

علم الأحياء الدقيقة  
**Microbiology**  
*Introduction to Bacteriology*



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مكتب ٢ ب ٤٥



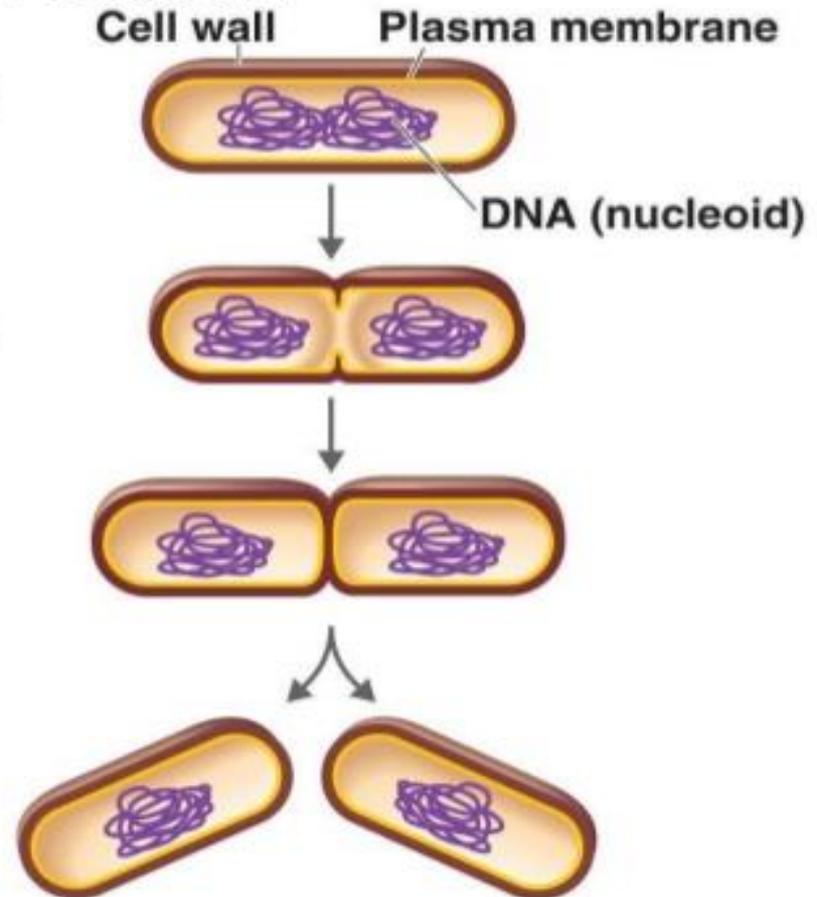
# Bacterial Growth & Reproduction

- Bacteria multiply by a simple cell division known as binary fission (splitting into two). The single piece of DNA reproduces itself exactly.
- When bacterial species produce several forms, these variants are called *strains*.
- The calculation of bacterial growth is fairly simple, since each original cell divides to form two new cells, with the loss of the original parent.
- the calculation series describing growth is: 1, 2, 4, 8, 16, ...etc.

# Bacterial Growth & Reproduction

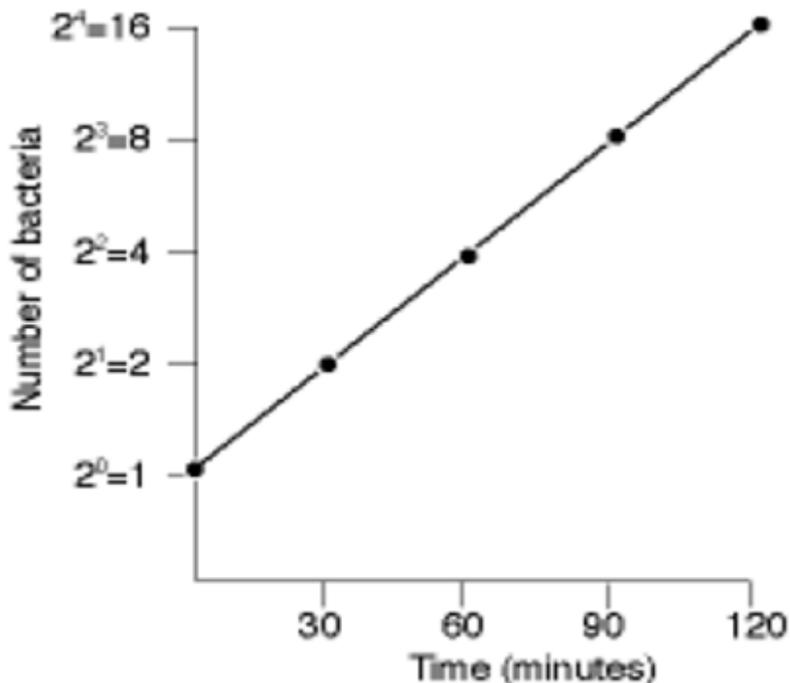
## Binary Fission

- 1** Cell elongates and DNA is replicated.
- 2** Cell wall and plasma membrane begin to constrict.
- 3** Cross-wall forms, completely separating the two DNA copies.
- 4** Cells separate.

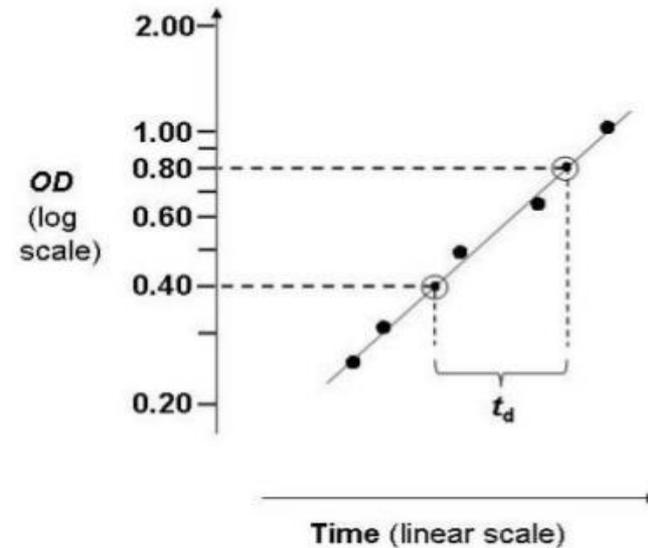


**(a)** A diagram of the sequence of cell division

- **The generation time** (time needed for the cell to divide into two- **Doubled**) differs according to species and prevailing conditions. For example, a bacterium that divides every 30 min has a generation time of 30 min.



Calculating doubling (generation) time from an OD measurement (indirect method):



# The bacterial growth curve

- Bacterial growth over time can be graphed as cell number versus time.
- This is called a growth curve.
- This curve typically has four distinct phases:

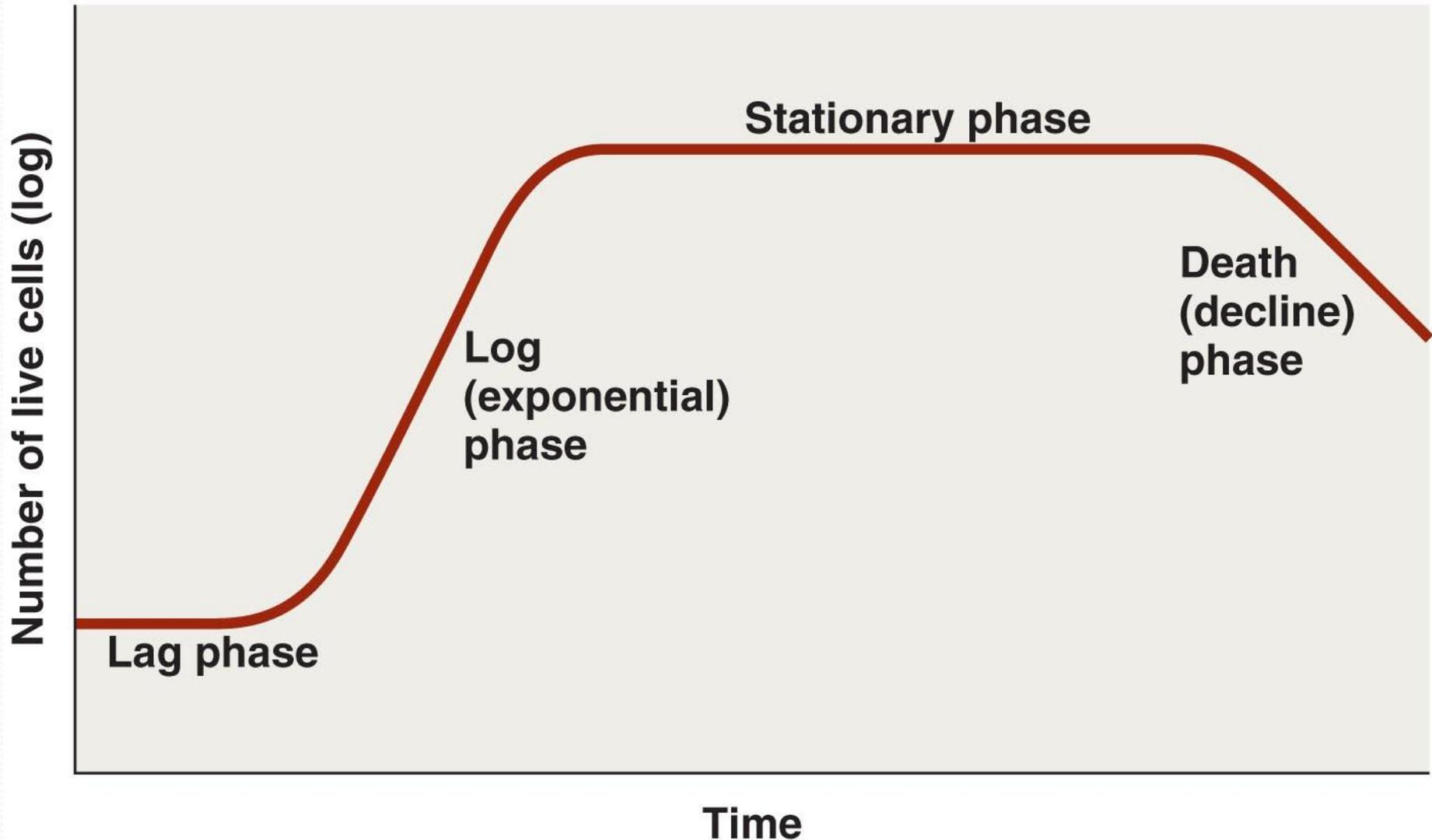
Lag  
phase

Exponential  
(log) phase

Stationary  
phase

Death  
phase

# The bacterial growth curve



## - **Lag phase:**

- \* **Is** the first phase.
- \* No increase in cell number
- \* Cells are actively metabolizing, in preparation for cell division.
- \* It may be short or very long, according to the growth medium.

## - **Exponential or log phase:**

- \* Is the second phase.
- \* called the exponential or log phase.
- \* This is the period in which the cells grow most rapidly, doubling at a fairly constant rate.

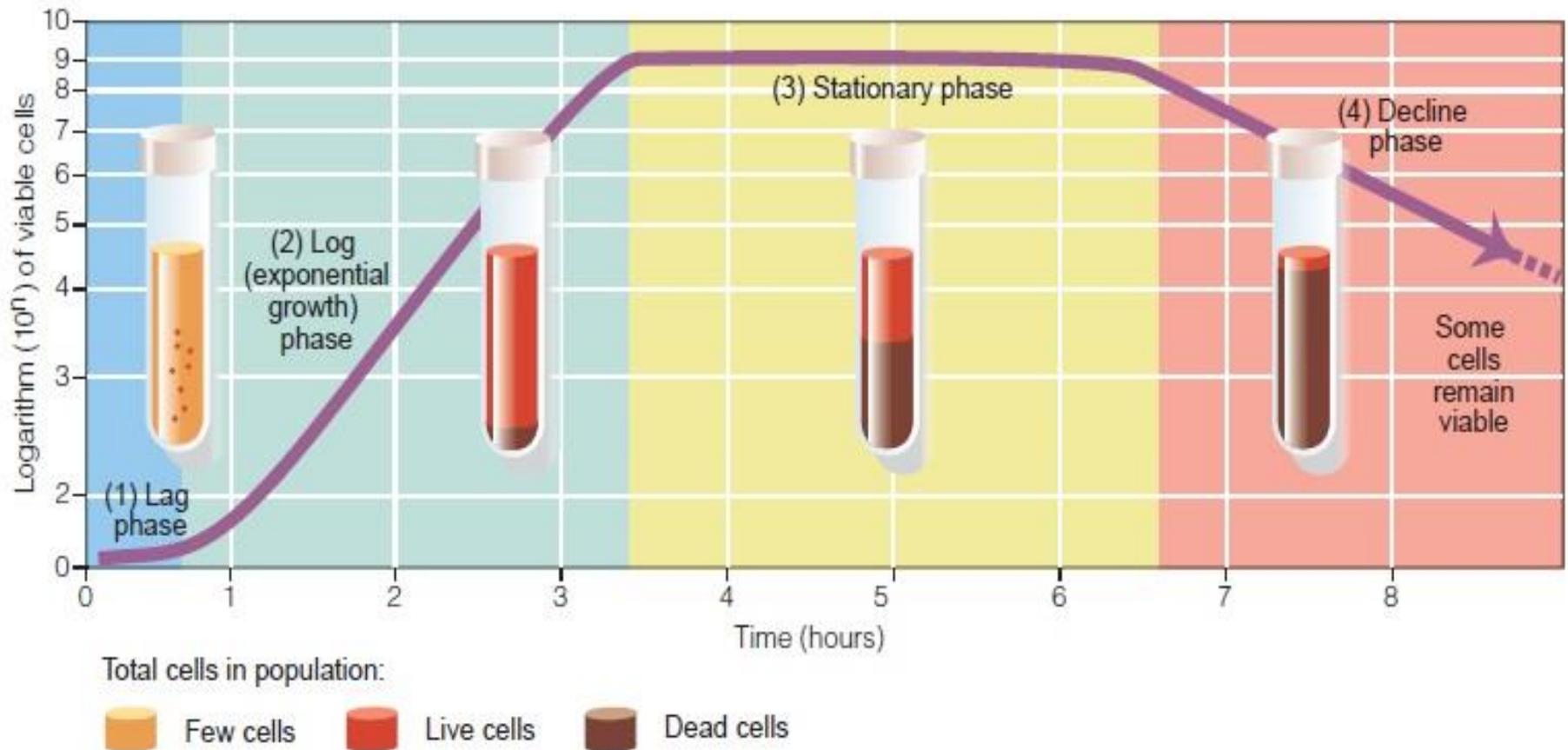
## - **Stationary phase:**

- \* Is third phase .
- \* metabolism slows.
- \* cells cease rapid cell division.
- \* high cell density, depletion of nutrients, accumulation of waste products.

## - **Death phase:**

\* **Is the final phase .**

\* **Cells are quickly losing the ability to divide.**



# Factors affecting bacterial growth

- Many factors affect the generation time of the bacterium:
  - Temperature.
  - pH.
  - Oxygen.
  - Salt concentration.
  - Nutrient.
- Most bacteria grow best when these parameters are optimum.

# Temperature

- According to the temperature degree that bacteria can grow and/or survive, they can be classified to:

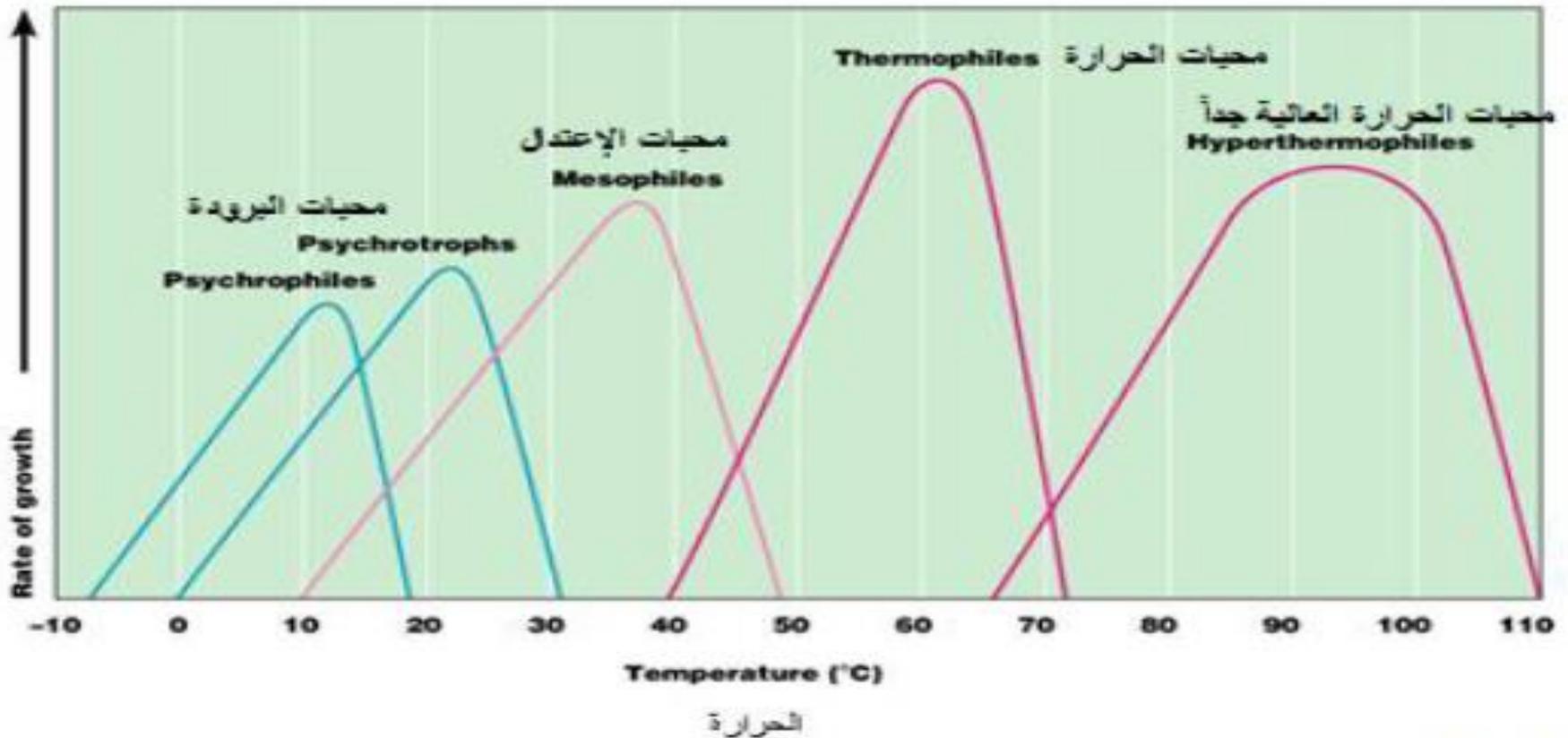


Figure 6.1

# Temperature

## Psychrotroph

Temp Range 0 – 30°C  
Common Optimum 20°C

Problem Zone

## Mesophile

Temp Range 15 – 40°C  
Common Optimum 35°C

Problem Zone

## Themophile

Temp Range 45 - 80°C  
Common Optimum 60°C

# QUESTIONS??

