

PhD POSITION TO APPLY TO THE SPANISH FPU PROGRAM

Research Project –

Base epigenética de la herencia transgeneracional y del dimorfismo sexual de talla

Reference: PID2022-139096OB-I00 (Agencia Española de Investigación)

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Centre: Institut de Ciències del Mar (ICM-CSIC)

Project description

Summary of project framework

Epigenetics studies modifications in gene expression that are independent of changes in the genotype. The main epigenetic mechanisms are DNA methylation, histone modifications and non-coding RNAs (ncRNAs). These mechanisms act during development, shape the epigenome and regulate the gene patterns that determine cellular identity. Transgenerational epigenetic inheritance (TEI), or environmentally-induced changes transmissible to subsequent generations even when the initial stimulus has disappeared, is a highly topical issue. In TEI, the sperm epigenome seems to play a major role. On the other hand, sexual size dimorphism (SSD), or differential growth between sexes, is a consequence of gene expression patterns that, together with the sex ratio, determine the biomass produced. Finally, although the epigenome is characteristic of each tissue, some recent observations indicate that there may be environmentally induced responses shared by several tissues. Therefore, being able to infer epigenetic patterns in internal tissues from the epigenome of liquid tissues such as sperm or blood would be very useful since it would allow successive and non-lethal sampling of the same individual. Based on the above, the general objective of this project is to understand the epigenetic basis of two important aspects of fish biology in general and of European sea bass—the species under study—in particular: the existence of TEI with the transmission of temperature-induced epigenetic patterns and the epigenetic basis of the onset of SSD. Epigenetic marks in sperm and blood will also be characterized in order to know the information they can provide. To achieve the proposed objectives, the experience gained in previous projects where advances were made in the development of epigenetic markers for aquaculture, some of them world firsts and others patented, will be used. A set of modern research techniques will be used to characterize DNA methylation, various histone modifications, the degree of chromatin compaction and ncRNAs. Gene expression will be measured by RNA-seq to link epigenetic changes with functional changes. This project will generate new information of a basic nature by addressing aspects that have been little or no studied at all. It will also generate practical information, with the possibility of patent protection by providing new epigenetic biomarkers associated with key functions such as reproduction, growth and response

to the environment. The research will be carried out by the Group of Biology of Reproduction, a group with strong international projection that has contributed significantly to the study of fish epigenetics and is a pioneer in the inclusion of epigenetics in aquaculture. The project will also benefit from the participation of renowned national and international researchers in the working group. Finally, the PI's experience in thesis direction, the productivity of the group, as well as the methodologies involved form a very appropriate framework to pursue a PhD. The student would gain experience with techniques related to epigenetics research, increasingly important in animal husbandry and aquaculture, and would allow him/her to participate in an exciting field of biology.

Sumamry of training progarm for the candidate

The Group of Biology of Reproduction and Environmental Epigenetics (GBR) offers an excellent environment for the training of young scientists, validated by several years of continuous success of the egregated PhD students. The proposed tasks for the present project constitute an interesting subject for a PhD thesis, not only because they relate to a timely research topic but also because the studies combine direct work with living animals with the use of techniques of molecular biology, several epigenetics techniques and bioinformatics, for which we not only apply existing pipelines but develop new ones when necessary. **The training programme** for the PhD student is detailed below and includes:

- To learn to work with live fish (husbandry, anesthesia, biopsies)
- To learn not only basic molecular biology techniques (DNA/RNA extraction/quantification, PCR) but also the standard and new techniques of functional genomics (RNA-seq, WGCNA) and, especially, of epigenetics research, including WGBS, RRBS, ATAC-seq, CHIP-seq and sncRNAs.
- To learn bioinformatics including working with Phyton for data processing and machine learning, and with Rstudio for statistics and data presentation.
- The possibility of taking part in the high-quality PhD programs offered at the University of Barcelona (Genetics and Genomics or Aquaculture), Autonomous University of Barcelona (Aquaculture) or at the University Pompeu Fabra (Biomedicine), our usual partners. We allow PhD students to participate in the selection of the specific doctoral program based also on their interests.
- To participate in face-to-face and online courses, as our PhD students did before. These include EMBL, Physalia and Phyton and Rstudio courses offered by the local universities.
- To regularly take part in GBR's group discussions and ICM Friday talks.
- To participate in national and international meetings presenting his/her data to develop and gain good presentation and communication skills.
- To visit our collaborators labs in stays abroad to learn and see other ways of doing.
- To interact with international collaborators when they visit or cooperate with our group so they know the, and are known by, the colleagues in the field.
- To learn how to identify the right question for research and to develop a critical approach to results and findings.

- To learn how to successfully prepare a scientific manuscript for submission for publication in international journals and to develop effective communication skills to present the work in a different variety of audiences.

Requirerments of the candidate

Education: Preference will be given to holders of Masters in Genetics and/or Genomics or in Aquaculture. Other suitable profiles include, but are not limited to, holders of Masters in Biotechnology, Evolutionary Biology, Molecular Biology or the like.

Complementary training: The following competences are not a requisite, since training in these aspects will be provided, but they will be considered an additional asset: Courses in bioinformatics, R-studio, and Manipulation of Animals for Scientific Experimentation.

Languages: A demonstrable good level of English, both written and spoken will be considered positive.

Other skills: Driving licence is not necessary but it will also be considered positive.

Hosting research team

Group of Biology of Reproduction and Environmental Epigenetics (GBR)

How to apply

- At the first step, the applicant will be evaluated based on the university degree. If appropriate, selected candidates could be invited for an interview. In case you are interested, please contact ASAP the PI of the project attaching your CV and your transcript record.
- At the second step, selected applicants, together with the PhD project, will be evaluated for a final selection.
- Applications to the FPU scholarships must be submitted through [the following official link](#). The the following official linkthe following official linkthe following official linkthe following official linkperiod of application is **from 17 January to 15 February 2024**.



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