Tissue repair and regeneration is an understated requirement of all adult organisms. Natural biotic and abiotic processes including sublethal predation, competition, or weather events routinely inflict physical damage onto organisms which require them to regenerate/repair damaged or lost tissue. Therefore, regenerative processes are essential in maintaining the physiological integrity—the rate and capacity for regeneration following damage—of an organism. From an ecological perspective, regeneration rate and capacity of the individuals composing a community may indicate the resiliency of an ecosystem. For example, if damaged individuals have compromised fitness, extended periods of convalescence may weaken ecosystem resilience. This is particularly important for species which fill critical ecological roles (i.e., keystone species and ecosystem engineers).

The ability to restore lost body parts (a unique and specialized form of regeneration) varies greatly across taxa. This phenomenon has been extensively studied in animals who are able to shed and regrow an appendage (autotomy) (e.g., amphibians, reptiles, fishes, and arthropods) and in animals who display whole-body regeneration (e.g., hydra, planarians, and nematostella). However, the cost of regenerating lost body parts has been documented to impact other life functions such as reproduction and growth. For example, previous studies have found complete loss of or reduced fecundity as a consequence of tail regeneration in salamanders and lizards (Maiorana, 1977, Bernardo & Agosta 2005) and growth reduction in crustaceans with increasing amount of limb regeneration (Griffen et al. 2023). In contrast, other studies show that food consumption or energy reserves can supplement or even over-compensate the costs of regenerating lost body parts. Therefore, to maintain physiological homeostasis, an organism must meet energetic requirements by 1) increasing their acquisition of food resources, 2) eating into their energetic reserves, and/or 3) reducing their energy allocation to other life functions.

Acquiring new energy and leveraging stored resources are mechanisms of maintaining an energetic budget which can support repair and regeneration. An organism’s ability to do this depends greatly on the conditions of the environment. Under stressful conditions where energy acquisition is inefficient and resources are exhausted, energetic tradeoffs will be most acute. ….

Corals maintain frequent physical damage from multiple sources. Tissue damage or loss is routinely caused by corallivore predation, intense wave action, and human activity including recreational or restoration practices.

Brain dumps:

Wound healing as an investment in immunity.

The costs of regeneration in colonial animals are less known.

Organisms can sustain immunocompetence by either increasing acquisition of food resources or reducing energy allocation to other physiological processes (Derting and Compton [2003](https://link-springer-com.proxy.library.ucsb.edu/article/10.1007/s00442-015-3365-8#ref-CR11))

sublethal predation

In a. pulchra maybe the increase in photosynthesis is an attempt at increasing their acquisition of food to sustain immunicompetence… which is why we didn’t see a decrease in growth? But there is still likely a limit to this capacity.

Much less is known about the physiological impactions of wound healing in colonial organisms.

Wound healing is an investment in immunity.

coral tissue loss reduced temporarily reduced their ability to acquire new resources

. A model of energy acquisition versus loss (scope for growth) indicated that tissue growth is more responsive to resource variation and physiological stress than skeletal growth. (Anthony et al 2002)

The capacity for regeneration and the mechanisms of wound healing vary greatly across taxa. Regeneration has been extensively studied in animals who are able to shed an appendage (autotomy) as in many amphibians, reptiles, fishes, and arthropods. Similarly animals who display ability to replace lost body parts

The capacity for regeneration varies greatly across taxa for which the costs and benefits of individual organisms and populations have been and is for which the mechanisms of the wound healing has been extensively studied in a number of animals.

The ability to restore lost body parts (regeneration) varies greatly across taxa. This phenomenon has been extensively studied in animals who are able to shed and regrow an appendage (autotomy) (e.g., amphibians, reptiles, fishes, and arthropods) and in animals who display whole-body regeneration (e.g., hydra, planarians, and nematostella). The energetic cost of regenerating lost body parts has been documented to impact other life functions such as reproduction and growth. For example, previous studies have found complete loss of or reduced fecundity as a consequence of tail regeneration in salamanders and lizards (Maiorana, 1977, Bernardo & Agosta 2005) and growth reduction in crustaceans with increasing amount of limb regeneration (Griffen et al. 2023). These energetic tradeoffs between vital life history functions play a critical role in organismal performance and are most acute under stressful conditions.

While an organism may meet the energetic requirements for regeneration may be great under optimal conditions, forAnd organismal variation in regeneration capacity is dictated intrinsically by an organism’s energetic budget for maintaining basic life functions and extrinsically by changing environmental factors. For example,

with respect to maintaining basic life functions

that determine the costs and benefits of regeneration.

In other systems such as crabs it is hypothesized that energy allocated to limb regeneration will result in altered food consumption- could increase to meet necessary energetic requirements or could decrease due to being handicapped

Under acute disturbance, corals will either reallocate must meet their energetic demand they must reallocate energy to maintain homeostasis in response to whatever environmental change is causing that stress

Corals don’t have a localized area for resource storage (like lizards do in their tails or crustaceans do in their hepatopancreas). Some animals might be able to compensate energy requirements by increasing food intake, however corals are not likely to meet their energetic requirements with heterotrophy. Corals heavily rely on photosynthetic algae which live inside their tissues to acquire energy. The implications of wounded coral tissue is decreased energy production (due to the physical removal of algal symbionts), decreased immunity (due to presence of open lesion), and reduction in size (if the cause of wounding also removes coral skeleton). Coral size is important in resisting mortality by predation.

Corals maintain frequent physical damage from multiple sources. Tissue damage or loss is routinely caused by corallivore predation, intense wave action, and human activity including recreational or restoration practices.

In suboptimal conditions where energy acquisition can be inefficient and energetic tradeoffs as a result of resource reallocation will be most acute under stressful conditions If these mechanisms are not sufficient, an individual will be forced to reallocate energy resulting in tradeoffs.

depend on an organism’s ability to acquire and store resources, the abiotic conditions of their environment can impose the efficiency of these mechanisms.

Corals maintain frequent physical damage from multiple sources. Tissue damage or loss is routinely caused by corallivore predation, intense wave action, and human activity including recreational or restoration practices.

The fitness of damaged individuals will also

enAnimals energetic tradeoffs between vital life history functions play a critical role in organismal performance and are most acute under stressful conditions. Trad

Organisms can sustain immunocompetence by either increasing acquisition of food resources or reducing energy allocation to other physiological processes (Derting and Compton [2003](https://link-springer-com.proxy.library.ucsb.edu/article/10.1007/s00442-015-3365-8#ref-CR11))

Corals maintain frequent physical damage from multiple sources. Tissue damage or loss is routinely caused by corallivore predation, intense wave action, and human activity including recreational or restoration practices.

environmental factors including sublethal predation and weather events. The resilience of an organism is in part characterized by their ability to regenerate

Corals display remarkable resilience to physical damage including sublethal predation, fragmentation by wave action or restoration practices

Things to mention in introduction

* Energetic trade offs
* Regeneration
* Wound healing
* Energetic budget