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April 2022

The March newsletter presented some of the DIRNANO Early Stage Researchers.

Through the introduction of their backgrounds and the detailed descriptions of their individual research projects published on the website, the purpose of the DIRNANO project has been revealed.

In these April newsletter, the other ESRs will be presented.
The DIRNANO Consortium is made up of a total of 15 ESRs operating in Italy, Spain, Portugal, the Netherlands, Switzerland, England, Austria, and Norway.

Srdjan Tadic

Individual Research Project:

Generating a mRNA vaccine to target tumor-mediated angiogenesis and metastasis. Demonstrating, in vivo, anti-tumoral and anti-metastatic activity of candidate nanovaccines

Supervisor: Alfredo Martinez

Department of Oncology - Angiogenesis Unit

University of La Rioja (Spain)

My project addresses the immune response in animal metastatic tumor models after immunization with candidate nanovaccines. Additionally, I am focused on

the development of a mRNA vaccine targeting adrenomedullin, which is one of the crucial regulators of angiogenesis. The process of angiogenesis is a main driver of metastasis. Cancer is the leading cause of death worldwide and metastasis is responsible for 90% of cancer patient deaths. That said, development of a successful cancer vaccine formulation would have tremendous impact on this defeating statistic and remains one of the main goals of new era medicine.

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Tobias Komsthoeft

Individual Research Project:

Novel Coating Technology for Immuno-Directing NP Coatings

Supervisor: Samuele Tosatti

Department of Mechanical and Process Engineering

SuSoS AG (Switzerland)

In my PhD project I try to develop a new type of coating for nanoparticles that enables very specific interactions in the body. This coating should provide the nanoparticle with the ability to interact with proteins and cells in a two-folded way. Firstly, the nanoparticles with this coating should be able to target specific cells (e.g., tumor cells). Secondly, the coating should prevent other interactions between the nanoparticle and untargeted proteins and cells. This would potentially allow the coated nanoparticles to be used for new types of drugs and nanovaccines.

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Margarita Kislukhina

Individual Research Project:

New diagnostic techniques based on Doctor Vida point-of-care platform

Supervisor: Gonçalo Doria

Department of Biological Sciences

STAB VIDA (Portugal)

My project is focused on the development of monoclonal antibodies using novel techniques and early-stage point-of-care diagnostics. The idea is to provide natural polyclonal or monoclonal antibodies and collaborate in cloning appropriate variable genes to produce artificial recombinant antibodies. Moreover, new specific immune-based assays for complement and other corona protein assays will be developed. The aim of point-of-care diagnostic testing or near-patient testing is to minimize the time and accurately achieve real-time, lab-quality diagnostic results, thereby allowing clinicians and patients to make quick clinical decisions.

Find Out More

Tom Kalathil Raju

Individual Research Project:

Characterization of immune response generated by the nanovaccine candidates

Supervisor: Alfredo Martínez

Oncology Area, Center for Biomedical Research of La Rioja

Fundación Rioja Salud (Spain)

In the project, I am trying to characterize the immune response in animals after injecting them with the nanovaccines generated by our fellow members of the consortium. This analysis would help them to have a better understanding for proposed modification and improve their anti-cancer vaccine candidates. In addition, I am trying to develop prophylactic vaccine to prevent tumor metastasis, in which tumor associated angiogenesis will be targeted by inserting the DNA sequence of an angiogenic factor (PAMP, N-terminal peptide) in attenuated Salmonella typhimurium bacteria.

Development of a successful cancer vaccine formulation would have tremendous impact on world health and remains one of the main goals of new era medicine.

Find Out More

Hajira Banu H.

Individual Research Project:

Complement Benign Nanoparticles

Supervisor: Moein Moghimi

School of Pharmacy

Newcastle University (UK)

On intravenous administration many nanomedicines trigger uncontrolled complement activation resulting in adverse reactions. To circumvent this, refined nanoengineering strategies are needed to design nanomedicines that escape detection by the complement system. This research will explore new strategies for surface functionalisation of particulate drug delivery systems with polymers to overcome complement activation in the human blood. The project will involve nanoparticle engineering, biophysical analysis of nanoparticle characteristics and

mechanistic profiling of complement activation processes in human serum. This study will help in the development of innovative complement benign surfaces for targeted delivery of medicine with fewer side effects conferring patient safety.

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Pedro Rafael Magalhães Veloso

Individual Research Project:

Protein composition and functional effects of the species-specific biomolecular corona formation on NPs

Supervisor: Emanuele Papini

Department of Biomedical Sciences

Università degli Studi di Padova (Italy)

As nanoparticle-based formulations enter the human body, they come into contact with biological fluids, which are constituted by, among many others, endogenous proteins that will interact with the nanoparticles. As a result, due to specific interactions, an outer layer of proteins will form on the surface, which is commonly referred to as the "protein corona".

My project focuses on the characterization of the protein corona in different nanoparticles, and the respective response by the immune system. Ideally, this will establish relevant correlations between different nanoparticle formulations and an appropriate immune response, either evading the immune system, or by an increase in their proinflammatory effect.

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Rita Ribeiro

Individual Research Project:

The interaction between nanovaccines and Dendritic cells

Supervisor: Jutta Horejs-Hoeck

Department of Biosciences, Cancer Cluster Salzburg

Paris-Lodron University of Salzburg (Austria)

My projects focuses on the effects of nanovaccines on dendritic cells (DCs), which are first responders of the immune system and at the same time have the great ability of orchestrating a potent anti-tumour response. As new immunotherapy developments are increasingly combined with nanomedicines, understanding the interaction between DCs and nanoparticles is crucial for early stages in the development of safe and effective nano-based tumour vaccines. We hypothesize that specific nanovaccine formulations – formulated by other partners within the DIRNANO consortium – have the potential to efficiently reactivate DCs following tolerogenization induced by the TME, driving strong and effective host anti-tumour immune responses.

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Marek Feith

Individual Research Project:

Exploitation of Immune Cell Infiltration for Optimal Nanoparticle-based Cancer Treatment

Supervisor: Gunhild Mælandsmo

Department of Tumor Biology

University of Oslo (Norway)

My project focuses on the characterization of the immune response in animal models with breast cancer induced by chitosan NPs and illumination. The NPs, developed together with PCI Biotech AS can escape lysosomal degradation via so-called photochemical internalization technology (PCI). I am going to use the PCI technology and the chitosan NPs loaded with a drug to study the antitumor effects in breast cancer animal models. The main goal is to induce higher immune cell infiltration into tumors and elucidate the composition of the tumor immune microenvironment. Moreover, I will also use selected NP formulations designed by the others in the DIRNANO consortium to study their anticancer effect in our cancer models.

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