



Dr. Imran Hussain is currently serving as an Assistant Professor of Bioengineering at Integral University, Lucknow, India, with extensive academic and research experience in biochemistry, molecular biology and cancer biology. He obtained his Master in Agricultural Biotechnology from IIT Kharagpur. He earned his PhD in Biochemistry from the University of Texas at Arlington, USA, and has completed postdoctoral research at the University of Texas Southwestern Medical Center and the University of Oklahoma Health Sciences Center, USA. He has published extensively in reputed international journals, authored and edited academic books, book chapters, and holds multiple granted patents in biomedical and diagnostic technologies.



Dr. Sujeet Pratap Singh is faculty member at the Amity Institute of Biotechnology, Amity University Lucknow, with over 19 years of teaching and research experience in Industrial Biotechnology, Bioprocess Technology, and Microbial Applications. An alumnus of IIT Kharagpur, he has published several research papers and book chapters in reputed international journals and publishers including Springer and CRC Press. He is the co-author/editor of multiple biotechnology textbooks and holds granted patents in healthcare and sustainable technologies. Dr. Singh is actively involved in research, innovation, academic administration, and intellectual property development, and is also the founder of ThinkNew, an IPR-focused startup supporting innovators and researchers.

EMERGING TRENDS IN BIOTECHNOLOGY

Emerging Trends in Biotechnology

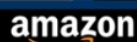


Dr. Imran Hussain
Dr. Sujeet Pratap Singh



BOOK RIVERS
WE CREATE READERS

BOOK AVAILABLE



9 789368 184460

₹ 399/-

Emerging Trends in Biotechnology

Editors:

Dr. Imran Hussain

Assistant Professor

Department of Bioengineering

Integral University, Lucknow, UP

Dr. Sujeet Pratap Singh

Assistant Professor

Amity Institute of Biotechnology

Amity University, Lucknow, UP



No part of this publication may be reproduced, transmitted or stored in a retrieval system, in any form or by any means, electronic, mechanical, photocopying recording or otherwise, without the prior permission of the author.

Published by: - Book Rivers

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

Email: publish@bookrivers.com

1st Print Edition - 2026

Copyright©: Editor

Title: Emerging Trends in Biotechnology

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

All Rights Reserved

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

MRP: 399 /-INR

(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

TABLE OF CONTENTS

Chapter No.	Chapter Title	Page No.
Chapter 1	Jasmonic Acid-Mediated Defense in <i>Vicia faba</i> : Alleviating Fungicide-Induced Oxidative Stress <i>Aneeta Tiwari and Ashish Verma</i>	1 - 25
Chapter 2	Natural Bioactives for Skin Therapeutics: <i>Cydonia oblonga</i> and Cyanobacteria-Based Approaches <i>Anjeeta Singh and Kaiser Younis</i>	26 - 47
Chapter 3	Polyhydroxybutyrate (PHB): Microbial Production, Properties, Extraction and Biomedical Applications <i>Anuj Yadav and Roohi</i>	48 - 77
Chapter 4	Physical Properties, Extraction, Stability, and Applications of Steviol Glycosides from <i>Stevia</i> <i>rebaudiana</i> <i>Farhana Trannum and Soban Ahmad Faridi</i>	78 - 97
Chapter 5	Molecular Insights and Therapeutic Advances in Breast Cancer <i>Heena Bano and Rahul Singh</i>	98 - 128
Chapter 6	Antimicrobial, Antioxidant and Anticancer Potential of <i>Andrographis paniculata</i> : Phytochemical Insights and Biomedical Implications <i>Hina Khatoon, Mohammad Haneef and Salman Akhtar</i>	129 – 153

Chapter 7 Essential Oils from *Cymbopogon flexuosus*: 154 - 187
Biosynthesis, Extraction, Phytochemistry,
Applications, and Cultivation

Nargis Aftab and Ahamad Faiz Khan

Chapter 8 Stress-Responsive Mechanisms in 188 - 215
Cyanobacteria: Implications for Bioremediation
and Crop Enhancement

Pratibha and Alvina Farooqui

Chapter - 4

Physical Properties, Extraction, Stability, and Applications of Steviol Glycosides from *Stevia rebaudiana*

*Farhana Trannum and Soban Ahmad Faridi **

Department of Bioengineering, Integral University, Lucknow

*Corresponding author: soban@iul.ac.in

Abstract

Stevia rebaudiana Bertoni, commonly known as the "sweet herb of Paraguay," is a perennial plant of the Asteraceae family renowned for its intensely sweet glycosides—primarily stevioside and rebaudioside A—which are over 200 times sweeter than sucrose. This chapter provides a comprehensive overview of *Stevia*'s botanical origin, chemical constituents, agronomic potential, and diverse applications in food and pharmaceutical industries. Emphasis is placed on the plant's health-promoting attributes, including antidiabetic, antihypertensive, antioxidant, and antimicrobial properties, which have elevated its status as a safe, natural alternative to synthetic sweeteners. In addition to reviewing traditional and modern extraction techniques—such as hot water, solvent extraction, supercritical CO₂, and microwave-assisted extraction—the chapter explores the metabolic fate and digestibility of steviol glycosides in the human gastrointestinal system. With increasing global demand and regulatory approvals in countries such as the U.S., Japan, and India, *Stevia* presents substantial opportunities for sustainable agriculture, public health, and the development of functional food products. The chapter concludes by highlighting its potential for commercialization and

the need for further optimization of extraction and formulation strategies.

Keywords: Stevia rebaudiana Bertoni, Stevioside, Glycosides, Solvent extraction, Physical properties

1. Introduction

Stevia (*Stevia rebaudiana* Bertoni), a naturally sweet herb belonging to the Asteraceae family, originates from Paraguay and is popularly referred to as the “sweet herb of Paraguay.” It is also commonly known as honey leaf, sweet leaf, candy leaf, and sugar leaf due to its intensely sweet-tasting leaves. These leaves contain two primary compounds—stevioside and rebaudioside A—which are estimated to be over 200 times sweeter than sucrose (Anon, 2004). Nearly 100% of the sweet profile of the leaves is attributed to these glycosides. *Stevia* has been traditionally used for centuries in Paraguay and Brazil to sweeten local teas, medicinal preparations, and various foods. Although there are over 200 species in the *Stevia* genus, *S. rebaudiana* is considered the most potent in sweetness (Savita et al., 2004). Currently, more than 150 species are cultivated globally (Carakostas et al., 2008).

Agronomically, *S. rebaudiana* has a productive lifespan of about four years, yielding three to four harvests annually. With an initial investment of ₹3.7 lakh per hectare, growers can potentially earn approximately ₹2 lakh each year, with annual yields ranging from 7.41 to 9.88 tons per hectare. The dried leaves are sold at around ₹200 per kilogram, making it a profitable crop (Sharma & Chattopadhyaya, 2007). *Stevia* has gained regulatory approval for food use in countries like Brazil, Argentina, Paraguay, China, Korea, and Japan. In the United States, it has been marketed as a dietary supplement since 1995. Although widely used in Asia and Europe, *Stevia* has only recently gained popularity in India as a natural, zero-calorie sugar substitute.