A mathematical model for wound healing in the reef-building coral *Pocillopora damicornis*

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Coral reefs, among the most diverse ecosystems on Earth, currently face major threats from pollution, unsustainable fishing practices, and perturbations in environmental parameters brought on by climate change. Corals also sustain regular wounding from other sea life and human activity. Recent reef restoration practices have even involved intentional wounding by systematically breaking coral fragments and relocating them to revitalize damaged reefs, a practice known as microfragmentation. Despite its importance, very little research has explored the inner mechanisms of wound healing in corals. Some reef-building corals have been observed to initiate an immunological response to wounding, similar to that observed in humans and other vertebrates. Utilizing prior models of human tissue wound healing, we formulated a mechanistic model for wound healing in a reef-building coral *Pocillopora damicornis*. The model consists of four differential equations which track changes in remaining wound debris, number of cells involved in inflammation, number of cells involved in proliferation, and amount of wound closure through re-epithelialization. The model is fit to experimental wound size data from linear and circular shaped wounds on live coral fragments. Mathematical methods, including stability analysis and local sensitivity analysis, were used to analyze the resulting model. The parameter space was also explored to investigate drivers of other possible wound outcomes. This model serves as a first step in generating mathematical models for wound healing in corals that will not only aid in the understanding of wound healing as a whole, but also help optimize reef restoration practices and predict recovery behavior after major wounding events.