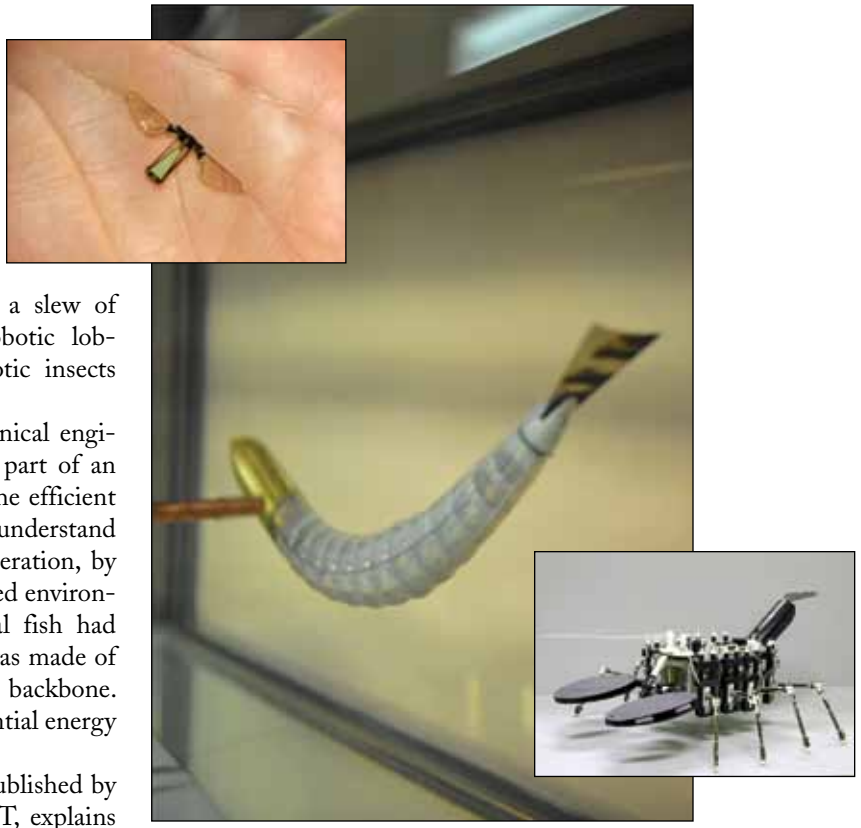
When (Robotic) Animals Rule The Earth …

Flip through the pages of *Wired* or *Popular Science* and you're sure to find an article or two about robots. Not so much the kind that shoot lasers from their eyes, but the compact, programmable taskmasters engineered to take on dangerous functions such as clearing land mines, inspecting nuclear reactors or trolling around Mars.

Furthermore, you'll find scientists and engineers "creating" micro-robotic creatures for a slew of fascinating research projects. These include robotic lobsters (Northeastern University), free-flying robotic insects (Harvard University) and mechanical fish.



Robotic insects, fish and lobsters are just a few of the micro-robotic creatures you'll find on college campuses.

Yahya Modarres-Sadeghi, professor of mechanical engineering at the University of Massachusetts, was part of an MIT team that developed such a fish to mimic the efficient start time of a pike. "The main purpose was to understand the basic physics behind a pike's very high acceleration, by emulating their fast-start mechanism in a controlled environment," says Modarres-Sadeghi. "Our mechanical fish had three parts: a head, a body and a tail. The body was made of a soft rubber material cast around a spring steel backbone. When bent to a C-shape, the body stores the potential energy which is necessary for the fast start."

An article in *Bioinspiration and Biomimetics*, published by Modarres-Sadeghi and four colleagues from MIT, explains the concept in detail: "The system consists of a thin metal beam covered by a urethane rubber, the fish body and an appropriately shaped tail. The body form of the mechanical fish was modeled after a pike species and selected because it is a widely-studied fast-start specialist. The mechanical fish was held in curvature and hung in water by two restraining lines, which were simultaneously released by a pneumatic cutting mechanism. The potential energy in the beam was transferred into the fluid, thereby accelerating the fish."

Modarres-Sadeghi says the maximum acceleration of the mechanical fish is around 40 m/s^2, with the maximum final velocity around 1.2 m/s (acceleration just over four g underwater, fast and furious for those playing the home game).

"By using our mechanical fish we can understand the fundamentals of fast-start, which can be used when designing future autonomous underwater vehicles," Modarres-Sadeghi says. "Also, with the help of biologists, we can relate these fundamental understandings to the evolutionary changes of the live fish."

Today, Modarres-Sadeghi and his colleagues are designing a new mechanical fish concept using internal machinery instead of an external actuator and clamping mechanism. Currently in the design phase at the University of Massachusetts in Amherst, the project aims to place servomotors close to the head with pull strings attached to the tail through the body.

"We have built a preliminary version of this fish, and currently we are testing it to finalize our design," Modarres-Sadeghi says. "We will use this new fish to study various methods of achieving high accelerations."

Although the mechanical fish will probably never shoot lasers from its eyes (fingers crossed!), it's a safe bet scientists will continue to identify areas where robotic engineering can enhance productivity in everyday life.

For more information on this and other mechanical engineering projects, visit *http://mielsvr1.ecs.umass.edu/fsi/index.htm*.