Advances in
Biotechnology & Microbiology
ISSN 2474-7637

Juniper Publishers
key to the Researchers

Mini Review
Volume 17 Issue 4 - November 2023
DOI: 10.19080/AIBM.2023.17.555969

Adv Biotechnol Microbiol

Microbes In the Spotlight: The Latest in Microbiology Advancements

Sonal Mishra

Department of Botany, Acharya Narendra Dev College, Kanpur, India

Submission: October 26, 2023; **Published:** November 13, 2023

***Corresponding author:** Sonal Mishra, Department of Botany, Acharya Narendra Dev College, Kanpur, India, Email: mishrasona227@gmail.com

Abstract

Several noteworthy developments have occurred recently in the quickly developing science of microbiology. Here are some of the latest developments in microbiology such as clustered regularly interspaced short palindromic repeats (CRISPR) and CRISPR-associated (Cas) systems, microbiome research, antibiotic resistance, synthetic biology, microbes and agriculture, bioinformatics and data analysis, single-cell microbiology, and environmental microbiology.

Keywords: Agriculture; Antibiotic Resistance; Bioinformatics; Crispr; Microbiology; Microbiome

Introduction

Modern molecular biology discoveries have expanded our understanding of the metabolic pathways involved in microbial transformation. Our ability to investigate the dynamics of microbial communities has improved because of new molecular approaches [1]. The most popular genome editing method in molecular biology laboratories worldwide, CRISPR-Cas systems are employed because of its straightforward design, low cost, high efficiency, strong repeatability, and short cycle [2]. Because of the microbiome's crucial involvement in both human health and disease, modern biology has been transformed. Because it affects incidence, mortality and health care expenditures for certain pathogen-drug combinations, antimicrobial resistance poses a danger to human health globally [3]. According to Gardner [4], synthetic biology is the study of constructing new, functional systems by the disassembly and reassembling of biological cells and processes. A key element of sustainable agriculture is the microbiome, which is the collective of microorganisms in the soil environment [5].

Bioinformatics is a new field focused on the solution of biological problems, usually on the molecular level, using techniques including computer science, applied mathematics, statistics, and artificial intelligence [6]. When it comes to constructed genome fragments and gene expression activity at the level of individual prokaryotic genomes, single-cell microbiology can offer trustworthy context [7]. The study of microorganisms in the soil, water, and air as well as their use in bioremediation are the focus of environmental microbiology [8].

CRISPR-Cas systems

Clustered regularly interspaced short palindromic repeats (CRISPR) and CRISPR-associated (Cas) systems have revolutionized microbiology. They allow for precise gene editing and have numerous applications, including modification of genomic deoxyribonucleic acid (DNA) at a specific target site in a wide variety of cell types and organisms, including insertion, deletion and replacement of DNA, resulting in inactivation of target genes, acquisition of novel genetic traits and correction of pathogenic gene mutation. CRISPR technology is continuously advancing, with new and more efficient variants being discovered [2,9].

Microbiome Research

Understanding the human microbiome's role in health and disease, and how they interact with the host has gained significant attention. Advances in metagenomics, meta-transcriptomics and metabolomics have enabled researchers to study the complex microbial communities in the human gut, skin and other body sites. This has implications for personalized medicine and the development of probiotics (Gao et al., 2023; Li et al., 2020). Furthermore, because of cyanobacterial potential uses in pharmaceutics and biotechnology, cyanobacteria have drawn a lot

of attention recently. Sunscreen products contain cyanobacterial photoprotective metabolites such as mycosporine-like amino acids and scytonemin, since they improve skin's water retention and UV protection [10].

Antibiotic Resistance

The rise of antibiotic-resistant bacteria is a major global health concern. Researchers are using genomics and advanced molecular techniques to better understand antibiotic resistance mechanisms and develop novel strategies to combat them. This includes the development of new antibiotics and alternative treatment approaches [3].

Synthetic Biology

Synthetic biology techniques are being applied to engineer microorganisms for various purposes such as biofuel or green energy production [10], bioremediation and the production of pharmaceuticals. These advancements are not only scientifically exciting but also have practical applications [4,11]

Microbes and Agriculture

Microbes play a crucial role in agriculture, affecting soil health, crop growth and protection against pests and diseases. Research into the microbiome of plants and soil has led to the development of microbial-based biofertilizers and biopesticides [5].

Bioinformatics and data analysis

As microbiology generates vast amounts of sequencing data, bioinformatics tools and data analysis methods are continually evolving. These tools are essential for studying complex microbial communities and understanding their functions [6].

Single-Cell Microbiology

Advances in single-cell genomics and transcriptomics have allowed researchers to explore microbial diversity at the single-cell level. This has revealed previously undiscovered microorganisms and their functional roles in various environments [7].

Environmental Microbiology

Understanding how microbes interact with and respond to environmental changes, including climate change, pollution, and habitat disruption, is essential for addressing global environmental challenges. Microbes are key players in nutrient cycling and environmental remediation [8-14].

Conclusion

These advancements in microbiology have far-reaching implications for medicine, agriculture, environmental science and many other fields. As technology and research techniques continue to improve, we can expect even more exciting discoveries and innovations in the field of microbiology in the coming years.

Funding

This research has no funding.

Acknowledgement

None.

Conflicts of Interest

The author declares no conflict of interest.

References

1. Van Hamme JD, Singh A, Ward O P (2003) Recent advances in petroleum microbiology. Microbiology and Molecular Biology Rev 67(4): 503-549.
2. Xu Y, Li Z, (2020) CRISPR-Cas systems: Overview, innovations and applications in human disease research and gene therapy. Computational and Structural Biotechnology J 18: 2401-2415.
3. Murray C J, Ikuta K S, Sharara F, Swetschinski L, Aguilar GR, et al. (2022) Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. The Lancet 399(10325): 629-655.
4. Garner K L, (2021) Principles of synthetic biology. Essays in Biochem 65(5): 791-811.
5. Suman J, Rakshit A, Ogireddy SD, Singh S, Gupta C, Chandrakala J (2022) Microbiome as a key player in sustainable agriculture and human health. Frontiers in Soil Science 2: 821589.
6. Di Gesù V (2007) Data Analysis and Bioinformatics. In: Ghosh A, De RK, Pal SK (eds) Pattern Recognition and Machine Intelligence. PReMI 2007. Lecture Notes in Computer Science, 4815. Springer, Berlin Heidelberg pp. 373-388.
7. Kaster A K, Sobol MS (2020) Microbial single-cell omics: the crux of the matter. Applied Microbiology and Biotechnology, 104(19): 8209-8220.
8. Briški F, Vuković Domanovac M (2017) Environmental microbiology. Physical Sciences Reviews 2: 20160118.
9. Hille F, Charpentier E (2016) CRISPR-Cas: biology, mechanisms and relevance. Philosophical Transactions of the Royal Society B: Biological Sciences, 371(1707): 20150496.
10. Mishra S, Richa, Sinha RP, (2022) Biotechnological exploitation of cyanobacterial photoprotective metabolites. Vegetos 35: 281-297.
11. El Karoui M, Hoyos-Flight M, Fletcher L, (2019) Future trends in synthetic biology—a report. Frontiers in Bioengineering and Biotechnology 7: 175.
12. Mishra S, Kumari N, Singh V, Sinha R (2023) Cyanobacterial Biofuel: A Platform for Green Energy. Advances in Environmental and Engineering Research 5: 1-42.
13. Gao Y, Li D, Liu YX (2023) Microbiome research outlook: past, present, and future. Protein & Cell 14(10): 709-712.
14. Li D, Gao C, Zhang F, Yang R, Lan C, et al. (2020) Seven facts and five initiatives for gut microbiome research. Protein & Cell, 11(6): 391-400.

How to cite this article: Sonal M. Microbes In the Spotlight: The Latest in Microbiology Advancements . Adv Biotech & Micro. 2023; 17(4): 555969. DOI: 10.19080/AIBM.2023.17.555969

DOI: 10.19080/AIBM.2023.17.555969

How to cite this article: Sonal M. Microbes In the Spotlight: The Latest in Microbiology Advancements . Adv Biotech & Micro. 2023; 17(4): 555969. DOI: 10.19080/AIBM.2023.17.555969