



*Traditional and Innovative
Pharmaceutical Technologies Center,
Department of Life Science, University of
Modena and Reggio Emilia*



UNIMORE
UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

NANOTECH LAB TEFARTI

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DESIGN OF NANOCARRIERS

1a. CORE MATERIAL(S)

POLYMERIC AND HYBRID NANOPARTICLES

1. Synthetic Polymers (PLGA, PLA)
2. Natural polymers (Chitosan, Albumin)
3. Mixed polymer/lipid (PLGA/DOPE; PLGA/Chol; PLGA/Dotap)

MICROPARTICLES

1. Synthetic polymers (PLGA, HPMC ...)
2. Natural Polymers (Trehalose, Mannitol ...)

LIPID NANOPARTICLES

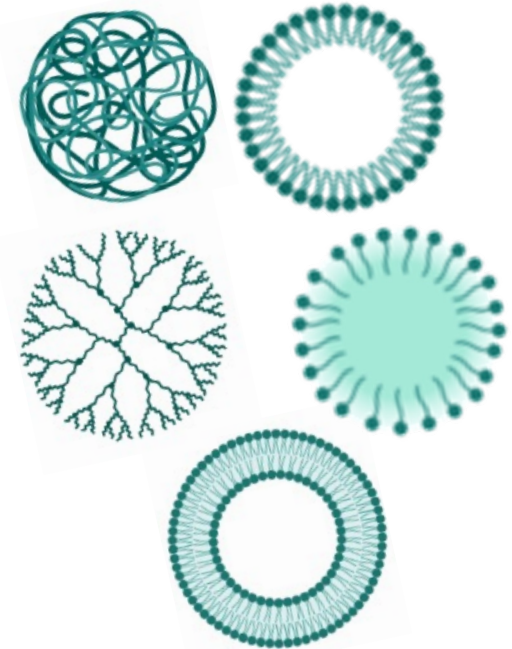
1. Solid lipid nanoparticles
2. Cholesterol/surfactant

SELF-ASSEMBLY

1. Lactoferrin
2. Cyclodextrins

LIPOSOMES

1. Natural phospholipids
2. Synthetic lipids
3. Additives



1b. DRUG(S)

SMALL MOLECULES

1. Ibuprofen, T3, Hinokitiol, Chaperones ...
2. Chemotherapeutics (Paclitaxel, Temozolomide...)
3. Novel synthesized compounds

PEPTIDES, PROTEINS, ENZYMES

1. H105A peptide
2. PEDF
3. β -Galactosidase, IDS

GENETIC MATERIAL

1. Plasmid DNA, cDNA
2. mRNA / siRNA

DESIGN OF NANOCARRIERS

2. DRUG LOADING / FORMULATION TECHNIQUES

PREFORMULATIVE STUDIES

Solubility / stability / cristallinity / structure / salts... → use of stabilizers

NANOPRECIPITATION

Miscible solvents

- Gelification of the aqueous phase
- Modified viscosity/temperature/pH

SELF-ASSEMBLY

1. pH/Temperature
2. denaturation

LIPIDIC SYSTEMS

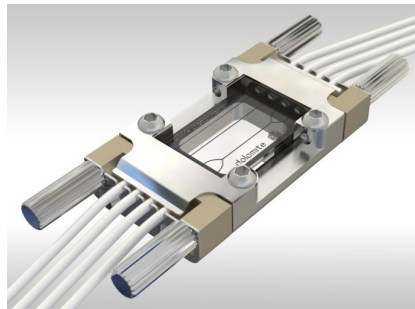
1. Thin layer evaporation
2. Extrusion and Sonication
3. Reverse phase evaporation
4. Ethanol Injection
5. Hot Homogenization

EMULSIONS + SOLVENT EVAPORATION

1. Single O/W emulsion
2. Double W/O/W emulsion

MICROFLUIDICS

SPRAY DRYER (MICROPARTICLES)



DESIGN OF NANOCARRIERS

3. SURFACE MODIFICATION

TARGETING LIGANDS

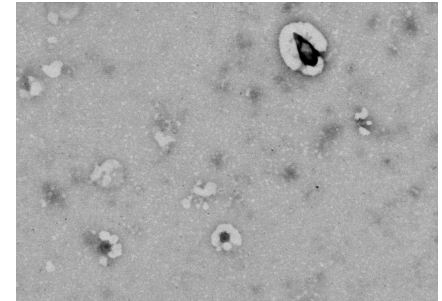
Pre-formulation or post-formulation:

- g7 peptide
- AAVF peptide
- M08 antibody etc

SURFACE COATINGS

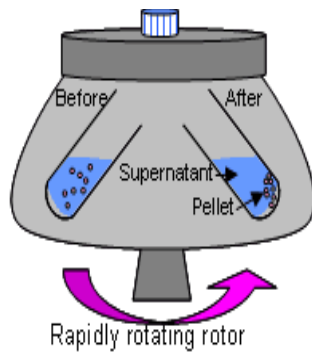
For stealth or targeting

- PEGylation
- Hyaluronic Acid

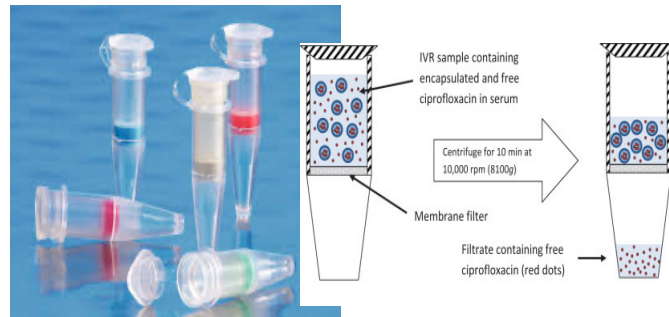


4. PURIFICATION

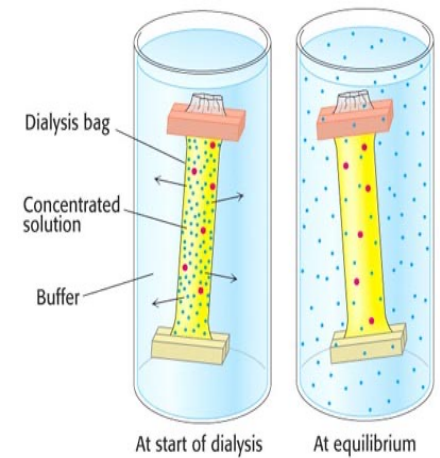
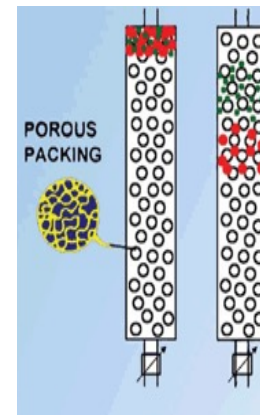
ULTRACENTRIFUGATION



ULTRAFILTRATION



SIZE EXCLUSION CHROMATOGRAPHY



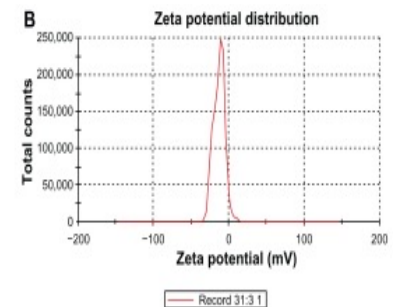
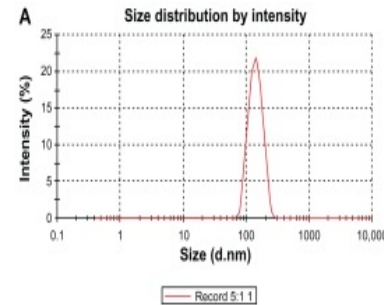
DIALYSIS

DESIGN OF NANOCARRIERS

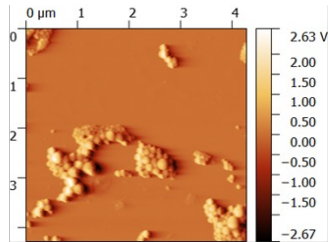
5. CHARACTERIZATION

TECHNOLOGICAL

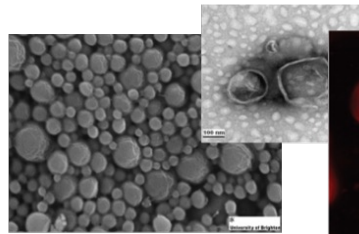
1. Size distribution
2. Polydispersity Index
3. Zeta Potential



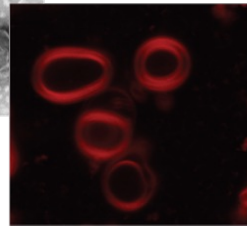
MORPHOLOGICAL



Atomic Force Microscopy

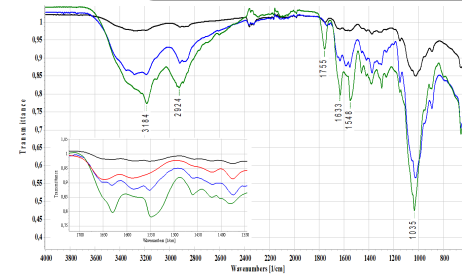


Scanning transmission electron microscopy



Confocal microscopy

STRUCTURE/COMPOSITION

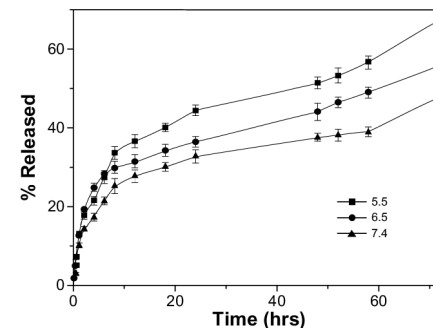


1. Differential scanning calorimetry
2. NMR
3. X-Ray
4. FTIR

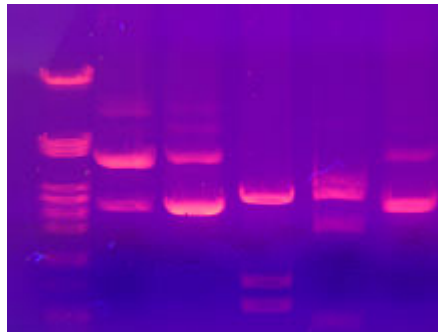
DRUG LOADING

- UV_Vis Spectroscopy
- HPLC-UV/FLUORESCENCE/MS
- Electrophoresis

DRUG RELEASE PROFILE



STORAGE STABILITY



2023-2025 Telethon grant: Deciphering Cholesterol efficacy on cognition in prodromal **Huntington's disease**



2018-2023 IMI EU Grants: Investigating Mechanisms and Models predictive of accessibility of **therapeutics (IM2PACT) Into the Brain.**



innovative
medicines
initiative



2023-2025 Progetti PORFERS: Piattaforma per la prototipizzazione di Nanomedicine per proteine terapeutiche: la terapia enzimatica sostitutiva per malattie rare neurometaboliche



Regione Emilia-Romagna

Delivery di enzimi in malattie neurometaboliche

2023-2026 PNRR: CN_3 - National Center for Gene Therapy and Drugs based on **RNA Technology Spoke 1 Genetic Diseases**

2022-2026 PNRR: CN3 Centro Nazionale, National Center for Gene Therapy and Drugs based on **RNA Technology, Spoke 2, Cancer**

2022-2026 PNRR: Health Extended ALLiance for Innovative Therapies, Advanced Lab-research, and Integrated Approaches of Precision Medicine - HEAL ITALIA, **Spoke 6, Development of innovative devices for precision diagnosis and personalized therapy**



2023-2025: PRIN 2022 Deciphering cell- and circuit-specific behavioral correlates following cholesterol-based **Precision Nanomedicine in early Huntington's disease**



2022-2023 FAR GBM: Nuovi approcci per il trattamento di **Glioblastoma** con Nanoparticelle e CAR-T

2023-2024 FAR: Nanomedicine for therapy of genetic iron-loading disorders: application in **hemochromatosis, ferroportin disease and aceruloplasminemia.**

2023-2024 FAR: Integrated in silico, in vitro, and in vivo approaches to develop therapeutic small chaperones for **Retinitis Pigmentosa** linked to dominant rod opsin mutations



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