

Tutorial session 6: Bacterial growth

Learning objectives:

- Understand the main concepts of bacterial growth
- Analyze and interpret microbiological data
- Perform basic calculations related to bacterial cultures
- Apply quantitative methods used in microbiology

Exercise I: Bacterial growth curve

A culture of *Escherichia coli* is incubated at 37°C in a suitable growth medium. The number of bacteria per milliliter (N) is measured at different time intervals.

The results are expressed as Log N and presented in the table below:

Time (h)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Log N	2	2	2	2.5	3.2	4.0	4.8	5.6	6.4	7.0	7.0	7.0	7.0	7.0	7.0	6.7	6.0	5.2	4.4	3.6	2.8

1. Plot the graph of **Log N as a function of time (t)**
2. Identify and clearly label the different phases of bacterial growth
3. Explain why the last phase of the growth curve occurs.

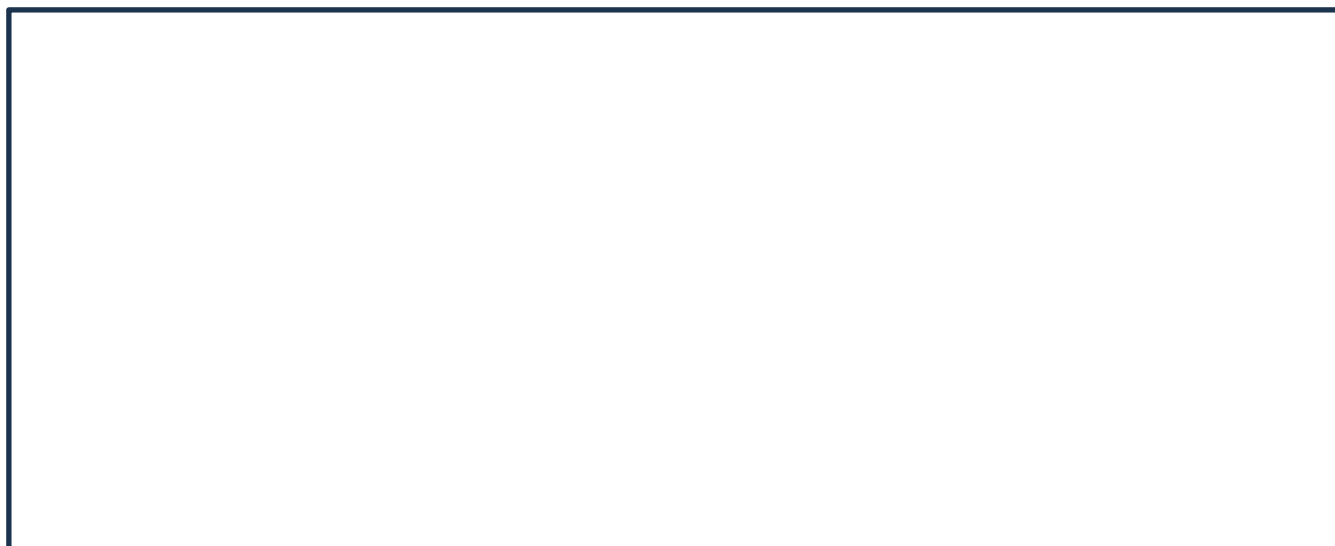
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Exercise II: Growth parameters

A bacterial culture is prepared by inoculating an initial number of bacteria: $N_0=2 \times 10^2$

The generation time of this bacterium is **G = 20 minutes**.

The culture is incubated for **6 hours**.

- Calculate the number of generations
- Calculate the number of bacteria present in the culture medium after 6 hours of incubation

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Exercise III: Bacterial enumeration (Dilution method)

A bacterial suspension is serially diluted up to 10^{-5} . Then, **0.1 mL** (Volume plated) of each dilution is spread onto **3 agar plates**. After incubation, the following colony counts are observed:

Plates	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}
Plate 1	Uncountable	318	182	31	2
Plate 2	Uncountable	305	176	39	1
Plate 3	Uncountable	309	168	23	0

Standard microbiological practice accepts only plates with **30 to 300 colonies** as valid.

- Select two successive valid dilutions that can be used for the calculation
- Calculate the number of viable bacteria per mL (**CFU/mL**)

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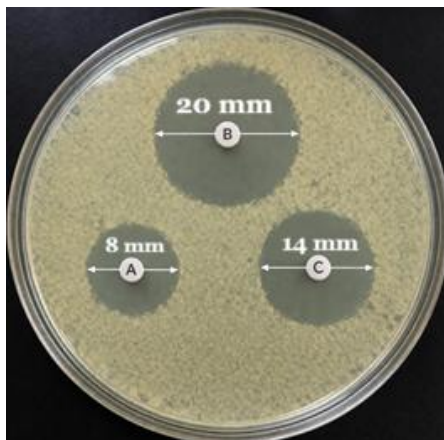
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Exercise IV: Antibiotic susceptibility

IV.1. Disk diffusion method (antibiogram): A Petri dish is inoculated with a bacterial strain. Three antibiotic disks, labeled **A**, **B**, and **C** are placed on the agar surface.

After incubation, the following diameters of inhibition zones are measured:



Using the following interpretation criteria:

Susceptible (S)	Intermediate (I)	Resistant (R)
diameter ≥ 18 mm	diameter 12–17 mm	diameter ≤ 11 mm

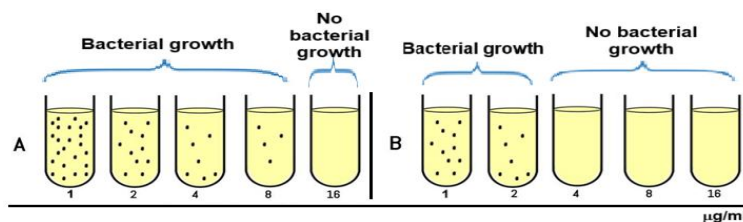
- Classify each antibiotic as Susceptible (S), Intermediate (I), or Resistant (R).

A : B : C :

- Which antibiotic is the most effective against this bacterial strain?.....

Justify:.....

IV.2. Determination of MIC: The figure below shows bacterial growth in culture tubes containing increasing concentrations of an antibiotic.



Determine the MIC in the following cases:

A: MIC =

B: MIC =

Justify your answer.....

