Scientific and Technical Report

DYNAMICS OF NANOPARTICLES TRANSPORT THROUGH CELLULAR BARRIERS - RELEVANCE IN TOXICOLOGY AND DRUG DELIVERY SYSTEMS

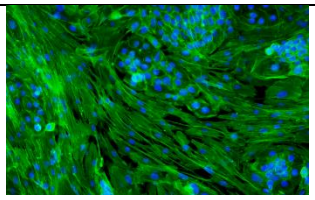
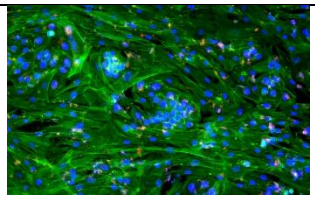
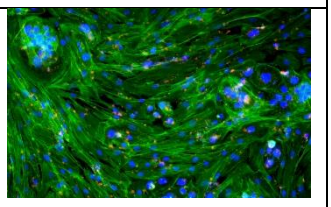
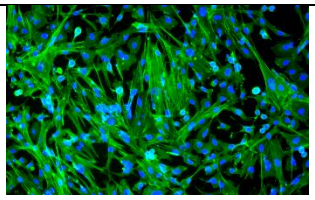
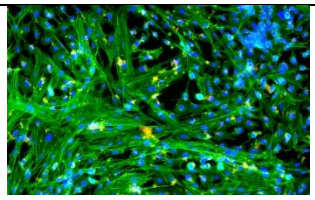
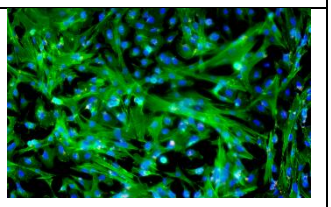
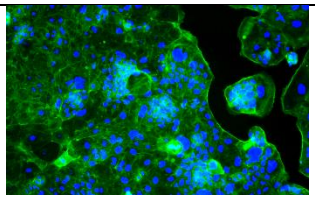
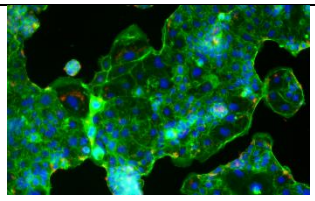
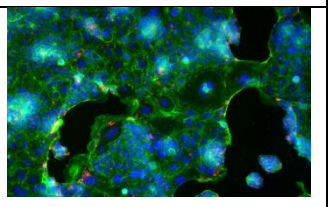
Project no. 81TE/2022

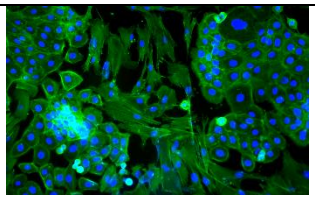
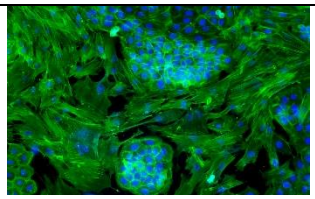
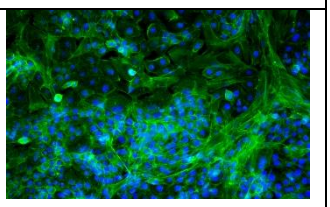
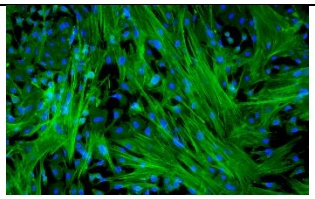
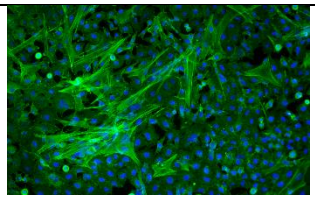
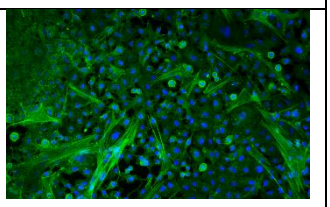
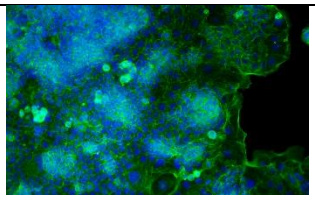
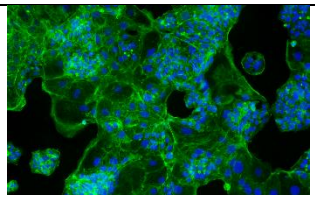
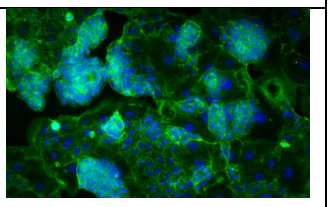
Execution phase nr. 1/2022

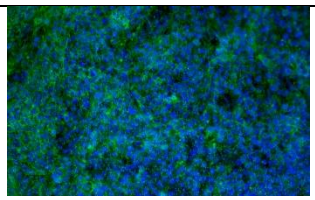
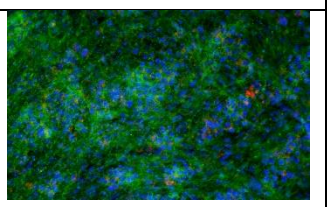
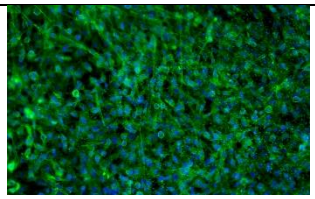
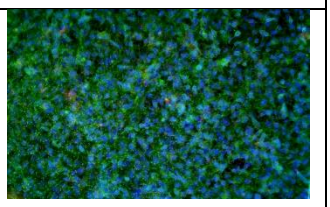
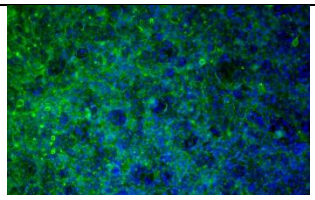
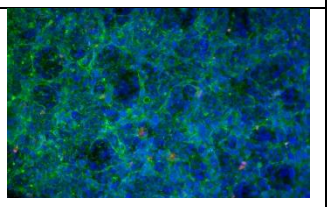
Project director,

Assoc. Prof. Miruna Stan

In the first stage of this Young Teams project "DYNAMICS OF NANOPARTICLES TRANSPORT THROUGH CELLULAR BARRIERS - RELEVANCE IN TOXICOLOGY AND DRUG DELIVERY SYSTEMS" all the proposed objectives were achieved. Nanoparticles with different characteristics have been obtained and characterized, and in vitro models that mimic the biological barriers of skin, lung and intestinal tissue have been developed. Their importance is continuously increasing in toxicity testing and targeted delivery of different types of nanoparticles that can be used in medical applications. In this regard, polymeric chitosan nanoparticles conjugated with fluorochrome, magnetite nanoparticles functionalized with fluorochrome and titanium dioxide nanoparticles were selected, and their effects exerted on the biological barriers were investigated. The results obtained showed a low toxicity, without affecting the cell morphology, and without the production of an inflammatory process, except for the larger iron oxide nanoparticles. These data were correlated with structure-activity relationship predictions to build in silico models and validate the applicability of in vitro models for nanoparticle transport in the next step of execution.

CO-CULTURE ON COVERSLIP **Incubation for 24 h with NP**	**Control**	**NP chitosan - Gd**	**NP chitosan + Gd**
Skin barrier			
Pulmonary barrier			
Intestinal barrier			

CO-CULTURE ON COVERSLIP Incubation for 24 h with NP	Fe_3O_4 – Fraction1	Fe_3O_4 – Fraction2	Fe_3O_4 – Fraction3
Skin barrier			
Pulmonary barrier			
Intestinal barrier			

CO-CULTURE ON INSERTS Incubation for 24 h with NP	Control	NP chitosan - Gd
Skin barrier		
Pulmonary barrier no. 1		
Intestinal barrier		

Dissemination and performance indicators:

- one WEB page with the project' s description

https://unibuc.ro/cercetare/promovarea-rezultatelor-cercetarii/proiecte-de-cercetare/proiecte-cu-finantare-nationala/trans-nano-bio/?lang=en

- 2 abstracts presented at international conferences

• Voicu S.N., Voinea I.C., Stan M.S. *"Assessment of the in vitro toxicity induced by rare earth-doped phosphor nanoparticles on human lung fibroblast cells"*, NanoBioMat2022 winter edition, 24-26 November 2022, Online.

• Stan M.S., Voinea I.C., Voicu S.N. *"In vitro evaluation of rare earth-doped phosphor nanoparticles to assess their anti-tumoral efficiency on lung cancer cells"*, The 8st International Electronic Conference on Medicinal Chemistry, 1–30 November 2022.

- 2 articles published in ISI journals

• Florea DA, Grumezescu V, Bîrcă AC, Vasile BȘ, Iosif A, Chircov C, Stan MS, Grumezescu AM, Andronescu E, Chifiriuc MC. Bioactive hydroxyapatite-magnesium phosphate coatings deposited by MAPLE for preventing infection and promoting orthopedic implants osteointegration. Materials 2022; 15(20), 7337. https://doi.org/10.3390/ma15207337

• Miu BA, Dinischiotu A. New green approaches in nanoparticles synthesis: an overview. Molecules. 2022; 27(19):6472. https://doi.org/10.3390/molecules27196472

- participation at a practical course in cell biology methods

• EMBO Practical Course "Current methods in cell biology", Heidelberg, Germany, 4 – 13 September 2022.