



## Review

# Nanostructured Antibiotics and Their Emerging Medicinal Applications: An Overview of Nanoantibiotics

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**Abstract:** Bacterial strains resistant to antimicrobial treatments, such as antibiotics, have emerged as serious clinical problems, necessitating the development of novel bactericidal materials. Nanostructures with particle sizes ranging from 1 to 100 nanometers have appeared recently as novel antibacterial agents, which are also known as “nanoantibiotics”. Nanomaterials have been shown to exert greater antibacterial effects on Gram-positive and Gram-negative bacteria across several studies. Antibacterial nanofilms for medical implants and restorative matters to prevent bacterial harm and antibacterial vaccinations to control bacterial infections are examples of nanoparticle applications in the biomedical sectors. The development of unique nanostructures, such as nanocrystals and nanostructured materials, is an exciting step in alternative efforts to manage microorganisms because these materials provide disrupted antibacterial effects, including better biocompatibility, as opposed to minor molecular antimicrobial systems, which have short-term functions and are poisonous. Although the mechanism of action of nanoparticles (NPs) is unknown, scientific suggestions include the oxidative-reductive phenomenon, reactive ionic metals, and reactive oxygen species (ROS). Many synchronized gene transformations in the same bacterial cell are essential for antibacterial resistance to emerge; thus, bacterial cells find it difficult to build resistance to nanoparticles. Therefore, nanomaterials are considered as advanced solution tools for the fields of medical science and allied health science. The current review emphasizes the importance of nanoparticles and various nanosized materials as antimicrobial agents based on their size, nature, etc.

**Keywords:** nanomaterials; nanocomposites; antibiotics; antimicrobial agents

## 1. Introduction

Heavy metals, such as copper, gold, silver, and others, have been employed as antibacterial agents over the last few decades owing to their nature and properties [1]. Considering