Department of Engineering
Seminar Program
Wednesday, Feb 15, 2017
Shanahan Teaching and Learning Center
Lecture Hall 1430, 4:15pm

"Bioinspired Propulsion for Water Exit: Strategies from the Archer Fish"

Leah Mendelson

Summary:

With the increasing popularity of small, power-dense autonomous vehicles, it is becoming more feasible for a well-designed vehicle to travel in both air and water. An efficient, easy to actuate, and noninvasive water-to-air takeoff is necessary for these vehicles to be useable in oceanographic and rescue scenarios. Swimming organisms ranging in size from plankton to large marine mammals present us with numerous possible solutions to this water-exit problem. Archer fish, best known for their ability to spit jets of water at aerial prey, also jump multiple body-lengths out of the water to feed. Their remarkable accuracy is facilitated by jumping from a stationary position directly below the water's surface. Rapid acceleration to a ballistic velocity sufficient for reaching the target occurs with a mere body-length to travel before the fish leaves the water completely and experiences a thousandfold drop in force producing ability.

In this seminar, I will discuss my use of high-speed imaging and particle image velocimetry (an experimental technique to measure fluid velocity fields by filming the motion of tracer particles) to study jumping hydrodynamics using live archer fish. In particular, I introduce a three-dimensional measurement system to simultaneously measure water flow fields around the fish, individual fin movement patterns, and the fish's aerial trajectory. These measurements highlight strategies for stable, spatially-constrained acceleration including the use of multiple fins to simultaneously produce thrust and modulation of body and tail motion while the fish breaks the water's surface. Finally, I survey opportunities for undergraduate research exploring the engineering applications of these behaviors.

Bio:

Leah Mendelson is a Ph.D. candidate in mechanical engineering at the Massachusetts Institute of Technology. Leah earned a B.S. in mechanical engineering from Olin College in 2011 and a M.S. in mechanical engineering from MIT in 2013. Her research interests include biological fluid dynamics, their bioinspired engineering applications, and the development of imaging systems for both experimental research and classroom use. An avid swimmer, Leah has been known to throw on a pair of flippers and try (unsuccessfully) to emulate her research subjects.

There will not be a dinner with the speaker this week.