

Microfabricated Biomimetic Sensors: Artificial Haircell and Artificial Lateral Line

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My research group is currently focused on developing sensors with functions and/or structures based on inspiration from biology. Biology offers exquisite examples of sensors and sensory intelligence. These have been the subjects of observation by biologists for hundreds of years. With the advent of micro and nanotechnology, it now becomes possible to build engineering-equivalent of biological sensors, mimicking functions and/or structures in order to enhance the performance of engineering sensors and reduce their costs.

For example, our group is developing artificial haircell sensors that mimic the haircell sensor, widely found in many animals and perform a large variety of functions. Haircell is responsible for human hearing, flow sensing of fish and other animals, vibration sensing, to name a few. Biologically hairs are extremely sensitive even though they are very simple and made entirely of organic substances. Artificial haircell sensors are being developed as modular building blocks of sensors for flow, vibration, touch, and acoustic vibration. Further, we build arrays of artificial haircells, such as artificial lateral line that mimics the functions of lateral line flow sensing organ of fish. The lateral line organ is a primary sensing of millions of fish to detect hydrodynamic disturbances and to interpret its surroundings. The lateral line organ is responsible for such fish behaviors as obstacle avoidance, schooling, and prey/predator localization. We are building artificial lateral line sensors that will enable underwater and surface vehicles to gain a completely new mode of sensing and enhance their maneuverability, stability, and security.

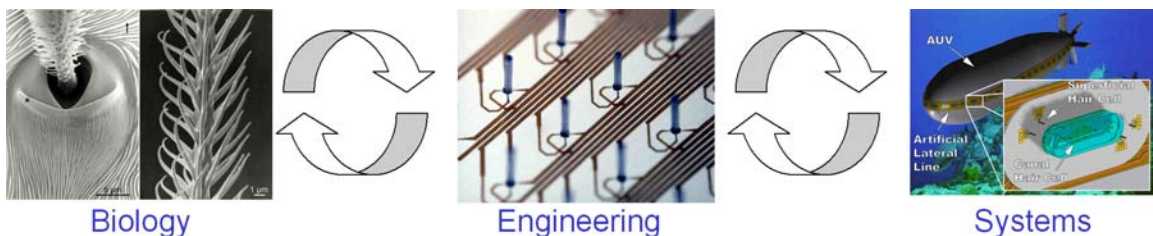


Figure 1: Pictures of biological haircells on spider legs for flow sensing. Polymer based artificial haircell sensors. Future submarines may be decorated with artificial lateral line to enhance its underwater flow awareness.

Broadly speaking, developing engineering sensors and systems under biological inspiration is extremely exciting and productive research. Biological systems, honed over millions of years, provide many amazing and ready inspirations of both structures and functions, along with exciting new challenges and opportunities. On the hand other, engineering pursuits will accelerate the pace of biological discovery and direct them in specific areas that may have been ignored in the past.

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