

Porifera: Services and Disservices

Invertebrate Biology

Kaylyn Flanigan

Week 1 - Invertebrate Biology

Service: Filtering Water

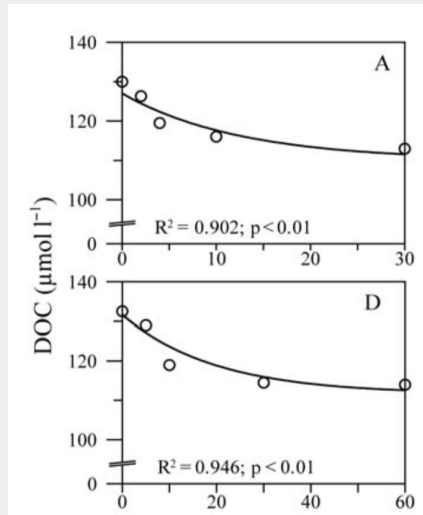


**1 kg of sponge can
filter 24,000 L of
water per hour!**

Shape of Life - Vimeo

(Batista et. al 2013)

Service: Filtration



Dissolved organic carbon
consumption by encrusting
sponges

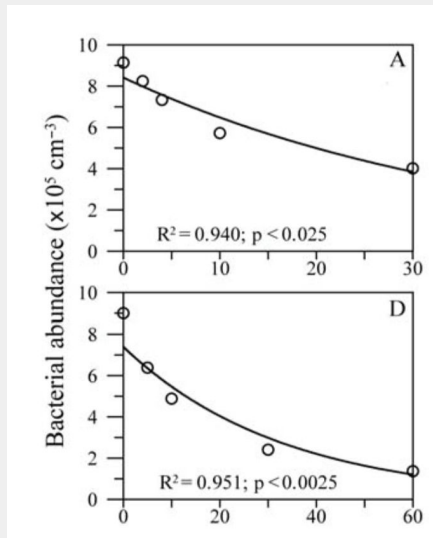
de Goeij, J.M., et al 2008

de Goeij, J.M., et al. "Major bulk dissolved organic carbon (DOC) removal by encrusting coral reef cavity sponges." *Marine Ecology and Progress Series*, vol. 357: 139-151. 2008

Studied three sponge species: *Halisarca caerulea*, *Mycale microsigmatosa* and *Merlia normani* along the coast of Curacao, Netherlands Antilles.

The sponge assimilates some of the DOC it filters into its own structure

Service: Filtration



Bacterial filtration by encrusting sponges

de Goeij, J.M., et al 2008

Bacterial abundance significantly decreased when encrusting sponges were present. In their absence (with just coral or just ambient water) bacterial abundance did not decrease, which suggests that these encrusting sponges are in fact cycling bacteria within the water column.

Service: Medicine



Sven Zea, Sweetings Bay, Bahamas *Ircinia sp.*

What health benefits could humans develop from a sponge?

Sponges produce secondary metabolites (chemicals that are not necessary for their survival). Typically these metabolites are used as allomones to deter predators (the allomone actually alters the predators behavior). When humans harvest them, these chemicals can be used for medicinal purposes.

What they provide: antibacterial, antiviral, antifungal, anti-prion, antimalarial, anti-inflammatory and immune or neuro-suppressive characteristics

Mioso, R., et. al, 2017. "Cytotoxic Compounds Derived from Marine Sponges. A Review." *Molecules*. 2017.

Service: Medicine



Sven Zea, Sweetings Bay, Bahamas *Ircinia sp.*

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Service: Medicine

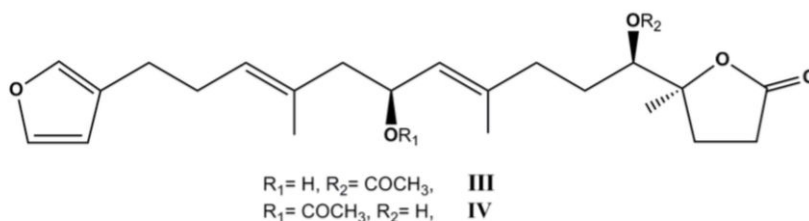


Figure 2. Two new structures 15-acetylirciformonin B (**III**) and 10-acetylirciformonin B (**IV**) isolated from the marine sponge *Ircinia* sp.

Mioso, R., et. al, 2017

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Service: Medicine

Cytotoxic and anti-cancer
properties!

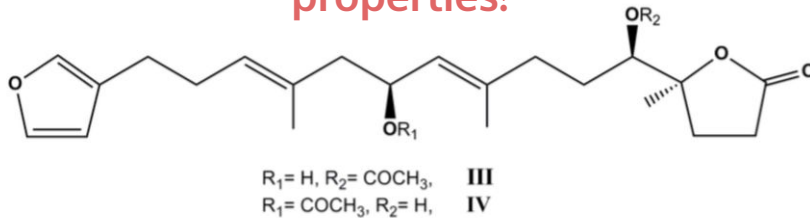
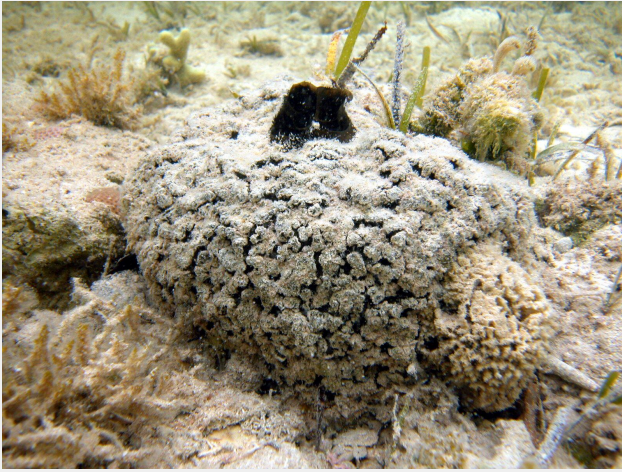


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Service: Medicine



Tectitethya crypta

Sven Zea, Little San Salvador, Bahamas

- AZT
- Antiviral
- Anti-Leukemia

(Pomponi, National Museum of Natural History)

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Service: Medicine

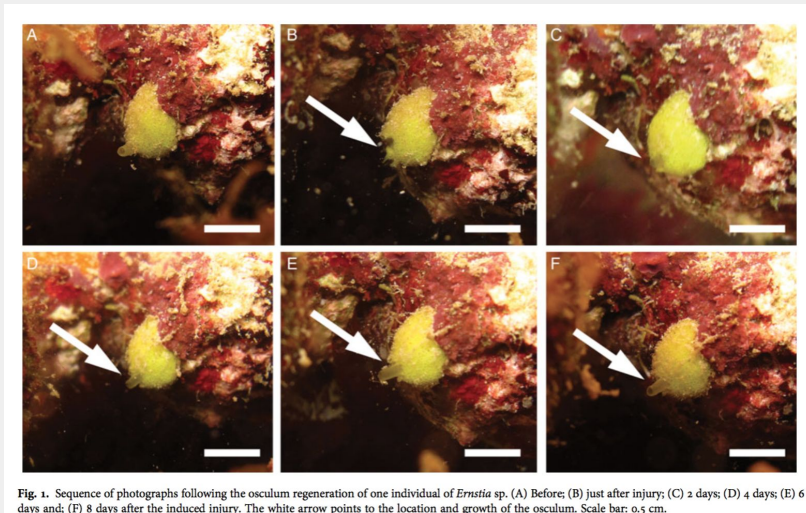


Fig. 1. Sequence of photographs following the osculum regeneration of one individual of *Ernstia* sp. (A) Before; (B) just after injury; (C) 2 days; (D) 4 days; (E) 6 days and; (F) 8 days after the induced injury. The white arrow points to the location and growth of the osculum. Scale bar: 0.5 cm.

Padua, A. and Klautau, M. 2016

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Regenerative medicine.

While Padua and Klautau (2016) found that, in sponges, regeneration depends on morphology and body polarity, Wang, Schröder, and Müller (2014) believe that the enzymatic processes that occur during regeneration in sponges, including biosilicate and biocalcite, could be manipulated to grow bone in humans.

Padua, A. and Klautau, M. "Regeneration in calcareous sponges (Porifera)." *Journal of the Marine Biological Association of the United Kingdom*, (96)2: 553-558. 2016.

Wang, X., Schröder, HC., and Müller, W. "Enzyme-based biosilicate and biocalcite: biomaterials for the future of regenerative medicine." *Trends in Biotechnology*, (32)9. 2014.

Service: Bioindicators



Nick Hobgood

- Polycyclic aromatic hydrocarbons (PAHs)
- Metal



NOAA

Sponges are ideal bioindicators because of their location in the water column. Mussels, and other intertidal species, are not a true reflection of the contaminants in the water column. Moreover, the research that is conducted with intertidal species to measure the amount of contaminants in the water are unreliable because most of the contaminant forms a film on the top layer of the water. Sponges, due to their high rate of filtration, are more likely to absorb contaminants than their intertidal counterparts.

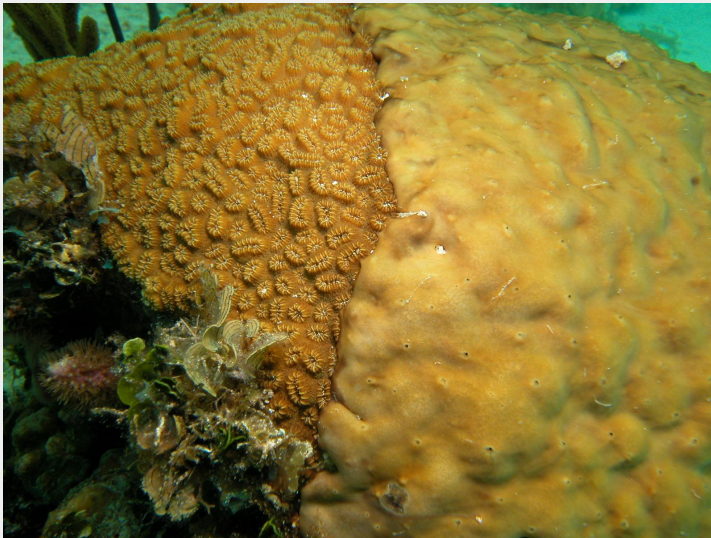
Batista, D., et. al. "Marine sponges as bioindicators of oil and combustion derived PAH in coastal waters." *Marine Environmental Research*, 92: 234-243. 2013.

What does coral have to do with sponges?



Toby Hudson

Disservice: Outcompeting Coral for Space



Sven Zea, Sweetings Cay, Bahamas

Overfishing and coral-excavating sponges are promoting sponge growth on reefs

(NSF, 2014)

Suchanek, T.H., et al. "Sponges as Important Space Competitors in Deep Caribbean Coral Reef Communities." *West Indies Laboratory*.

Mueller, B., et al. "Natural Diet of Coral-Excavating Sponges Consists Mainly of Dissolved Organic Carbon (DOC)." *PLoS ONE* 9(2): e90152. 2014.

Coral excavating sponges are the most abundant and destructive bioeroders on coral reefs and are strong competitors for space. They can remove as much CaCO_3 as a coral accretes within a year.

Reefs are important because they protect the land from power wave surges, erosion of coast lines, maintain coastal livelihoods of fishers, and maintain the tourism industry. They are also at the head of biodiversity on the planet.

Slow growing sponges are the ones that have chemical defenses. The fast growing ones are good competitors. Reefs that are off-limits to fishers have an abundance of fish that will consume the fast growing, coral-competing sponges which help the reef to thrive.

Works Cited

Batista, D., et. al. "Marine sponges as bioindicators of oil and combustion derived PAH in coastal waters." *Marine Environmental Research*, 92: 234-243. 2013.

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"From Sea Sponge to HIV Medicine." *Smithsonian National Museum of Natural History*,
<http://ocean.si.edu/ocean-photos/sea-sponge-hiv-medicine>

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<http://www.spongeguide.org>

Suchanek, T.H., et al. "Sponges as Important Space Competitors in Deep Caribbean Coral Reef Communities." *West Indies Laboratory*.

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