Tutorial session 5: Bacterial nutrition

Exercise 1: Elementary needs and energy sources

Bacteria require several chemical elements for their metabolism and structure.

- Classify the following elements into **macroelements** and **microelements (trace elements)**: C, H, O, N, S, P, K, Mg, Fe, Zn, Cu, Co.

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- What is the main biological role of microelements in bacterial cells?

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- Why are microelements required only in very small amounts?

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- What are the two main sources of energy for bacteria?

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- Define the following terms:

Photolithotroph:.....

Photoorganotroph:.....

Chemolithotroph:.....

Chemoorganotroph:.....

Exercise 2: Growth factors and specific requirements

- What are growth factors? How do they differ from essential metabolites?

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- A bacterium requires vitamin B_{12} as a growth factor and cannot synthesize it.
  What term describes this bacterium?.....

Exercise 3: Physicochemical parameters of bacterial growth

What is the difference between halotolerant and halophilic bacteria?

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What is water activity (Aw)? How does it affect bacterial growth?

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A bacterium is isolated from a hot spring at 55°C. It uses CO_2 as a carbon source and oxidizes hydrogen sulfide for energy.

a) What is its trophic type? .....

b) How would you classify it based on its temperature preference?.....

A bacterium can grow in the presence of oxygen but also by fermentation in its absence. What is its respiratory type? .....

Give an example.....

Exercise 4: Analysis of culture media and bacterial growth

Medium 1:

- K_2HPO_4 : 13.6 g/L
- $(NH_4)_2SO_4$: 2 g/L
- $FeSO_4 \cdot 7H_2O$: 0.5 mg/L
- $CaCl_2$: 0.02 g/L
- $MgSO_4 \cdot 7H_2O$: 0.2 g/L
- pH 7.0

Medium 2:

- Same mineral salts as Medium 1
- Glucose : 10 g/L
- pH 7.0

Medium 3:

- Yeast Extract: 5 g/L
- Casein Peptone: 10 g/L
- NaCl: 5 g/L
- pH adjusted to 7.4
- Agar: 15 g/L (for solidification)

Questions

1. For each medium, specify if it is defined/synthetic or complex. .....
2. What is the primary role of glucose in Media 2?..... .....
3. What is the role of casein peptone in Medium 3? .....
4. What is the function of yeast extract in Medium 3?.....

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5. Among the three media, which one would be most suitable for attempting to cultivate a chemolithoautotrophic bacterium? Justify.

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6. Three bacterial strains (X, Y, Z) are tested on these media. The table below shows growth (+) or no growth (-) after incubation.

Strain	Medium 1	Medium 2	Medium 3
X	-	+	+
Y	-	-	+
Z	-	+	+

a. Which strain(s) is/are the least nutritionally demanding? ....
Justify. .....
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b. Why does Strain X not grow in Medium 1 but grows in Medium 2?

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c. Why does Strain Y grow only in Medium 3?

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