MELIS-UPF (Barcelona) International PhD call 2022

The Department of Medicine and Life Sciences of the Pompeu Fabra University (MELIS-UPF) opens a call for the academic year 2023-24, for accomplished and driven students with an excellent academic record to carry out a PhD in Biomedicine.

The research and teaching excellence of the MELIS-UPF is widely acknowledged, for instance, the MELIS-UPF has been awarded the "María de Maeztu" distinction and grant in 2014 and 2018. Furthermore, the MELIS-UPF offers a unique and international research environment and cutting-edge scientific facilities, thanks to its privileged location in the Barcelona Biomedical Research Park (PRBB).

Ten PhD contracts are offered in groups led by recognized scientists performing research in biomedicine, please see below for more information on the scientific projects. Candidates can choose one or two groups they would like to join (please see the Selection process section).

Contracts, training and advantages

Contracts will be funded by the "Training Program" of the Spanish Research Agency well as by the MELIS-UPF. All positions will offer the same wage conditions, for 4 years, and fellows will be registered in the Spanish Social Security System, which provides health and occupational insurance coverage. Academic costs (except fees) are also covered.

The PhD programme in Biomedicine of UPF has been certified by the ANECA, and in October 2011 it was awarded the "Mention towards Excellence". Since the academic year 2012-13, the PhD Programme in Biomedicine follows the latest regulations for doctoral studies in Spain, the so-called Royal Decree (RD) 99/2011, which were introduced to comply with the guidelines and recommendations of the European Higher Education Area (EHEA) on doctoral studies. The contents of this doctoral programme have been verified by the Catalan Agency for Quality Assessment and Accreditation with a qualification "Quality Label towards Excellence" (2018).

The PhD programme, all of whose activities are carried out in English, attracts every year a large number of international students. These activities aim at preparing students to become independent researchers pursuing a scientific career. Fellows will have access to a wide range of academic activities, as well as ad hoc training in scientific skills, and access to the PRBB Intervals programme, an interdisciplinary education programme for professionals working in the PRBB.

Requirements

Candidates must have excellent academic qualifications and good command of English. Research experience and authorship of scientific publications will be a plus.

Candidates must have obtained a University Degree and a Master's Degree in natural or medical sciences (Biology, Medicine, Biochemistry, Biomedicine, Chemistry, Physics, etc), or in other quantitative disciplines (Mathematics, Computer Science, Bioengineering, etc) within the European Higher Education System (minimum 300 ECTS), or an equivalent university degree, of at least 300 ECTS, that would allow the candidate to start a PhD thesis in their home country by September 2022 (candidates who expect to be awarded such degree by September 2022 are eligible to apply).

Candidates are advised to check that they fulfil the requirements for admission to the UPF PhD in Biomedicine as those who do not will be considered ineligible. **Please note that it is not necessary to start the admission process for the PhD programme at this stage**; if you are selected we will help you prepare your application for admission.
All candidates will be required to present their academic record.
Reference letters will be requested for **pre-selected** candidates only. Also, pre-selected candidates who obtained their degree and/ or Master's in a country other than Spain will have to present the conversion of their grades to the Spanish 0-10 scale.
MELIS promotes diversity in an inclusive environment that welcomes applicants regardless of age, disability, gender, nationality, race, or religion.

Application

To apply, please register and send the required information and documents through the *Interfolio* website: http://apply.interfolio.com/109587

You will be able to choose one or two positions in order of preference.
Deadline for applications: September 5, 2022, at 17h CET.

Selection process and calendar

The pre-selection of the candidates will be based on academic qualifications and research experience. Candidates will receive feedback on pre-selection before September 20.
Pre-selected candidates will be interviewed by at least one Principal Investigator in the MELIS facilities or via videoconference during September and early October and will receive feedback in early November.
Contracts are expected to start from June 2023 (depending on the publication and resolution of the "Training Program" call).
These contracts are partially funded by the CEX2018-000792-M grant, funded by the MCIN/AEI/10.13039/501100011033/

Contact (for enquiries only; applications must be sent via Interfolio)
Dr Regina López, recruitment.melis@upf.edu

Principal Investigator: José Ayté

Oxidative Stress and Cell Cycle group

https://www.upf.edu/web/osccg

Research project title

Controlling the cell cycle: elaborating an integrative map of the genetic regulators of DNA synthesis and tumor progression.

Research project summary

At the Oxidative Stress and Cell Cycle group (Universitat Pompeu Fabra) we are ultimately interested in deciphering the mechanisms that control cell cycle progression. Inactivation of the Retinoblastoma protein (pRB) leads to unregulated cell cycle progression promoting uncontrolled cell growth, genomic instability and aneuploidy, hallmarks of tumor progression. pRB tumor suppressor activity is achieved through binding and regulating the E2F family of transcription factors. It is well known that a tumor process is very complex, accumulating numerous secondary mutations that aim to eliminate the brakes to the uncontrolled proliferative process. Even though many individual regulators of the pRB-E2F complex are known, an integrative view of all the regulatory events controlling the G1/S transition is required to anticipate putative interventions able to block proliferative processes.

The PhD candidate will characterize the regulation of the yeast MBF complex (functional homolog of protozoa RB/E2F). The regulated activity of this complex is essential for the G1/S transition: cells with hypoactive MBF complex are unable to complete S phase while cells with hyperactive MBF have genomic instability. The candidate will perform a triple whole-genomic screen searching for global regulators of MBF. We have developed two different reporter strains that are capable of measuring MBF activity *in vivo* as a YFP/RFP output, either on FACS or on an automated fluorescence microscope, and will be introduced in a commercial yeast KO deletion library. The screenings will allow the creation of a complete map with the MBF regulators and, by extrapolation, will establish the nodes that regulate the pRB pathway.

As a plus, the PhD candidate will have opportunity to participate in the teaching of Biology and Medicine studies.

Preferred background of candidates

Biochemistry; Microbiology; Molecular and Cellular Biology; Genetics.

Selected references

The full list can be downloaded from https://www.upf.edu/web/osccg/relevant-articles

1. Salat-Canela et al. (2022) **Trends in Cell Biol.** (in press)
2. Hummer et al. (2021) **Cell Rep.** 37:109893
3. Borao et al. (2021) **Int. J. Mol. Sci.** 22:12444
4. Salat-Canela et al. (2021) **Cell Rep.** 37: 109951
5. González-Medina et al. (2019) **Nucleic Acids Res.** 47:8439-8451
6. Knezevic et al. (2018) **FEBS Journal** 285:3870
7. Alves-Rodrigues et al. (2016) **Cell Rep.** 14:885
8. Eckert et al. (2016) **PLoS Genet.** 12:e1005768
9. Gómez-Escoda et al. (2011) **EMBO Rep.** 12:84
10. Moldón et al. (2008) **Nature** 455:997

Principal Investigator: Marta Barniol-Xicota

Chemical Biology Research Group

https://www.barniolxicotalab.com/

Research project title

Metabolic enzymes as new targets for breast and drug resistant cancers

Research project summary

Aberrant lipid metabolism and altered plasma membrane composition are hallmarks of cancer that affect cell proliferation and response to therapeutics. In addition, mounting evidence points at certain fatty acids as key players of metastasis. Despite this, the underlying molecular mechanism through which lipid dysregulation drives cancer progression remains poorly understood.

We will develop **activity assays, new chemical tools and inhibitors** for **key enzymes involved in lipid metabolism** with the goal to characterize their **roles in breast and drug resistant cancers**. In the long run, we aim to use the tools prepared in this project as **prognostic biomarkers and in cancer therapeutics**. This project has the potential to identify novel therapeutic targets to treat breast cancer and drug resistant forms of the disease.

This is a highly interdisciplinary project in the area of chemical biology where a wide range of skills and technologies will be employed, including:

- Phage display to develop chemical probes and inhibitors
- Activity assay development for metabolic enzymes
- Native nanodisc technology to study membrane enzymes

Preferred background of candidates

We are a young and dynamic group looking for a motivated and curious PhD student with interest in metabolic enzymes and chemical biology to be part of our team.
The candidates should have a degree in the field of Sciences including, but not limited to: biotechnology, biomedical sciences, chemistry, pharmacy, biotechnology, biochemistry and/or medicine.
Strong academic record is a plus.
Experience in molecular biology (bacterial and cell culture, phage display) will be highly appreciated, and synthetic chemistry and/or molecular modeling skills will be positively evaluated.

Principal Investigator: Elena Bosch

Evolutionary Population Genetics Lab

http://biologiaevolutiva.org/ebosch/

Research project title

Genetic adaptation: from the genomic signal to the adaptive phenotype

Research project summary

The primary goal of this research proposal is to understand how adaptive selection has shaped the genetic and phenotypic variation in present day human populations (but also open to other species scenarios) using genomic data. For that, we propose first to: (i) compile genome-wide data across several populations to analyze the footprints of positive (adaptive) selection by considering different modes of selection (hard and soft sweeps and polygenic selection) and second (ii) try to understand the biology behind the detected selection signals by using in silico functional predictions, molecular biology techniques and different association approaches to locate and experimentally validate any putative adaptive functional (coding and non-coding) variant, determine their corresponding adaptive phenotypes and try to identify the environmental selective pressures at play. The search of positive selection will be done at genome-wide level, in general, as well as for predefined groups of genes (pathways and/or biological networks). Moreover, we plan to analyze several populations under particular environmental pressures or for which we will have phenotypic data.

Preferred background of candidates

We welcome candidates with backgrounds in either theoretical, computational or experimental fields such as bioinformatics, statistics, anthropology, evolutionary genetics, functional genetics, theoretical and experimental population genetics.

Selected references

- Roca-Umbert et al. (2022). Understanding signatures of positive natural selection in human zinc transporter genes. *Scientific Reports* 12(1):4320.
- Casadó-Llombart S et al. (2021). Contribution of evolutionary selected immune gene polymorphism to immune-related disorders: the case of lymphocyte scavenger receptors CD5 and CD6. *International Journal of Molecular Sciences* 22(10):5315
- Urnikyte et al. (2019). Patterns of genetic structure and adaptive positive selection in the Lithuanian population from high-density SNP data. *Sci Rep.* 9(1):9163.
- Rodríguez, et al. (2019). Retesting the influences of mutation accumulation and antagonistic pleiotropy on human senescence and disease. *Nature Ecology & Evolution* 3: 994-995.

Principal Investigator: Oriol Gallego

Live-cell Structural Biology

www.gallegolab.org

Research project title

Advanced imaging to investigate interespecies hybridization as a mechanism to preserve cellular processes threaten by climate change

Research project summary

Climate change is now breaking historic temperature profiles. In the Mediterranean region it is expected that frequency and intensity of heatwaves will dramatically increase, duplicating the number of days with temperatures higher than 35ºC. The consequences on the biodiversity of eukaryotic microorganisms is dramatic, and it will certainly threat the survival of multitude of species that, like most of the yeast, are not adapted to such temperatures. The loss of eukaryotic microorganisms will challenge the functions that eukaryotic microorganisms require to preserve their essential cellular processes in front of a thermal threat is fundamental to predict the impact that global warming will have on the eukaryotic microorganisms' biodiversity and their ecological roles.
Hybridization of two species to generate a new organism (the hybrid) can increase the adaptative potential of populations by introducing genetic variation. Yeast species are a good example, as they naturally hybridize to adapt to different environments. As example, we will use *S. cerevisiae,* which can grow above 40ºC, and *S. uvarum* which grow in colder environments, two species that hybridize to form a new organism capable to grow both a high and low temperature. In this project we will study protein networks that control membrane dynamics in interspecies hybrids: **How two species reproduce together to generate an organism harboring a chimeric AND FUNCTIONAL proteome?**
We will use multimodal bioimaging (advanced live-cell imaging, super resolution microscopy and electron tomography) as a quantitative tool to explore the molecular basis of interspecies hybrids' adaption to the foreseen thermal pressures driven by global warming. We will use yeast genetics, CRISPR/Cas9 and proteomics. We will also implement new model organisms by growing wild yeast species that we will isolate from nature to the laboratory. Comparative analysis with corresponding interspecies hybrids will identify the molecular traits that allow chimeric protein networks of the hybrids to overcome the adaptative constraints of original species and to preserve cellular processes functional.

Although a PhD contract will be provided, the candidate is meant to apply for his/her own fellowship.

Preferred background of candidates

- BS in Biology, Biochemistry, Physics or similar. The average BS marks must be 8,5 (scale 1-10) or higher.
- A minimum of 1-year expertise in a research lab is required.
- Expertise with yeast and/or fluorescence microscopy is a plus.
- Expertise in programming or membrane trafficking is a plus.

Selected references

1. Cavicchioli, R. et al. Scientists' warning to humanity: microorganisms and climate change. Nat. Rev. Microbiol. 17, 569–586 (2019).
2. Piatkowska, E. M., Naseeb, S., Knight, D. & Delneri, D. Chimeric Protein Complexes in Hybrid Species Generate Novel Phenotypes. PLoS Genet. 9, (2013).
3. Picco, A. … **Gallego, O.** The In Vivo Architecture of the Exocyst Provides Structural Basis for Exocytosis. Cell 168, 400--412.e18 (2017).

Principal investigator: Jordi Garcia-Ojalvo
Dynamical Systems Biology lab

https://www.upf.edu/web/dsb

Research project title

Microbial cognition from single cells to populations

Research project summary

We offer a 4-year predoctoral contract (FPI) financed by the Spanish State Research Agency. The goal of the PhD project is to establish how bacteria encode their time-varying external environment in the dynamics of their gene regulatory networks. The selected candidate will learn and utilize a variety of advanced experimental techniques including microfluidics, time-lapse microscopy and fluorescence monitoring of gene expression and abundance, to uncover how microbes learn and react to their natural external world. The project is highly flexible and will be adapted to the background and interests of the selected candidate, both in terms of the specific bacterial species chosen (either laboratory workhorses such as *E. coli* and *B. subtilis*, or species from our microbiome), and of the potential use of theoretical and computational methods (including dynamic modeling to test hypothesis, and/or machine learning methods to analyze the data obtained in the lab).

Preferred background of candidates

We are searching for candidates with undergraduate degrees in areas such as Biology, Physics, Biomedical Engineering, or Biotechnology. Experience in laboratory work involving bacterial cell culture, molecular cloning, microscopy and/or microfluidics will be highly valued. Knowledge of computational methods for data analysis and modeling is preferred but is not necessary.

Selected references

- Chou, K.-T et al, 2022. A segmentation clock patterns cellular differentiation in a bacterial biofilm. Cell 185, 145-157.e13. https://doi.org/10.1016/j.cell.2021.12.001
- Toscano-Ochoa, C., Garcia-Ojalvo, J., 2021. A tunable population timer in multicellular consortia. iScience 24, 102347. https://doi.org/10.1016/j.isci.2021.102347
- Galera-Laporta, L., Garcia-Ojalvo, J., 2020. Antithetic population response to antibiotics in a polybacterial community. Science Advances 6, eaaz5108. https://doi.org/10.1126/sciadv.aaz5108
- Park, J. et al, 2018. Molecular Time Sharing through Dynamic Pulsing in Single Cells. Cell Systems 6, 216-229.e15. https://doi.org/10.1016/j.cels.2018.01.011
- Liu, J. et al, 2017. Coupling between distant biofilms and emergence of nutrient time-sharing. Science 356, 638–642. https://doi.org/10.1126/science.aah4204

Principal Investigators: Cristina López-Rodríguez and José Aramburu
NFAT proteins and immune cells

https://www.upf.edu/web/genimmune/adscripcion/-/-/15818/adscripcion/jose-francisco-aramburu
https://www.upf.edu/web/genimmune/adscripcion/-/-/23934/adscripcion/maria-cristina-lopez
https://www.upf.edu/web/genimmune/research-interests

Research project title

Immunometabolic control of lymphocyte and macrophage function in homeostasis and disease

Research project summary

Metabolism regulates immune responses, both ensuring energy and metabolites necessary for immune functions as well as influencing gene expression and functional specialization of immune cells. Metabolism and immune response co-regulate each other, and immune cells are capable of adapting their metabolism to function in different niches, but on the other hand altered metabolic conditions can lock immune cells in a detrimental functional state.

We are currently studying how metabolism influences immune responses in two pathological settings, obesity and cancer. We have combined high-throughput RNA-sequencing analyses and metabolomics to identify metabolic pathways and metabolism-regulated gene signatures and functions in different populations of immune cells in these scenarios. This project will modify specific metabolic pathways in T lymphocytes and macrophages to redirect immune responses and enhance their therapeutic effectiveness in cancer and obesity. We will also explore how metabolic signals can influence immunosenescence and stem cells under hematopoietic stress.

The selected candidate will acquire conceptual fluency in current trends in immunometabolism research, in parallel with hands-on experience in diverse cellular, molecular and immune function techniques (for instance flow cytometry, CRISPR-directed deletions, gene expression, chromatin analyses, cell differentiation assays, metabolic activity, antitumor function) of primary immune cells isolated from gene-edited mice under different pathological settings.

Preferred background of candidates

Candidates must have finished a degree in Biochemistry, Biology, Biomedicine, Biotechnology or similar, and have finished their master before mid-September 2022. The average academic score must be 8,1 (scale 1-10) or higher for both degrees and candidates must also have a fluent ability to communicate in English.

We search for candidates with a clear motivation towards the research career that have experience with projects in immunology. We value knowledge with gene expression approaches (such as RT-qPCR), flow cytometry, mouse models of disease and bioinformatics analysis.

Selected references

- Lunazzi et al 2021 *Journal of Immunology*;
- Huerga Encabo et al 2020 *Journal of Experimental Medicine*;
- Aramburu and Lopez-Rodriguez 2019 *Frontiers in Immunology*;
- Tellechea et al 2018 *Journal of Immunology*;
- Buxadé et al 2018 *Journal of Experimental Medicine.*

Principal investigator: Andrés Ozaita
Neuropharmacology

https://www.upf.edu/es/web/neurophar

Research project title

Interaction of the endocannabinoid system with vagal afferents in the context of cognitive enhancement and its assessment on aging models

Research project summary

Cognitive decline naturally develops during aging at different rates. In some cases, cognitive decline occurs prematurely and may be indicative of the development of some type of dementia. Currently, there are no efficacious therapeutic approaches that can mitigate or prevent cognitive decline or dementia, which is associated to inflammation and is twice as frequent in females than males. The endocannabinoid system (ECS) is a neuromodulatory system widely distributed throughout the body and with a relevant role, among others, in the modulation of cognitive processes. We have revealed that acute peripheral CB1 receptor inhibition improves cognitive functions in healthy adult mice with the participation of vagus nerve afferents. The vagus nerve is an important component of the parasympathetic autonomous nervous system playing a fundamental role in gut-brain axis bidirectional communication, but its role in cognitive improvement or aging is not well understood. We propose to evaluate, under conditions where the activity of vagal afferents is hijacked through pharmacogenetic techniques, the relationship of sub-chronic peripheral CB1 receptor blockade with cognitive improvements, modifications of the synaptic transcriptome, the intestinal microbiome, and the impact on brain connectivity, to understand the role of peripheral CB1 receptors in the modulation of the gut-brain axis. In this way, we will obtain information on aging mechanisms sensitive to sustained peripheral CB1 receptor inhibition. Together, we will assess novel strategies to enhance cognitive performance that could attenuate cognitive decline, as well as discover new targets that could help prevent cognitive decline.

Preferred background of candidates

Wet lab experience, behavior in mice/rats, bioinformatics

Selected references

- Vazquez-Oliver A, Perez-Garcia S, Pizarro N, Molina-Porcel L, de la Torre R, Maldonado R, Ozaita A (2021). Long-term decreased cannabinoid type-1 receptor activity restores specific neurological phenotypes in the Ts65Dn mouse model of Down syndrome. BIORXIV/2021/469296; doi: https://doi.org/10.1101/2021.11.22.469296
- Martinez-Torres S, Bergada-Martinez A, Ortega J, Galera-Lopez L, Hervera-Abad A, Ortega-Alvaro A, Remmers F, Muñoz-Moreno E, Soria G, del Rio JA, Lutz B, Ruiz-Ortega JA, Meana JJ, Maldonado R, Ozaita A (2021) Peripheral CB1 receptor blockade acts as a memory enhancer through an adrenergic-dependent mechanism .BIORXIV/2021/448227; doi: https://doi.org/10.1101/2021.06.16.448227
- Vázquez-Oliver A, Brambilla-Pisoni C, Domingo-Gainza M, Maldonado R, Ivorra A, Ozaita A (2020). Auricular transcutaneous vagus nerve stimulation improves memory persistence in naïve mice and in an intellectual disability mouse model. Brain Stimul. 13:494-498.
- Martínez-Torres S, Cutando L, Pastor A, Kato A, Sakimura K, de la Torre R, Valjent E, Maldonado R, Kano M, Ozaita A (2019). Monoacylglycerol lipase blockade impairs fine motor coordination and triggers cerebellar neuroinflammation through cyclooxygenase-2. Brain Behav Immun. 81:399-409.
- Navarro-Romero A, Vázquez-Oliver A, Gomis-González M, Garzón-Montesinos C, Falcón-Moya R, Pastor A, Martín-García E, Busquets-Garcia A, Revest JM, Piazza PV, Bosch F, Dierssen M, de la Torre R, Rodríguez-Moreno A, Maldonado R, Ozaita A (2019). Cannabinoid type-1 receptor blockade restores cognitive impairment of Down syndrome mouse models. Neurobiol Dis. 125:92-106.
- Busquets-Garcia A, Gomis-González M, Guegan T, Agustín-Pavón C, Pastor A, Mato S, Pérez-Samartín A, Matute C, de la Torre R, Dierssen M, Maldonado R, Ozaita A (2013). Targeting the endocannabinoid system in the treatment of fragile X syndrome. Nat Med. 2013 May;19(5):603-7.

Principal investigator: Cristina Pujades

Neurodevelopmental Dynamics

https://www.upf.edu/web/pujadeslab

Research project title

Transitioning from cell states to cell fates: how cell proliferation and neuronal differentiation are coordinated during brain morphogenesis

Research project summary

We aim at understanding how spatiotemporally coordinated cell progenitor specification and differentiation occur during morphogenesis to construct a functional brain. While incorporating time as a missing-yet-crucial factor, we want to gain biological insight into how the heterogeneity of neural progenitors is generated, and how individual progenitors behave during brain patterning and morphogenesis. We will focus on the brainstem, which controls life-sustaining functions and is extremely conserved in vertebrates. We will analyze brainstem development in zebrafish embryos, using cutting-edge complementary approaches: high-resolution 4D-imaging paired with cell tracking tools for cell lineage reconstruction, transcriptional profiling, and regulatory landscapes. With these tools, we will elucidate how gene regulatory networks operate during development, tissue degeneration, and regeneration. Our results should pave a better understanding of the ontogeny of neurological disorders as well as provide much-needed knowledge for future production of stem cell–derived neurons for the therapeutic reconstruction of neural circuits.

Preferred background of candidates

- Candidates with background in Biomedicine, Biotechnology, Biomedical Engineering or similar are required.
- Computer skills (Python, R) will be also considered.
- To be competitive for PhD fellowships, candidates must have good marks in the Degree and Master studies. There are possibilities of a salary in the meantime the fellowship is awarded.
- Interested candidates are encouraged to contact Cristina Pujades for more information. To apply, send a letter of interest and CV to cristina.pujades@upf.edu

Selected references

- Hevia, CF, Engel-Pizcueta, C, Udina, F, Pujades C. The neurogenic fate of the hindbrain boundaries relies on Notch-dependent asymmetric cell divisions. Cell Reports Jun 7; 39(10): 110915, 2022;
- Engel-Pizcueta, C, Pujades C. The interplay between mechanical cues and Notch-pathway in the regulation of cell fate during embryo development. Invited review, Frontiers in Cell and Developmental Biology 9: 711531, 2021;
- Pujades, C. The multiple functions of hindbrain boundary cells: tinkering boundaries? Invited review, Seminars in Cell and Developmental Biology May 21:S1084-9521(19)30238-1, 2020;
- Voltes, A, Hevia, CF, Engel-Pizcueta, C, Dingare, C, Calzolari, S, Terriente, J, Norden, C, Lecaudey, S, Pujades, C. Yap/Taz-TEAD activity links mechanical cues to specific to cell progenitor behavior during hindbrain segmentation, Development Jul 22; 146(14): dev176735, 2019;
- Letelier, J, Terriente, J, Voltes, A, Belzunce, I, Undurraga, C, Polvillo, R, Devos, L, Tena, J, Maeso, I, Retaux, S, Gomez-Skarmeta, JL, Martinez-Morales, JR, Pujades, C. The evolutionary emergence of the rac3b/rfng/sgca regulatory cluster refined mechanisms for hindbrain boundaries formation. Proc Natl Acad Sci USA Apr 17; 115(16):E3731-E3740, 2018.

Principal investigator: Pilar Rivera Gil

Integrative Biomedical Materials and Nanomedicine Lab

https://www.upf.edu/web/nanomed

Research project title

Coadjuvant plasmonic photothermal therapy

Research project summary

Plasmonic nanomaterials are excellent heaters with a validated functionality to kill tumor cells.

Recently there are evidence pointing out to the coadjuvant effect of photothermal therapy to immunotherapy.

The objective of this PhD is to elucidate the mechanisms underlying activation of the immune system to fight against the tumor after they have been treated with plasmonic nanoparticles.

Preferred background of candidates

Nanotechnology, Chemistry, Chemical Engineering, Physics.

Principal Investigator: Mireia Valles-Colomer

Microbiome Research Group

https://mireiavallescolomer.github.io/

Research project title

Transmission of the human gut microbiome and its role in health and disease

Research project summary

The human microbiome plays a key role in maintaining host health. Through the microbiota-gut-brain axis (a bidirectional communication system between the gut microbiome and the brain) the microorganisms residing in the gut can also influence mental health and wellbeing. We recently showed evidence of extensive vertical transmission of the gut microbiome between mothers and their offspring, together with horizontal transmission between individuals that cohabitate. This suggests that microbiome-linked diseases that we consider non-communicable could become at least partially communicable through transmission of the microbiome. However, how microbiome transmission influences host health and disease remains largely unknown. In this project, the candidate will 1) use high-resolution strain-level metagenomics to explore the association between microbiome transmission in diverse populations and host health status, and 2) characterize the transmissible disease-associated fraction of the gut microbiome.

Preferred background of candidates

- MSc degree in Biological, Biomedical, Computational Sciences or related degree awarded by summer 2023
- Familiarity with Python or R programming languages
- Experience or interest in working with metagenomic data
- Proficiency in written and spoken English
- Motivation to work collaboratively in multidisciplinary projects

Selected references

Ianiro G*, Punčochář M*, Karcher N*, Porcari S, Armanini F, Asnicar F, Beghini F, Blanco-Míguez A, Cumbo F, Manghi P, Pinto F, Masucci L, Quaranta G, De Giorgi S, Sciumè GD, Bibbò S, Del Chierico F, Putignani L, Sanguinetti M, Gasbarrini A, **Valles-Colomer M#**, Cammarota G#, Segata N#. Variability of strain engraftment and predictability of microbiome composition after fecal microbiota transplantation across different diseases. *Nature Medicine, in press.*

Valles-Colomer M*, Bacigalupe R*, Vieira-Silva S*, Suzuki S, Darzi Y, Tito RY, Yamada T, Segata N, Raes J#, Falony G# (2022). Variation and transmission of the human gut microbiota across multiple familial generations. *Nature Microbiology,* 7(1):87-96. doi: 10.1038/s41564-021-01021-8.

Valles-Colomer M, Falony G, Darzi Y, Tigchelaar EF, Wang J, Tito RY, Joossens M, Wijmenga C, Van Oudenhove L, Zhernakova A, Vieira-Silva S#, Raes J# (2019). The neuroactive potential of the human gut microbiota in quality of life and depression. *Nature Microbiology,* 4623-632. doi: 10.1038/s41564-018-0337-x.