6.7A: Microbial Growth Cycle

Increases in cell size are tightly linked in unicellular organisms and under optimal conditions bacteria can grow and divide rapidly.

LEARNING OBJECTIVES

Duplicate the requirements of microbial growth cycles

KEY TAKEAWAYS

Key Points

• Bacteria grow to a fixed size and then reproduce through binary fission which is a form of asexual reproduction. Under optimal conditions, bacteria can grow and divide extremely rapidly.

• Different kinds of bacteria need different amounts of oxygen to survive.

• For microbial growth to process, microorganisms require certain nutrients including carbon, nitrogen, phosphorus, sulfur, and metal ions.

• Various types of bacteria thrive at different temperatures.

Key Terms

• binary fission: The process whereby a cell divides asexually to produce two daughter cells.
• **Anaerobe**: An anaerobic organism; one that does not require oxygen to sustain its metabolic processes.

• **Aerobe**: Any organism (but especially a bacterium) that can tolerate the presence of oxygen or that needs oxygen to survive.

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**Microbial Growth Cycle**

All microbial metabolisms can be arranged according to three principles: 1) How the organism obtains carbon for synthesizing cell mass. 2) How the organism obtains reducing equivalents used either in energy conservation or in biosynthetic reactions. 3) How the organism obtains energy for living and growing (for more detail on this topic see atom on Growth Terminology). Unlike in multicellular organisms, increases in cell size (cell growth and reproduction by cell division) are tightly linked in unicellular organisms. Bacteria grow to a fixed size and then reproduce through binary fission which is a form of asexual reproduction. Under optimal conditions, bacteria can grow and divide extremely rapidly. These optimal conditions are discussed below.

![Flowchart: Metabolic characteristics of microorganisms]

Figure: **Metabolic characteristics of microorganisms**: This is a flowchart to help determine how a microorganism undergoes growth development.

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**Oxygen Requirements**

Different kinds of bacteria need different amounts of oxygen to survive, which determines which bacteria can infect which parts of the body. They are not able infect the skin because oxygen is present, and they can only grow in the presence of oxygen. Conversely, obligate anaerobes are killed by oxygen and carry out fermentation. Tetanus is an obligate anaerobe so it will infect areas where oxygen in limited. Aerotolerant anaerobes breath anaerobically (without oxygen), but they are able to survive when oxygen is present.

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**Nutrient Requirements**

For microbial growth to process, microorganisms require certain nutrients including carbon, nitrogen, phosphorus, sulfur, and metal ions.
Temperature Requirements

Various types of bacteria thrive at different temperatures. Microorganisms that grow best at moderate temperatures are called mesophiles. Those surviving at high temperatures are thermophiles and microorganisms surviving at very low temperatures are called psychrophiles.