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Aquatic Robotics

Source: Wendy Kaveney, CC by SA

Personal photo

When crabs molt, they're left without the structural support of their exoskeleton. It ought to leave their muscles without anything to pull against. Instead, the crab creates a hydrostatic skeleton - a way to transmit muscle force using incompressible fluid. The crab, when molting, has a unique problem it doesn't otherwise experience, and this solution is incredible!

I find this particularly fascinating because I'm a biomechanist. Someday, I will get a PhD in biomechanics, but for now, I'm in my third year working on a sea star locomotion research project. Why sea star locomotion? Everyone asks, and, in general, the answer (beyond "sea stars are really freaking cool") is to improve underwater robotics. My research will, ideally, contribute to a bioinspired design project. But such a robot would not be limited to being inspired by only *one* organism. That would be so limiting!

Sea stars use hydraulic pressure to move, but in a different way than these crabs. My present research on the sea star gait could combine with research on how these crabs maintain structure when molting to create a robot that would be able to transition form. It could use a crab-inspired hydrostatic skeleton to change shape and stiffness as the situation requires, and use the efficiencies of sea star motion to travel effectively!

Sources:

Taylor, J. R., & Kier, W. M. (2003). Switching skeletons: hydrostatic support in molting crabs. *Science*, 301(5630), 209-210. Found via https://asknature.org/strategy/fluid-pressure-provides-support/