Visiting Students Research Program BESE

Screening for Carotenoid-Derived Signaling Molecules

Internship Description

The project focuses on novel signaling molecules involved in plant development and response to environmental stress. It includes studies on the activity of selected carotenoid-metabolizing enzymes and the identification of their enzymatic products. Biological activity of products will be investigated by developmental assays using Arabidopsis and rice and by determining the effect of these compounds on the transcript levels of selected genes including strigolactone biosynthesis genes. These studies will be complemented by phenotyping of mutants disrupted in the corresponding genes.

Deliverables/Expectations

Identification of new bioactive compounds/Better understanding of the regulation of strigolactone biosynthesis. Significant contribution to a publication

Faculty Name

Salim Al-Babili

Field of Study

Plant Biochemistry and Development

Deciphering the molecular mechanisms of DNA replication and repair – integration of computational and experimental approaches

Internship Description

Genomic DNA is under constant assault by environmental factors that introduce variety of DNA lesions. The cell evolved several DNA repair and recombination mechanisms to remove these damages and ensure the integrity of the genomic DNA. These mechanisms use DNA structures that deviate from the heritable duplex DNA (flaps, nicks, gaps, bubbles and four-ways Holliday junctions) as common pathway intermediates. However, these structures are extremely toxic since they break the continuity of the heritable duplex DNA and impose impediment to replication and transcription. Members of 5'nuclease excise these aberrant DNA structures during replication, repair and recombination. It is not surprising therefore that mutations in members of 5'nucleases have been linked to various disease states including cancer and aging. Furthermore, some of these nucleases are highly over-expressed in several cancers to compensate for deficiencies in their damage response pathways.

Despite the importance of 5'nuclease it remains unclear how they recognize normal DNA sequence just based on their structure and precisely cleave them. The knowledge gap in structural studies that can access protein and DNA dynamics in 5'nucleases impairs substantially the drug development enterprises against numerous severe human cancers.

The proposed research project within the framework of the VSPR (Visiting Student Research Internship Program) program is mainly focused on the molecular bases of substrate recognition by 5'nucleases. The project combines cutting-edge computational resources and state-of-the-art biophysical computational tools, including full-atom molecular dynamics (MD) simulations, to establish the conformational states and dynamics of bubble DNA structure and how they are influenced by the bubble size and DNA sequence. DNA bubbles structure is the key intermediary step during nucleotide excision repair that separate the strand containing the lesion site from the intact one before two members of 5'nucleases, XPG and XPF, perform two concerted cleavages to release the damage-containing ssDNA. Establishing the bubble conformer(s) will pave the way for better understand of its interaction with XPG and XPF.

These studies will be accompanied and verified side-by-side by experimental results derived from the cutting-edge biophysical techniques, including single-molecule FRET (smFRET) and high-resolution multidimensional Nuclear Magnetic Resonance (NMR) experiments. In one alleged model, the bubble DNA structure might display dynamic conformations and the nucleases involved in NER simply capture the correct conformer. In another model the bubble might have stable conformer(s) and the nucleases actively bind to them and mold them into the "correct" conformer. The computational work, like full-atom molecular dynamics simulations assisted with the experiments smFRET and NMR data would help in decoding the actual mechanism of action of XPG and XPF against the bubble DNA. This project is suitable for students with bioscience, physics, or engineering background.

Deliverables/Expectations

We offer the students participating in this project to learn:

- how to use the biophysical techniques and design the workload;
- how to become self-reliant in the design, preparation, running and analysis of the molecular dynamics (MD) simulations of biologically essential macromolecular systems;
- how to analyze and integrate the results derived from different computational techniques with the experimentally derived information from the cutting-edge biophysical techniques, including smFRET and Bio-NMR.

To complete the above tasks we expect from the students:

- A positive approach and strong will to work in the interdisciplinary and international research team;
- the preparation of the final report in the article format;
- the preparation of presentation that will be given during the group meeting.

Faculty Name

Mariusz Jaremko

Field of Study

Structural Biology, Computational Biology, Protein-DNA interactions, FRET, NMR, Molecular Dynamics (MD), Biophysics

Why it is so difficult to find potent drugs against cancer? - decoding the druggability of molecular targets

Internship Description

The drug discovery process aims at finding novel, more potent small molecules (ligands) that can treat/cure certain human diseases, being a therapeutic agent, or serve in diagnosis of the early stages and progression of the disease. Despite the extensive joint efforts of many laboratories around the world, developing a potent drug is still a major and often a daunting challenge. As of now only 2% of human proteins interact with the currently approved drugs. On the top of that only 10% of human proteins are relevant to the disease. If a drug interacting with the target protein is known, and this interaction leads to therapeutic benefits of patients, then this target protein is called druggable. By simple approximation one can expect that other similar proteins, belonging to the same or related families, can be targeted by ligands - meaning: are druggable. Unfortunately it is often not a case, and only 10-15% of the human genome is predicted to be druggable, with only half of the targets being essential to any disease process.

Our group is focused on understanding the molecular determinants driving the protein-protein and protein-ligand interactions, thus druggability of protein targets. We focus our attention on the closely related groups of proteins involved in the gene regulation processes, like histone methyltransferases and demethylases. These proteins covalently modify flexible tails of histones by attaching or removing the -CH_3 groups to the side-chains of lysines and arginines. This way they modulate the accessibility of the DNA double strand - genes - toward transcription factor proteins and RNA polymerase. The miss-function of methyltransferases and demethylases is well known to lead to numerous severe cancers in human, like acute leukemia, variety of gastric carcinomas as well as several mental disorders, like schizophrenia.

With the combination of molecular biology approaches we prepare and purify the human proteins of interest and subsequently study their structures and interactions with known drugs and other small molecules – ligands - potential candidates for becoming more potent drugs. In the lab we use multidisciplinary approaches and combine several state-of-the-art molecular biology and biophysical techniques. Our main technique, used and developed in the group, is the cutting-edge

high-resolution nuclear magnetic resonance (NMR) spectroscopy. The conformational studies in solution are supplemented by other experimental biophysical methods, like X-ray crystallography, isothermal titration calorimetry (ITC), circular dichroism spectroscopy (CD), as well as advanced computational approaches - molecular dynamics (MD) simulations.

In conclusion, with the combination of experimental and computational data for selected families of disease related proteins, we try to understand the molecular determinants that make closely related proteins druggable or not druggable.

The proposed interdisciplinary project can host two VSRP students.

The project offers the wide range of experience, from the protein biochemistry techniques that lead to preparation of biologically relevant material, followed by hands-on experience, i.e. from the design and performing the advanced nuclear magnetic resonance NMR experiments to preparation and running the comprehensive molecular dynamics MD simulations and finally integration of the results coming from the different fields of expertise.

Students with the background in bioscience, physics and engineering, who enjoy working in the international and interdisciplinary environments, are welcomed to apply.

Deliverables/Expectations

We offer the students participating in this project to learn:

• how to efficiently work in the state-of-the-art protein biochemistry lab, prepare own protein(s) for the biophysical and spectroscopic (e.g. NMR) studies and design the workload;

• how to become self-reliant in the design, preparation, running and analysis of the advanced multidimensional NMR experiments, molecular dynamics (MD) simulations of biologically essential macromolecular systems;

• how to analyze and integrate the results derived from different computational techniques with the experimentally derived information from the cutting-edge biophysical techniques, including Bio-NMR and X-ray.

To complete the above tasks we expect from the students:

• a positive approach and strong will to work in the interdisciplinary and international research team;

• the preparation of the final report in the article format;

• the preparation of presentation that will be given during the group meeting.

Faculty Name

Lukasz Jaremko

Field of Study

bioscience, molecular biology, protein biochemistry, nucleic acids – DNA, computational structural biology, nuclear magnetic resonance NMR, epigenetics

Polymeric Membrane Development

Internship Description

The research will be focus on one of the following areas, depending on the student background:

(a) Development of organic solvent resistant polymeric membranes for application in chemical and pharmaceutical industry

(b) Green manufacture of membranes

(c) Self-assembly of block copolymers for membrane manufacture

Deliverables/Expectations

(a) Chemical modified and crosslinked polymeric membranes with high thermal and/or solvent stability

(b) New process or solvents with low toxicity for membrane preparation

(c) Porous structures with sharp morphology control and chemical functionalization

Faculty Name

Suzana Pereira Nunes

Field of Study

Chemistry or Chemical Engineering

An iPSCs-based approach to model Type Two Diabetes in-vitro

Internship Description

Studying the transcriptional and epigenetic mechanisms dysregulated in patients affected by metabolic disorders such as insulin resistance (IR) and type 2 diabetes mellitus (T2DM) is essential to derive efficient pharmacological approaches. We are seeking an outstanding student to work on a project focused on the study of the role of histone modifiers to the onset of metabolic disorders.

Deliverables/Expectations

The selected candidate will use human stem cells and terminally differentiated glucose sensitive cell types and will acquire skills in molecular biology techniques including Chromatin Immuno-precipitation (ChIP), quantitative real-time PCR (Q-PCR) and next generation sequencing (NGS).

Faculty Name

Antonio Adamo

Field of Study

Molecular and Cellular Biology and/or Bioinformatics

Chemistries in Electrosprays

Internship Description

When a polar or non-polar liquid passes through a narrow metallic capillary (~0.1 mm), connected to electrical voltage (~3 kV), the liquid breaks into what is known as an electrospray. Electrosprays are exploited in analytical techniques, such as Electrospray Ionization Mass Spectrometry (ESIMS), to characterize ionic or neutral species in the solution. Recently, we observed that the rate of polymerization of isoprene (C_5H_8) was dramatically enhanced in electrosprays in comparison to reactions in condensed phase and oil-water emulsions. However, the underlying mechanisms are unclear. We would like to understand the effects of electrical voltage, temperature, capillary diameters, gas flow rates, etc., factors on the rates of reactions.

Deliverables/Expectations

The VSRP intern will work with a senior graduate student and learn the following skills:

Laboratory experiments: ESIMS, voltage sources, identifying reactions of interest

Theory: basic electrostatics, data analysis, data plotting

We expect the intern to be driven by curiosity, hard working, and thrive in a multicultural work environment.

Faculty Name

Himanshu Mishra

Field of Study

Engineering, Physics, Chemistry, Applied Math

Wetting Transitions in Doubly Reentrant MicroTextures

Internship Description

Our research Group has recently reported on surface microtextures comprising of doubly reentrant cavities that render common surfaces omniphobic, i.e. an ability to sustain non-wetting states. Remarkably, omniphobicity of our microtextures is not compromised even if there is minor surface damage or if surfaces are immersed in wetting liquids. To further assess the suitability of those microtextures for marine applications, we are investigating the role of capillary condensation, liquid imbibition along corners, and gas dissolution on wetting transitions in our microtextured surfaces on immersion.

Deliverables/Expectations

The VSRP intern will work with senior Group members and learn the following skills:

Laboratory experiments: contact angle cells, immersion studies, imaging (optical and confocal), microfabrication and IIID printing

Theory: data analysis, data plotting

We expect the intern to be driven by curiosity, hard working, and thrive in a multicultural work environment.

Faculty Name

Himanshu Mishra

Field of Study

Engineering, Physics, Chemistry, Applied Math

Evaporation of liquid marbles

Internship Description

Interestingly, when a drop of water is rolled on a powder made of hydrophobic particles, the particles adsorb onto the liquid-vapor interface, creating what are known as ‘liquid marbles’. Liquid marbles can roll around; collide gently, etc., without releasing water.
Recently, we observed that the rates of evaporation of water from liquid marbles could be higher or lower in comparison to bare water drops depending on the choice of hydrophobic particles. To understand what factors control these phenomena, we will conduct systematic experiments and theoretical analysis.

Deliverables/Expectations

The VSRP intern will work with a senior graduate student and learn the following skills:

Laboratory experiments: wet chemistry (silanation of glass beads), optical imaging

Theory: data analysis, data plotting

We expect the intern to be driven by curiosity, hard working, and thrive in a multicultural work environment.

Faculty Name

Himanshu Mishra

Field of Study

Engineering, Physics, Chemistry, Applied Math

Marine microbial mats: Characterization and potential pharmaceuticals

Internship Description

Microbial mats are complete, highly structured and highly diverse ecosystems on small scales (mm to cm) that inhabit a wide range of environments including marine waters. They function as almost closed systems with steep oxidation-reduction gradients and restricted mass flow through their different layers. Their continued success through billions of years is partly due to highly efficient defensive mechanisms developed by bacteria and archaea. The overall aim of the research the project is to characterize microbial mat ecosystems from coastal Red Sea environments (with initial focus on intertidal mangrove flats) and to search for potential pharmaceutical products.

During the internship, the student will conduct microsensor measurements of pohtosynthesis and respiration rates within microbial mats in the lab. After that different layers will be sliced and used to extract DNA and analyze their chemical composition. Metagenomic approaches will allow to search for polypeptides with potential antimicrobial and anticancer capabilities. Linking the target molecules to the organisms producing them will help us in isolating them for future studies.

Deliverables/Expectations

1. Structural and functional characterization of selected coastal Red Sea microbial mats

2. Identification of potential bioactive peptides and their producers using metagenomics

Faculty Name

Xose Anxelu G. Moran

Field of Study

Microbial ecology, microbiology, environmental sciences

Stress Chromatin Biology

Internship Description

We are working on the plant responses to biotic and abiotic stresses at the level of chromatin regulation by protein kinases. Our previous research has shown that protein kinases transmit extracellular signals to chromatin by phosphorylating specific chromatin-associated factors including transcriptional regulators and parts of the epigenetic machinery. The direct effects of these modifications of the chromatin states range from the transcriptional reprogramming to altered memory rendering plants more resistant to subsequent stresses. The aim of the current project is to unravel by genetic and biochemical means the function and regulation of these key factors in stress signaling and stress memory in the genetic model plant *Arabidopsis thaliana*.

Deliverables/Expectations

Genetic, epigenetic and biochemical characterization of chromatin factors involved in plant stress signaling, gene expression and memory. Use of in vivo and in vitro protein-protein, protein-DNA and protein-RNA interaction studies. Application of RNAseq, ChIPseq, BiFC, EMSA, confocal microscopy, proteomics and bioinformatics techniques.

Faculty Name

Heribert Hirt

Field of Study

Biochemistry, molecular biology, Bioinformatics

Plant-Beneficial Microbe Interaction

Internship Description

Abiotic stresses are the most important factors for hampering plant growth and yield world-wide. However, beneficial microbes can help plants to enhance stress tolerance of plants. DARWIN 21 is a large scale project to isolate and study the interaction how rhizophere microbes contribute to enhance the capacity of plants under the most difficult abiotic stress conditions (http://www.darwin21.net/index.htm).

In this project, the student will characterize several rhizosphere microbes and investigate whether they can confer plant resistance to different abiotic stresses.

The student will learn how to apply techniques in microbiology, molecular biology and plant biology.

Deliverables/Expectations

Isolation and characterization of bacterial strains. Analysis of beneficial microbes on plant physiology. Sequencing and bioinformatics to analyze microbial genomes, transcriptome and proteome analysis of beneficial microbes and plants.

Faculty Name

Heribert Hirt

Field of Study

Microbiology, Genomics, Plant biology, Bioinformatics

Morphological basis on brain energy metabolism

Internship Description

The other half of the brain, astrocytes, has been receiving particular attention lately, thanks to the discovery that their metabolic support to neurons is not simply limited to routine cellular metabolism, but it has a strong correlation with synaptic plasticity and memory formation (Suzuki et al., 2011). In our team, we are interested to investigate such feature from a structural point of view, by studying the distribution of glycogen, the primary source of lactate, specifically located in astrocytes, in relation to synapses and neuronal mitochondria. To this aim, we use state of art Serial Block-Face Electron microscopy, from which we segment and reconstruct in 3D neurons and astroyctes, and quantitatively analyze their spatial relationship using custom made tools, as well as virtual reality (Cali et al., 2016).

Deliverables/Expectations

Successful candidate will be expected to become familiar with brain electron micrographs, as well as software tools for segmentation, reconstruction, and analysis. He will enrich our database of reconstructed structures and possibly use them for quantitative analysis.
At the same time, candidates with a background in computer science and visual computing are welcomed, to build analysis tools that take advantage of Virtual Reality and 3D interaction.

Faculty Name

Pierre Magistretti

Field of Study

Neuroscience, Computer Vision

Learning Generative Causal Models from Sparse Temporal Observations during Cellular Reprogramming

Internship Description

Recent work on stem cells and different mature specialized cells in different systems/organs (neurons, blood cells,) has revealed a stunning plasticity and capacity of reprogramming cells. For example, mature cells can be reprogrammed into pluripotent stem cells, and exciting work on engineered design of tissues and organs (organoids) are underway. On the one hand the community has since the sequencing of the human genome produced very efficient tools to read off the corresponding molecular events accompanying reprogramming and engineering of cells. Recently, the discovery of the CRISPR techniques has equipped us with unprecedented opportunities for precise writing or editing of the genomes. These developments in fundamental biology and biotechnology are currently opening new tools and perspectives of vital significance for drug development, regenerative medicine, synthetic biology, and personalized medicine. Yet, in essence all these efforts require and would be greatly facilitated if we could advance from correlative data-analysis to a predictive discovery of which interventions (edits, engineering) are producing which effects. Thus, we are facing the fundamental problem on how to discover causal relations from data, or in other words, can we derive quantitative predictive laws from data?

We offer internships for several highly motivated bachelor (B.Sc.) or master (M.Sc.) students who will explore this fundamental question primarily from a computational standpoint. This includes using high-performance simulations of dynamical models, and design of algorithms in a controlled in-silico environment. For example, to identify (a) efficient algorithms for generation of ensembles of dynamical models, (b) use supervised deep learning algorithms for pattern discovery in large-scale simulation data-sets, (c) to perform deep data-driven analysis of computational models in biology, (d) pursue investigations of transfer entropy and related techniques for system identification. These tools will be tested utilizing rich and recent molecular data on cellular reprogramming.

Deliverables/Expectations

Individual projects will be tailored and narrowly designed from the above palette according to interest of the student, technical proficiency, and level of study. The project is suitable for candidates fascinated by dynamical causal systems, be it computational or those we find in the natural world, i.e. living cells. We expect you (a) to bring enthusiasm, creativity, and hard work, (b) give lab seminars on your work, and (c) produce a final written report. In return this facilitates your critical thinking, presentations skills, and scientific writing. Your research, in collaboration and with support of team members, may lead to scientific publications. We publish avidly in both bioscience and computational sciences, not for the fame but rather as steps aiming to and motivated both by our quest of asking fundamental questions of relevance to human nature and discovery of transformative intelligent technologies inspired from nature. You will get a good hands-on perspective on the frontiers in dynamical systems and bioscience using state-of-the-art simulation and machine learning tools.

Faculty Name

Jesper Tegner

Field of Study

computer science, mathematical modeling, machine learning, systems biology, bioscience

Deep Learning and Machine Intelligence for Single Cell Genomics

Internship Description

Single cell biology and genomics in particular are currently transforming the biosciences. Single cell RNA sequencing (scRNAseq), method of the year 2013 (Nature Methods), has now matured and large amounts of scRNAseq are now available. These data, characterizing living systems at an unprecedented level of resolution, hold the promise to set the stage for a fundamental quantitative understanding of living systems with special reference to genomic regulation and collective computation. Yet, there are a number of open problems on how to think about these data and how to pragmatically analyze them.

In parallel, we have witnessed a rapid development in machine learning. The rise of computation, such as supercomputers (shaheen@KAUST) and GPU based techniques, in conjunction with data explosion (often referred to as big data), has fuelled the development of new techniques aiming for machine intelligence. In particular, techniques inspired from livings systems, such as deep convolutional networks, currently experience a renaissance. Driving forces include not only data and computation but also the availability of suite of open source platforms (e.g. Theano, Caffe, Torch7, TensorFlow) supporting machine-learning algorithms. These algorithms represent industry standard for processing images, speech, text, and runs on the majority of services and devices provided by Google, Amazon, Facebook, to name a few big players, as well as a numerous startups.

We offer internships for several highly motivated bachelor (B.Sc.) or master (M.Sc.) students who will identify (a) appropriate supervised deep learning architectures and training algorithms for scRNAseq data, (b) explore generative adversarial network (GANs) techniques for estimation of high-dimensional data distribution in the single cell gene expression space. This work will be used to develop new techniques and to address open problems in single cell genomics such as pseudo-temporal ordering of single cell data, clustering of data, investigate representations, transfer learning, and unsupervised feature discovery.

Deliverables/Expectations

Individual projects will be tailored and narrowly designed from the above palette according to interest of the student, technical proficiency, and level of study. The project is suitable for

candidates fascinated of living systems, interested in cutting edge bioscience, and artificial intelligence for science and not for discovering cats in YouTube. We expect you (a) to bring enthusiasm, creativity, and hard work, (b) give lab seminars on your work, and (c) produce a final written report. In return this facilitates your critical thinking, presentations skills, and scientific writing. Your research, in collaboration and with support of team members, may lead to scientific publications. We publish avidly in both bioscience and computational sciences, not for the fame but rather as steps aiming to and motivated both by our quest of asking fundamental questions of relevance to human nature and discovery of transformative intelligent technologies inspired from nature. You will also get a good hands-on perspective at the frontier of bioscience and machine intelligence in an interdisciplinary research group and environment.

Faculty Name

Jesper Tegner

Field of Study

computer science, bioscience, machine learning, systems biology, artificial intelligence

Assessment of adhesion mechanisms in adult stem cells

Internship Description

The mechanisms underlying the ability of stem cells, after their infusion in the bloodstream,to find niches that support their self-renewal is limited. Work on this project focuses on examining the molecular mechanisms involved in cell migration relating both to the expression and the regulation of expression of cell surface glycoproteins as well as the underlying signaling pathways within the cell in response to interactions of the stem cells with their microenvironment. A number of biochemical and biophysical approaches are being taken to tackle these questions.

Deliverables/Expectations

The student will learn various biochemical approaches to evaluate cell migration and signaling processes within the cell mainly focused on the culturing of human cell lines, flow cytometry, western blotting and some live cell flow-based in vitro assays.

Faculty Name

Jasmeen Merzaban

Field of Study

Biochemsitry

Bioinformatics on population genetics and adaptation to climate change in a coral reef fish

Internship Description

We are seeking a highly motivated internship student to work on the computational analysis of a long-term experimental project on damselfish *(Acanthochromis polyacanthus)*. Our data has the main focus to understand adaptational processes to climate change on the molecular level. Adaptive transgenerational measurements were taken in different projects looking at temperature as well as ocean acidification. We are using High throughput Sequencing approaches (mostly Illumina based) and have collected integrated genome-wide sequencing datasets. The intern will be able to look at a variety of data, but will mostly be working on the computational analysis of comparative genomics and transcriptomics. This will be a great opportunity for a student to be able to work on a large dataset and be part of large project and can learn and improve his/her knowledge on population genomic analyses. The intern will need to have some experience in bioinformatics work and will be expected to work independently.

Faculty Name

Timothy Ravasi

Field of Study

Marine Genomics, Transcriptomics, Adaptation, Evolution, Computer Sciences, Marine Sciences

Symbiodinium Virus Screen

Internship Description

Coral reef ecosystems are based on the mutualistic relationship between scleractinian corals and their dinoflagellate symbionts in the genus Symbiodinium. During the last decades, coral reef cover has declined worldwide and coral bleaching and disease belong to the major drivers of coral reef deterioration. A myriad of studies have identified environmental stressors such as temperature, irradiation and pollution as causes for increased bleaching and widespread disease outbreaks. However, several recent studies have identified potentially symbiont derived viral sequences in coral samples. In this study, we want to identify Symbiodinium associated viruses and analyze if and how they contribute to coral bleaching and disease. The project will include collecting environmental samples from bleached and diseased corals and establishment of a screening method that allows testing them for viral activity. Potentially active samples will be further evaluated by re-infection experiments and characterized using next generation sequencing and electron microscopy.

Deliverables/Expectations

- Collection of samples in the field
- Setup of suitable extraction protocols for virus particles
- Setup of suitable virus screen in Symbiodinium using 48- or 96-well format
- Determine suitable stress conditions to initiate viral activity if needed (temperature, pollution, etc.)
- Validation of active samples as per Koch’s postulate (modified by Rivers for viruses)
- Batch culturing of active samples
- Genomic analysis of active samples
- Electron microscopic characterization of active samples (depending on the progress and duration)

Faculty Name

Manuel Aranda

Field of Study

Biology/Marine Biology

Establishing a transgenic Aiptasia pallida line

Internship Description

Coral reefs provide a diverse ecosystem for many different marine organisms. Reef building corals form the majority of reefs, and their survival and growth depends on their mutualistic relationship with dinoflagellate symbionts of the genus Symbiodinium. The molecular mechanisms that underlie the symbiosis between corals and Symbiodinium are largely unknown. Corals harbor the symbiodinium in symbiosomes and provide them with the nutrients they need; while the symbiodinium, through photosynthesis, provides corals with photosynthates and other metabolites needed for growth. Due to their slow growth rate and difficulty of rearing in the lab, Aiptasia pallida, a sea anemone, is used as a model organism to this symbiotic relationship. To find out what genes are responsible for the initiation, maintenance and breakdown of the symbiotic relationship, we hope to establish methods to generate transgenic A. pallida lines that allow us to analyze and manipulate the function of target genes.

Deliverables/Expectations

- Up keeping and maintenance of A. pallida
- Cloning of suitable targeting vectors
- Testing of different transformation methods (electroporation, biolistics)
- Grafting of transgenic cells and generation of mosaic anemone

Faculty Name

Manuel Aranda

Field of Study

Biology/Marine Biology

Graphene based membranes for nanofiltration

Internship Description

Graphene, a flat monolayer nanosheet of carbon atoms arranged in a two-dimensional honeycomb lattice, has attracted intense interest in recent years owing to its intriguing properties. In this project, different methods of making graphene membrane will be investigated and the synthesized membranes will be systematically examined in terms their performance in nanofiltration for water treatment. The results of this project will shed light on what control the water filtration performance and ultimately how to optimize the graphene membranes toward pre-designed purposes in water filtration.

Deliverables/Expectations

The student(s) will be trained on synthesis of graphene and graphene membranes by chemical vapor deposition, vacuum filtration, spraying coating, spinning coating, etc. The student will learn how to conduct filtration experiments. He/she will be trained on literature reading, time management, critical thinking, etc. The student(s) are expected to attend weekly meeting with the mentor(s) in which the students make presentation. The presentation and overall research progress will be evaluated and feedback will be provided. At the end of the project, the student(s) are expected to deliver a project report, which has a high potential to be published later.

Faculty Name

Peng Wang

Field of Study

Environmental Sci. Chemistry, Chemical Engineering, Materials, Physics

Polymeric Materials and Morphology Control for Membrane Application

Internship Description

The project will be conducted at the Nanostructured Polymeric Membranes lab (npm.kaust.edu.sa). The student will develop new materials and polymeric membranes with controlled morphology and chemical functionalization. The target applications can be nano- and ultrafiltration for separations in the chemical industry, water treatment and separation of biomaterials.

The student should have a strong background in chemistry or chemical engineering.

Faculty Name

Suzana Pereira Nunes

Field of Study

Biological & Environmental Science

The Salt Lab

Internship Description

Soil salinity is a major constraint to crop productivity, particularly in arid and semi-arid regions. The aim of the research program is to understand the basis for natural variation in salinity tolerance of plants such as barley and tomatoes and use this knowledge to increase the salinity tolerance of existing crops such as wheat, rice, barley and tomatoes. We are targeting gene discovery in barley and tomatoes because they have a good degree of tolerance already (so have genes worth discovering!), are diploid, inbred, with a publicly available genome sequence and can be genetically transformed. We are focusing on naturally existing genetic diversity within the plants, as it is thought that genes discovered from this source are less likely to be associated with significant deleterious side effects. We do not study salinity tolerance in toto, but instead we use forward genetics to discover new QTLs/genes for specific traits that we hypothesize contribute significantly to the salinity tolerance of the whole plant.

In addition to our work on salinity tolerance, we are also working to increase the domestication of quinoa, a plant that already has considerable salinity tolerance, but which still contains numerous undesirable traits. A forward genetic approach is also being taken for this work, using association genetics, powered by modern genomics.

Deliverables/Expectations

Lots of good research / lots of hard work and fun.

Faculty Name

Mark Tester

Field of Study

Biological and Environmental Science

The metabolism of tropical marine habitats in the Red Sea

Internship Description

Shallow marine benthic habitats play an important ecosystem role by providing habitat, food and refugia for a large number of marine mega fauna, including sea turtles, dugongs, sharks and groupers, among others. These ecosystems experience extreme temperature regimes, especially during the summer months. Although these marine benthic ecosystems are adapted to thermal stress, the effect of high-temperature events on the metabolism of organisms and communities have not been assessed. The intern students contributing to this project will assess the effect of thermal stress events on the metabolism of coral reefs, seagrass meadows and mangrove ecosystems, including those of key species within these habitats. The effect of thermal stress on the fate of primary production, via herbivory and consumption will also be assessed. To achieve these goals, students will conduct field measurements and observations using also advanced loggings instruments and sensors along with controlled field and laboratory experiments to resolve the mechanisms that drive community metabolism in a warming Red Sea.

This project allows for a number of independent projects to be conducted by visiting students under the VRSP program. Each of these projects wiII lead to an independent research output. Examples of individual research projects, addressing more specific questions within the broad topic proposed are described below and will be adjusted to the interest of the applicants and the length of their stay.

I. The photosynthetic performance of an array of primary producers and symbionts at increasing temperatures during the summer will be assessed. Chlorophyll a fluorescence will be assessed in situ and in the laboratory using pulse amplitude modulated (PAM) fluorometers in seagrass meadows and shallow coral reefs in the central Red Sea. The targeted organisms will comprise species of corals, seagrasses, fleshy and calcareous macroalgae, crustose coralline algae, and symbiotic giant clams.

2. The metabolic rates of different benthic coastal ecosystems, including coral reefs, seagrass meadows and benthic macroalgae will be assessed across a natural range of temperature. The metabolism of Red Sea primary producers will be assessed using different approaches. First, using in situ incubation chambers and logging oxygen fluctuations to estimate

carbon and oxygen fluxes. Second, performing short laboratory incubations in which the CO2 release/uptake will be recorded.

3. Experiments will be assessed in the new marine life-support system facilities at KAUST to assess metabolic rates of key organisms of Red Sea benthic marine ecosystems. We will control variables such as temperature and light to estimate the thermal and depth limits of organisms in the Red Sea.

4. We will perform exclusion experiments in the field to evaluate the effect of mega and meso herbivores (e.g. turtles, dugongs, fish and shrimps) on the fate of the primary production of coastal benthic habitats and the role of these hervibores in maintaining coral reefs away from an algal-dominated phase. Experimental cages will be deployed on coral reefs and seagrass meadows to assess short-term changes in community composition and standing stocks.

Deliverables/Expectations

Deliverables: During their stay, the students will acquire the following skills:

Bibliographic search and bibliomctric analysis.

Design of field and laboratory experiments.

Use of advanced instruments and field equipment such as driving fluorometers (:\c1w1tion Shutter Fluorometer and Walz Diving PAM CO2 Infrared Gas Analyzer (EGM) and field loggers Dissolved Oxrgen and Temperature logger, EXO sonde, ldronaut CTD).

Statistical analysis, data manipulation and graphical representation and oral presentation of results.

Write and format manuscripts to be submitteded to a scientific journal.

Faculty Name

Carlos M. Duarte

Field of Study

Biology, Environmental Sciences, Marine Sciences

Carbonate dynamics in Red Sea coastal habitats

Internship Description

This last decade, the emergence of the thematic "ocean acidification" (QA) have caused the rise of a very strong interest in the response of marine biota, mostly calcifiers, to increasing concentration of dissolved inorganic carbon, linked to increased atmospheric partial pressure of CO2 (pC02). These studies, all or almost, considered open ocean pH and pC02 as basis for the scenarios used to study the impact of OA. Indeed, the carbonate system (pH, pC02, [HC03-), [CO32-), TA: Total Alkalinity) in surface oceans is stable, well known, and numerous models exist predicting the future rise of pC02 and decrease of pH. However, very recent articles point the irrelevance of tbese predictions for the nearshore area and the serious lack of relevant datasets for the different major types of benthic habitats worldwide.

In nearshore areas, metabolic processes by flora and fauna, such as photosynthesis, respiration and calcification, but also degradation of organic matter strongly affects the carbonate chemistry of the water column, generating important disequilibrium for CO2 and 02 between the sea and the atmosphere. Cycles of super-and undersaturation for these two metabolic gases have been observed in all kind of benthic habitats at the daily and seasonal scale, but also in relation to physical forcing such as tide, wind or precipitations.

Besides temporal variations, the metabolic activity of marine fauna and flora create local differences of carbonate chemistry at the scale of the µm to the meter above them. Within the first mm directly in contact with the organism stands the diffusive boundary layer. In this layer, the viscosity of water oppose to the diffusion of molecules, creating steep concentration gradients of metabolites arounds animal and vegetal tissues.

Respiration, calcification or photosynthesis alter the carbonate chemistry of the bounda1y layer altering in return the efficiency of theses metabolic processes by limiting the exchanges with bulk seawater of 02 and carbonate species. Within the first meter(s) above the benthic habitats stand the benthic boundary layer generated by the friction of water with reefs or macrophyte canopy. So as for the diffusive boundary layer, steep gradients of carbonate species and 02 are generated by respiration, calcification or photosynthesis, altering in return the efficiency of these processes.

Independent projects will be conducted by the visiting students under the VRSP program leading to an independent research output. Examples of individual research projects (adjustable to the internship duration and the interest and academic grade of the applicant):

Characterization of seasonal variations and day/night cycles of carbonate chemistry in Red Sea reefs/seagrass beds/carbonated sand lagoons /Halimeda sp. beds (calcifying bed-forming algae) I Mangrove using autonomous sensors deployments and sampling campaigns

Characterization of the vertical stratification of carbonate chemistry within the benthic boundary layer (0-1 m) in Red Sea reefs/ sea grass beds/ carbonated sand lagoon/ Halimeda sp. beds using 3D pH sensor mapping frames.

Study in aquaria, in the marine life-support system facilities at KAUST, of the effect of day-night fluctuations of 02, pC02 and temperature on calcifying species metabolism, such as coral, giant clams Tridacna sp. and Halimeda sp. under actual and expected future scenario.

Characterization of pH and 02 in diffusive boundary layer surrounding corals, seagrass, carbonated sand and Halimeda sp. under actual and future expected pC02 conditions using microsensor techniques in aquaria.

Faculty Name

Carlos M. Duarte

Field of Study

Marine Benchic Ecology, Marine Chemistry, Biogcosciences, Climate Change

Assessing in situ functions of different reef communities in the Central Red Sea

Internship Description

Scleractinian corals fulfill a number of important structural and functional roles that make them key ecosystems engineers in tropical coral reefs. However, under increasing environmental stress they are often replaced by communities dominated by benthic algae, thereby altering critical biogeochemical and recycling processes in the reef ecosystem. We are looking for a highly motivated master student who will be responsible for investigating a few selected biogeochemical parameters (e.g. fluxes of oxygen, dissolved inorganic carbon - DIC, or dissolved and particulate organic matter - DOM and POM) at the reef community level in reef sections dominated by scleractinian corals or benthic algae. The project will involve in situ measurements of biogeochemical fluxes on coral reefs with benthic incubation chambers, subsequent sample preparation and analysis. All work will be in close collaboration with a current PhD project.

Faculty Name

Burton Jones

Field of Study

Biology; Marine Science; Oceanography; Physics

Interaction of bio-optical variability with physical forcing in the Red Sea – Observations from autonomous platforms

Internship Description

The biogeochemical response of the ocean is strongly driven by physical processes that determine the context within which the biogeochemical processes and transformations occur. Autonomous vehicles and floats are used to observe the physical and biological environment of the Red Sea through all seasons and in various locations within the Red Sea. The student will participate in the analysis of bio-optical data that can be used as proxies for biogeochemical variables that in turn analyzed to understand the productivity, transport, and long-term climatology of the Red Sea. The student will participate with post-docs and graduate students working on these problems to better understand and interpret the data. We expect that this research will lead to publications in which the student can participate.

Faculty Name

Burton Jones

Field of Study

Biology; Marine Science; Oceanography; Physics

Effect of ocean acidification on the small RNA expression of a coral

Internship Description

Small RNAs (e.g. small interfering RNA, microRNA, Piwi-interacting RNA) are essential in the correct functioning of many biological processes of metazoans. To investigate the effect of ocean acidification on the small RNA profile of corals, we extracted and sequenced the small RNA fraction of a coral that was subjected to four different pCO_2 levels under controlled conditions.

This project will involve the use of bioinformatics tools (and possibly even self-written ones!) to analyse the changes in expression of small RNAs, and identify biologically interesting small RNAs for further downstream verification

Deliverables/Expectations

Trimming and removing low quality reads in the dataset

- Using a differential expression pipeline to identify small RNA with biologically interesting expression profiles
- Correlate small RNAs of interest to known siRNAs / miRNAs / piRNAs
- Perform further analysis on the data pending earlier results

Write a (short) manuscript on these analyses

Faculty Name

Manuel Aranda

Field of Study

Biological Sciences, Computational Biology or Environmental Engineering

Improving coral thermal tolerance through association with acclimatized Symbionts

Internship Description

Corals have shown capable of coping with increasing temperatures; however strong inter-species and intra-species variation is evident. Different thermal tolerances between members of the same species have been attributed partially to the associated zooxanthellae. The Red Sea offers a unique environment to understand these associations as host and symbiont live in higher annual temperatures than counterparts elsewhere. Using the coral model organism Aiptasia pallida, a small anemone, we investigate whether Symbiodinium from anemones of the Red Sea can improve heat stress resilience of individuals from geographically distant locations

Deliverables/Expectations

Bleaching and re-infecting anemones with different strains of Symbiodinium cultured in the lab

Quantification of phenotypic changes between host-symbiont combinations during and after heat stress exposure

RNA extraction and gene expression analysis of interesting and informative biomarkers

Perform further analysis on data obtained

Write a (short) manuscript of these analyses

Faculty Name

Manuel Aranda

Field of Study

Biological Sciences, Marine Sciences

A UAV based meteorological sensor package using Arduino

Internship Description

Unmanned aerial vehicles represent a revolution in earth observation. Through combination with cheap miniaturized sensors and on-board processing, powerful sensing tools can be developed. Here we will explore the design and integration of an Arduino based meteorological sensor package for deployment on a UAV quad-copter system. The system will be tested in the field and compared against ground based weather stations and atmospheric profiles of temperature. The opportunity to explore a range of sensor, data collection and processing challenges related to UAVs also exists.

Deliverables/Expectations

Integrate meteorological sensors (GPS, temperature, humidity, radiation etc) into an Arduino based board to allow for placement on a quad-copter. Collection of 2D and 3D meteorological profiles onboard the UAV and evaluation of data against available ground-based sensing systems. Project can be expanded to include other UAV integration activities, including RTK-GPS, multi-spectral and hyperspectral sensing and improved data processing algorithms and work-flows.

Faculty Name

Matthew McCabe

Field of Study

Hydrology, remote sensing, earth science, electronics, electrical engineering, mechatronics, computer science.

High resolution satellite based sensing of vegetation and surface characteristics

Internship Description

A range of high-resolution (1-10m) space based commercial systems have recently become available for earth observation. There is considerable capacity to develop products on various earth surface features from these systems, including vegetation health and stress, land cover changes and even digital surface models. Here we will explore some of these opportunities using high-resolution commercial as well as government based satellite systems, with a focus on applications in precision agriculture.

Deliverables/Expectations

The project will be using high resolution cubesat data to retrieve information on vegetation health and structure for precision agriculture applications. Data will be compared against other satellite based systems as well as field-based collections of relevant metrics. A focus on either vegetation retrieval or other land surface features (land cover change, cropping patterns, digital elevation models) can also be explored or researched in parallel.

Faculty Name

Matthew McCabe

Field of Study

Hydrology, remote sensing, earth science, image processing, data visualization, computer science

Role of nuclear RNAi in gene regulation and chromatin organization

Internship Description

The role of RNAi in post-transcriptional gene silencing in the cytoplasm is well characterized. Although, nuclear RNAi proteins and ncRNAs have shown to be enriched in the chromatin, however, their collective role in genome organization and gene expression remains elusive. To understand the mechanism and function of nuclear RNAi components (AGO1 and DICER1) we are using an integrated proteomic approach to decipher in vivo protein-protein interactions and applied this strategy to globally map the AGO1 and DICER1 interaction network in human cells. This project involves the generation of stable cell lines expressing FLAG-HA-tagged RNAi components (AGO1 and DICER1) proteins. By tandem affinity purification (TAP-TAG) and mass spectrometry analysis we will identify various interacting partners of from different cellular compartments (Cytoplasm, Nucleoplasm and Chromatin).

Deliverables/Expectations

This will be a great opportunity for young students to involve in different aspects of the project from bench experiment to trouble shooting. We expect from intern students;

1. Quality efforts and meaningful written results
2. A positive approach to solving research problem
3. Expect that intern students get a rewarding experience in handling their projects and learn how to train students in future
4. A final report with detail description and results in article format.

Faculty Name

Valerio Orlando

Field of Study

Bioscience

The role of Polycomb Group of proteins in somatic cell plasticity and adaptation

Internship Description

Polycomb repressive complexes (PRC2-Ezh2 and PRC2-Ezh1) control gene silencing via histone H3K27me3 modification. While the repressive role of PRC2-Ezh2 complex, distinctive of proliferative cells, is well understood, PRC2-Ezh1 complex characteristic of the majority of post-mitotic differentiated adult tissues, has still an elusive function. Our lab, identified a novel PRC2 component that controls adaptation to atrophic stress by regulating PRC2 assembly and activity on targets. To further our understanding of the mechanism that how these components work we will use biochemical approach by identification of protein complexes in normal and stress conditions. The project will involve cloning of novel PRC2 components in expression vector containing FLAG-HA and GFP tagged. Using these vectors we will generate stable C2C12 cell lines. By tandem affinity purification (TAP-TAG) and mass spectrometry analysis we will identify interacting protein complexes.

Deliverables/Expectations

This will be a great opportunity for young students to involve in different aspects of the project from bench experiment to trouble shooting. We expect from intern students;

1. Quality efforts and meaningful written results
2. A positive approach to solving research problem
3. Expect that intern students get a rewarding experience in handling their projects and learn how to train students in future
4. A final report with detail description and results in article format.

Faculty Name

Valerio Orlando

Field of Study

Bioscience

Label free vibrational imaging of metabolic pathways in human cancer cells

Internship Description

Metabolic re-programming from normal to cancer cells has been shown as a hallmark for their ability to grow and invade. The ability to analyse metabolic profiles in live cells is limited due to the requirement of purifying the metabolic analyte using an invasive method or the use of some labelling procedure which are not suitable for live cells. The use of vibrational spectroscopy allows, non-invasive, non-destructive and label free imaging of live cells. Such a technology has shown grown potential for direct visualization of metabolite turnover in cells and label free analysis of diseases.

Deliverables/Expectations

The student will learn the technique for the culture of human cancer cell lines. They will devise a plan for analyzing a metabolic pathway within the cell which they would like to monitor using novel, label free vibrational imaging (Raman and infrared spectroscopy). They will compare the altered metabolites of their cells from variable conditions using these novel vibrational imaging techniques and discuss its relation to cancer physiology.

Faculty Name

Carlo Liberale

Field of Study

Cell biology, metabolomics, spectroscopy and microscopy

Development of a novel Stimulated Raman Scattering microscopy system

Internship Description

Microscopy techniques based on vibrational spectroscopy are poised to be part of the next generation of microscopes for biological applications based on their unique chemical contrast and sub-cellular resolution for non-invasive, non-destructive and label free imaging of biological samples as live cells.

The project will focus on the development of a low-noise detection system in a setup for fast microscopic vibrational spectroscopy based on Stimulated Raman Scattering, which is one of the most advanced and sensitive methods for label-free microscopy for bio-imaging. The system will be applied to vibrational imaging of cancer stem cells to unveil their specific biochemical signatures.

Deliverables/Expectations

Learn Coherent Raman Scattering techniques. Design, assemble and test circuitry for multiplexed and low-noise detection in a Stimulated Raman Scattering microscopy setup based on femtosecond broadband laser sources. Demonstrate fast and high S/N ratio imaging with multiplex (broadband) Stimulated Raman Scattering microscopy.

Faculty Name

Carlo Liberale

Field of Study

Electrical Engineering, physics

Novel Micro-optical structures on optical fiber tip with two-photon lithography

Internship Description

Optical fibers are nowadays an ubiquitous core element of telecommunication systems, new laser technologies and biomedical devices. Manufacturing techniques for optical fibers have been developed and refined in order create manifold geometries and optical properties (e.g.

Dual clad fibers, fiber bundles, Photonic Crystal Fibers, to name a few). Yet the capability to fabricate complex miniaturized structures integrated with optical fibers to realize important optical functions (like beam shaping, beam deflection, fiber optical tweezers, etc.) has been demonstrated only very recently.

The project will focus on the fabrication of optical wave-guiding structures on the tip of optical fibers exploiting to flexibility, resolution and 3D fabrication capability of Laser Direct Writing based on Two-Photon Lithography (TPL).

Deliverables/Expectations

Learn Two-Photon Lithography. Design structures using wave-optics propagation software. Fabricate structures on optical fibers. Measurements to assess optical function of fabricated structures.

Faculty Name

Carlo Liberale

Field of Study

Electrical Engineering, physics

Bioelectronics: Fabrication of Flexible Metabolite Sensors Using Inkjet Printing

Internship Description

The field of bioelectronics couples the worlds of biology and electronics by developing electronic devices that can interface with the body. These devices can pick up biological signals and convert them into an electrical output. Electrochemical transistors are amplifying transducers that can measure such biological signals with high sensitivity. In our lab, we fabricate organic electrochemical transistors, devices that employ conducting polymers, for sensing applications. One specific application is on sensing of metabolites, such as glucose, in body fluid.

Deliverables/Expectations

In this internship, the student will be engaged in the fabrication and testing of conducting polymer based transistors on flexible substrates. He/she will first learn how to prepare ink formulations of polymers for ink jet printing. These inks are novel combinations of functional polymers. Once the formulations are prepared and validated for printing, the student will print the inks in on flexible substrates. He will be guided by the members of the lab who are experienced in fabricating such sensors.

Faculty Name

Sahika lnal

Field of Study

Electrical Engineering, Materials Science, Physical Chemistry

Bioelectronics: Recording and Stimulation of Neurons with Organic Electronic Materials

Internship Description

The field of bioelectronics couples the worlds of biology and electronics by developing electronic devices that can interface with the body. These devices can acquire biological signals and convert them into an electrical output (recording) or send electrical signals to trigger a biological event (stimulators). In clinic, device devices can be used to record electrical activity of neurons (for instance ECOG, EEG arrays) or implanted in the body for therapy. In our lab, we develop micron scale electronic devices based on organic electronic materials (carbon based semiconductors) to interface the body because these materials have properties that are advantageous for interfacing the tissue.

Deliverables/Expectations

In this internship, the student will be engaged in the fabrication and testing of conducting polymer based microelectrodes. Once the student gains the required literature knowledge on conducting polymer electrodes and completes lab safety /tool access trainings, he/she will fabricate electrodes using photolithography, which is a common knowledge of our team. The student will then use the available recording/stimulation tools to test the electrodes and quantify their efficiency. He is expected to focus on optimizing the commercially available electronics used to perform electrode recordings/stimulation. The student will be supported by the other members of our team. These electrodes and electronics will then be finally integrated with neural culture in order to validate their recording/stimulation efficiency.

Faculty Name

Sahika lnal

Field of Study

Electrical Engineering

Paleoclimate reconstructions within the 'NICE' project

Internship Description

Increasing temperatures and CO2 levels in the ocean and urban pollution from waste water urban nutrient drainage pose threat to tropical coral reef ecosystems by altering their physical and chemical conditions. Within the framework of the "Nitrogen cycling in Coral reef Environments ---NICE" project, collaborators investigate macronutrient fluxes through coral reef organisms of the Red Sea in relationship to environmental stressors. The internship project would support the NICE project through paleo-climate reconstructions using the stable isotopic composition of coral skeleton cores. Important information about historical environmental variability in the Red Sea can be revealed by the skeletal material of massive reef-building corals, such as of Porites spp. corals. The process of reconstruction includes two phases. Phase one includes the selection of suitable Porites spp., core extraction and processing at KAUST. X-ray imaging, dating and age-model development, as well as measurements of oxygen and carbon stable isotope ratios at high (seasonal) resolution (phase two) will be supported by the Museum of Natural History in Bremen.

Deliverables/Expectations

The expected deliverable is a peer-reviewed publication that describes multi-decadal changes in the climate regime of the Red Sea.

Faculty Name

Burton Jones

Field of Study

Coral reef ecology; Marine Science; Paleoceanography

Measuring Biogeochemical Fluxes

Internship Description

Scleractinian corals fulfill a number of important structural and functional roles that make them key ecosystems engineers in tropical coral reefs. However, under increasing environmental stress they are often replaced by communities dominated by benthic algae, or, in case of the Red Sea, soft corals of the family Xeniidae. These "new" communities can thereby critically alter biogeochemical and recycling processes in the reef ecosystem.

Understanding how those changing Red Sea reef communities function when dominated by soft corals instead of scleractinian corals is therefore a key scientific priority. We are looking for a highly motivated bachelor or master student who will be responsible for investigating a few selected biogeochemical parameters (e.g. fluxes of oxygen, dissolved organic matter - DOM, and inorganic nutrients) at the reef community level in reef sections dominated by the soft coral Xenia sp. The project will involve in situ measurements of biogeochemical fluxes on coral reefs with benthic incubation chambers, subsequent sample preparation and analysis. This project will be integrated in a wider research scheme that aims at assessing biogeochemical and recycling processes in various marine communities. We expect that this research will lead to publications, which the student can contribute.

Deliverables/Expectations

We are seeking a B.Sc. (Bachelor of Science) or M.Sc. (Master of Sciences) student who is interested in the stated topic for his / her thesis research. The project is suitable for candidates interested in coral reefs, particularly physiological ecology and biogeochemical processes. He / she should be willing to learn ecophysiological and biogeochemical analysis ,with marine organisms. A proficiency in statistical analysis and good speaking and writing skills in English is an asset. The applicant should have an effective time management and shows the ability to work self-dependent under direct guidance. A dive certificate (Advanced Open Water or higher) is desirable.

Faculty Name

Burton Jones

Field of Study

Ecology, Biology, Marine Science, Oceanography