

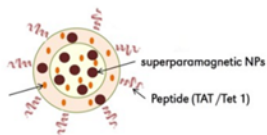


Functionalized polymer drug delivery systems for targeted therapy

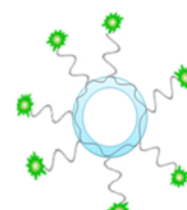
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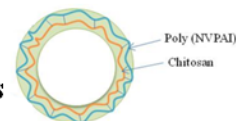


Ligand-functionalized particles for active targeting



Hybrid particles based on polymers and inorganic particles

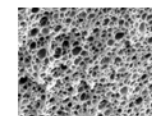
Polysaccharides based nano/micro-capsules



Micelles

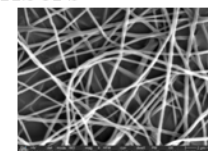


Hydrogels

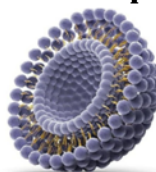


Nano/micro-spheres based on natural or synthetic polymers

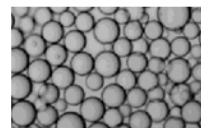
Electrospun fibers



Liposomes



Emulsions



Romanian and European research projects:

- RO-NO-2019-0187**: "Active targeted drug delivery systems based on peptide-functionalized magnetic nanoparticles for the treatment of inner ear diseases" (2020-2023; 1.2 M euro)
- ERANET-TRANSCAN-3-SeqPerGlio**: "Intraoperative tumour sequencing for personalized loco-regional drug combination therapy against glioblastoma recurrences" (2025-2028; 200 000 euro)
- PN-IV-P1-PCE-2023-0588**: "Complex polymer systems with antimicrobial action based on biodegradable polyesters" (2025-2027, 240 000 euro).
- PN-IV-P7-7.1-PED-2024-1065**: "Peptide-functionalized biocomposite microparticles for the therapeutic management of pulmonary infections" (2025-2027, 165 000 euro)
- PN-III-P4-ID-PCE-2020-2009**: „Dual active targeting carriers for the treatment of pulmonary infections based on drug loaded peptides-functionalized polymeric nano/microparticles" (2021-2024, 240 000 euro)
- PN-III-P4-ID-PCE-2016-0613**: „Topical nanoparticle formulations with aptamer for the treatment of basal cell carcinoma"(2017-2019;180 000 euro)
- PN-III-P1-1.1-TE-2019-0664**: "Design and "in vitro" assessment of novel biocompatible and biodegradable polyester block copolymers based on poly(ethylene adipate) and poly(ε-caprolactone) as drug delivery systems" (2020-2022; 90 000 euro)
- PN-III-P1-1.1-TE-2016-0532**: "Biomaterials obtained from non-aqueous and drug-loaded emulsions" (2018-2020; 100 000 euro)



Project idea:

Synthesis and characterization of polymer microparticles functionalized with specific ligands for the treatment of pulmonary infections

Objectives:

1. Design and engineering of targeted polymeric carriers

Develop and optimize ligand-functionalized polymer particles capable of selectively targeting pulmonary pathogens and/or infected lung tissues, with tunable size, surface chemistry, and drug loading capacity.

2. Mechanistic understanding of targeting and uptake

Elucidate the molecular mechanisms governing ligand–receptor interactions and cellular uptake pathways in relevant lung cell types (e.g., epithelial cells, macrophages, biofilm-associated bacteria).

3. In vitro evaluation of therapeutic efficacy

Assess antimicrobial efficacy, cytotoxicity, and intracellular delivery performance in advanced in vitro models (e.g., air–liquid interface cultures, lung organoids, biofilm models).

4. In vivo pharmacokinetics, biodistribution, and safety

Characterize pulmonary deposition, retention, systemic exposure, and organ biodistribution following inhalation or intratracheal administration, and evaluate safety and immunological responses in relevant animal models.

5. Optimization of drug release and formulation

Develop scalable and inhalable formulations (e.g., dry powders, nebulizable suspensions) with controlled drug release profiles and stability suitable for preclinical development.

6. In vitro–in vivo correlation (IVIVC) and translational modeling

Establish predictive IVIVC models linking in vitro targeting and uptake data with in vivo pharmacokinetic and therapeutic outcomes to accelerate clinical translation.

7. Computational modeling and design tools

Use computational modeling (molecular docking, PK/PD modeling, particle transport simulations) to guide ligand selection, particle design, and dosing strategies.

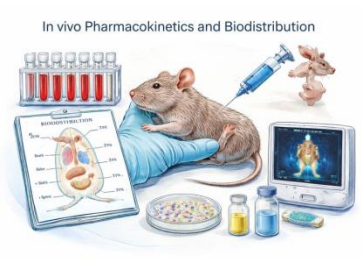
8. Proof-of-concept preclinical demonstration

Demonstrate therapeutic efficacy in relevant pulmonary infection models (e.g., bacterial pneumonia, CF-related infections, tuberculosis models), providing a preclinical proof-of-concept for clinical translation.

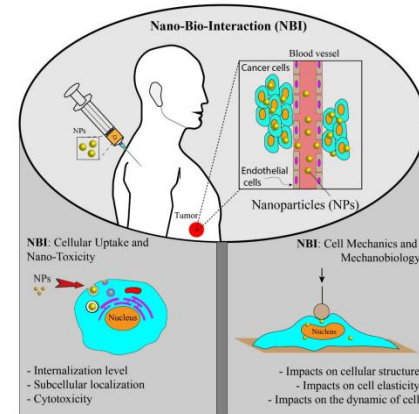


**Synthesis of ligands
(peptides, aptamers)**

**in vivo
pharmacokinetics
and biodistribution**



in vitro cellular uptake

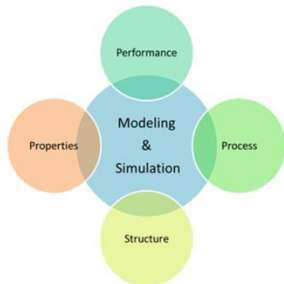


**in vitro receptor-ligand
targeting validation**

in vitro/in vivo correlation



Computational modeling



**Partners'
skills**

Academic and research institutions for in vivo testing



Clinicians and hospital research centers



Pharmaceutical and biotech companies



SME for GMP methodology and scale-up





Collaborations



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