

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. Ogun 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: Ogun 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

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DRUG DELIVERY SYSTEMS USED FOR BIOLOGICAL PRODUCTS

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Biological products (biologicals, biopharmaceuticals) can be defined as any drug which was produced by living organisms using any biotechnological methods. They can be composed of peptides, proteins, antigens, antibodies, nucleic acids, and cell therapies [1, 2]. Protein therapeutics offer a highly specific and rather complex set of functions not always achievable by a biomimetic approach. Their main advantages over conventional drugs lie in their high selectivity, potent therapeutic efficacy, and limited side effects. On the other hand, biopharmaceuticals are prone to aggregation, hydrolysis, oxidation, deamidation, isomerization, and denaturation due to their huge chemical structure [3, 4]. To overcome these stability issues, we need using drug delivery systems by parenteral administration. In addition, specific challenges in nonclinical safety testing of biologics for controlled and targeted therapy need to be addressed and optimized [5, 6].

All approved gene-based biopharmaceuticals were all prepared with the viral vector. These viral vectors have been critical in realizing the therapeutic potential of gene-based biopharmaceuticals [7-9]. Unfortunately, undesired viral vector-mediated immune responses remain a major safety concern. The use of non-viral vectors increases because of the potential of viral vector titer and immunogenicity [8, 9]. In contrast to viral gene therapy systems, non-viral gene therapy systems utilize nanometer-sized synthetic and biological-derived materials as basic vector building blocks for gene delivery vector construction and harnesses bio-physicochemical interactions between nanomaterial and nucleic acid cargos to achieve cargo encapsulation and cellular delivery [10].

Polymers have been extensively utilized for biomedical drug delivery applications. Biodegradable drug delivery systems have great biocompatible and biodegradable properties. Additionally, they can easily be manipulated for expected modifications [1, 7, 10]. Gelatin and cellulose derivative polymers have been widely used to prepare gene-delivery vectors by their low antigenicity and high biocompatibility. Cationic polymers are generally preferred to form nucleic acid-polymer complexes, due to the lack of positively-charged motifs. Relevant transfection results indicated that cationic polymers with a high molecular weight show better gene complexing ability, cell uptake, and transfection efficiency [1, 4, 5].

In order to increase the effectiveness of non-viral drug delivery systems, they need to be overcome extracellular and intracellular barriers. The biologically active substance

may degrade due to heat and shear stress during formulation. Also, the reticuloendothelial system are responsible for the clearance of biologics in blood circulation. Additionally, a number of enzymes rapidly inactivate them after systemic application. Drug delivery systems also help the transition from the plasma membrane. They can also trigger an inflammatory response, since they do not provide a specific recognition [1, 10-12].

Drug carrier systems are called by different names according to the auxiliary materials and methods used. Liposomes are biologic membrane-like sacs in sphere form consist of lipidic barriers. The advantages of liposomes include effectiveness at small doses, extended dosing interval, and ideal transport for active substances with a short half-life [6]. Dendrimers are nanostructures which have functional groups on their surface. Micellar structure is obtained with the use of appropriate surfactant group. The micellar structure is obtained with the use of an appropriate surfactant group. Carbon nanotubes, DOT matrices, and gold particles are the other carrier systems used for biologics. Hybrid systems will be developed in the near future to combine the advantageous parts of both the individual systems. Moreover, the design of smart vectors capable of releasing their loaded protein payloads in a timely and spatially-controlled manner is crucial for the development of next-generation biological delivery vectors.

Keywords: Biologics, viral drug delivery systems, non-viral drug delivery systems.

REFERENCES

- [1] Saka OM, Bozkir A. Formulation and in vitro characterization of PEGylated chitosan and polyethylene imine polymers with thrombospondin-I gene bearing pDNA. *J Biomed Mater Res B*. 2012; 100b: 984-992. [\[CrossRef\]](#)
- [2] He JB, Ding RH, Tao YP, Zhao ZY, Yuan RR, Zhang HQ, Wang AP, Sun KX, Li YX, Shi YA. Folic acid-modified reverse micelle-lipid nanocapsules overcome intestinal barriers and improve the oral delivery of peptides. *Drug Deliv*. 2023; 30(1):2181744. [\[CrossRef\]](#)
- [3] Prasertpol T, Tiyaboonchai W. Nanostructured lipid carriers: A novel hair protective product preventing hair damage and discoloration from UV radiation and thermal treatment. *J Photochem Photobiol B*. 2020; 204:111769. [\[CrossRef\]](#)
- [4] Kucukturkmen B, Devrim B, Saka OM, Yilmaz S, Arsoy T, Bozkir A. Co-delivery of pemetrexed and miR-21 antisense oligonucleotide by lipid-polymer hybrid nanoparticles and effects on glioblastoma cells. *Drug Dev Ind Pharm*. 2017; 43: 12-21. [\[CrossRef\]](#)
- [5] Omid Y, Kianinejad N, Kwon Y, Omidian H. Drug delivery and targeting to brain tumors: Considerations for crossing the blood-brain barrier. *Expert Rev Clin Pharm*. 2021; 14: 357-381. [\[CrossRef\]](#)
- [6] Saka OM, Bozkir A. Preparation and evaluation of Tsp-1 loaded pegylated cationic liposomes for inhibiting angiogenesis. *Int J Biotechnol Bioeng*. 2018; 4: 1-6.
- [7] Bozkir A, Saka OM. Chitosan-DNA nanoparticles: Effect on DNA integrity, bacterial transformation and transfection efficiency. *J Drug Target*. 2004; 12: 281-288. [\[CrossRef\]](#)
- [8] Ren D, Fisson S, Dalkara D, Ail D. Immune responses to gene editing by viral and non-viral delivery vectors used in retinal gene therapy. *Pharmaceutics*. 2022; 14. [\[CrossRef\]](#)
- [9] Shirley JL, de Jong YP, Terhorst C, Herzog RW. Immune responses to viral gene therapy vectors. *Mol Ther*. 2020; 28: 709-722. [\[CrossRef\]](#)
- [10] Yin H, Kanasty RL, ItoukhyAAE, Vegas AJ, Dorkin JR, Anderson DG. Non-viral vectors for gene-based therapy. *Nat Rev Genet*. 2014; 15: 541-555. [\[CrossRef\]](#)
- [11] Bozkir A, Saka OM. Chitosan nanoparticles for plasmid DNA delivery: Effect of chitosan molecular structure on formulation and release characteristics. *Drug Deliv*. 2004; 11: 107-112. [\[CrossRef\]](#)
- [12] Lai CM, Estcourt MJ, Wikstrom M, Himbeck RP, Barnett NL, Brankov M, Tee LBG, Dunlop SA, Degli-Esposti MA, Rakoczy EP. rAAV.sFlt-1 Gene therapy achieves lasting reversal of retinal neovascularization in the absence of a strong immune response to the viral vector. *Invest Ophth Vis Sci*, 2009; 50: 4279-4287. [\[CrossRef\]](#)