Emlet Lab projects 2024 REUs

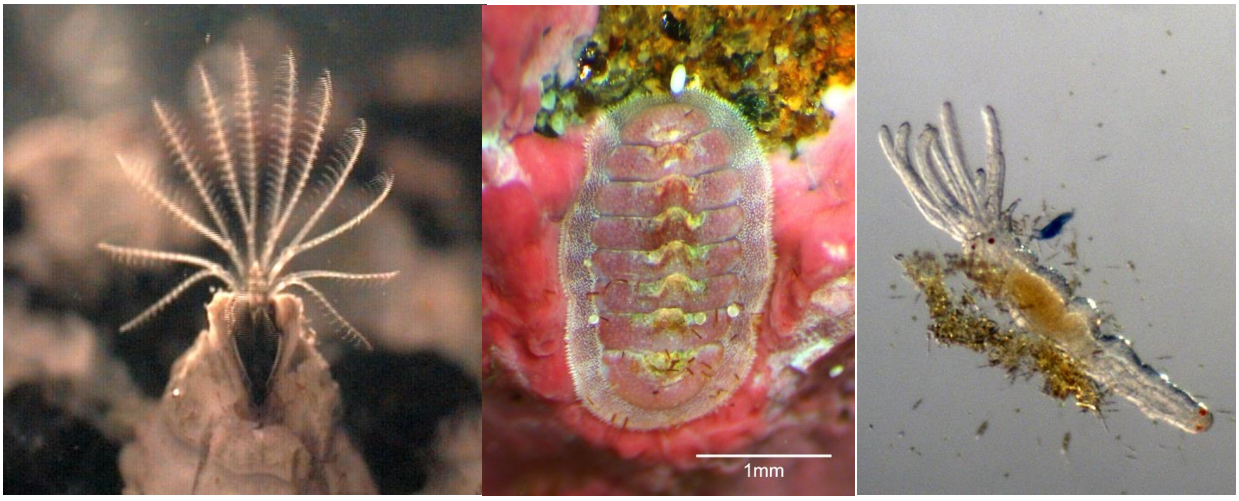
Studies of invertebrate larvae or newly metamorphosed juveniles

In my laboratory we study how larvae work (as feeding and swimming machines) and we study how the tiny juveniles (that resemble adults forms) work soon after metamorphosis. It's important to understand how young animals work so we can then study how changes in the environment might impact their every-day requirements.

What does it mean to be small?
The offspring of marine invertebrates are tiny and most of them live as plankton for short (hours) or longer periods (weeks) before they settle and metamorphose into the forms most people know as sea stars, crabs, clams, worms, etc. The shapes of larvae can be very different due to the functional requirements of living (for feeding on algal cells or other larvae and for swimming) in the water column (instead of on the sea floor) AND because of the minute size of their early life stages.

Following settlement and metamorphosis, post-larval benthic marine invertebrates begin life in their new habitat as tiny juveniles with a body plan very similar to the adult. Surviving juveniles may increase in size (length or mass) from 10 to 1000 times. A common assumption is that ecology of juvenile invertebrates is like that of adults, but their small size alters virtually every environmental interaction from feeding to predators to physical stresses. REU interns in my laboratory will explore very basic ecology and natural history and collect information that is essentially non-existent for juvenile stages of most organisms. General areas (bolded) to explore along with targeting questions (low case letters) follow:

Projects might examine how the feeding biology of small juveniles – like
a) suspension feeding in barnacles, young polychaete worms, or bivalves,
b) rasping by chitons, and sea urchins
c) using claws to feed by young crabs.



A juvenile barnacle, a juvenile chiton and a juvenile feather duster worm

Projects might examine predation on newly metamorphosed juveniles –
d) Who eats these tiny juveniles? Do they have a different set of predators such as flatworms, omnivorous crustaceans, polychaetes, "herbivorous" snails?
e) How do these predators capture prey, how does the prey respond?

A newly metamorphosed bryozoan colony with defensive spines (left) and a sand dollar juvenile

Effects of environmental change – projects could examine temperature/desiccation tolerance of larvae and juveniles. In times of climate change knowing how changes in temperature impact growth and survival or impact food intake could help reveal us predict increased vulnerability of these crucial early life stages.

f) Many of these tiny juveniles become intertidal adults. How do intertidal barnacles survive? How much water can they loose and survive? What is their temperature tolerance. Does it differ from larval stages? How does the settlement surface (its roughness, color, etc) impact survival?

A barnacle cyprid larva next to a newly metamorphosed juvenile

Considerations:
None of these questions or organisms come with instructions on how to study or answer them. A big part of this work will be to specify the question(s), the observations, and the experimental manipulations in order to **evaluate juvenile biology and performance**.

The very small size of both larvae and juvenile marine invertebrates means **you have to be willing to use microscopes** to see anatomical features, to count individuals, and carry out most studies. (My laboratory has good microscopes and cameras for making images or movies of what you see).