

Position Offered: JAE PRE/MED

Project: *Mechano-memory of patrolling monocytes during intravascular immune-surveillance*

Research fields: Biomedicine, Immunology

Location: Madrid, Madrid. Centro de Investigaciones Biológicas Margarita Salas, <https://www.cib.csic.es/es>

Research Group/PI: Matrix metalloproteinases in Angiogenesis and Inflammation, Alicia G. Arroyo, <https://www.cib.csic.es/research/biomedicine/matrix-metalloproteinases-angiogenesis-and-inflammation>

PROJECT SUMMARY

Patrolling monocytes (PMo) are a subset of circulating leukocytes capable of crawling on the endothelium in search of damage or harmful particles, in order to eliminate them and restore homeostasis. They therefore play a beneficial role in pathological contexts such as lung metastasis, Alzheimer's angiopathy, vaso-occlusive disorders and sepsis, among others, and also, potentially, in vascular health, as we have recently proposed. Our current research explores the molecular mechanisms underlying the intravascular immune surveillance actions of PMo, with the aim of identifying biomarkers that can serve as prognostic/diagnostic indicators of disease, as well as therapeutic targets whose modulation could enhance the intravascular activity of these monocytes. PMo dynamically adapt their shape and crawling during their exploration of the vascular system. The most recent studies on innate immune system training and memory have identified epigenetic changes as the main mechanism and show that this training can have beneficial or detrimental effects by boosting acute inflammation or promoting chronic inflammation.

Based on recent observations (Clemente et al., *Nat Commun* 2018; Moreno-Cañadas et al., *Front Immunol* 2021; Cuesta-Ramos et al., *Sci Adv* 2026, to be submitted), we hypothesize that PMo acquire mechanical memory during their surveillance rounds in the bloodstream, which could enhance their intravascular actions and help ameliorate various diseases. To this end, we propose the following objectives: i) to explore changes in PMo related to “mechanical properties” such as cell size and morphology, plasma membrane fluidity and also cell deformability with cell confiners and confocal microscopy in response to prolonged ‘damage’ (circulating tumor cells, hyperglycemia, etc.); and ii) to investigate how this mechanical memory influences the crawling, search and clearance of damaged endothelial cells and harmful particles by trained PMo, using flow cytometry (conventional, spectral and image modalities), confocal microscopy, image analysis and single-cell-based unsupervised clustering for distinctive behaviors.

This project will engage the researcher in an innovative, multidisciplinary and ambitious doctoral program, generating knowledge about the new mechanisms underlying the training and memory of innate immune cells, an emerging field of growing interest. Furthermore, the pathways identified could serve as

prognostic biomarkers or as targets whose modulation could lead to new host-directed immunotherapies for metastatic cancer, but also for infectious and cardiovascular diseases.

PROFESSIONAL PROFILE

Minimum requirements:

Degree in Science (Biochemistry, Biotechnology, Biology, etc.) or Health Science (Biomedicine, Pharmacy, etc.); English (at least B2);

Other merits to be considered:

Knowledge of language R; accreditation for animal experimentation; experience in flow cytometry.

WHAT IS OFFERED

The JAE-PRE researcher will use **cutting-edge techniques** (high resolution and expansion microscopy, 3D image analysis, single-cell and imaged-based computational tools, spectral and image flow cytometry, mechano-biology devices, and functional cell models) to develop this innovative and challenging project, that combines biological questions with computational solutions. The predoctoral researcher will actively collaborate with national and international groups, within the current network established by the principal investigator. The researcher will perform at least one **short research stay** in highly reputed international laboratories to learn advance techniques such as quantitative microscopy of plasma membrane receptors, advanced live microscopy and novel approaches to mechanical immune memory.

Finally, the researcher training and progress will be closely followed up by regular meetings with the PI to assess the results achieved in relation to the objectives and document the objectives for the following period. The meetings will also serve to identify potential problems and propose solutions and improvements. In addition, the laboratory holds bi-weekly meetings with regular progress reports and/or journal clubs where manuscripts of interest are discussed with the rest of the team. And the JAE-PRE researcher may meet with the supervisor whenever necessary to clarify any questions about the assigned activities. A quarterly evaluation will also be conducted to assess progress toward the thesis objectives. Finally, an evaluation committee, composed of two researchers—one from the CIB and one from another research center—will be established to allow for an external and independent assessment of the thesis's development and progress. This committee will meet annually and prepare a progress report that will set the guidelines for the following period. The committee's evaluation will be particularly relevant during the final year of the contract to prioritize tasks that ensure the preparation and defense of a high-quality thesis project.

Contract conditions:

JAE PRE/MED: Predoctoral Researcher 4 years contract. Gross annual salary of 32.565,71€. (Employer's contribution included)

Start date: before 15th December 2026

PRINCIPAL INVESTIGATOR. CONTACT DETAILS

Email: agarroyo@cib.csic.es



MINISTERIO
DE CIENCIA, INNOVACIÓN
Y UNIVERSIDADES



Phone: 34 91 837 31 12, ext 442709