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Opinion Article

Bacteriology and bacterial metabolisms

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DESCRIPTION

Bacteriology is a branch of biology that studies the morphology, ecology, genetics, and biochemistry of bacteria, as well as a wide range of other aspects of their life. This discipline of microbiology deals with the identification, categorization and characterisation of bacterial species.

Identification, classification, and characterization of bacterial species are all part of this branch of microbiology. Because thinking and dealing with microorganisms other than bacteria, such as protozoa, fungi, and viruses, is comparable, the field of bacteriology has tended to expand into microbiology.

The birth of bacteriology coincided with the invention of the microscope. The Dutch naturalist Antonie van Leeuwenhoek, who reported certain animalcules, as they were then termed, in water, saliva, and other fluids in 1683, was most likely the first person to see microbes. These were observed using a basic lens with a magnification of around 100–150 diameters. The creatures appear to be related to some of the most massive bacteria currently known.

Bacteria are single-celled microorganisms with no nuclear membrane, metabolic activity, and binary fission division. In terms of medicine, they are a major source of sickness. Bacteria appear to be simple forms of life on the surface, but they are smart and adaptive organisms. Many bacteria reproduce quickly, and different species can grow on a wide range of hydrocarbon substrates, such as phenol, rubber, and petroleum. Both parasitic and free-living species of these creatures are extensively distributed. The relevance of bacteria in every branch of medicine cannot be emphasised because they are ubiquitous and have a remarkable capacity to adapt to changing surroundings through the selection of spontaneous mutations.

The need for physicians to test and apply the germ hypothesis of disease, as well as economic concerns about food and wine deterioration, gave rise to the science of bacteriology. The identification and characterization of bacteria linked with specific diseases led to the first developments in pathogenic bacteriology.

Over the last century, major developments in bacteriology have resulted in the production of a number of successful vaccinations, as well as a number of vaccines that are less effective or have adverse effects. Antibiotics were discovered, which was another big breakthrough.

Because a well-adapted parasite persists in its host without inflicting major damage, many bacterial infections might be considered as a failure of the bacterium to adapt. Medical researchers have been focusing on pathogenic processes and host defences in recent years. Understanding the underlying properties of the bacteria, the host, and their interactions is required to comprehend host-parasite connections involving specific infections.

Bacteriology Metabolisms

Heterotrophic Organisms: Heterotrophic metabolism is the biological oxidation of organic substances like glucose to produce ATP and simpler organic (or inorganic) components that the bacterial cell requires for biosynthesis or assimilation activities.

Respiration: Respiration is a kind of oxygen-dependent heterotrophic metabolism in which 38 moles of ATP are produced from the oxidation of 1 mole of glucose, resulting in 380,000 calories.

Fermentation: The terminal electron acceptor in fermentation, another type of heterotrophic metabolism, is an organic substance rather than oxygen. Although this imperfect form of glucose oxidation produces less energy, it promotes anaerobic development.

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Krebs cycle: The Krebs cycle is an oxidative process in which pyruvate is entirely decarboxylated to CO_2 during respiration. 15 moles of ATP are produced by this route.

Glyoxylate Cycle: The glyoxylate cycle is a variation of the Krebs cycle that occurs in some bacteria. The oxidation of fatty acids or other lipid molecules produces acetyl coenzyme A.

Transport of electrons and oxidative phosphorylation: A sequence of electron transfer processes within the cytoplasmic membrane drive the oxidative phosphorylation of ADP to ATP, which is the ultimate stage of respiration. This process is carried out by bacteria using flavins, cytochrome, and non-heme iron components, as well as numerous cytochrome oxidases.

Photosynthesis in Bacteria: Bacterial photosynthesis is an anaerobic way of metabolism that requires light. Carbon dioxide is converted to glucose, which is employed in biosynthesis as well as energy production. In bacteria, photolithotrophic and photoorganotrophic processes exist depending on the hydrogen source used to decrease CO_2.

Anaerobic Respiration: Another heterotrophic method of metabolism is anaerobic respiration, which uses a molecule other than oxygen as a terminal electron acceptor. NO^{3-}, SO_4^{2-}, fumarate, and even CO_2 are examples of acceptor chemicals for methane-producing bacteria.

Nitrogen Cycle: The nitrogen cycle is a recycling process in which microbes, plants, and mammals consume organic and inorganic nitrogen compounds metabolically and recycle them. Bacteria are principally responsible for important activities such as ammonification, mineralization, nitrification, denitrification and nitrogen fixation.