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Instituto de Parasitología y Biomedicina López-Neyra

CSIC
Consejo Superior de Investigaciones Científicas

Call for candidates: PhD fellowship in bone mineralization and electron microscopy

Unravelling nanoscale interactions between glycosaminoglycans and mineral precursors in bone formation (GLYCOMIN)

Project description:

The project GLYCOMIN aims to gain insight into the mechanisms of the initiation of mineralization in bone. It is focused on determining the role of proteoglycans (especially biglycan) as stabilizers of mineral precursors and facilitators of phase transformation.

Proteoglycans are heavily glycosylated proteins, constituted of a small core protein with one or more covalently attached carbohydrate chains (glycosaminoglycans, GAGs). They control collagen fibril formation, by regulating the size, shape, alignment, and inter-fibrillar spacing (Robinson et al. 2017). They also play a decisive factor in inducing collagen mineralization (Milan et al. 2004, Wojtas et al. 2020) but their exact role is still unclear, mainly due to their structural diversity and multi-functional character. A key question, how and when they interact with the developing mineral, is still to be resolved.

Given the hierarchical nature of bone, we apply a correlative approach combining a range of high-resolution techniques to connect the different hierarchical levels. We integrate X-ray diffraction and absorption techniques with advanced electron microscopy, including FIB-SEM 3D tomography and lamellae preparation, high resolution imaging and diffraction, Electron Dispersive X-ray spectroscopy and Electron Energy Loss Spectroscopy. This is therefore a highly multidisciplinary project, combining biochemistry and materials science.

Profile and skills required

The ideal candidate will have a solid background in biology, (bio)chemistry, biotechnology, materials science and/or electron microscopy, with a Master degree in a relevant discipline. Candidates should be fluent in oral and written English and possess good quantitative analytical skills. Ability to work independently, and a serious commitment to research will be an asset.

Contact:

To apply, please send a complete CV and a motivation letter to:

Dr. Elena Macías-Sánchez (elena.macias@ipb.csic.es)

Start date: 1 September 2025

Application deadline: 15 June 2025

Interviews will take place during the month of June.

Publications related to the project:

1. Hua, Ni, Eliason, Han, Gu, Nicolella, Wang, Jiang. Biglycan and chondroitin sulfate play pivotal roles in bone toughness via retaining bound water in bone mineral matrix. Matrix Biology 94, 95109 (2020) DOI 10.1016/j.matbio.2020.09.002
2. Rutten, Macías-Sánchez*, Sommerdijk*. On the Role of Glycosylation of Type I Collagen in Bone. *Journal of Structural Biology* 206, 108145 (2024) DOI 10.1016/j.jsb.2024.108145
3. Macías-Sánchez*, Tarakina, Ivanov, Blouin, Berlanovich, Fratzl*. Spherulitic crystal growth drives mineral deposition patterns in collagen-based materials. *Advanced Functional Materials*, 32, 2200504 (2022). DOI 10.1002/adfm.202200504

Keywords:

Bone mineralization, collagen, proteoglycans, Transmission Electron Microscopy, FIB-SEM, 3D reconstruction, image analysis.

Institution:

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https://www.ipb.csic.es/

https://www.youtube.com/watch?v=6E8CbJVtLiE