Journal of Science and Technology
ISSN: 2456-5660 Volume 10, Issue 01 (Jan -2025)
www.jst.org.in *DOI:https://doi.org/10.46243/jst.2025.v10.i01.pp48- 49*

Editorial: Beyond conventional antibiotics: advancements in chemical modulators, biology, and microbiome modification

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To Cite this Article
M. Kishore Babu, I. Devi, S.Gowthami, M.Vamshi Krishna, "**Editorial: Beyond conventional antibiotics: advancements in chemical modulators, biology, and microbiome modification**" *Journal of Science and Technology, Vol. 10, Issue 01- Jan 2025, pp38-47*

Article Info
Received: 29-12-2024 Revised: 06-01-2025 Accepted: 17-01-2025 Published: 27-01-2025

Abstract
Researchers have been exploring various alternative strategies to combat microbial infections, including bacteriophages, engineered antibodies, antimicrobial peptides, chemical modulation, microbiome manipulation, and novel technologies, in response to the global trend of increasing antimicrobial resistance. This Research Topic is based on these. The current area of study encompasses mABs, AMPs, anti-infective bone cements, a probiotic fungus, and antibiotic-free infection control, among other things.
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Introduction
One approach to reducing the use of antimicrobial drugs is to modulate the host immune system. In a single-center study, Gao et al. investigate the use of tocilizumab, a repurposed monoclonal antibody that targets the interleukin-6 receptor (IL-6R) and was approved for rheumatologic conditions, to treat critically ill COVID patients. The levels of inflammatory markers improved in all patients who had 1–3 doses of this medicine, although there was no correlation between higher dosages and death or secondary problems.
As a family of natural products having antimicrobial properties via many mechanisms, AMPs are at the forefront of the hunt for new antimicrobials. Bacillus strains are the primary producers of bacteriocins, an AMP that inhibits closely similar bacteria. The characterization of the Staphylococcus aureus-active bacteriocin P7 from Bacillus velezensis was reported by Li et al. We also report on our attempts to optimize the medium, as its composition significantly affects bacteriocin production.

An anti-infective bone cement based on calcium phosphate is the specific kind of antimicrobial material reviewed by Liu et al. The structure of bone makes it difficult to treat infections in the bone (often caused by Staphylococcus aureus) with traditional antibiotics. Antimicrobial resistance (AMR) is a major concern due to the high systemic antibiotic doses that are used. A variety of anti-infective compounds, including antibiotics, amphetamines, graphene, and therapeutic inorganic ions (TIIs), may be included into bone-compatible polymers known as calcium phosphate cements (CPCs).

A meta-analysis of Saccharomyces boulardii, a probiotic, as a microbiome manipulator for H. pylori

infection management is presented by Li and Xie. Their meta-analysis of 19 trials shows that traditional therapies for H. pylori are much enhanced by the addition of S. boulardii. In addition, the symptoms of the condition, including gas, nausea, diarrhea, and constipation, are lessened.

The infections caused by Carbapenem-resistant (CR) Gram-negative bacteria pose a substantial risk of death; thus, Shariati et al. examine several antibiotic-free methods for managing these bacteria. Bacteriophages, AMPs, nanoparticles, small-molecule natural products, the modified amino acid N-acetylcysteine, and the licensed anti-addiction medication disulfiram are all part of this category.

According to Parthasarathy et al., a potent antibiotic cocktail that can combat MDR bacteria is created when co-isolated Gram-positive Exiguobacterium and Gram-negative Acinetobacter interact. The authors also note that the lead compounds obtained from the crude extract's chromatography include multiple AMPs. As a whole, this Research Topic provides an overview of a few key developing methods that aim to curb the spread of AMR. Some examples of such methods include anti-infective bone cements that may be loaded with antibiotics or antibiotic alternatives, bacteriophages, AMPs, repurposed small molecule medicines, probiotics, and combinations of the two.