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THE EVOLUTION OF BACTERIA FROM ANCIENT MICROORGANISMS

Priya Shukla
Department of Microbiology, Jadavpur University, Kolkota, India
Email: Priya.sh@gmail.com

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ABOUT THE STUDY

Bacteria have evolved over billions of years since the Precambrian period, with their first significant split from the archaeal or eukaryotic lineage occurring at 3.2-3.5 billion years ago. This was discovered through gene sequencing of bacterial nucleoids to reconstruct their phylogeny. Furthermore, evidence of permineralized microfossils of early prokaryotes was identified in Australian Apex Chert rocks going back about 3.5 billion years during the Precambrian epoch. This shows that the most recent common ancestor of contemporary bacteria was an organism from the phylum Thermotogota.

Further chemical and isotopic research of old rock suggests that oxygen arrived around 2.45 billion years ago, during the Siderian epoch. This shows that marine, photosynthetic cyanobacteria emerged during this epoch since they were the first microorganisms to create oxygen as a by-product of their metabolic activity. Therefore, this phylum was assumed to have been prevalent around 2.3 billion years ago.

However, other scientists believe they might have existed as early as 2.7 billion years ago, because this was close to the period of the Great Oxygenation catastrophe, which meant oxygen levels in the atmosphere had time to rise before the catastrophe disrupted the ecology.

Pseudomonadota formerly proteobacteria evolved as atmospheric oxygen levels increased. Many nitrogen fixing bacteria, diseases, and free-living microorganisms now belong to this phylum. During the Paleoproterozoic epoch, this phylum developed roughly 1.5 billion years ago. However, there are several competing ideas on the origins of bacteria. Despite the discovery of microfossils of ancient bacteria, some scientists claim that the absence of recognisable morphology in these fossils means they cannot be used to derive an accurate evolutionary chronology of bacteria. Nonetheless, modern technical advancements have resulted in the discovery of further evidence.

Bacteria

Bacteria are prokaryotic microorganisms that can be bacilli, spirillum, or cocci in form and range in size from 0.5 to 20 micrometres. They were among the earliest living cells to develop and have since expanded to a wide range of environments, including hydrothermal vents, glacial rocks, and other animals. They have cytoplasm, cell membranes, and ribosomes in common with eukaryotic cells. The cell wall, which is also present in plants and fungi, flagella, which is not seen in all bacteria, and the nucleoid are all distinct bacterial traits.

Bacteria can metabolise in a variety of ways, the most prevalent of which are heterotrophic or autotrophic photosynthetic or chemosynthetic activities. Bacteria reproduce by binary fission, although they can exchange genetic information between individuals *via* transduction, transformation, or conjugation.

Process of bacterial evolution

Bacteria develop in the same way as other species do. This is accomplished by the process of natural selection, in which advantageous adaptations are handed down to subsequent generations until the characteristic becomes prevalent throughout the whole population. However, because bacteria reproduce by binary fission, a type of asexual reproduction, the daughter and parent cells are genetically identical. This renders bacteria vulnerable to environmental stresses, which can be mitigated by

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transferring genetic information through transduction, transformation, or conjugation. This enables for the development of new genetic and physical adaptations, allowing bacteria to adapt to their environment and evolve. Furthermore, bacteria may reproduce in as less as 20 minutes, allowing for rapid adaptability and the rapid evolution of new strains of bacteria. This has become a problem due to antibiotic-resistant microorganisms.

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