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Review of "The Role of Bacteria in Climate Change: Emissions and Carbon Cycling

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Abstract
The accumulation of greenhouse gases has been slowly increasing over time due to various anthropogenic natural processes. These determinants include burning of excess coal, oil, and coal, biodegradation, and biomass burning Currently, climate change and global warming are formidable challenges that nations between people meet. This phenomenon negatively affects many natural processes. It also affected the structure, efficiency, and metabolism of microbial assemblages. It identifies strategies for effectively addressing climate change. For example, microorganisms and other organisms have great potential for mitigation through adaptve responses. They play various roles in preventing and reducing greenhouse gases, especially through nutrient recycling processes. They act constructively as producers or consumers of this gas. This project serves to address environmental hazards from natural and man-made sources. In summary, biogeochemical cycles and climate change should not be interpreted as separate events.
Keywords: Bacteria, Climate Change, Emissions, Carbon Cycling, Mitigation

1-Introduction

Important challenges of the 21st century include climate change, energy supply, health and disease management, and the promotion of sustainable environmental practices,These issues represent urgent issues in contemporary discourse. Current global climate change action is at the forefront of scientific research[1], while carbon and nitrogen, which are cellular structures [2,3]. Using biological methods to manage greenhouse gas emissions is critical when it comes to nutrient recycling. Biodiversity contributes significantly to mitigating climate change and its negative impacts, due to its remarkable versatility and adaptability to a wide range of environmental conditions . . . . This review aims to elucidate the role of microorganisms in concerted efforts to combat climate change and reduce greenhouse gas emissions and furthermore, seeks to investigate how these roles can be developed in in future mitigation strategies. This study attempts to clarify the critical role of ecosystems in climate change mitigation and highlights the critical importance of microorganisms in this ongoing struggle. Microbial organisms respond to climate change and global warming by exhibiting immediate and long-term response mechanisms that can facilitate or inhibit development [6,7]. Microorganisms act as key agents of environmental sustainability due to their ability to recycle and transform essential cellular elements including carbon and nitrogen [8,9 In nutrient a for recycling, ecological strategies aimed at reducing greenhouse gas emissions are proving to be more beneficial. Microbial communities in many ecosystems play an important role in mitigating and managing the negative impacts associated with climate change, due to their remarkable metabolism and ability to thrive for environmental reasons

2-Climate chang

Ecology seeks to understand the mechanisms by which ecosystems arise and sustain themselves in time and space, climate strongly influences community interactions and organizational patterns, and their functional characteristics Projected global warming , distinct from other putative environmental determinants, have dramatic effects on changes in soil microbial diversity by increasing surface temperature and simultaneously reducing water a on the inner surface [13,14]. his statement is true

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for all environmental factors altered by climate change, including changes in precipitation patterns, drought conditions, and wind variability In the broad climate characteristics of a region—e.g temperature, precipitation, and wind patterns—collectively known as the climate. Oceans, other Water resources and ecosystems exist [15, 16]. Many factors such as latitude, axial tilt of the earth, wind belt movement, ocean and land temperature changes, and geophysical factors greatly influence planet this so the weather. .. of microbial life, plants and animals They dilute nutrients. This gas acts like a heat blanket. Without this protective layer, ground temperatures would drop by 20–30°C, making it extremely uninhabitable [17**].**

2-1 Changes in climate and their effects on microbes

Climate change has direct and indirect effects on the structural and functional dynamics of soil microbial ecosystems. The following list illustrates the many impacts of climate change on microorganisms: mortality and environmental degradation; significant direct and indirect effects on metabolism; extinction or modification by reduction or increase in biodiversity, species, and structure; and physiological effects, as well as greenhouse gas emissions, which can have positive or negative consequences. Structural changes of the cellular community take place in response to increased temperature, simultaneously accelerating processes such as methanogenesis, fermentation and respiration. Risk of injury, illness and death from heat waves, wildfires, extreme weather events, sea level rise, natural disasters, extreme heat, oxygen depletion, drought, disease new spread and occurrence are serious consequences Climate change affects both ecosystems and ecosystems . Climate change has direct and indirect effects on the structural and functional dynamics of soil microbial ecosystems. An overview of the effects of climate change on microorganisms is presented. These branches include mortality and environmental disturbance, direct and indirect severe metabolic effects, biodiversity reduction (or stimulation), species and systemic processes leading to extinction or change occurs, and the physiological effects of greenhouse gas emissions. with simultaneous rates of methanogenesis, fermentation, and respiration. Important ecological and abiotic impacts of climate change are subsequent risks of damage, disease and death from heat waves, wildfires, extreme weather events, floods, natural disasters, warming a severe weather, decreased ventilation, drought, and the spread of other diseases.

3- Microbial populations and the carbon cycle

Bacteria play an important role in the carbon cycle by influencing the stability and longevity of carbon compounds, as well as by determining whether carbon is released into the atmosphere as a greenhouse gas [22 Important for natural resource degradation importance based on microbial activity, such as if the nitrogen cycle. Bacteria play an important role in breaking down decomposed organic matter and converting it into products that can be used by other organisms [23 Thus, microbial enzyme systems are considered an important "engine" of Earth's biogeochemical cycles thrive. The balance of respiration and photosynthesis is a key mechanism for the terrestrial carbon cycle. Autotrophs—such as photosynthetic plants and microorganisms that produce photographs and chemicals—play an important role in "carbon fixation," converting atmospheric carbon dioxide into organic matter and facilitating the transfer of carbon from the atmosphere to the soil In reactions, bacteria use carbon as a metabolite, from the atmosphere It absorbs significant amounts of carbon dioxide. A variety of bacteria and fungi are involved in the carbon cycle in aquatic environments. Anaerobic carbon metabolism can also occur in low-oxygen environments, such as aerobic-anaerobic metabolism in lakes, ponds, and other deep water bodies, where algae are transported by aerobic processes the involvement of the. Moreover, under anaerobic conditions, microorganisms can recycle carbon molecules through fermentation for energy [24, 25].

3- Bacteria that consume carbon: A new finding

Advances in biotechnology and genetic engineering have greatly facilitated the manipulation of native biological processes in microorganisms. A recent study by an Israeli research group developed an E. coli strain capable of efficiently utilizing carbon, showing how obligate heterotrophs are converted to full form during experimental This mutant bacterium uses a Kelvin cycle non-native uses to convert CO_2 to biomass carbon] . With respect to biomass production and the utilization and

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storage of atmospheric CO2, the abundance of heterotrophs on Earth is generally high. A deeper understanding of their metabolic properties enabled researchers to develop metabolically altered autotrophic E. coli strains [27]. E. coli in its natural state produces an enzyme called formate hydrogenlyase (FHL), which oxidizes formaldehyde to carbon dioxide, and directly links this process to the reduction of protons to molecular hydrogen Researchers have found that FHL acts as a hydrogen-dependent CO2 reductase can, if Formate causes FHL to accumulate outside the cell by a reversible reaction, a Compressed CO2 and H2. The reduction energy derived from formate (HCOO-) can be used for carbon fixation through the Kelvin cycle to conserve energy. [28].

The transition to a new diet was accomplished in approximately 200 days by means such as introducing mutations in genes encoding enzymes to alter the mechanisms of action through chemostat-directed growth cell culture played a role This research undoubtedly provides a practical alternative to atmospheric CO2 reduction and forms the basis for new projects aimed at address global climate change challenges [30].

4- Microbes in the soil and oceans' contribution to lowering GHG emissions

Microorganisms in soil play an important role in maintaining the environmental balance necessary for the functions of life. According to [31], soil microbes play an important role in organic matter decomposition, nitrogen cycle, trace gas generation, and metal-elemental biotransformation Through these processes, soil microbes contribute significantly to the aerobic process are hot in birth and consumption. Understanding how soil microorganisms respond to and are affected by global climate change is essential for implementation to reduce greenhouse gas emissions. Soil microbes can effectively harness the emissions generated by human activity to counteract the effects of climate change. Various microorganisms such as decomposers, nitrogen-fixing bacteria, chemolithoautotrophs, and photosynthetic cyanobacteria play important roles [32].

Decomposers are especially important in controlling global environmental temperatures. The decomposition is highly influenced by atmospheric temperature; with higher or optimal temperatures, the bacterial activity increases, promoting the decomposition and causing more CO2 migration into the atmosphere [33, 34]. There is emerging evidence that simultaneous GHG mitigation may be more effective than CO2-mitigation alone. As early as 1901, Beijerinck noted that atmospheric nitrogen is converted into nitrogenous compounds such as ammonia (NH3) . in the soil by nitrogen-fixing bacteria. These viruses exist independently and in association with plants, especially in maize [35, 36].

Nitrogen-deficient cells convert nitrogen oxide, a potent greenhouse gas, into harmless nitrogen gas. In addition, many bacteria are able to reduce N2O emissions into the environment. Cyanobacteria as photosynthetic bacteria contribute to the reduction of greenhouse gas emissions, especially from the marine environment, where Prochlorococcus and Synechococcus species are commonly encountered [37, 38, 39].

Conclusion

Bacteria play important roles in biodegradation, greenhouse gas release, and contribute to global climate change through nutrient cycling. But they can reduce emissions of various gases and slow climate change by converting this gas into useful biomass for themselves and other organisms Microorganisms are important in the environment monitoring environmental improvements through gas production and consumption. Ecosystems regulate the movement of carbon and nitrogen between the soil and the atmosphere. Microbial ecology is useful for analyzing the terrestrial carbon cycle, which is critical for maintaining ecosystem balance and regulating the atmosphere. Methylotrophs can use greenhouse gases as resources to meet their carbon and energy needs. Greenhouse gases are released from the atmosphere due to processes such as respiration, decomposition and combustion. Nature is adept at balancing nitrogen and carbon within the biogeochemical nutrient cycle.

Further research and collaborative projects are needed to explore the relationship between microbes, climate change, and human well-being to address complex issues Microbial pathogens can directly impact human health through infection and infection changing networks, changing microbial biogeography, and terrestrial, marine, and urban microbes Given the scope of this issue, microbes can be used in a variety of ways to address global climate change role through production reduction and consumption, there is a need for more innovative solutions with special focus on microorganisms.

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