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SEMINAR

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Evolution of thermal tolerance in corals from the world's hottest reefs





By Emily Howells

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Reef-building corals are globally threatened by rising sea temperatures and must adapt if they are to persist in the future. However, understanding adaptive potential in corals is complicated by the difficulty of tracking selection in natural populations as well as interactions between symbiotic partners that define stress responses. To address these challenges, my research focuses on Persian Gulf corals which already experience considerable warming on par with end-of-century projections for most reefs. I will present recent findings on the traits that have enabled Gulf populations to withstand temperatures of ~36°C and evaluate their suitability for heat tolerance selective breeding. My first set of experiments compared the thermal tolerance traits of populations of a common coral (*Platygyra daedalea*) from the Gulf and the milder Indian Ocean. Under elevated temperatures, Gulf *P. daedalea* had ~50% higher survival accompanied by greater capacity to mitigate oxidative stress in the coral host and better retention of photosynthetic performance in their algal symbionts. Superior heat tolerance in Gulf *P. daedalea* was maintained after 6 months acclimatisation and was underpinned by genetic divergence in host and algal symbionts. These findings provide evidence that genetic adaptation of both symbiotic partners have enabled corals to cope with extreme temperatures. My second set of experiments crossbred *P. daedalea* from Gulf and Indian Ocean populations and compared the heat tolerance of hybrid offspring with purebreds from each region. Overall, 50 family crosses were bred under controlled conditions and the survival of >10,000 non-symbiotic larvae was tracked at ambient and elevated temperatures. On average, hybrid crosses had 37% higher survival at elevated temperatures than purebred Indian Ocean crosses. In most cases, this hybrid gain in heat tolerance also exceeded the mean tolerance of Gulf purebreds, indicative of hybrid vigour. The next step in this research is to identify the coral genotype combinations that were successful in selective breeding for enhanced heat tolerance.

About the Speaker

Emily Howells in an Australian marine scientist with 10 years of experience working on coral reefs. Her research combines field and experimental ecology with molecular tools to investigate evolution and plasticity of thermal tolerance in corals. Emily undertook her PhD on the Great Barrier Reef at James Cook University and the Australian Institute of Marine Science. Currently, she is a postdoctoral researcher at New York University Abu Dhabi which allows her to be in close proximity to corals living in the world's hottest sea

Artwork by Ann Nee, DBS, NUS