

Understanding the environment-to-epigenetic alterations driving ecosystem function and resilience under continuing climate change

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Goals

- Investigate the role of epigenetic processes in providing rapid phenotypic plasticity within an ecosystem severely threatened by ocean warming
- Examine epigenetic patterns and their connection to varying genotypes, demography, and physiology in *Diadema antillarum*, an organism with direct positive impacts in Caribbean coral reef ecosystems (Figure 1)

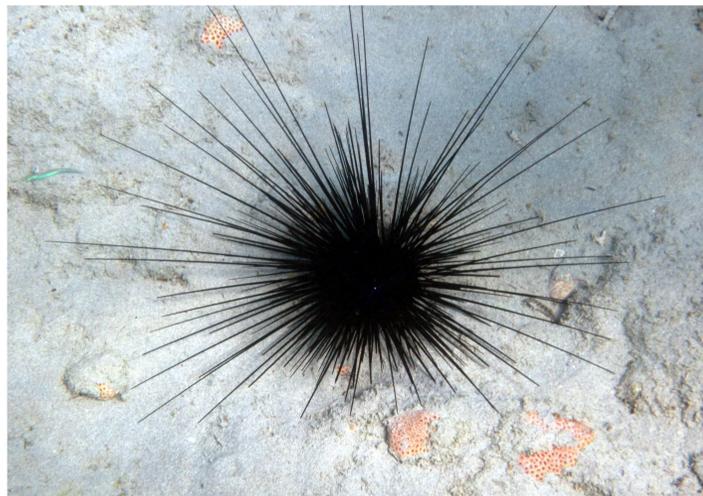


Figure 1. A long-spined sea urchin (*Diadema antillarum*) in Culebra, Puerto Rico. Photo by Kent Miller, <http://www.inaturalist.org/photos/722343>

Research Methodology

- Assess existing environmental and biological variability and assemble a draft genome for *D. antillarum*
- Conduct a reciprocal transplant experiment to determine how temperature influences epigenetic marks and physiology on locally adapted or phenotypically plastic populations (Figure 2)
- Compare larvae that differ in their developmental and parental thermal history exposure to investigate epigenetic inheritance and transgenerational plasticity

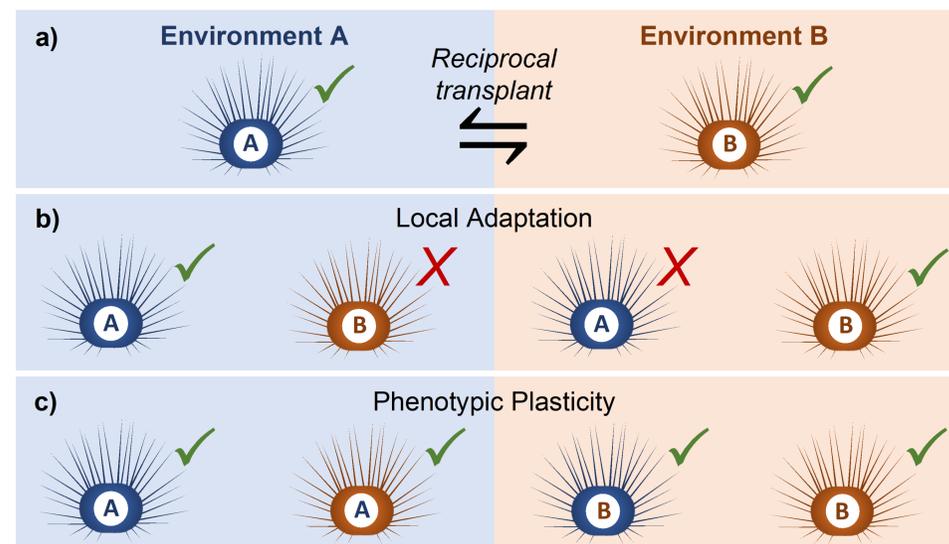


Figure 2. **a)** Urchins inhabiting their respective environments exhibit phenotypes (A or B) suited to that environment. Upon reciprocal transplantation to a new environment, urchins may exhibit **b)** local adaptation or **c)** phenotypic plasticity.

Expected Outcomes

- This project will elucidate the environment-to-epigenetic relationship (Figure 3) by identifying:
 1. How different temperatures induce epigenetic modifications
 2. The connection between these modifications and phenotype
 3. If these modifications can contribute to epigenetic inheritance
- A draft genome will serve as a valuable molecular resource for studying the ecology and evolution of *D. antillarum*
- Results will inform the conservation of a species that directly impacts coral reef health, particularly as ocean warming continues

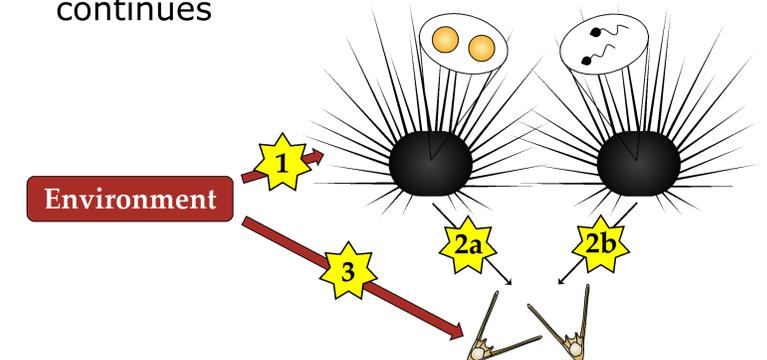


Figure 3. The environment may alter the epigenome as **1.** epigenetic effects in adults (intragenerational plasticity), **2.** epigenetic inheritance, **a.** maternal and/or **b.** paternal (transgenerational plasticity), and **3.** epigenetic effects during early development (intragenerational/developmental plasticity).



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