Cicerone Program

Laboratory internships at the CNIC for university students during the summer months

List of Scientists and Research Lines 2026

1. **Research line: Effect of posttranslational modifications on mechanical protein unfolding as a main contributor to the elasticity of the myocardium.**

Research Group: Molecular Mechanics of the Cardiovascular System

Supervisor: **Elías Herrero Galán**

Summary: The new concept that mechanical protein unfolding is behind the elasticity of tissues has been proposed based on indirect observations. Here, we plan to observe, for the first time, protein unfolding as a main contributor to the elasticity of muscle tissue and determine the effect of posttranslational modifications of constituent proteins on the mechanical response of cardiomyocytes and skeletal muscle. This is an interdisciplinary project involving instrument development, protein biochemistry, polymer physics and single-molecule methods.

More information at:

https://www.cnic.es/en/investigacion/molecular-mechanics-cardiovascular-system

2. **Research line: Molecular events leading to the development of familial cardiomyopathies.**

Research Group: Molecular Mechanics of the Cardiovascular System

Supervisor: **Jorge Alegre-Cebollada**

Summary: The human heart is a formidable mechanical machine that pumps thousands of liters of blood every day. We are far from understanding how the heart works at the molecular level, and much less so how diseases of the heart develop. Following an interdisciplinary approach that includes protein biochemistry, biophysics, animal models and human clinical research, we plan to uncover how point mutations in cardiac proteins lead to life-threatening cardiomyopathy.

More information at:

https://www.cnic.es/en/investigacion/molecular-mechanicscardiovascular-system

3. **Research line: Role of A-type lamins and progerin in aging and cardiovascular disease.**

Research Group: Molecular and Genetic Cardiovascular Pathophysiology

Supervisor: **Vicente Andrés**

Summary: Cardiovascular disease (CVD) is the main cause of morbimortality, in part due to the progressive aging of our societies. CVD and aging are much accelerated in Hutchinson-Gilford progeria syndrome (HGPS), a rare genetic disorder caused by the expression of progerin, a mutant form of lamin A which is also expressed at low level in tissues of non-HGPS individuals. The CICERONE student will learn about mechanisms through which A-type lamins and progerin regulate CVD and aging.
More information at:
https://www.cnic.es/en/investigacion/molecular-and-genetic-cardiovascular-pathophysiology

4. **Research line: Molecular Mechanisms of Ventricular Wall Development and Cardiomyopathy.**

Research Group: Intercellular Signaling in Cardiovascular Development & Disease
Supervisors: **José Luis de la Pompa, Marcos Siguero-Álvarez**
Summary: We explore the genetic signals and networks that drive heart development to understand the origins of congenital heart disease and cardiomyopathies. Using CRISPR-based approaches, we generate patient-relevant mouse models in close collaboration with clinical partners. By integrating single-cell omics, structural analysis, and advanced imaging, we uncover how disrupted developmental pathways lead to disease. We seek a motivated Cicerone student to join a collaborative, supportive environment and begin a successful research career.
More information at:
https://www.cnic.es/en/investigacion/intercellular-signaling-cardiovascular-development-and-disease; https://pubmed.ncbi.nlm.nih.gov/?term=de+la+pompa+JL&sort=date

5. **Research line: The Placenta-Heart axis in normal development and in congenital heart disease.**

Research Group: Intercellular Signaling in Cardiovascular Development & Disease
Supervisors: **José Luis de la Pompa, Marcos Siguero-Álvarez**, **María Teresa Soto-Navarrete**
Summary: The placenta–heart axis highlights the tight link between placental function and cardiac development. Altered placental signaling, vascularization, or nutrient and oxygen supply can impair fetal heart growth and increase CHD risk. We study how extra-cardiac cues shape heart development by analyzing GWAS- and single-cell–derived genes in genetically modified mouse models. We seek a motivated Cicerone student to join a collaborative, supportive research environment.
More information at:
https://www.cnic.es/en/investigacion/intercellular-signaling-cardiovascular-development-and-disease; https://pubmed.ncbi.nlm.nih.gov/?term=de+la+pompa+JL&sort=date

6. **Research line: Mechanisms integrating blood flow sensing, arterial wall remodeling and inflammation during atherogenesis.**

Research Group: Mechanoadaptation and Caveolae Biology

Supervisors: **Miguel Ángel del Pozo, Michela Terri, Seung Jae Shin**

Summary: Although cardiovascular risk factors are systemic, atherosclerosis arise at sites exposed to disturbed blood flow, whereas regions experiencing laminar flow are protected. The CICERONE student will actively explore in vitro and in vivo approaches to understand the molecular mechanisms how blood flow and arterial extracellular matrix modulate atherogenesis. Particular attention will be given to vascular inflammation and macrophages, providing the student with hands-on experience at the interface between vascular biology, immunology, and cardiovascular disease.

More information at: https://www.cnic.es/en/investigacion/mechanoadaptation-and-caveolae-biology

7. **Research line: Impact of matrix remodeling in immunotherapy.**

Research Group: Mechanoadaptation and Caveolae Biology

Supervisors: **Miguel Ángel del Pozo, Laura Sotodosos Alonso**

Summary: Immunotherapy efficacy is influenced by tumor-intrinsic features, including the architecture of the tumor microenvironment. Cancer-associated fibroblasts (CAFs) subpopulations modulate antitumor immunity through extracellular matrix (ECM) remodeling, which can limit immune infiltration. Our group has identified caveolin-1 as a pivotal regulator of CAF phenotype, ECM organization, and tumor architecture. In this project, the CICERONE student will investigate how CAV1-dependent ECM remodeling influences tumor immunity in breast cancer, using modern approaches in cell biology, imaging, and bioinformatics.

More information at: https://www.cnic.es/en/investigacion/mechanoadaptation-and-caveolae-biology

8. **Research line: Evaluating the spectrum of cardiometabolic diseases through advanced imaging techniques.**

Research Group: Cardiometabolic Diseases and Advanced Imaging

Supervisor: **Ana Devesa**

Summary: Our group focuses on the study of the impact of cardiometabolic diseases such as metabolic syndrome, insulin resistance and diabetes on different organs. The CICERONE student in our group will learn the uses of state-of-the-art imaging techniques including positron emission tomography, computed tomography, magnetic resonance and magnetic resonance spectroscopy. They will learn the applicability of these techniques to evaluate early cardiovascular changes in individuals that are exposed to cardiometabolic risk factors.

More information at: https://www.cnic.es/en/investigacion/cardiometabolic-disease-and-advanced-imaging

9. **Research line: Mitochondrial performance in heart disease.**

Research Group: Functional Genetics of the Oxidative Phosphorilation System (GENOPHOS)
Supervisor: **José Antonio Enríquez**
Summary: Our laboratory researches the mammalian mitochondrial physiopathology.
We view this system as a functional entity, and use a range of approaches aimed at determining its role in health and disease. We are particularly interested in the role of the OXPHOS system in the development of the cardiovascular system, its relevance to ischemia-reperfusion, and its influence on microvascular blood flow. We also investigate the relevance of mitochondria on inflammation, obesity and vascular physiopathology.
More information at: https://www.cnic.es/en/investigacion/functional-genetics-oxidative-phosphorilation-system-genophos

10. **Research line: Modelling data in cardiovascular prevention and health promotion.**

Research Group: Cardiovascular Health and Imaging Laboratory
Supervisors: **Rodrigo Fernández Jiménez, Jesús Martínez Gómez, Marcos Machado Fragua**
Summary: Our group focuses on health promotion and cardiovascular prevention. The CICERONE student joining our team will work on data analysis and visualization, and the application of statistical modelling strategies to epidemiological datasets, metabolomics, and lifestyle-related variables, all within the framework of cardiovascular prevention and health promotion programs.
The student will have the opportunity to collaborate with the research team on ongoing projects and will be encouraged to develop their own research ideas.
More information at: https://www.cnic.es/en/investigacion/cardiovascular-health-and-imaging

11. **Research line: Biomarkers associated with individual specific progression of atrial remodeling during atrial fibrillation.**

Research Group: Advanced Development in Arrhythmia Mechanisms and Therapy Laboratory.
Supervisor: **David Filgueiras Rama**
Summary: The main objective of the project is to characterize the proteomic, structural and functional changes that determine atrial fibrillation (AF) progression in an individual-specific manner. The objective includes the identification and analysis of functional, structural, proteomic and metabolic biomarkers that determine the individual specific risk to develop persistent AF. The multidisciplinary and translational design of the project includes the study of an in vivo model of AF that resembles clinical progression of the arrhythmia.
More information at:
https://www.cnic.es/es/investigacion/desarrollo-avanzado-sobre-mecanismos-terapias-arritmias

12. Research Line: Acquired mutations in immune cells as a driver of cardiovascular disease.

Research Group: Hematovascular Pathophysiology Laboratory

Supervisors: **José J. Fuster, María A. Zuriaga**

Summary: Advanced age is the greatest risk factor for cardiovascular disease (CVD), but we have an incomplete understanding of how aging promotes CVD. In this context, we are investigating how age-related acquired mutations in blood and immune cells contribute to the development of cardiovascular disorders, such as atherosclerosis and heart failure. By participating in this project, the student will gain expertise in many research techniques and in the use of mouse models in cardiovascular research.

More information at: https://www.cnic.es/en/investigacion/hematovascular-pathophysiology

13. Research Line: New inflammatory drivers of human atherosclerosis.

Research Group: Hematovascular Pathophysiology Laboratory

Supervisors: **José J. Fuster, María A. Zuriaga**

Summary: Atherosclerosis, the primary cause of the most frequent cardiovascular disorders, results from a maladaptive inflammatory response. However, the specific inflammatory pathways that drive atherosclerosis remain largely unknown. From human data, our laboratory has identified new targets that correlate with rapid initiation of atherosclerosis, and aims to establish causal relationships using experimental models. The student will contribute to the investigation of new factors that regulate inflammation, by using innovative mouse models and several biomedical research techniques.

More information at: https://www.cnic.es/en/investigacion/hematovascular-pathophysiology

14. Research Line: Imaging the early stages of human atherosclerosis.

Research Group: Cardiovascular Prevention through Non-Invasive Imaging

Supervisors: **Inés García Lunar, Carlos Nicolás Pérez García**

Summary: Being the principal cause of death worldwide, the study of cardiovascular diseases (CVD) is of high priority. Atherosclerosis is the underlying cause responsible for most of the clinical CVD events. Our group uses state-of-the-art conventional and advanced diagnostic modalities (including ultrasound, cardiac magnetic resonance, and computed tomography) to study cardiovascular health and transition to subclinical macro- and microvascular damage (closely collaborating in major CNIC projects such as the Progression of Early Subclinical Atherosclerosis [PESA] cardiovascular cohort).

More information at: https://www.cnic.es/en/investigacion/cardiovascular-prevention-through-non-invasive-imaging

15. Research line: Uncovering New Genetic Mechanisms in Dilated Cardiomyopathy.

Research Group: Inherited Cardiomyopathies

Supervisors: **Pablo García Pavía, Juan Pablo Ochoa**

Summary: Dilated cardiomyopathy (DCM) is a complex condition with high morbidity and mortality; more than 60% of the cases are genetically elusive. This project aims to uncover novel disease mechanisms by exploring non-coding regions and non-Mendelian inheritance patterns, using large-scale genetic and clinical data from the largest Spanish DCM cohort. We seek a motivated candidate with a background in biology/bioinformatics eager to learn disease mechanisms. The student will gain expertise in genetic data analysis, phenotypic integration, and translational research in a dynamic and international academic environment.

More information at: https://www.cnic.es/en/investigacion/inherited-cardiomyopathies-0

16. **Research line: Inter-organ crosstalk and immunometabolism during the development of chemotherapy-induced cardiotoxicity.**

Research Group: Translational Laboratory for Cardiovascular Imaging and Therapy

Supervisor: **Borja Ibáñez**

Summary: Cancer therapy–induced cardiotoxicity affects up to 30% of patients receiving anticancer treatments. Beyond direct myocardial injury, emerging evidence indicates that cardiotoxicity involves complex interactions between the heart and peripheral organs, together with profound alterations in immune and metabolic pathways. Building on our previous work in mitochondrial dysfunction and metabolic remodeling, this research line focuses on dissecting the role of inter-organ crosstalk and immunometabolic reprogramming in chemotherapy-induced cardiotoxicity.

More information at: https://www.cnic.es/en/investigacion/translational-laboratory-cardiovascular-imaging-and-therapy

17. **Research Line: Gene Therapy Strategies for Inherited Cardiomyopathies.**

Research Group: Molecular regulation of heart failure

Supervisor: **Enrique Lara-Pezzi**

Summary: Inherited cardiomyopathies cause heart failure and sudden death, but the pathways linking genetic mutations to dysfunction are not fully understood. We use mouse models of dilated and arrhythmogenic cardiomyopathy to study how mutations alter cardiac structure, metabolism, and electrical stability. Through longitudinal analysis, we identify mechanisms of compensation and deterioration. The project develops gene-therapy strategies to correct the genetic defect. The internship includes work with mouse models, molecular biology, and cardiac functional assessment.

More information at: https://www.cnic.es/en/investigacion/molecular-regulation-heart-failure

18. **Research line: Disentangling heart failure to improve diagnosis, prevention and treatment.**

Research Group: Molecular regulation of heart failure

Supervisor: **Enrique Lara-Pezzi**

Summary: Heart failure with preserved ejection fraction (HFpEF) is a major public health problem, especially among the elderly. Available diagnostic tools are inaccurate at best and treatment is largely based on "one-size-fits-all", disregarding the specific pathophysiological substrate in each patient. The aim of the project is to disentangle the HFpEF mesh, to deepen our understanding of HFpEF progression, and to develop precise diagnostic and therapeutic tools that will prevent or reverse HFpEF symptoms.

More information at: https://www.cnic.es/en/investigacion/molecular-regulation-heart-failure

19. **Research line: Early diagnosis of Immune Checkpoint Inhibitor myocarditis.**

Research Group: Regulatory Molecules of Inflammatory Processes

Supervisor: **Pilar Martín**

Summary: Chemotherapy and novel cancer therapies have various cardiotoxicities, ranging from heart failure to arrhythmias. Immune checkpoint inhibitors (ICIs) are monoclonal antibodies that target the host immune negative regulation receptors, such as CTLA-4 and PD-1. The most common fatal immune-related adverse event is ICI-myocarditis (50% mortality). There is a need for increased awareness to suspect, diagnose, and treat ICI-myocarditis. Our group studies new treatments and early diagnosis of ICI-myocarditis both in animal models and in patients.

More information at: http://www.cnic.es/es/inflamacion/moleculas/index.php

20. **Research line: Role of the Aryl Hydrocarbon Receptor (AhR) in Alzheimer's disease and vascular dementia.**

Research Group: Neurovascular Pathophysiology

Supervisors: **Mª Ángeles Moro, Carmen Nieto, María Isabel Cuartero**

Summary: Aging decreases cerebral perfusion and raises vulnerability to cerebral vascular failure. The AhR is known for its role in xenobiotic metabolism as well as being a regulator of inflammation. Recent findings support a link between AhR and aging. The student will participate in a project examining AhR's potential involvement in Alzheimer's disease. The student will thus be exposed to a variety of techniques as well as to the use of animal models related to dementia.

More information at: https://www.cnic.es/en/investigacion/neurovascular-pathophysiology

21. **Research line: Human antibody-enabled cardiovascular personalized theranosis.**

Research Group: Nanomedicine and Molecular Imaging
Supervisor: **Carlos Pérez Medina**
Summary: The ultimate goal of our research is to develop fully human antibodies (HuAbs) into diagnostic tools and personalized therapeutic agents to treat atherosclerosis. Specifically, we are isolating promising candidates from a macrolibrary of HuAbs selected in vivo from atherosclerotic samples. These candidates are subsequently characterized and produced in different formats suitable for therapeutic purposes or imaging with positron emission tomography (PET). In vivo testing of HuAb-based therapies and PET radiotracers is carried out in animal models of atherosclerosis.
More information at: https://www.cnic.es/en/investigacion/nanomedicine-and-molecular-imaging

22. **Research line: The antibody immune response in cardiovascular disease.**

Research Group: B Lymphocyte Lab
Supervisors: **Almudena R Ramiro, Ana Rodriguez Ronchel**, **María Juárez**
Summary: In our lab we are interested in B cell biology, the generation of antibodies and their functional relevance during the immune response as well as in pathological contexts. The internship will immerse in the study of antibody responses during atherosclerosis taking advantage of genetic models of disease combined with precise B cell genetic tracing, and state-of-the-art single cell technologies.
More information at: https://www.cnic.es/es/investigacion/biologia-linfocitos-b

23. **Research line: Human-based tools and strategies for cardiac regeneration studies.**

Research Group: Myocardial regeneration via cardiomyocyte cell cycle regulation
Supervisors: **Hesham Sadek, Maria Rosaria Pricolo**
Summary: Our group studies mechanisms of heart regeneration in neonatal mammals to identify strategies that could re-activate cardiomyocyte proliferation in adults. We are developing human iPSC-derived cardiomyocyte platforms to overcome the immaturity of current models. We hypothesize that modulating pathways controlling hyperplastic versus hypertrophic growth will enhance iPSC-CM maturation for drug screening and future therapies. The student will help generate, maintain, and characterize iPSC-CMs, performing culture, gene expression, imaging, functional assays, and pathway-modulation experiments.
More information at: https://www.cnic.es/en/investigacion/myocardial-regeneration-cardiomyocyte-cell-cycle-regulation

24. Research line: New RNA-Based Approaches for Regenerating the Injured Heart.

Research Group: Myocardial regeneration via cardiomyocyte cell cycle regulation

Supervisors: **Hesham Sadek, Maria Rosaria Pricolo**

Summary: Ischemic heart disease remains the leading global cause of death, and current treatments do not restore lost cardiomyocytes. This project tests whether adult cardiac regeneration can be reactivated by targeting pathways that control the cardiomyocyte cell cycle. The student will assist in inducing cardiomyocyte-specific knockdown of Meis1 and Hoxb13 in hiPSC-derived cardiomyocytes and adult mouse models. They will gain experience in siRNA-based approaches, imaging, and core molecular and cell-biology techniques.

More information at: https://www.cnic.es/en/investigacion/myocardial-regeneration-cardiomyocyte-cell-cycle-regulation

25. Research line: Generation of bispecific antibodies for immunotherapy.

Research Group: Immunobiology

Supervisors: **David Sancho, Ignacio Heras-Murillo**

Summary: We are generating and characterizing a new generation of bispecific antibodies designed to boost immunotherapy. The initial characterization in vitro and in vivo in models of immunization will determine whether we obtain an immunogenic or tolerogenic effect that will guide our in vivo efforts to cancer or cardiovascular immunotherapy respectively. The student will learn many techniques working in vitro (cell culture, molecular biology, biochemistry and Immunology techniques) and will analyze models of disease in vivo.

More information at: https://www.cnic.es/en/investigacion/immunobiology

26. Research line: Modulating fatty acid oxidation in microglia to manipulate their function in neuroinflammation.

Research Group: Immunobiology

Supervisors: **David Sancho, Annika Bestehorn**

Summary: We will use a complex genetic mouse model that increases fatty acid oxidation (FAO) in microglia to explore how metabolic reprogramming influences their effector functions. By enhancing FAO, we aim to determine if microglia can adopt a protective state that reduces neuroinflammation and tissue damage. The student will gain experience with in vitro and in vivo methods, such as tissue culture, multicolor flow cytometry, and mouse models of neuroinflammation.

More information at: https://www.cnic.es/en/investigacion/immunobiology

27. Research line: Autophagy and Cell Competition in Postnatal Cardiomyocytes.

Research Group: Genetic Control of Organ Development and Regeneration
Supervisors: **Miguel Torres, Glória Conceiçao**
Summary: Previous studies from our group suggest that enhanced autophagy improves cardiomyocyte fitness in the postnatal heart. Given the limited regenerative capacity of the adult heart, which contributes to maladaptive ventricular remodeling after ischemic injury, understanding autophagy-related mechanisms is critical. This project will allow the student to investigate the role of autophagy in cardiac remodeling while gaining hands-on training in advanced molecular and histological techniques, as well as experience working with animal models used in cardiovascular research.
More information at: https://www.cnic.es/en/investigacion/genetic-control-organ-development-and-regeneration

28. **Research line: Advanced proteomics methods for the analysis of post-translational modifications to Cardiovascular Biology.**

Research Group: Cardiovascular Proteomics
Supervisors: **Jesús Vázquez, Ana Martínez del Val**
Summary: We are developing "open search" algorithms that allow true hypothesis-free identification and quantification of any post-translational modification from high-throughput mass spectrometrybased proteomics. In this project, we aim to further extend the development of semisupervised approaches to the interpretation of the data and to integrate the quantitative information in large-scale experiments. We will also apply these developments to study molecular mechanisms underlying cardiovascular diseases, including subclinical atherosclerosis and other diseases related to vascular-remodelling.
More information at: https://www.cnic.es/en/investigacion/cardiovascular-proteomics

29. **Research line: Harnessing anti-fibrotic strategies to improve pluripotent stem cell-derived cardiomyocyte transplantation for heart repair.**

Research Group: Cardiac tissue engineering and regenerative therapies
Supervisors: **Florian Weinberger**, **Romina di Mattia**
Summary: Transplanting cardiomyocytes derived from pluripotent stem cells is a promising strategy for repairing the heart. However, its effectiveness in chronically infarcted hearts is limited due to the presence of fibrosis. This project aims to investigate whether antifibrotic treatments can create a more favorable tissue environment, thereby improving cell engraftment and cardiac function. The selected student will gain hands-on experience in cardiac histology, quantitative tissue analysis, and the assessment of fibrosis, infarct size, and graft integration.
More information at: https://www.cnic.es/en/investigacion/cardiac-tissue-engineering-and-regenerative-therapies-0