

Postgraduate opportunities at UKZN: Accelerated Coral Evolution

Climate-induced coral bleaching is considered an existential threat to coral reefs globally and is exacerbated by other stressors, including coral diseases. Some corals are more resistant to bleaching than others, for reasons that include genetic variability among colonies, species and locations or gene expression. An evolutionary perspective is therefore integral to understanding resilience in corals. The ability of corals to resist bleaching and disease is additionally dependent on maintaining a healthy microbiome (assemblage of microorganisms, including algae, other protists, bacteria, archaea, fungi, and viruses). While the importance of endosymbiotic microbes in coral health is well known, the effect of temperature on coral-associated bacterial diversity is not fully understood. The many interactions between the coral animal and all its symbionts provide many opportunities for adaptation to changing environments and there is some evidence that corals may adapt to climate change. However, it is recognised that they are unlikely to naturally adapt fast enough to avoid catastrophic loss of species and populations.

Our research programme at UKZN and the Oceanographic Research Institute (ORI) in Durban will therefore focus on 'accelerated' coral evolution to increase the rate and scope of adaptation. To this end, we invite applications for four PhD and two MSc projects as outlined below to investigate aspects of resilience of corals to thermal stress. We are looking for motivated, self-driven students with a keen interest in contributing to understanding of global coral health.

Studentships have standard NRF bursaries attached. These are R90 000 per annum for an MSc and R120 000 per annum for a PhD. All applicants for PhD projects must be in possession of an MSc or SAQA equivalent in the requisite topics. All applicants for MSc projects must be in possession of a BSc honours degree or SAQA equivalent.

Applications for all projects should include a CV, proof of qualifications, academic record, a cover letter stating how you meet the requirements for the project and the names of two academic referees. Applications or enquiries should be directed to the person whose details are listed under each project. The deadline for applications is 21st January 2019. The researchers reserve the right not to appoint students if no suitable applications are received.

1) Investigation of the coral prokaryotic microbiome:

PhD Project:

The PhD project will entail a metagenomic approach to understanding coral-associated bacterial population shifts following thermal bleaching events. The candidate would investigate bacterial diversity as well as variation in selected functional genes following exposure to varying temperatures. Candidates with a background in Bioinformatics and Microbiology would be preferred.

MSc:

The Masters project will entail culturing and identifying coral-associated bacteria following exposure to varying temperature events. This would be followed by investigating their antimicrobial potential against selected coral pathogens. Candidates with a background in Microbiology and interest in Marine Biology would be preferred.

Candidates with an interest in Microbiology, Bioinformatics, Marine Biology are invited to apply for the following studies in 2019:

Please submit a detailed cover letter, comprehensive CV, certified academic record and contact details for two referees to Dr. Hafizah Chenia (Cheniah@ukzn.ac.za). Based on above, students will be contacted for interviews before selection is made.

2) A comparative framework for the assisted evolution of hard corals (Scleractinia)

PhD project:

Hard corals from South Africa's shallow sub-tidal assemblages in KwaZulu-Natal are noteworthy both in terms of their diversity and their apparent 'resilience' in the face of climate change. This presents a unique opportunity for assessing the basis of this resilience in a phylogenetic context. Interested candidates should have experience in genetics and evolutionary biology and a passion for marine science. Experience with next generation sequencing and bioinformatic analysis will be an advantage.

Please send applications to Dr A Macdonald (macdonalda@ukzn.ac.za). Include the subject line "Hard Coral comparative phylogenetics" together with the required documentation.

3) Physiological and transcriptional responses of corals from a range of habitats to future warming: PhD project: To determine whether there are particular determinants of resilience (genotype, microbiome, symbiont) and how best to preserve and/or enhance these. The student will be based at the Oceanographic Research Institute at uShaka Marine World in Durban, South Africa and registered at the University of KwaZulu-Natal. They would be involved with the collection of experimental material (inter and sub-tidally), running a long term experimental aquarium system, measuring physiological responses of corals, isolation of RNA and analysis of differential RNA expression via NGS RNASeq (transcriptomics).

Essential	Desirable (1 to 5 level of importance, with 1 being very and 5 being less important)
<ul style="list-style-type: none">• MSc in bioinformatics and/or a marine related subject with good grades• Experience in molecular biology• Sound knowledge in bioinformatics	<ul style="list-style-type: none">• Experience with linux and cluster computing (1)• A good communicator with good interpersonal skills (2)• Experience in coral husbandry or aquariums (3)• Resourceful, curious and open minded (3)• Basic diving qualifications with desire to upgrade (5)• previously worked with next generation (Illumina) data and high performance cluster computing• experience with coral husbandry and/or aquaria

To apply: submit documents as one PDF via email to Dr David Pearton (dpearnton@ori.org.za). Subject of email: PhD Coral transcriptomics – application.

4. Responses of corals to thermal stress:

One PhD and one MSc project:

To study differences in responses to thermal stress in corals from different species, habitats and regions. The work will encompass stress responses of the coral holobiont and on each of its components. Students will collaborate with colleagues, to understand how responses of algal and

prokaryote symbionts to thermal stress affect the functioning of the holobiont and how each component influences the susceptibility or resilience of the holobiont to such stress.

Projects may combine field-work, aquarium-based experiments and measures of stress biomarkers in corals subjected to thermal stress. Experimental testing of the performance of varying assemblages of symbionts inoculated into corals may form part of the protocol. Within these parameters the successful applicants will have considerable input into the specific project scope and design.

Students with a background in marine biology and able to demonstrate an interest in corals and coral reefs would best suit these projects. The ability to work independently in the field and laboratory are vital. SCUBA diving qualifications and some knowledge of invertebrate physiology and molecular biology will be advantages.

For these projects, please contact David Glassom (glassom@ukzn.ac.za) or Dalene Vosloo (Voslood@ukzn.ac.za).