Institut de Ciències del Mar

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

INPHINIT INCOMING ICM-CSIC POSITIONS

1. A multidisciplinary 'big data' approach to identify early warning signals in microalgae production systems

PhD Supervisors: Dr. Pedro Cermeno pedrocermeno@icm.csic.es

Project description

Scaling up biological processes from laboratory-scale experimental trials to industrial-scale applications leads to a systematic loss of efficiency, negatively impacting the economic viability and potential environmental benefits of the technology. Process instability is critical in nonlinear dynamic systems, such as bio-based production systems, where the functioning of complex microbial communities controls the their performance stability. These dynamic systems can undergo transitions in which the system shifts from one stable state to another at a critical threshold, also called 'tipping point'. Because state transitions alter the efficiency of microbial communities for the provision of services, anticipating the failure of the system is key for the timely implementation of prevention measures that ensure process stability and technology profitability. This project aims to establish a base of knowledge for the development of a system failure prediction technology that increases the performance of microalgae production and biomass conversion systems and advances towards a more sustainable production of biogas from algal feedstocks. The project will be carried out in the research group Plankton Ecology and Ocean Health of the Institut de Ciencies del Mar (ICM-CSIC). Among other interests, the group harnesses the diversity marine living resources for the development of efficient and environmentally-integrated bioenergy/food/remediation technologies. If awarded, this doctoral project will contribute to boost an innovative research line on blue bio-energy that, in collaboration with 7 other European research institutions, has recently been awarded by the EU with a research and innovation grant (a total of 2.5 million euros) to develop early warning technologies in microbial-based production systems (**PRODIGIO project** - https://prodigio-project.eu/).

Job position description

Process monitoring is a crucial task for bio-process optimization and will play a decisive role in the digitization of the future bio-based production systems. System failure prediction technologies are an integral part of monitoring schemes; however, these technologies are underdeveloped as far as the bioenergy industry is concerned. By combining perturbation experiments in lab-scale bioreactors, multi-omics, chemical fingerprinting technologies, and cutting-edge methods for big data analysis, this project will decode the triggers, identify early-warnings, define threshold values and calculate warning times for critical state transitions in microalgae production and conversion to biogas systems. The research will be carried out at the Institut de Ciencies del Mar CSIC within the framework of the EU

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

Research & Innovation Action PRODIGIO, an ambitious green bioenergy initiative aimed at moving the entire biogas production chain efficiently towards its theoretical maximum. The doctoral student will acquire skills in multi-Omics, chemical fingerprint technologies, bioinformatics, and computational ecology methods, and will join an international research team involved in the reconstruction of the interaction networks operating normal, pre-failure and failure state bioreactors. The research programme will be performed in close collaboration with project partners in Spain (Universidad de Almeria and IMDEA-energia), France (MINES Paris-Tech), Germany (Alfred Wegener Institute), Norway (University of Life Sciences), and Taiwan (National Taiwan University), agglutinating tremendous expertise in the fields of microbiomics, analytical chemistry, bioprocess engineering & technology assessment. In order to bring microbial-based production systems faster to commercialization, the development of process-control algorithms with system failure prediction capabilities is a must, positioning this project at the leading edge of bioreactor research.

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

2. Aerosol formation in the pristine oceans

PhD Supervisors: Dr. Rafel Simó rsimo@icm.csic.es

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

Project description

Thirty-five years after the hypothesis that oxidation of ocean-leaving DMS to sulfuric acid was the main source of new aerosol in marine pristine atmospheres, the picture has become more complicated and it has been recognised that a cocktail of volatiles is needed for acidic clusters to stabilise and grow to active, cloud seeding aerosols. However, the chemical species in this cocktail have long remained elusive. Recently, ternary nucleation of sulfuric acid, water and bases such as ammonia or amines has been observed; and organics with large potential for oxidation, condensation and aerosol growth have been identified amongst oceanic emissions. It has also become more evident that sea spray and its load of sea salt and organic matter contribute to marine aerosol as well. In regions like the polar oceans, all these ingredients arise from a number of emission sources, some diffuse like plankton or wave associated waves, some localised like the marginal sea ice zone or coastal animal colonies. This PhD project aims to identify sources of new aerosols, particularly in the Arctic and the Southern Ocean. This will be conducted through (a) the analysis of aerosol size distribution data collected by international collaborators at a number of Arctic and Antarctic research stations and on board research vessels; (b) the analysis of satellite data on sea surface salinity and temperature, solar radiation, chlorophyll a concentrations, sea surface organic matter, wind speed, and aerosol concentration and size; (c) the identification of relevant aerosol-forming volatiles by Proton Transfer Time-of-Flight Mass Spectrometry (PTR-ToF-MS). This project will be supervised by Rafel Simó and co-supervised by Manuel Dall'Osto and Carolina Gabarró, both scientist at ICM.

Job position description

This PhD project aims to identify sources of new aerosols in the pristine oceans, particularly in the Arctic and the Southern Ocean. This will be conducted through (a) the analysis of aerosol size distribution data collected by international collaborators at a number of Arctic and Antarctic research stations and on board research vessels; (b) the analysis of satellite data on sea surface salinity and temperature, solar radiation, chlorophyll a concentrations, sea surface organic matter, wind speed, and aerosol concentration and size; (c) the identification of relevant aerosol-forming volatiles by Proton Transfer Time-of-Flight Mass Spectrometry (PTR-ToF-MS). The candidate should preferentially hold Bachelor and MSc studies in Environmental Sciences or Engineering (Atmosphere / Ocean / Chemistry / Physics / Climate / Geosciences) and be proficient in a programming language for data processing (Python, R, MATLAB or alike). We seek a motivated student who is primarily willing to do computing work but is ready to do fieldwork when opportunities arise. The ICM-CSIC is an excellent host centre for the project. It provides the computing and analytical

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

facilities, the access to fieldwork on oceanographic cruises and polar research stations, and, above all, a multidisciplinary work environment with clustering of the relevant expertise. The candidate will integrate in the Research Group of Marine Biogeochemistry, Atmosphere and Climate, with a longstanding research record on ocean-atmosphere interactions (e.g., publication in Nature Geoscience in 2021) and a consolidated international network of collaborators. She/he will work closely with the Barcelona Expert Centre for Remote Sensing Applications, also hosted in the ICM, which will provide the required data and expertise for the satellite-based studies.

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

3. Aerosol Characterization of seabird ecology using advanced technologies and citizen science based approaches

PhD Supervisors: Dr. Francisco Ramírez ramirez@icm.csic.es

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

Project description

Two research groups will be involved in the project: (1) "EnvironMental and sustainaBility particIpatory inforMatiOn systemS" (EMBIMOS) is an interdisciplinary research group that focuses on implementing participatory information systems for decision-making in favour of environmental sustainability. The research group generates research on technologies that optimize citizen science. We are currently evaluate the integration of citizen observatories in the European Open Science Cloud (EOSC) in the framework of H2020 Cos4Cloud project. EMBIMOS creates low-cost technologies such as sensors to monitor environmental parameters and citizen science plarforms to report both biodiversity and environmental observations. At present we are developing different citizen science technologies within the framework of the H2020 projects MINKE, MONICLE and ARSINOE. (2) "Functioning and Vulnerability of Marine Ecosystems". The principal aim of the group is focused on global change ecology and marine biodiversity conservation, with a special emphasis on investigating the long-term trends in key environmental and biological variables in the world's oceans; identifying those marine areas most at risk due to climate and human-driven environmental changes; evaluating wildlife responses to environmental changes in highly-impacted marine systems; and designing suitable management alternatives to enhance ecosystems' resilience to climate change and to ensure a sustainable balance between marine biodiversity conservation and human use of ecosystem services. To accomplish these goals, the group has worked at different levels of ecological complexity (from individuals to communities and ecosystems), with different study models (e.g. seabirds, cetaceans and waterbirds), and in various biogeographical areas (from template to polar regions).
The main supervisor of the project is Prof. Francisco Ramírez and the co-supervidor Prof. Jaume Piera, both from ICM.

Job position description

Automated time-lapse or motion detection cameras can facilitate reliable and consistent monitoring of sea-bird populations. At present, this type of monitoring technologies may produce thousands of pictures that maybe challenging to process in a cost-effective way. Citizen science provides a means by which large and otherwise intractable photographic data sets can be processed. The new generation of citizen science technologies combine not only the possibility of human-human interaction, but also the possibility to incorporate

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

artificial intelligence (AI-agents), with human-computer interaction, that may improve the capacity of reporting and analysing the data in a much effective way. The hybrid nature of this new generation of citizen science, places at the intersection of several important research disciplines, including data analysis, social computing, and collective intelligence. The project proposes to test and develop methods based in such approach in two different ecological scenarios: sea-bird populations in urban and polar areas, sea-gulls and cormorants in the first case and mainly penguins in the second, to demonstrate the general applicability of these new technologies.

These interdisciplinary project will integrate different disciplines advanced technologies of computer vision, and edge computing combined to be applied in the context of of population (bird) ecology and animal ethology. The fact that will include also volunteer based observations and analysis will include also the development of specific algorithms for the analysis and validation of citizen science based data. This co-supervisors (Fran Ramírez and Jaume Piera) have complementary expertise to cover this wide range of disciplines.

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

4. DOGMA: THE ROLE OF PLANKTON ECOLOGY IN THE DEGRADATION OF ORGANIC MATTER

PhD Supervisors: Dr. Montserrat Sala msala@icm.csic.es

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

Project description

Understanding the role of biotic and abiotic factors in regulating the decomposition rates of organic matter (OM) in marine ecosystems has become one of the top priorities in ocean biogeochemistry. During the last few years, this topic has generated enormous interest due to the assumed role of plankton ecology and hydrodynamics in driving organic carbon fluxes and budgets in the ocean. However, the mechanisms that regulate the link between plankton ecology, ocean turbulence, and OM transformation processes remain poorly understood. To advance knowledge in this field, the objective of DOGMA is to examine the controls that plankton communities and small-scale turbulence exert on the degradation and remineralization rates of organic matter. DOGMA will use a multidisciplinary approach including expertise in biogeochemistry, microbiology and physical-biological interactions and apply state of the art methodologies. Within DOGMA we will experimentally address: 1) The role of the phytoplankton structure of natural and induced proliferations in regulating the chemical composition of the derived OM and its microbial degradation; 2) The response of heterotrophic prokaryotic communities to additions of exudates of cultured phytoplankton species; 3) The impact of turbulence on the degradation of different types of dissolved organic matter and on prokaryotic activity; 4) The role of turbulence in aggregate formation and its consequences for vertical particle flux and water viscosity. For this purpose DOGMA has assembled a consortium of experts in plankton, turbulence, prokaryotic diversity and activity, and biogeochemistry that also includes external experts in specific techniques.This knowledge is key to better understand the carbon cycle in the ocean and refine transfer rates in Earth System models, especially in a climate change scenario that favors certain types of plankton communities.

Job position description

Understanding the role of biotic and abiotic factors in regulating the decomposition rates of organic matter (OM) in marine ecosystems has become one of the top priorities in ocean biogeochemistry. The topic has generated enormous interest in recent years due to the assumed role of plankton in driving organic carbon fluxes in the ocean. However, the mechanisms that regulate the link between OM degradation and turbulence remain poorly understood. To advance in this field, the objective of this thesis will be to examine the controls that prokaryotic activity and composition and turbulence exert on the degradation

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

of organic matter originated from different phytoplankton species. The thesis will specifically address 1) the response of heterotrophic prokaryotic communities to the addition of exudates of cultured phytoplankton species, using genomics and metatranscriptomics, and 2) the role of turbulence in the prokaryotic degradation of DOM. The knowledge obtained in this thesis will be key to better understand the carbon cycle in the ocean specially in a climate change scenario that will favor certain types of plankton communities. Within the project the student will use a multidisciplinary approach including expertise in biogeochemistry, microbiology and physical-biological interactions and apply state of the art methodologies. The student will be trained in biochemical and molecular techniques within the group Ecology of Marine Microbes, and will be complemented by that of the collaborators in other institutions through 3-months placements in France and Sweden. Depending on the needs of the student, he will be invited to assist to specific courses and also to enroll on oceanographic cruises or join experiments, at the ICM or other institutions within our broad network of international contacts.

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

5. Exploring evolutionary changes in wild aquatic microbes exposed to simulated global change

PhD Supervisors: Dr. Ramiro Logares ramiro.logares@icm.csic.es

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

Project description

The ocean microbiome is fundamental for the functioning of the biosphere. Microbes are the foundation of the ocean ecosystem, responsible for approximately 50% of global primary productivity transporting at least five gigatons of carbon to the depths of the ocean each year, equivalent to approximately 50% of current anthropogenic carbon emissions. Global change can affect the marine microbiome and affect key ecosystem functions, yet we know very little about how microbes will respond to long-term environmental challenges and the role that evolution and epigenetics will play. This represents a major knowledge gap considering the potential large-scale effects that changing microbial assemblages could have for global ecosystem function. The supervisory team is addressing this challenge in the projects MINIME and WILDE and in order to investigate long-term environmental effects in microbial populations the team, together with other ICM colleagues, has generated one of the longest marine metagenome time-series to date, The Blanes Bay Microbial Observatory (BBMO; monthly samples over 12 years (2009-2020). The team has also access to a second metagenome time-series (the SOLA station in the Bay of Banyuls sur Mer, France; monthly samples over 7 *y*ears: 2009-2015). The team is also generating state-of-the-art long-read sequences from Blanes samples (SMRT PacBio Sequel II) from samples taken 10 years apart that will enable the direct comparison of high-quality genomes and functional groups over evolutionary relevant timescales for microbes. These unique datasets will be available for the student. The team has already shown the value of metagenomic dataset for investigating the evolution of marine microbes. Overall, the PhD candidate will carry out research in expanding interdisciplinary research fields such as microbial population genomics, microevolution, paelogenomics and epigenetics.

Job position description

This project includes state-of-the-art techniques in omics, biocomputing, evolutionary theory, epigenetics with the expertise in these fields from the supervisory team, contributing to its overall excellence. The training will allow the PhD candidate to acquire an in-depth knowledge of advanced methods in evolutionary genomics, epigenetics, high-throughput DNA sequencing and 'omics' techniques to understand the genomic reactions of ocean microbes to global change, likely leading to high impact publications. The PhD candidate will be integrated into the Log Lab, the Ecology of Marine Microbes (EEM) research group, and the ICM community, putting him/her in an extremely advantageous position to

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

exchange knowledge with experts in marine microbial ecology and evolution, oceanography, paleo-oceanography, biogeochemistry, omics and bioinformatics. The PhD candidate will contribute to seminars and international conferences to disseminate research findings and create new collaborations. Furthermore, publication of results in peer-reviewed journals will further strengthen the communication skills of the candidate. The student will be trained in the new and emerging fields of time-series metagenomics and epigenetics, which are highly relevant and complementary to other research fields such as, evolution of pathogens (perfectly exemplified by the evolutionary tracking of new strains of SARS-CoV-210), microbes that could be evolved and used in bioremediation, degradation of pollutants (e.g. microplastics) or in biotech, greatly increasing opportunities to transfer to future research positions.

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

6. FUM: Enhancing multifractal FUsion Methods for better monitoring marine litter

PhD Supervisors: Dr. Jaume Piera jpiera@icm.csic.es

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

Project description

Nowadays there are many kinds of observations coming from in situ, citizen science and satellite measurements having very different accuracy, resolution and coverage. They come from heterogenous methods of collection, and they have different reporting and different quality control methods applied.
The main objective of the PhD thesis is developing enhanced methods for merging ocean measurements. For this, we will develop enhanced data fusion methods. Data fusion is any technique capable of merging data of different quality and/or sampling characteristics, and generating a new dataset with characteristics that are superior to those of the merged data. The overall aim of the PhD thesis is to develop guidelines and proposed methods to produce global (i.e. large-scale) ocean and marine data products.
The thesis will be focused on two main challenges:
1. To improve the global data products that integrate different data streams with different accuracy, resolution and coverage, applying advanced methods of data fusion (mainly based on the multifractal paradigm).
2. To improve the global data products that integrate heterogeneous data derived from different methods of collection, reporting and quality control. Marine debris has been selected as the Essential Ocean *V*ariable test case considering not only the metrological challenges but also the social interest of this type of observations.

The PhD activities will be carried out in cooperation with the GCOS GSRN action and the EMPIR 19SIPO3 "CRS" project. We also plan to collaborate with Universidad Católica del Norte (Chile) and its Latino-american citizen science network "Científicos de la basura". In the **framework of** the MINKE project, another PhD student will work on the implementation of the platform to support all these measurements.

Job position description

The Phd thesis is structured in two main activities. First we will define the case of study. An extensive revision of the existing methods (sampling, extraction, analysis, capabilities and limitations of satellite measurements) is foreseen in order to consolidate an acquisition framework adequate to sample and detect plastic litter in the open ocean / water column and on shorelines (plastic stocks and fluxes). Once defined, data for a case study will be generated in a real environmental setting by collecting macroplastics on beaches by researchers, citizen scientists and the support of satellite images.

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

Second, we plan to develop a high-quality method to merge these measurements. The spatial and temporal scaling properties of the case study dataset will be characterized according to the multifractal paradigm. A spatio-temporal dense template will be constructed by means of multiscale joint information of all observations. The geometrical structure of the template will be validated with independent data from other observation systems (for instance, currents from buoys or radars). The sparse measurements from the merger dataset will be combined with the **dense t**emplate to produce the final high-quality fusion variables. Error will be propagated to the final fusion variables that will be produced for the case study. Systematic reporting, sharing, quality control and data processing (polymer types, sizes, units of concentration mass vs. number) will be produced for the merger variables.
The studies addressed in this PhD are in alignment with one of the two Join Research Activities of the MINKE projects. The methods to be developed during this thesis are expected to have a significant and positive impact in different initiatives of Digital Twin of the Ocean.

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

7. Molecular characterization and optimization of plastic-degrading systems from the deep ocean

PhD Supervisors: Dr. Francesco Colizzi fcolizzi@icm.csic.es

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

Project description

Plastics have been found widespread in the global ocean, in the soil, and entrained in the air. In response to the planetary diffusion of plastic pollution, microbes are evolving the capacity to utilize such polymers as carbon and energy sources. These plastic-degrading systems offer a starting point for biotechnology applications where enzymes are engineered to improve their catalytic efficiency, toward a circular materials economy. This project focuses specifically on the enzymatic degradation of polyethylene terephthalate (PET)—the most abundant polyester in the Ocean. Building on the recent metagenomic-based identification of PET digesting enzyme from the Tara Ocean and Malaspina gene catalogs, this proposal aims to develop a computational framework—in tight collaboration with experimentalists at ICM and abroad—based on the combination of advanced molecular simulations, quantum mechanics, phylogenetic analysis, and high-performance computing to enable the design & engineering of next-generation PET-degrading systems. The long-term goal is to create a set of nature-inspired catalyst showing enhanced PET depolymerization in a variety of conditions relevant to industrial and natural settings—thus mitigating the staggering plastic leakage into the ocean. The successful implementation of this ambitious goal will rely on transversal collaborations with ICM experts in marine microbiology, physics, and biogeochemistry of plastic pollution, among others. The Molecular Ocean Lab at ICM is a newly-established team of young and dynamic scientists applying & developing biomolecular-simulations technologies to marine sciences. We are embedded in the multidisciplinary group of Ecology of Marine Microorganisms (https://emm.icm.csic.es) where master students, PhD candidates, postdocs and senior scientists, contribute to a friendly and diverse community of individuals gravitating around marine research.

Job position description

At ICM we focus on a personalized mentoring of the junior researchers through advising of their research work and the teaching of highly specialized courses. Specifically, the research program will span among various molecular modeling & simulations techniques including new enhanced-sampling molecular dynamics, free-energy methods, quantum mechanical calculations, correlation-based analysis of allosteric communication, and phylogenetics. The student will be encouraged, and put in the best-possible position, to

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

generate experimentally-testable hypothesis built upon the analysis of the simulations. Besides the training-through-research mentioned above, the student will gain additional skills from participating in specific workshops (e.g. in advanced data processing and workflows generations) and in sessions on the development of transferable skills such as patent law, entrepreneurship, innovation management, open innovation, technology transfer and science communications. Overall, we aim at providing high-quality and technical training to raise the student's awareness and self-confidence in order to turn them into independent-thinking scientists able to compete, and arguably lead, the fast-changing marine biotechnological landscape.

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

8. PARAFISH: Towards understanding the parasite-fish interactions in the gonads: the role of epigenetics

PhD Supervisors: Dr. Laia Ribas lribas@icm.csic.es

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

Project description

A frequent problem for aquaculture is fish disease outbreaks occurred by parasites because they can cause serious economic losses due to high mortality. The presence of infections in the environment where animals live are able to alter the final phenotype through epigenetic mechanisms. Nevertheless, data on the crosstalk between disease-epigenetic-phenotype is almost non-existent in fish and thus, no information regarding the epigenetic mechanisms in the fish gonads after infections and the consequences in their progeny is available. The present Ph.D. project will work on zebrafish *(Danio rerio),* a popular animal model used in many research areas including aquaculture, with the aim to decipher host-parasite interactions in the fish gonads. To do this, the Ph.D. student will study the microsporidium, which are a group of spore forming unicellular parasites. They were once considered protist but are currently known to be fungi or a sister group to fungi. Particular attention to *Pseudoloma neurophilia,* the most prevalent parasite found in zebrafish facilities will be performed. Nevertheless, none effective treatment has been described so far and thus, causing many problems in the zebrafish facilities around the world. Further, zebrafish shows a sexual dimorphic prevalence of *P. neurophila* infections being males more susceptible than females. In contrast, this parasite is present in ovaries but not in testes, thus vertical transmission is done throughout the ovaries.
The main supervisor is Dr. Laia Ribas who leads the Repro-Immune Team (RIT, https:IIribasreproimmuneteam.wordpress.com/. She is an expert on fish reproduction, immune system and genomics and has been working with zebrafish since 13 years. The co-supervisor is Dr. Esther Garcés who leads the Coastal Biological Processes group (https://www.icm.csic.es/en/research- group/littoral-biologicaI-processes) and is an expert in parasitic ecology in marine systems for more than 25 years.

Job position description

The Ph.D. thesis will consist on multidisciplinary objectives: (1) description of the physiological traits and the life cycle of *P. neurophilia* parasite, (2) understanding host-parasite interactions by *in yitro* models in gonadal cell cultures, (3) deciphering molecular interactions by studying epigenetic alterations occurred by these interactions, (4) understanding the relevance of the sexual dimorphism when coping infections. To achieve them, here we proposed using state-of-the-art biotechnologies like next-generation sequencing (RNA-seq) together with computational genomic analyses, global methylation analysis, classical molecular methods such as real time PCRs, fluorescence-activated cell

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

sorting (FACs) and, microscopical examinations. This ground-breaking research will provide important outcomes: (1) better comprehension of the ecological niche of this parasite coupled with their fish hosts in cultures, (2) novel data on host-parasite interactions from a molecular point of view, (3) knowledge of sexual dimorphism-dependent mechanisms involved in the fish immunity. In terms of prospects, this research will be of interest for aquaculture production by helping in the control of parasitic outbreaks, for understanding marine ecological niche of parasites coupled with their hosts in coastal ecosystems and, for biomedical- related research that use zebrafish as a model.
The training and supervision of the candidate's work will be continuous and will include interactions with all members of the two research teams. In addition to on-the-job training, several specific activities have been planned, some of them offered by the Postgraduate and Specialization Department at CSIC: (1) a specialized course in advanced imaging techniques in microscopy, (2) the use of R software, (2) Data science, application in biology and medicine with Python and R (University of Barcelona).

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

9. Physical and biogeochemical connections between the Southern and Atlantic Oceans

PhD Supervisors: Prof. Josep Lluís Pelegrí pelegri@icm.csic.es

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

Project description

The interdisciplinary Southern-Atlantic INTeractions (SAINT) proposal is led by the Physical and Technological Oceanography group (Camila Artana, Mikhail Emelianov, Nina Hoareau, Josep L Pelegrí, Ignasi Vallès) with participation of researchers from the Ocean and Littoral Sedimentary Processes (Enrique Isla) and Functioning and Vulnerability of Marine Ecosystems (Camila Artana) groups.
The SAINT proposal focuses on the Atlantic Sector of the Southern Ocean – where the two Spanish Antarctic bases are located – through the modelling of processes that range from meso- to submesoscales, including surface and bottom mixed-layer dynamics, and involve freshwater fluxes, air-sea interactions and flow-topography interactions. The proposal fits well under the umbrella of internationally-funded projects currently working in West Antarctica (PICCOLO, U.K.; GOAL, Brazil; ECCO-Darwin, USA; TABASCO, USA), and shall empower the ongoing Spanish-led South Atlantic Gateway (SAGA) initiative, aimed at assessing the returning limb of the global overturning circulation. It also connects with two new proposals on the Atlantic Meridional Overturning Circulation and its connection with the Southern Ocean, submitted to Horizon Europe and Spanish calls. . The proposed research will be an opportunity to study the dynamics of the Southern Ocean through the combination of in situ novel data (cruises and instrumented moorings) and public data from several sources (Argo program, instrumented Elephant seals). The junior researcher is also expected to gain field experience through participation in oceanographic cruises in the South Atlantic and Southern Oceans. The approach will combine observational with satellite data, atmospheric reanalysis and numerical modeling techniques, with special emphasis on shelf-slope dynamics, its role in deep-ocean ventilation, and its impact on biogeochemistry processes and climate.

Job position description

The Southern Ocean is the only region of the Earth System where the deep ocean is permanently in direct contact with the atmosphere. Air-sea-ice heat and water exchanges at the ocean surface regulate dense water formation, deep-ocean ventilation and ultimately determine – via physical and biogeochemical interactions – carbon export to the deep ocean. Therefore, modifications of the circulation over the Antarctic margin, shaped by a mélange of physical processes, have a direct impact on the global overturning circulation and become a key central element to understand, quantify and potentially alleviate future

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

climate change scenarios. The SAINT project will study the role of physical processes on biogeochemical processes, particularly on atmosphere-ocean carbon exchange in the Atlantic sector of the Southern Ocean. Understanding the physical mechanisms and spatiotemporal scales that drive changes in polar ocean circulation is fundamental for quantifying deep-ocean export, as well as to estimate the uncertainties in future climate scenarios. SAINT will represent an interdisciplinary approximation to the dynamics of the Southern Ocean through the combination of in situ novel data (cruises and instrumented moorings) and public data from several sources (Argo program, instrumented Elephant seals). The approach will combine observational with satellite data, atmospheric reanalysis and numerical modeling techniques, with special emphasis on shelf-slope dynamics, its role in deep-ocean ventilation, and its impact on biogeochemistry processes and climate. SAINT focuses on modelling of processes that range from meso- to submesoscales. The junior researcher will participate in oceanographic cruises and will be exposed to a plethora of observational and numerical techniques. SAINT fits well under the umbrella of internationally-funded projects currently working in West Antarctica and shall empower the ongoing Spanish-led South Atlantic Gateway (SAGA) initiative.

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

10. SinkPart: The role of ocean particles in the sinking of organic carbon and carbon sequestration

PhD Supervisors Prof. Josep Maria Gasol pepgasol@icm.csic.es

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

Project description

The biological carbon pump (BCP) is one of the main mechanisms by which the ocean sequesters atmospheric CO2 which is converted into particulate organic carbon (POC) in the surface ocean. POC sinks to the deep ocean, thus contributing to regulate the global carbon budget and, therefore, Earth's climate. Constraining the magnitude of global carbon export flux to the deep ocean, in order to reduce the uncertainties associated with current estimates, remains one of the greatest challenges in marine biogeochemistry. Accurate quantification of the strength and effectiveness of the BCP is needed to improve our currently limited predictive power to forecast future scenarios, particularly under the present context of anthropogenic forcing of rapid climate change. One of the most commonly used methods to quantify the carbon export flux in the open ocean is the use of the naturally occurring radioactive pairs 238U-234Th and, to a lesser extent, 210Pb-210Po. The use of radionuclides allows us to track the sinking particles that scavenge the particle-reactive radionuclides (i.e., 234Th and 210Po). Additionally, since these particle-reactive radionuclides are produced and decay at known rates, this approach also provides a time scale of the scavenging process. The effectiveness of the BCP is highly mediated by marine microbes that degrade and remineralize sinking organic particles. Yet, very little is known about which groups of microbes are responsible for most of the particle-carbon recycling in mesopelagic waters (~100 – 1000 m), nor how microbes respond to changes in the distribution, composition and magnitude of the flux of organic carbon. Understanding where the degradation takes place, which microbes are more actively degrading the sinking particles and under which environmental conditions, will provide the necessary information to improve marine biogeochemical models and, as a consequence, enhance our capability to constrain future scenarios of the global carbon budget.

Job position description

The main objective of SinkPart is to assess the changes in the microbial communities linked to the magnitude and efficiency of carbon export to establish a new method to derive estimates of the efficiency of the Biological Carbon Pump. The project will provide a conceptual framework and data supporting it to feed marine biogeochemical modelling efforts and address a significant gap in our understanding of the marine carbon cycle. This project is thus in line with international research efforts devoted to developing a predictive understanding of the export and fate of ocean net primary production and its implications

Pg. Marítim de la Barceloneta, 37-49
08032 Barcelona
+34 932 309 500
www.icm.csic.es

for present and future climate. An interdisciplinary approach will be pursued to achieve the main goal, combining the use of molecular biology and radiotracers and applying advanced genomic characterization techniques. These aspects involve well-developed techniques for which the PIs and the hosting center have robust and extensive knowledge and experience. Hence, the candidate will receive multidisciplinary training, building a unique set of skills that will prove advantageous in the future of the candidate's career, since the techniques learnt are widely applicable to other environments, thus not being limited to the marine environment, and will facilitate the diversification of the candidate's portfolio. The project will be conducted at ICM-CSIC, which is a research-intensive institution and world-leader in the core disciplines relevant to this proposal. It will involve both field work from oceanographic cruises, as well as microbiological, biogeochemical and molecular lab work. The hosting group is a multidisciplinary very productive group with state-of-the-art know-how and infrastructures to provide the resources for the development of the project and is led by Prof. Gasol, a world renowned expert in marine microbial ecology, with an excellent track record and mentoring success and Dr. Viena Puigcorbé.

INCOMING INPHINIT Fellowship Programme:

35 fellowships for early-stage researchers of any nationality to pursue their PhD studies in the best Spanish and Portuguese research centres and units with excellence distinction. This frame is addressed exclusively to PhD research projects on STEM disciplines: life sciences and health, experimental sciences, physics, chemistry and mathematics.

- *STEM disciplines (life sciences and health, experimental sciences, physics, chemistry and mathematics).*
- *Maximum duration: 3 years.*
- *Total maximum allocation: €122,592.*
- *Training programme in transversal skills.*

You can find more information and all details for apply here in the programme website. All applications should be made through the mentioned platform.