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Clinical Microbiology: Open Access

Commentary

The First Bacterium Illumination

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DESCRPITION

Bacteria are a biological cell type. They make up a broad group of prokaryotic organisms. Bacteria come in a variety of shapes, ranging from spheres to rods and spirals, and are typically a few micrometres long. Bacteria can be found in soil, water, acidic hot springs, radioactive waste, and the earth's crust's deep biosphere. Bacteria also coexist with plants and animals in symbiotic and parasitic interactions. It play an important role in several stages of the nutrient cycle, such as the fixation of nitrogen from the atmosphere, by recycling nutrients. The decomposition of dead bodies is a part of the nutrition cycle, and bacteria are in charge of the putrefaction stage. Unicellular microbes were the first forms of life on Earth, approximately 4 billion years ago, and their ancestors were modern bacteria. Most species were minuscule for nearly 3 billion years, with bacteria and archaea dominating. Although bacterial fossils such as stromatolites exist, their lack of distinguishing morphology hinders them from being utilised to study the history of bacterial evolution or to determine the time of genesis of a specific bacterial species. Gene sequences, on the other hand, may be used to rebuild the bacterial phylogeny, and these analyses show that bacteria separated from the archaeal branch earliest. Bacteria also had a role in the second great evolutionary split, between archaea and eukaryotes. Eukaryotes arose as a result of ancient bacteria forming endosymbiotic relationships with the ancestors of eukaryotic cells, which were likely connected to the Archaea.

The capacity to sequence genes and, more recently, complete genomes has revolutionised our knowledge of the tree of life, revealing the enormous diversity of microbes and placing plants, animals, and fungi as nested branches among microbial lineages. The resulting evolutionary tree separates life into three categories, including Bacteria and Archaea, which are entirely microbiological, and Eukarya, which are organisms with nuclei. The nature of now-extinct forebears and the sequence of the tree's earliest branching events are still unknown. The bacterial tree's root is crucial because it marks the evolutionary beginning point for Bacteria's vast diversity and provides insight into the biology of the initial bacterial cells. This involved alphaproteobacterial symbionts being engulfed by proto-eukaryotic cells and becoming mitochondria or hydrogenosomes, both of which are still prevalent in all known Eukarya. A hyperthermophile lived around 2.5 billion–3.2 billion years ago, and is most likely the most recent common ancestor of bacteria and archaea. 3.22 billion years ago, bacteria could have been the first life on land.

Bacterial growth is divided into four stages. The cells of a colony of bacteria must adapt to their new habitat when they initially enter a high-nutrient environment that allows them to flourish. The lag phase is the initial stage of growth, a period of slow growth during which the cells adjust to the high-nutrient environment and prepare for rapid growth. Biosynthesis rates are high in the lag phase, since proteins required for fast growth are generated. The logarithmic phase, also known as the exponential phase, is the second phase of growth. Rapid exponential development characterises the log phase. During the log phase, nutrients are metabolised at a high rate until one of them is depleted and development is limited. The third phase of growth is the stationary phase, which is brought on by nutrient deficiency. Non-essential cellular proteins are consumed as the cells diminish their metabolic activity. There is enhanced expression of genes involved in DNA repair, antioxidant metabolism, and nutrient transport during the stationary phase, which represents a shift from rapid growth to a stress response state. The bacteria eventually run out of nutrition and die during the death phase.

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Received: July 7, 2021; **Accepted:** July 22, 2021; **Published:** July 29, 2021

Citation: Ulger N (2021) The First Bacterium Illumination. Clin Microbiol. 10:213