International Scholars Journals

Advanced Journal of Microbiology Research ISSN 2736-1756 Vol.16 (2), pp.001-002, June, 2022.
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Perspective

The implications of bacterial metabolism

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Received: 17-May-2022, Manuscript No. AJMR-22-62929; Editor assigned: 20-May-2022, PreQC No. AJMR-22-62929 (PQ); Reviewed: 03-Jun-2022, QC No. AJMR-22-62929; Revised: 09-Jun-2022, Manuscript No. AJMR-22-62929 (R); Published: 16-Jun-2022.

DESCRIPTION

Metabolism refers to all biological reactions that occur in a cell or organism. The chemical diversity of substrate oxidations and dissimilation reactions (reactions that break down substrate molecules), which are commonly employed to create energy in bacteria, is the subject of bacterial metabolism research.

Within the live bacterial cell, integrated enzyme systems catalyse their respective exergonic (energy-yielding) and endergonic (energy-requiring) activities, culminating in cell self-replication. The ability of microbial cells to exist, function, and reproduce in a proper chemical environment (such as a bacterial culture medium) as well as the chemical changes that occur as a result of this transformation is referred to as bacterial metabolism.

Heterotrophic metabolism

Heterotrophic metabolism is the biologic oxidation of organic compounds, such as glucose, to yield ATP and simpler organic (or inorganic) compounds.

All pathogens are heterotrophic bacteria, which get their energy from oxidation of organic molecules. The most often oxidised substances are carbohydrates (especially glucose), lipids, and protein. As a result of bacteria's biological oxidation of these organic molecules, ATP is synthesised as a chemical energy source. This mechanism also allows the bacteria cell to produce simpler organic compounds (precursor molecules) that are required for biosynthetic or assimilatory reactions.

Intermediates of the Krebs cycle serve as precursor molecules (building blocks) for the energy-intensive production of complex organic compounds in bacteria. Amphibolic degradation reactions produce energy while also generating precursor molecules for the production of new cellular constituents. Preformed organic molecules are required by all heterotrophic bacteria. These carbon- and nitrogen-containing compounds are growth substrates that are used aerobically or anaerobically to generate reducing equivalents (e.g., reduced nicotinamide adenine dinucleotide dinucleotide; NADH+H+), which are all biological oxidative and fermentative systems use chemical energy sources.

Metabolic autotrophism

Autotrophic bacteria generate all of their cell contents using carbon dioxide as a carbon source. The most common ways for synthesising organic compounds from carbon dioxide are the reductive pentose phosphate (Calvin) cycle, the reductive tricarboxylic acid cycle, and the acetyl-CoA pathway. The Calvin cycle is used by plants, algae, photosynthetic bacteria, and most aerobic lithoautotrophic bacteria. It was discovered by American biochemist Melvin Calvin. The Calvin cycle's most critical phase is the interaction of ribulose 1,5-bisphosphate with carbon dioxide, which creates two molecules of 3-phosphoglycerate, a precursor to glucose. The cell must consume nine molecules of ATP and oxidise six molecules of the electron donor, nicotinamide adenine dinucleotide phosphate reduced, to produce one molecule of glyceraldehyde-3-phosphate (NADPH). Autotrophic behaviour requires a cell's ability to perform photosynthetic or aerobic respiratory metabolism, which are the only systems capable of giving enough energy to maintain carbon fixation.

Phototrophic metabolism

Phototrophic metabolism is a type of metabolism that uses light to produce. The process of photosynthesis converts solar energy into cellular energy, which is essential for life on Earth. Chlorophyll pigments absorb light energy from the Sun and

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release an electron with a higher energy level in the basic process of photosynthesis. This electron travels through an electron transport chain, generating energy through the production of a proton gradient and ATP synthesis in the process. The electron eventually makes its way back to the chlorophyll.

This cyclic reaction path can provide the cell's energy requirements. As a result, phototrophic cell development necessitates the availability of a source of electrons to replace those lost during biosynthetic reactions.

According to the nature of the electron supply, photosynthetic organisms are separated into two classes. Higher plants, eukaryotic algae, and cyanobacteria (blue-green algae) are among the species that possess the pigment chlorophyll and use water as an electron source in oxygen-generating activities. It's assumed that around 1.8 billion years ago, cyanobacteria's forerunners had created enough oxygen on a worldwide scale to allow the emergence of higher forms of life.