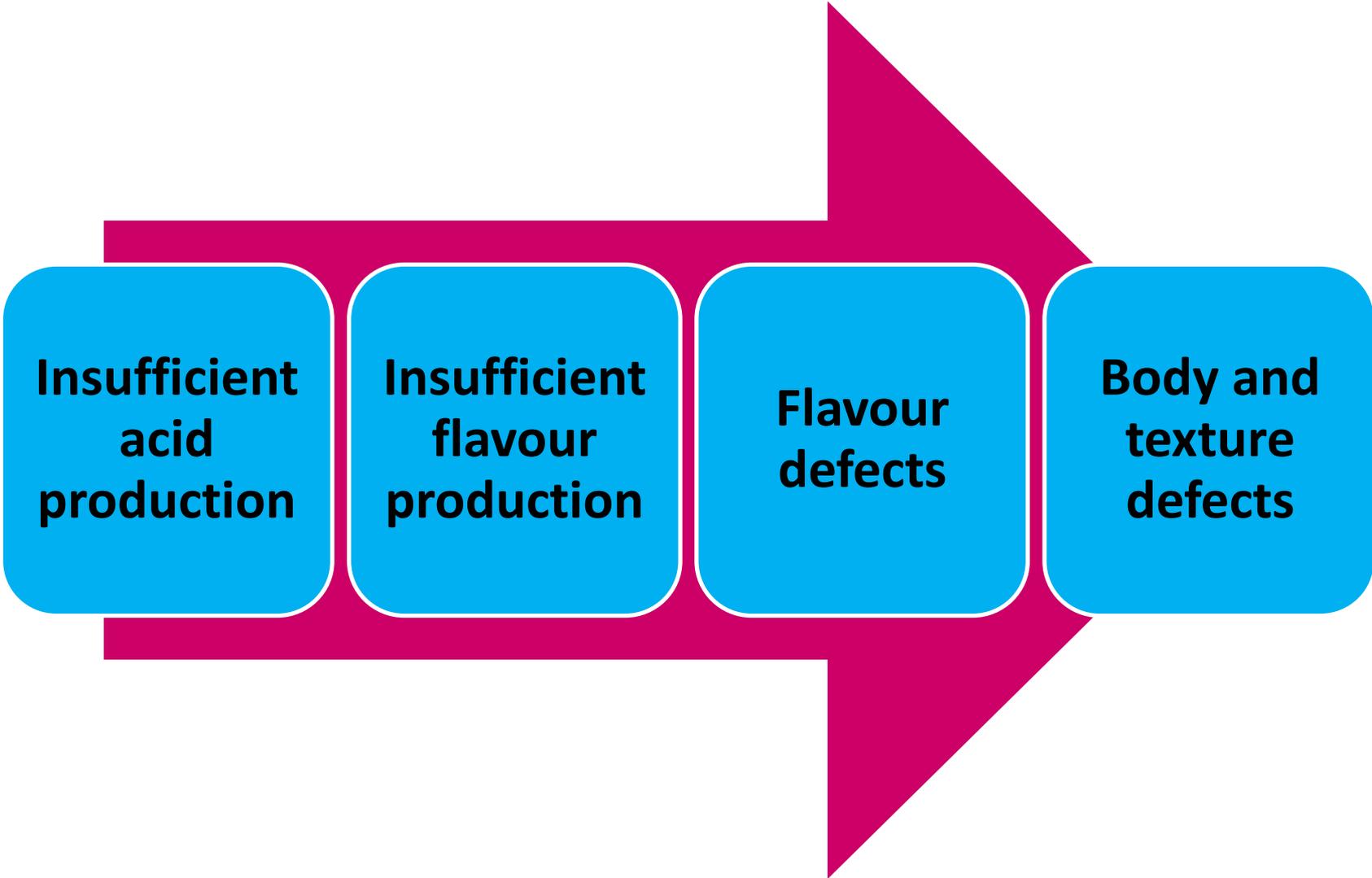


# **Starter Defects and Failures**

# Starter Defects



**Insufficient  
acid  
production**

**Insufficient  
flavour  
production**

**Flavour  
defects**

**Body and  
texture  
defects**

**Insufficient acid production:** Good starter should produce lactic acid at vigorous and steady rate. Insufficient acid production could be:

**a) Spontaneous loss of vitality inherent in starter itself:**  
Starter strain variation or genetic instability usually associated with plasmids, loss of lac' plasmid

**b) Incompetence in the control of starters**

- i. Allowing the starters becoming contaminated
- ii. Use of unsuitable media
- iii. Use of wrong incubation temperatures

## **c) Causes of slowness inherent in milk itself**

- i. Use of abnormal quality milk (mastitis, colostrums, late lactation milk).**
- ii. Milk containing antibiotic residues.**
- iii. Milk contaminated with bacteriophage**
- iv. Milk containing residues of detergents and sanitizers**
- v. Seasonal variations in milk composition**
- vi. Excessive aeration of milk**

## **d) Changes in method of making fermented milk**

## **e) Bacteriophage action**

**Insufficient flavour production:** Factors affecting acid production also affect flavour production.

- a) Improper acid production
- b) Milk having low citrate ions

**Flavour defects:**

- a) **Sharp acid taste:** Due to over ripening of culture which may be due to increased inoculum/higher incubation temperature/prolonged incubation period.
- b) **Malty flavour:** Due to variants of *L. lactis* ssp. *lactis* var *maltigenes*
- c) **Metallic flavour:** Due to over ripening of culture/due to use of poorly maintained containers with metallic contamination
- d) **Flat flavour:** Due to small amounts of citrates in milk
- e) **Bitterness:** Due to activity of proteolytic contaminants

## **Body and texture defects:**

- 1. Weak body:** Due to insufficient acid production or milk with low total solids or milk subjected to severe heat treatment.
- 2. Hard and lumpy:** Due to over ripening.
- 3. Wheying off:** Due to over ripening or due to low total solids in milk resulting in fracturing, defective starters, use of un-homogenized whole milk. Whey may collect on surface or at bottom of the culture.
- 4. Ropiness:** Due to contamination of starter with *Alcaligenes viscosus*.



## **Problems with production method:**

- **Use of abnormal milk**
- **Use of poor quality starter cultures**
- **Use of improperly cleaned utensils and equipment**
- **Use of milk subjected to improper heat treatment**
- **Unclean habits and unhealthy persons**
- **Use of improper storage conditions and temperatures.**

<b>Agents</b>	<b>Nature</b>	<b>Mode of action</b>	<b>Control steps</b>
<b>Penicillin, tetracycline,</b>	<b>Pharmacological antibiotics</b>	<b>Bacteriostatic, heat stable</b>	<b>Test milk supply, Reject contaminated milk</b>
<b>Chlorine, QAC, iodine</b>	<b>Sterilizing chemical</b>	<b>Bactericidal, heat stable</b>	<b>Checking of sanitary practices in farm and and plant</b>
<b>Bacteriophage</b>	<b>Viruses</b>	<b>Disintegrate bacteria, effectiveness depends on phage type, speed and bacterial growth</b>	<b>Change starter, heating milk at 85C for 30 mins destroys phage</b>
<b>Natural inhibitors of milk</b>	<b>Bacterial inhibitors</b>	<b>Bacteriostatic, heat labile</b>	<b>Pasteurization of milk at 72C for 15 s</b>

## Starters Failures

- 1. Effect of antibiotic residues:**
  - a. Low-level antibiotic contamination may be sufficient to inhibit starter cultures. Antibiotic levels in milk increase, acid production decreases.**
  - b. Lactic acid bacteria are very sensitive to antibiotics (penicillin, streptomycin and tetracycline) commonly used for mastitis treatment.**
  - c. Sensitivity of starter cultures to antibiotics is highly strain and species dependent. *S. thermophilus* is more susceptible to penicillin and cloxacillin than lactococci (sensitive to streptomycin and tetracycline).**

## **2. Effect of sanitizers:**

- 1. Chemical sanitizers may contaminate milk due to human error.**
- 2. Chlorine- and iodine-based sanitizers lose their activity in milk and don't cause starter culture inhibition.**
- 3. Quaternary ammonium compounds present more potential problems, as lactic acid bacteria are sensitive to low concentrations.**
- 4. High concentrations of  $H_2O_2$  or QAC are required to give positive results in antibiotic screening tests. Chemical sanitizer that might enter milk through lack of rinsing should not be sufficient to cause culture inhibition.**

### **3. Effect of bacteriophages:**

- 1. Bacteriophages are viruses that infect bacteria.**
- 2. Distributed in nature and found in intestinal contents of animals.**
- 3. Invented by Twort in 1915.**
- 4. All viruses contain nucleic acid, either DNA or RNA and a protein coat, which encases the nucleic acid. Without host cell, viruses cannot carry out life-sustaining functions or reproduce.**
- 5. Cannot synthesize proteins, because they lack ribosomes and use ribosomes of host cells to translate viral messenger RNA into viral proteins.**
- 6. Viruses cannot generate/store energy in the form of ATP, but derive their energy from host cell.**

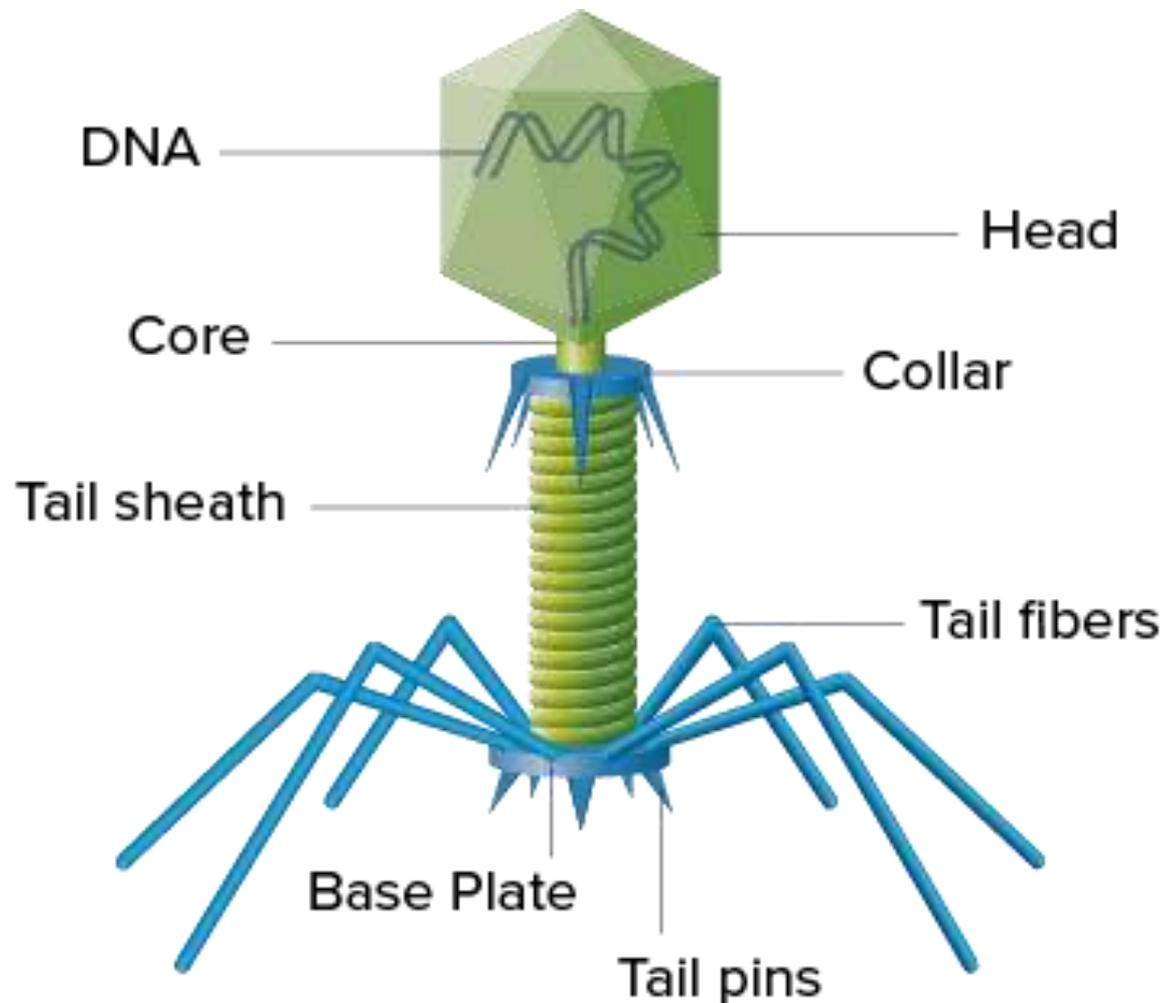
7. Bacteriophagic infections are caused by either **lytic or temperate phages**.
8. In lytic cycle, phages attach themselves to living cells and as they divide phages also multiply. Nucleic acid is injected through hollow tail of phage particle into the bacterial cell. Irreversible adsorption of phage to the cell triggers in the transport of viral nucleic acids into cytoplasm and nucleic acid gets metabolically active transforming cellular function to one of synthesizing viral components. As phage assembly completes, lysis of the host cell occur.

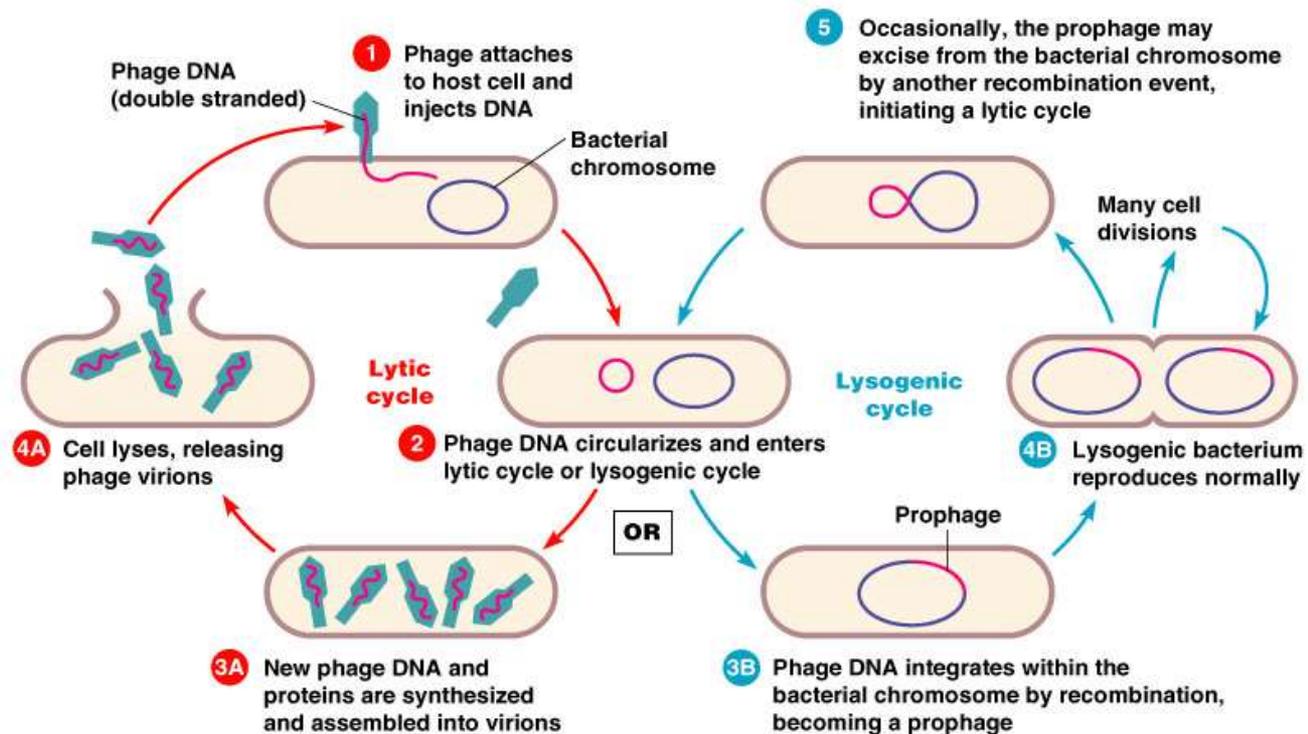
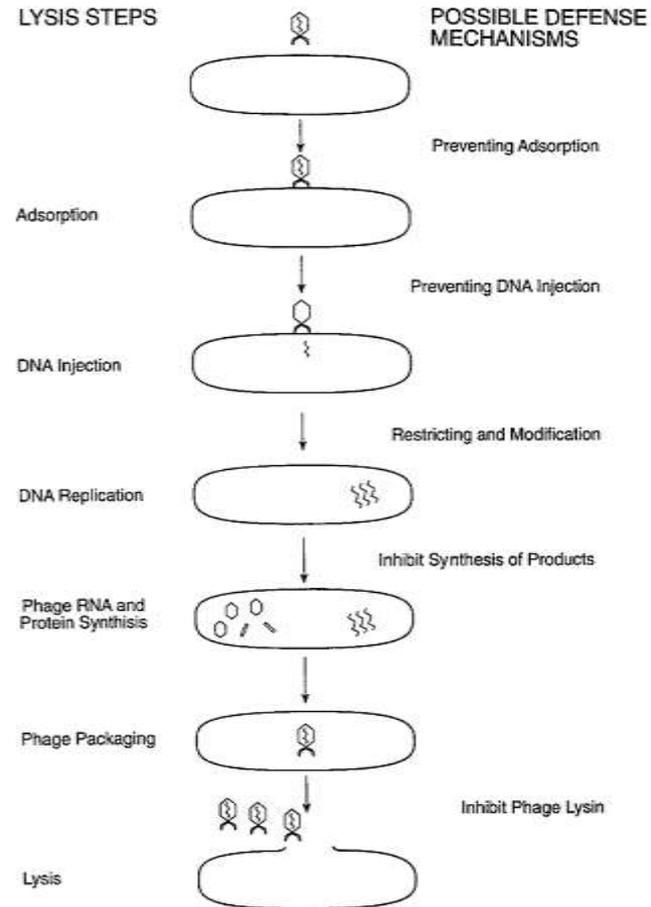


**Ultra structures** : Typical bacteriophage has a structure like tadpole.

Head – enclosing nucleic acids in protein sheath.

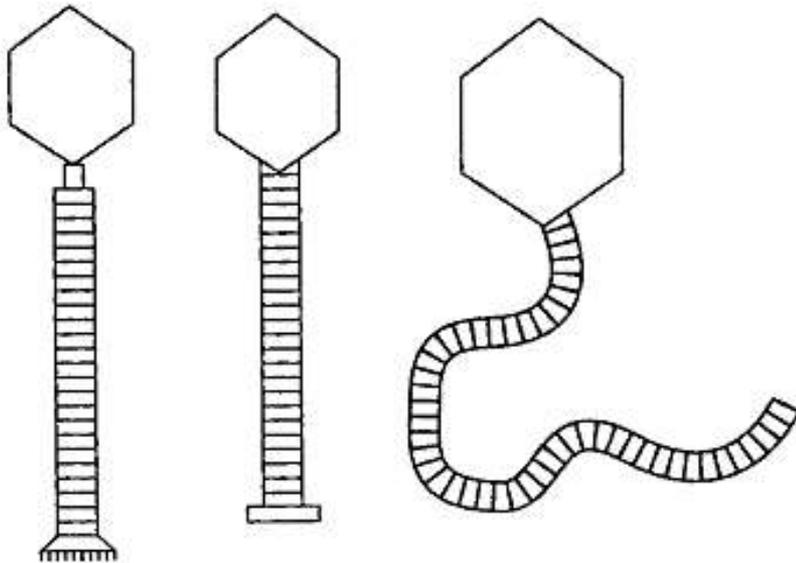
Tail – a hollow tube of proteins & bearing tail plate & tail fibers.



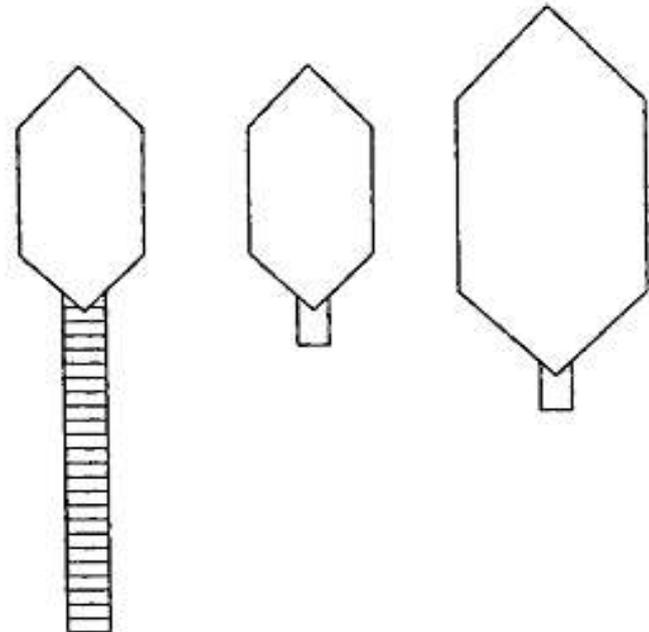


# Phages of LAB are having either prolate/isometric heads with contractile tails in some cases and variety of terminal fibres/plates in addition to collars and other structures along their length.

- ✓ Phages of *L. lactis* ssp *lactis* and *L. lactis* ssp *cremoris* have isometric heads of 45-65 nm diameter with non-contractile tails 100-250 nm long.
- ✓ Phages of *S. thermophilus* contains isometric heads of 50-70 nm diameter with non-contractile tails 200-300 nm long.



Isometric phage with long tails

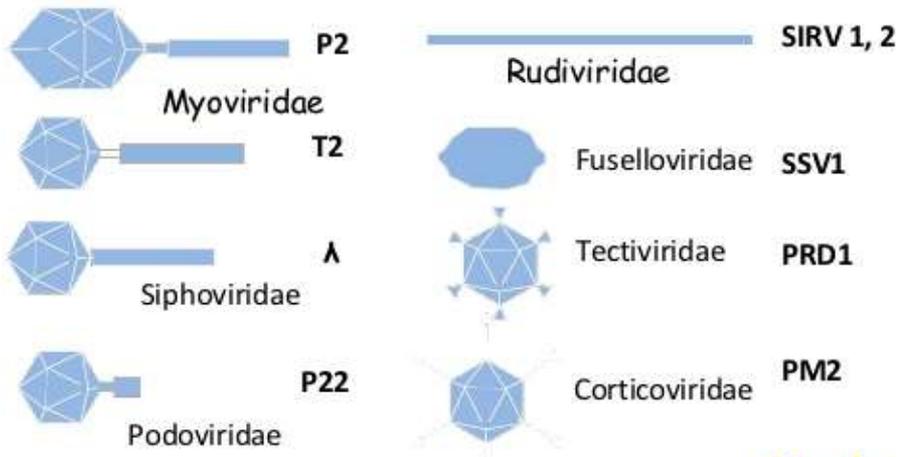


Prolate phage with short and long tails

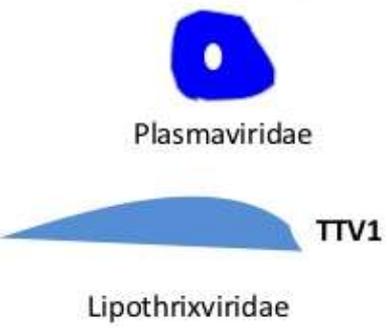
# Classification of Bacteriophages: On the basis of presence of single or double strands of genetic material, the bacteriophages are categorized as under:

1. ssDNA phages
2. dsDNA phages
3. ssRNA phages
4. dsRNA phages

## Double stranded DNA, Non-enveloped



## Double stranded DNA, Enveloped



## Single-stranded DNA



## Single stranded RNA

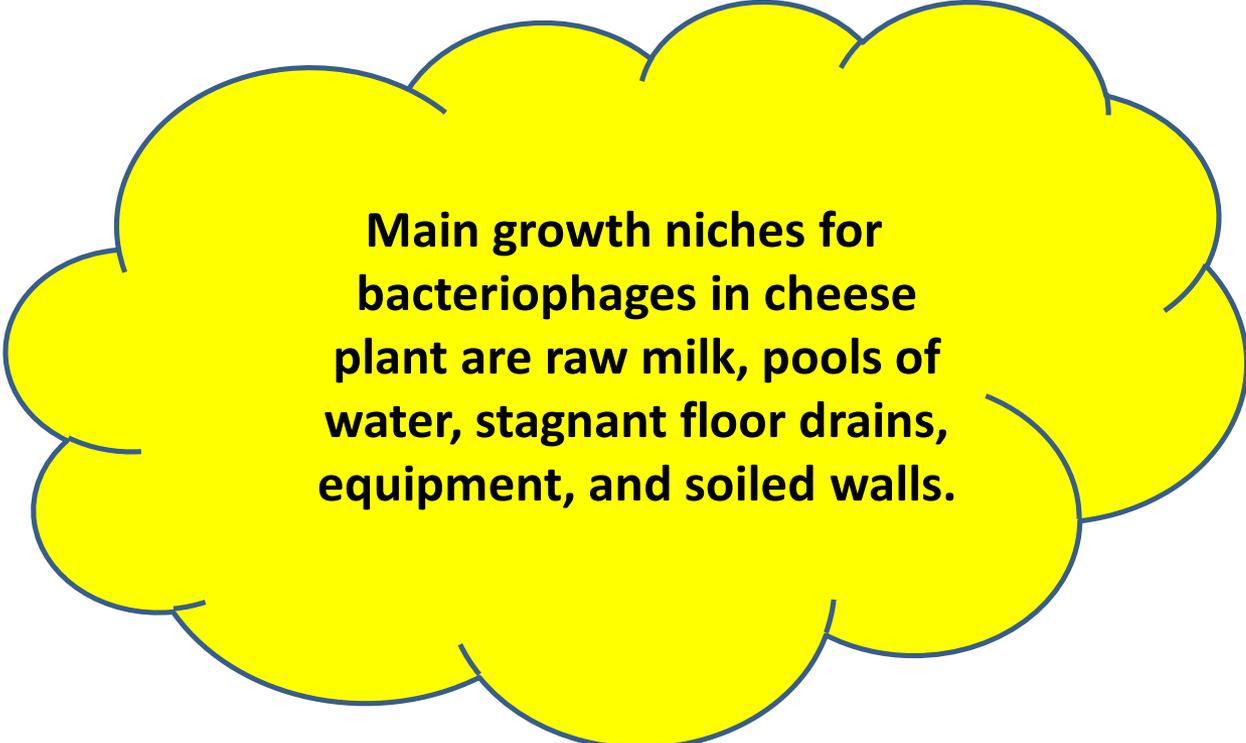


## Double stranded RNA



## Sources of Phage:

- ❖ **Whey** can form foci of infection and contaminate air, utensils etc.
- ❖ **Air** is another important factor for the spread of phagic infections.
- ❖ Phages could be inadvertently brought into cheese factories by **milk in cans** previously used to take whey to farms.
- ❖ Phage contamination of starter by **wind borne droplets** from the effluent which may be flowing near the factory.



Main growth niches for bacteriophages in cheese plant are raw milk, pools of water, stagnant floor drains, equipment, and soiled walls.

# Measures to control bacteriophage attack:

- ❑ **Aseptic techniques for propagation and production of starter cultures**
- ❑ **Ensure effective sterilization of equipment and utensils**
- ❑ **Ensure proper heat treatment of milk**
- ❑ **Restrict movement of plant personnel in starter handling room, and locate starter room far away from production area**
- ❑ **Check filtration of air into the starter room**
- ❑ **Grow starter cultures in phage inhibitory/resistant medium (PIM/PRM):** Growth of phages during production of bulk starter can be controlled by using phage-inhibitory media. Phosphate and citrate salts bind ionic calcium, thus inhibiting phagic absorption. Phage-control media often contain deionized whey, protein hydrolysates, ammonium and sodium phosphate, citrate salts, and yeast extract.

- ❑ **Use phage resistant strains:** LAB vary widely in their susceptibility to bacteriophagic infection, so the use of resistant strains is an important aspect of phage control.
- ❑ **Culture rotation:** Culture rotations control bacteriophagic infection by limiting length of time that a specific strain or mixture of strains is used.
- ❑ **Genetically modified resistance strains:** Since phage-resistance plasmids are transferrable by conjugation, application of genetic engineering technology can introduce industrially significant phage resistance starter strains.