

# CURRENT RESEARCH TOPICS IN PHARMACY: *Drug Delivery*

February 28th, 2023 12.00 PM ISTANBUL

FOR REGISTRATION:



## First Session- Moderator: Gülşah GEDİK 12.00-13.30 PM

Welcome- Prof. Oya Kerimoğlu  
Marmara University, Istanbul, Türkiye

Core-shell type lipid-polymer hybrid nanocarriers as novel-generation drug delivery platform – Assoc. Prof. Ceyda Tuğba Şengel Türk  
Ankara University, Ankara, Türkiye

Drug delivery systems used for biological products- Assist. Prof. Oğun Mehmet Saka  
Ankara University, Ankara Türkiye

Viral delivery systems within the gene therapy landscape- Dr.Ceyda Ekenok Atıcı  
Marmara University, Istanbul, Türkiye

## Second Session – Moderator: Oğun Mehmet SAKA 14:00-15.30 PM

Nanobiomaterials for drug delivery- Assist. Prof. Gülşah Gedik  
Trakya University, Edirne, Türkiye

Microneedles : A smart approach for intradermal and transdermal drug delivery systems-Assist.Prof.Ebru Altuntaş  
Istanbul University, Istanbul, Türkiye

Nose-to-brain drug delivery of nanoformulations:Preparation and in vitro evaluation– Dr.Özge Gün Eşim  
Ankara University, Ankara, Türkiye

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**Third Session- Moderator: Ceyda EKENTOK ATICI 16.00-18.30 PM**

**Microemulsion utility in pharmaceuticals: An overview and pharmaceutical applications- Assist.Prof.Emre Şefik Çağlar**  
University of Health Sciences, Istanbul, Türkiye

**Journey of the saponin from the plant to the formulation for the blocking tumor activities – Dr.Burcu Üner**  
The University of Health Science and Pharmacy in St. Louis, MO, USA

**Development of injectable ROS responsive nanoparticles with identified protein for improvement of the cardiac repair following myocardial infarction- Dr. Renuka Khatnik**  
Washington University in St.Louis, MO, USA

**Groundbreaking delivery systems: Liposomes-microbubbles complexes - Dr. Pankaj Dwivedi**  
University of Health Sciences and Pharmacy in St. Louis, MO, USA

**Breaking the barriers with cutting edge intradermal delivery towards pain-free skin therapy: Dissolvable microneedle devices for localized therapy – Dr.Monica Dwivedi**  
Birla Institute of Technology, Mesra, India

**Chair**

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# NANOBIOMATERIALS FOR DRUG DELIVERY

Gulsah GEDİK 

Department of Pharmaceutical Technology, Faculty of Pharmacy, Trakya University,  
Edirne, Türkiye

[gulsahgedik@trakya.edu.tr](mailto:gulsahgedik@trakya.edu.tr)

Nanobiomaterials are defined as biological materials, natural or synthetic substances, functional materials consisting of particles with at least one dimension below 100 nm for inventing practical applications in medicine, biology, chemistry, physics, and engineering which can be used to treat, support, or replace damaged tissue, organs, or bodily function or particularly drug and gene delivery for therapeutic applications [1-4]. A wide range of nanobiomaterials have been used to construct nanoparticles for encapsulation of chemotherapeutics to increase the capability of delivery or to provide unique optical, magnetic, electrical and structural properties for therapy as well as imaging [5]. Nanobiomaterials occur in various shapes such as rods, needles, platelets, and polygons, with spheres being the most common. Preparation techniques produce nanobiomaterials in different forms: deposited layers, dispersions, colloids, suspensions, or agglomerates [6].

Nanobiomaterials can be composed of organic (nanoparticles, dendrimers, cyclodextrins, liposomes, micelles, solid lipid nanoparticles), inorganic (metallics, bimetallics, and metal oxides, ceramics and silicates), carbon-based (fullerenes, carbon nanotubes, graphene, graphene oxide, nanodiamonds, carbon-based quantum dots), or composite-based materials in various morphologies of size and shape [7].

The composition of nanobiomaterials encompasses the core of the material, its shell, and any surface modifications. Generally, the first property to be modified for biocompatibility and reduced cytotoxicity is the chemical composition of nanobiomaterials [7].

Nanobiomaterials are used as reservoir of the drugs for prolonged or extended delivery. Therapeutics- drug and gene delivery systems include metallic, inorganic, organic/carbon, protein/peptide, polymeric and lipid, polymeric-lipid hybrid and biologically directed (virus) nanobiomaterials. These nanobiomaterials can be capable to provide a unique solution to overcome the limitations of existing conventional drug delivery systems, which include low bioavailability, non-targeting and potential toxicity [8].

The surface modification/functionalization of nanobiomaterials received significant attention in the treatment of cancers. Nazlı and Gedik are preparing various dendrimeric formulations of oxaliplatin and investigating their properties. First of all, the solubility enhancement capabilities of polyamidoamine (PAMAM) G3.5 and

PAMAM G4.5 dendrimers were investigated. The results showed that oxaliplatin solubility mostly increasing linearly with dendrimer concentration. Additionally, the increase was more notable in PAMAM G4.5 dendrimers. Then, drug-dendrimer complexes were prepared in different mediums, since the medium used can affect the amount of drug-loaded to dendrimers. PAMAM G3.5 conjugate was further evaluated for the cytotoxicity test. The IC<sub>50</sub> value of PAMAM G3.5 conjugate was found as 0.72  $\mu$ M. For unmodified oxaliplatin, this value was 14.03  $\mu$ M. As a result, a dendrimer-based drug delivery system that has been found promising for further improvement has been developed successfully [9].

The peptide based nanobiomaterials can incorporate the small hydrophobic molecules like lipophilic drugs and to be easily functionalized with targeting moiety. In a present study Gedik et al. aimed to develop anti-vascular endothelial growth factors (anti-VEGF) drug delivery systems that long-term sustained release using dendrimer technology and to evaluate its possible cytotoxic effects on the retina pigment epithelial cells (ARPE-19) and the irritation potential by Hen's Egg Test on a chorioallantoic membrane (HET-CAM) analysis. The drug carrier gel formulation was prepared by adding hyaluronic acid (HA) after bevacizumab (BEV) was complexed with poly-L-lysine (PLL) dendrimer. Prolonged BEV release from formulations has been observed for up to 21 days. The loading efficiency (LE) of the complex formulation was found 79.04%. The formulation's kinetic behavior was determined by the Higuchi and Korsmeyer-Peppas model. The formulations did not cause any irritation. According to the results obtained, gel formulation was innovative, effective and suitable for treatment [10].

Nanobiomaterial stability and toxicity are some of the important aspects of nanomedicine that need to be studied. With the lack of information in this area, near future biomedical and clinical requirements include more studies to improve clarity overregulation for the clinical use of nanobiomaterials. This results in the global issue of lack of formal regulation and the regulatory authorities in different countries have come to very different conclusions regarding what is acceptable and not, in nanomedicine and nano-medical devices [7].

**Keywords:** Nanomaterials, nanobiomaterials, nanotechnology, dendrimers, drug delivery

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