Universitat Pompeu Fabra Barcelona

Master in Bioinformatics for Health Sciences

Master project 2021-2022

Personal Information

Supervisor	Javier del Campo
Email	jdelcampo@ibe.upf-csic.es
Institution	Institut de Biologia Evolutiva (CSIC-UPF)
Website	delcampolab.com
Group	del Campo Lab. Microbial Ecology and Evolution

Project

Computational genomics

Project Title:

The genomic mechanisms of ichthyocarbonates precipitaion

Keywords:

fish, climate change, carbon cycle, genome, microbiome,

Summary:

The laboratory The del Campo Lab is based at the Institut de Biologia Evolutiva (UPF-CSIC) in Barcelona. The research at the del Campo Lab is focused on the study of host-associated microbes and the effect of global warming on the microbiomes of benthic and planktonic marine animals. We have a wet and dry lab, to perform experiments and bioinformatics analysis, enabling the broadest possible goals. The ongoing climate change and its effects on the environment, such as rising sea temperature, has strong impacts on free-living marine microbial communities. However, the effects of global warming have not been properly studied on host-associated microbiomes. Microbiomes (both prokaryotic and eukaryotic) associated with host organisms have a strong influence on host evolution, physiology, and ecological functions. We study how environmental changes resulting from global warming affect the composition and function of the microbiomes in key members of the marine fauna and consequently how these changes affect the hosts. Currently, our study focuses on these impacts on corals, teleost fish, and zooplankton. To tackle this novel research topic, we use a combination of molecular biology, ecophysiology, and bioinformatics. The project Calcium carbonate released by teleost fish in marine environments (AKA ichthyocarbonates) represents one of the main carbon sinks in the open ocean, so a mitigator of climate change. The ichthyocarbonate pellets released by fish have an impact on the global carbon cycles and based on the most recent predictions of temperature increase and acidification as a result of climate change its importance will increase in the future. The formation of ichthyocarbonates in the gut of the teleost fish is also a key mechanism for the fish survival because allows them to maintain their osmotic balance. However, despite its physiological importance and its role as an alternative carbon sequestration method, little is known about the genomic mechanisms involved in the precipitation of ichthyocarbonates. Using genomics and transcriptomics data from the Gulf Toadfish (Opsanus beta), a model organism for the study of osmoregulation, such genes involved in the calcium carbonate precipitation have not been found neither in any other fish genome as far as we know. Classically it has been thought that the responsible for the precipitation of calcium carbonate was the fish, but recently microorganisms have been reported on the surface of the ichthyocarbonates opening the door to the possibility that the fish microbiota might be playing a role in this process. So, it is possible that the genes directly involved in the precipitation of ichthyocarbonates are present in the microbiome. The aim of this project is to characterize the complete mechanism of ichthyocarbonates precipitation targeting at the same time the piscine host and its microbiome. We will compile a set of reference genomes of teleost fish and re-analyze them using alternatives approaches that would allow us to obtain a better assembly to minimize the loss of information and to assemble the genomes of the most abundant associated microbes using binning strategies on the “contaminant” fraction of the raw genomic data. We hope that using this strategy will allow us to reconstruct the complete carbonate precipitation pathway.

References:

Wilson, R. W. et al. 2009. Contribution of Fish to the Marine Inorganic Carbon Cycle Science 323, 359–362.

Expected skills::

R, Python, Genome Assembly and Annotation, Phylogeny, Binnig Strategies, Database Management

Possibility of funding::

No

Possible continuity with PhD: :

To be discussed