

# Antimicrobial Resistance in the Post-Antibiotic Era: Mechanisms, Challenges, and Future Perspectives

Prof. Nhavale Geeta.B<sup>1</sup>, Dr. Abhishek Kumar Sen<sup>2</sup>, Mr. Omkar Sambhaji Nagargoje<sup>3</sup>

<sup>1</sup> Professor, <sup>2</sup> Principal, <sup>3</sup> Student

Pratibhatai Pawar College of Pharmacy Shirampur, Ahilyanagar, Maharashtra, India

**Abstract:** *Antimicrobial resistance (AMR) has emerged as one of the most serious global public health threats of the 21st century, marking the onset of a post-antibiotic era in which once-curable infections are becoming increasingly untreatable. This review explores the complex biological mechanisms underlying AMR, including interference with cell wall synthesis, inhibition of protein and nucleic acid synthesis, disruption of essential metabolic pathways, and damage to cytoplasmic membranes. It also highlights the major drivers of resistance, such as misuse and overuse of antibiotics in humans and animals, environmental contamination, inadequate infection control, and poor stewardship practices. The global burden of AMR continues to rise, with millions of deaths annually linked to resistant pathogens. Artificial intelligence has shown promise in enhancing diagnostics, optimizing antibiotic use, and accelerating drug discovery. Strategies such as infection prevention and control (IPC), vaccination, and antimicrobial stewardship are essential to mitigate the crisis. Looking ahead, a coordinated One Health approach integrating human, animal, and environmental health is crucial. Strengthened global surveillance, investment in novel therapeutics, and public awareness are vital to preserve the efficacy of antimicrobials and safeguard future generations from the devastating consequences of resistance.*

**Keywords:** Antimicrobial resistance, post-antibiotic era, mechanisms, drivers, artificial intelligence, stewardship, One Health

