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# Emerging Trends in Biotechnology

EMERGING TRENDS IN BIOTECHNOLOGY

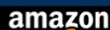


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# **Emerging Trends in Biotechnology**

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**Published by: - Book Rivers**

**Website: - <https://www.bookrivers.com>**

**Email: [publish@bookrivers.com](mailto:publish@bookrivers.com)**

1<sup>st</sup> Print Edition - 2026

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**Title: Emerging Trends in Biotechnology**

**Editors: Dr. Imran Hussain & Dr. Sujeet Pratap Singh**

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**ISBN: Book 11:978-93-6884-460-0**

**MRP: 399 /-INR**

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**(Printed in India)**

## Preface

Biotechnology stands at the forefront of scientific innovation, transforming the way we understand and interact with living systems. From advancements in genetic engineering and molecular diagnostics to breakthroughs in sustainable agriculture, environmental management, and personalized medicine, the field continues to evolve at an unprecedented pace. The present volume, *Emerging Trends in Biotechnology*, thoughtfully edited by Dr. Imran Hussain and Dr. Sujeet Pratap Singh, brings together diverse perspectives and cutting-edge developments that reflect the dynamic nature of this discipline.

This book offers a comprehensive overview of contemporary research areas, including synthetic biology, bioinformatics, nanobiotechnology, and translational research. It highlights not only the scientific progress achieved in recent years but also the practical applications that address global challenges such as food security, climate change, and human health. By integrating theoretical insights with real-world applications, this volume serves as a valuable resource for students, researchers, and professionals alike.

Dr. Imran Hussain has meticulously curated contributions that emphasize interdisciplinary approaches and innovation-driven research. The chapters presented in this book underscore the

importance of collaboration between academia, industry, and policy frameworks in advancing biotechnology for societal benefit. Moreover, the inclusion of emerging tools such as artificial intelligence and omics technologies reflects the future direction of the field.

I am confident that this book will inspire readers to explore new ideas, foster critical thinking, and contribute to the advancement of biotechnology. It is a timely and significant contribution that will undoubtedly serve as a reference for years to come. I congratulate Dr. Imran Hussain for his dedicated efforts in bringing together this important work and extend my best wishes for its success.

**Editors:**  
**Dr. Imran Hussain &**  
**Dr. Sujeet Pratap Singh**

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## Chapter-6

# Antimicrobial, Antioxidant and Anticancer Potential of *Andrographis Paniculata*: Phytochemical Insights and Biomedical Implications

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### Abstract

Oxidative stress and cancer continue to pose major challenges to global health, contributing significantly to illness and death worldwide. Growing concerns over the adverse effects of synthetic drugs have intensified interest in natural, plant-based remedies. This chapter presents an in-depth overview of the antioxidant and anticancer potential of *Andrographis paniculata*, commonly referred to as the "King of Bitters." It delves into the biochemical basis of oxidative stress, the therapeutic relevance of antioxidants, and the crucial role of natural compounds in cancer prevention and therapy. Additionally, the chapter discusses the phytochemical constituents, traditional applications, and pharmacological benefits of *A. paniculata*, particularly its anti-inflammatory, hepatoprotective, antidiarrheal, and anticancer effects. Emphasis is placed on the need for further targeted research to substantiate its clinical effectiveness and safety, underscoring its promise in the development of innovative therapeutic agents.

**Keywords:** *Andrographis paniculata*, Oxidative stress, Cancer, Antimicrobial activity, Biological diversity, Phytochemical