MAJESTIC AMERICAN JOURNAL OF NANOTECHNOLOGY (MAJN)

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CALL FOR PAPERS – OPEN THEMATIC ISSUE

Antimicrobial Nanoparticles: Synthesis, Mechanisms, and Translational Applications Against Drug-Resistant Bacterial Pathogens

Thematic Issue ID: MAJN01

MESSAGE FROM THE GUEST EDITOR

Dear Colleagues and Researchers,

It is my pleasure to invite microbiologists, nanotechnologists, pharmaceutical scientists, clinicians, public health experts, and regulatory scientists to contribute to this open thematic issue of the **Majestic American Journal of Nanotechnology (MAJN)** entitled "**Antimicrobial Nanoparticles: Synthesis, Mechanisms, and Translational Applications Against Drug-Resistant Bacterial Pathogens**."

Antimicrobial resistance (AMR) is recognized by the World Health Organization as one of the ten greatest threats to global public health. Bacterial AMR was directly responsible for more than 1.27 million deaths in 2019, and pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococci* (VRE), carbapenem-resistant *Enterobacteriaceae* (CRE), and multidrug-resistant *Pseudomonas aeruginosa* and *Acinetobacter baumannii* continue to erode the effectiveness of conventional antibiotics, while very few new antibiotic classes have been introduced in recent decades.

Nanoparticles offer a promising response to this crisis. Their high surface-area-to-volume ratio, tunable surface chemistry, and multiple simultaneous mechanisms of action allow them to overcome conventional resistance mechanisms, penetrate biofilms, act synergistically with existing antibiotics, and deliver drugs precisely to sites of infection. Questions of toxicity, biocompatibility, pharmacokinetics, nano-resistance, and regulatory approval must still be resolved before these advances can reach patients.

This thematic issue seeks original research, critical reviews, and short communications on the design, characterization, mechanisms, and translational application of antimicrobial nanoparticles against drug-resistant bacteria. I particularly welcome interdisciplinary contributions that connect nanoscience, microbiology, medicine, and public health, including work on low-cost green synthesis approaches suited to resource-limited settings.

I look forward to receiving your valuable contributions and to building a collection that informs future research, clinical translation, and policy in the fight against drug-resistant bacterial infections.

Sincerely,



Dr. Abayeneh Girma *(Thematic Issue Guest Editor)*
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Biography of Dr. Abayeneh Girma:

Dr. Abayeneh Girma is a microbiologist in the Department of Biology at Mekdela Amba University, Ethiopia. His research focuses on clinical microbiology, antimicrobial resistance, nanobiotechnology, and environmental health. He has published more than 50 articles in SCI/SCIE-indexed international journals and serves as an editor and reviewer for several SCI/SCIE journals.

As Guest Editor of this thematic issue, Dr. Abayeneh Girma aims to bring together researchers across nanoscience, microbiology, pharmaceutical science, medicine, and public health to advance nanoparticle-based strategies against drug-resistant bacterial pathogens.

Dr. Abayeneh Girma
Thematic Issue Guest Editor
Open Thematic Issue MAJN01: "Antimicrobial Nanoparticles: Synthesis, Mechanisms, and Translational Applications Against Drug-Resistant Bacterial Pathogens"

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SCOPE OF THE THEMATIC ISSUE

Background and Motivation

Antimicrobial resistance (AMR) has been recognized by the World Health Organization as one of the ten greatest public health threats facing humanity. With more than 1.27 million deaths directly attributable to bacterial AMR in 2019 alone, the need for novel antimicrobial strategies has never been more urgent. Drug-resistant bacterial pathogens, including methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococci* (VRE), carbapenem-resistant *Enterobacteriaceae* (CRE), and multidrug-resistant *Pseudomonas aeruginosa* and *Acinetobacter baumannii*, now threaten the foundations of modern medicine.

Nanoparticles (NPs) have emerged as a promising frontier in the fight against drug-resistant bacterial pathogens. Their distinctive physicochemical properties, such as a high surface-area-to-volume ratio, tunable surface chemistry, and multiple simultaneous mechanisms of action, offer novel ways to overcome conventional resistance mechanisms. Metallic and metal oxide nanoparticles (silver, gold, copper, zinc oxide, titanium dioxide, and Iron(II,III) oxide), polymeric nanoparticles, lipid-based nanocarriers, and carbon-based nanomaterials (graphene/graphene oxide, carbon nanotubes, fullerenes, carbon dots, and nanodiamonds) have demonstrated potent broad-spectrum antibacterial activity against multidrug-resistant (MDR) and extensively drug-resistant (XDR) strains. This thematic issue aims to gather cutting-edge research on the design, characterization, and translational application of antimicrobial nanoparticles developed specifically to combat drug-resistant bacteria.

Relevance to Current Research and Societal Needs

The global burden of bacterial infectious disease is compounded by the declining effectiveness of traditional antibiotics, and the pharmaceutical pipeline for new antibiotics remains inadequate. Nanoparticles offer a paradigm shift by providing:

- Multi-targeted antibacterial activity that minimizes the risk of resistance development
- Superior penetration and eradication of biofilms, a major source of chronic and device-associated infections
- Synergy with existing antibiotics, restoring their effectiveness against resistant strains
- Targeted drug delivery to infection sites with reduced systemic toxicity and improved therapeutic outcomes
- Cost-effective green synthesis using plant extracts and microorganisms, in line with the Sustainable Development Goals
- Immunomodulatory effects that strengthen host defense mechanisms against bacterial pathogens

Recent advances in nano-formulation, surface functionalization, and stimuli-responsive release systems have accelerated the clinical translation of nanoparticle-based antibacterials. However, challenges related to toxicity, biocompatibility, pharmacokinetics, bacterial resistance to nanoparticles, and regulatory approval remain. This thematic issue provides a timely platform to address these challenges and chart a path forward.

Recommended Topics/Sub-themes:

- Green synthesis and biogenic production of antibacterial nanoparticles using plant extracts, fungi, bacteria, and algae
- Metallic and metal oxide nanoparticles (Ag, Au, Cu, ZnO, TiO_2, Fe_3O_4): synthesis, characterization, and efficacy against MRSA, VRE, CRE, and MDR *Pseudomonas* and *Acinetobacter*
- Polymeric and lipid-based nanoparticles for antibacterial drug delivery and controlled release against resistant strains
- Carbon-based nanomaterials as antibacterial agents (graphene/graphene oxide, carbon nanotubes, fullerenes, carbon dots, nanodiamonds)
- Mechanisms of antibacterial action: oxidative stress, cell wall and membrane disruption, metal ion release, intracellular and nucleic acid damage, enzyme inhibition and metabolic interference, and efflux pump inhibition
- Nanoparticle–biofilm interactions: prevention, penetration, and disruption of bacterial biofilms
- Synergistic combinations of nanoparticles with conventional antibiotics, antimicrobial peptides, and phytochemicals
- In vitro and in vivo toxicity assessment: biocompatibility, immunotoxicity, and long-term safety
- Biodistribution, clearance, and clinical trial design for nano-antibacterials
- Bacterial resistance to nanoparticles: understanding and mitigating nano-resistance
- Regulation and standardization: quality control, safety evaluation, and approval pathways for nano-antimicrobials
- Computational and machine learning approaches to predict antibacterial activity and optimize nanoparticle design
- Wound healing and topical applications of antibacterial nanoparticles
- Nanoparticle-based diagnostics for rapid detection of drug-resistant bacterial pathogens

Expected Contribution to the Field

This thematic issue will bring the many dimensions of antimicrobial nanoparticle research together under one roof, offering a comprehensive, multidisciplinary overview of the current status and future prospects of nanoparticles against drug-resistant bacterial pathogens. It will serve as a key resource for:

- **Nanomaterials scientists** developing more potent and specific next-generation antibacterial agents
- **Microbiologists and infectious disease specialists** seeking new therapeutic approaches to MDR pathogens
- **Pharmaceutical researchers** working on nano-formulations of antibacterial drugs
- **Regulatory scientists and policymakers** needing evidence-based guidance on the safety and approval of nano-antibacterials
- **Clinicians and public health experts** seeking translational insights into drug-resistance management
- **Researchers in low-resource settings** exploring low-cost green synthesis methods for local use

By bringing together original research, critical reviews, and translational perspectives, this collection will:

- Compile mechanistic insights into nanoparticle–bacteria interactions
- Clarify the factors that govern the activity and selectivity of antibacterial nanoparticles against resistant bacteria
- Identify promising nano-formulations for clinical development
- Address knowledge gaps on toxicity, resistance evolution, and environmental impact
- Promote interdisciplinary collaboration across nanoscience, microbiology, medicine, and public health
- Offer evidence-based recommendations for regulatory harmonization

Article Types

- Original Research Articles
- Review Articles
- Short Communications

Target size: **8–10 articles** in the full thematic issue

Important Dates

- Full Paper Submission Deadline: **January 30, 2027**
- Expected Final Publication: **March 31, 2027**

Submit via the Online Journal System (OJS)

Authors are invited to submit original research articles, review articles, and short communications that align with the theme of this thematic issue and comply with the **MAJN** author guidelines. Manuscripts should be submitted via the journal's Online Journal System (OJS).

Submission Link: https://ma-nanotechnology.cmpublisher.com/index.php/ojs/login

Guideline for Authors: https://cmpublisher.com/journal/ma-nanotechnology/guideline-for-authors/

Note: All submissions must include a formal cover letter stating the name of the thematic issue (MAJN01) and the guest editor. All papers will undergo a double-blind peer review process in accordance with MAJN editorial standards to ensure high-quality contributions.

For inquiries, please contact Ms. Erica Solene, Editorial Manager, MAJN, at
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