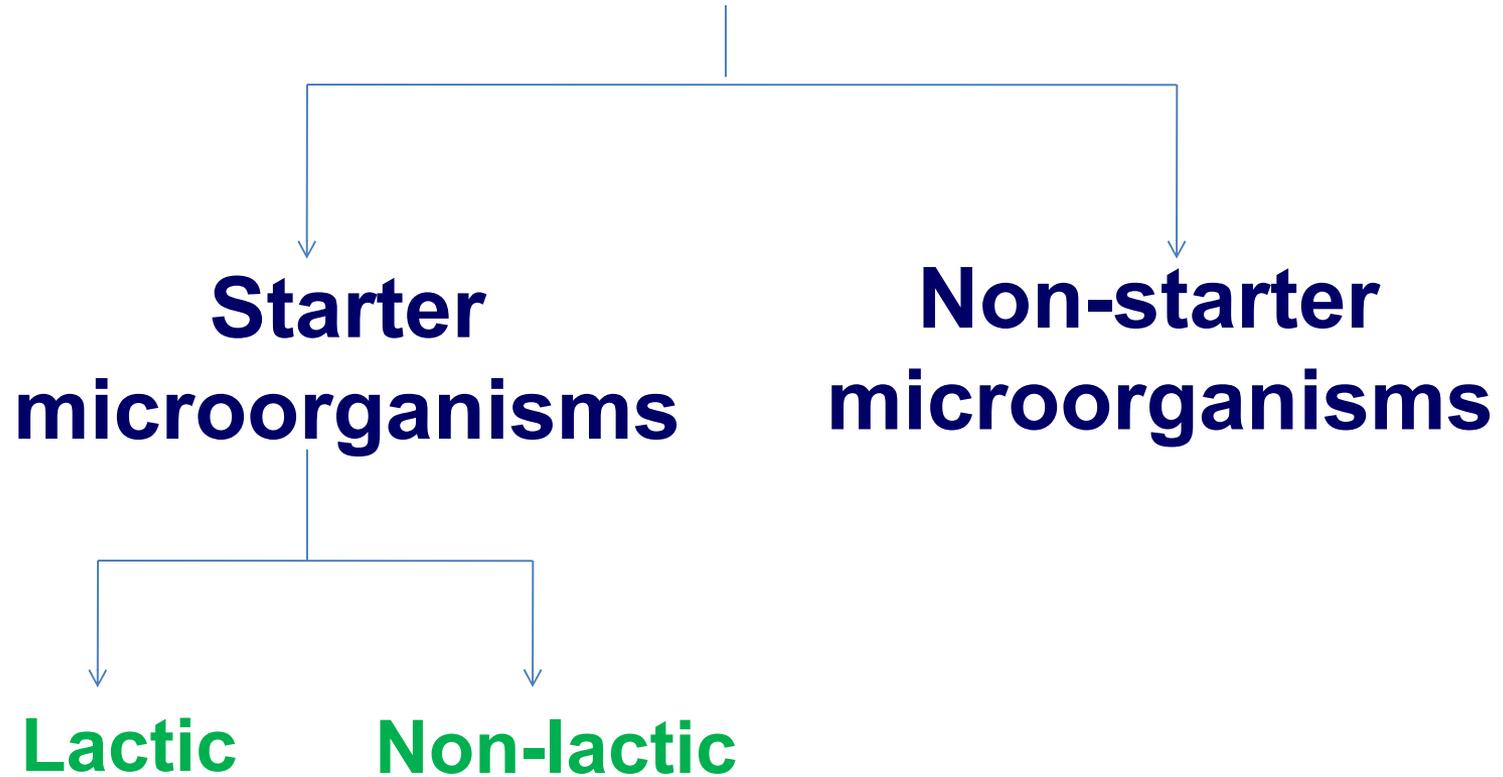
Surface ripened eg. Camembert

Unripened (Cottage, Mozzarella)

# 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 and syneresis.
- Activities of starter bacteria in addition to nonstarter bacteria, molds, yeast, smear flora, etc in specific varieties contribute to **flavor development** and **unique characteristics of a specific variety**.
- Also, starter and nonstarter lactic acid bacteria contribute to the **preservation** of some varieties through the activities of metabolites produced.

# Microorganisms



# Starter microorganisms

**Starter culture refers to the 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). Lactic acid also contributes to fresh acid flavour to curd cheeses.**

❖ **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];
```

Lactic Starter

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

Non Lactic Starter

- *Propionibacteria*  
(in Swiss cheese)
- *Leuconostoc*  
(in Gouda & Dutch cheese)
- *Brevibacterium linens*  
(Brick type of cheese)
- *Penicillium roqueforti*  
(blue-veined cheese)
- *Geotrichum candidum* (soft cheese)

# Functions of Lactic and Non-lactic starters

- ❖ **Primary lactic starter culture** ensure consistent acid development during cheese making.
- ❖ Involved in the degradation of protein and fat during ripening.
- ❖ Play an important role in the biological protection of the product (bacteriocin production).
  
- ❖ **Secondary starter** represents cultures that are added to a limited number of cheese varieties to provide well-defined functions, e.g., gas production in Swiss type cheese is ensured by *Propionibacterium shermanii* ssp. *freudenreichii*.
- ❖ *Brevibacterium linens* contributes to surface coloration in surface ripened cheese. *Penicillium roqueforti* and *Penicillium camemberti* can also be included in this group.
- ❖ Secondary starters involved in the ripening process; they contribute in the development of typical flavor of many cheeses, e.g. Emmental, Camembert, and Limburger.

# 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)]; B --> B1[✓ L. lactis subsp. lactis]; B --> B2[✓ L. lactis subsp. cremoris]; B --> B3[✓ Leuconostoc spp.]; C --> C1[✓ S. thermophilus]; C --> C2[✓ Lb. helveticus]; C --> C3[✓ Lb. bulgaricus];
```

## 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

<b>Cheese variety</b>	<b>Starters used</b>
<b>Cheddar</b>	<i>L. lactis (cit<sup>+</sup>)</i> , <i>L. cremoris</i> , <i>L. diacetylactis</i>
<b>Gouda</b>	<i>L. lactis (cit<sup>+</sup>)</i> , <i>L. cremoris</i> , <i>L. diacetylactis</i> , <i>Leuconostoc spp.</i>
<b>Cottage</b>	<i>L. lactis (cit<sup>+</sup>)</i> , <i>L. cremoris</i> , <i>Leuconostoc spp.</i>
<b>Swiss</b>	<i>S. thermophilus</i> , <i>Lb. helveticus</i> , <i>Propionibacterium shermanii</i>
<b>Brick</b>	<i>L. lactis</i> , <i>L. cremoris</i> , <i>S. thermophilus</i> , <i>Brevibacterium linens</i>
<b>Mozzarella</b>	<i>S. thermophilus</i> , <i>Lb. bulgaricus</i>
<b>Roquefort cheese</b>	<i>L. lactis</i> , <i>Penicillium roqueforti</i>
<b>Camembert</b>	<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 the 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
Thermoduric Streptococci	Play parallel role as their starter counterparts
Micrococci	Contribute to synergistic growth of lactic Streptococci along with Yeasts
Pediococci	Helps in flavour production
Gram negative rods	Produce enzymes for flavour production
Enterococci	Produces lipases & proteases
Coryneform Bacteria	In Cheddar cheese flavour development
Yeasts	Contribute to synergistic growth of starter organism by increasing pH & releasing vitamins

## Adjunct cultures

- ❖ For the cheese industry to offer to the consumers safe and consistent cheeses with high organoleptic properties in a reasonable ripening time, they began to look for new technologies such as “**adjunct cultures.**”
- ❖ 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.
- ❖ They were also developed to accelerate cheese ripening, which may allow substantial cost savings to the cheese industry.
- ❖ In contrast to naturally occurring NSLAB, adjuncts are specifically selected and intentionally added to supplement the microflora of cheese milk to improve overall quality of finished cheese.

# Artisanal cultures



- ❖ **Artisanal cheese refers to cheeses produced by hand using the traditional craftsmanship of skilled cheesemakers (hand created products, which may or may not include some manufacturing equipment, that will be enjoyed by many consumers).**
- ❖ **Example: Farmstead cheese, made traditionally with milk from the producer's own herds of cows, sheep, and goats. May be made from all types of milk and may include various flavorings.”**