Ian Hunter: Innovator Actuator

Professor Ian Hunter has high standards for his students. Of the six areas of knowledge required for his Bioinstrumentation Lab - biology, optics, mechanics, mathematics, electronics, and chemistry (which he dubs BOMMEC) - he expects his students to be proficient in at least three. Hunter seeks, in his own words, "Renaissance types who are broadly trained and can march across disciplines to find solutions."

While he prefers his work to stand as his biography, Hunter's background does help to explain his high standards. He published his first paper, for an Australian and New Zealand electronics journal, at age 10. He built his first scientific instrument, a gas chromatograph, when he was 14. Hunter has founded or co-founded 10 companies, and his dream is no less ambitious than to build artificial life forms.

"I am passionate about two things," he says. "Building things and teaching. One thing I insist on is no technicians. Students have to build and test things, combining theory and practice, for themselves. I believe that working with one's hands lubricates the brain."

Building blocks

While Hunter concedes that the development of an artificial life form is a long way off, the building blocks exist today. "Using conductive polymers rather than proteins, which is how nature builds life forms, we can create the subsystems that can be co-fabricated together," according to Hunter. "We have actuators to mimic muscles, sensors to serve as eyes and ears, methods of storing and delivering energy, structural materials to act as bones and skin, and computational devices to provide the reasoning. That's much of what we need to build intelligent systems."

Hunter is no Victor von Frankenstein, however. His vision is that such research can lead to a huge range of applications, such as devices that can move around bodies acting as health status sentinels (which can intervene as necessary), artificial muscles that help damaged limbs and organs to continue functioning, and robotic "critters" that can perform a number of useful tasks.

Bioinstrumentation Lab

Hunter's lab has two areas of focus: designing and constructing novel instruments for medical and scientific applications; and designing novel materials for biomimetic applications. The lab is fully stocked with advanced machining and testing tools so students can make real the ideas they have on paper.

Instruments can be for dispensing medical care or for conducting research. One example is a needle-free drug injector, which is currently being refined for an Australian company that wants to take it to market. Resembling an electric toothbrush in size and shape, it uses a combination of extremely concentrated pressure and very high velocity to shoot a drug through the skin without having to puncture the skin with a needle. While the injector has yet to be tested on humans, animal subjects evidenced no pain.

An example of novel materials is an artificial pectoral fin on behalf of the Office for Naval Research. The project team is studying the hydrodynamic properties of pectoral fins that enable fish to maneuver so efficiently and effectively. Using conductive polymers as actuators, the team is engineering a robotic fin that operates just like the fins of a sunfish. The robotic fins could influence construction of undersea vehicles that have increased steering control and locomotion.

New techs for teaching

Hunter's passion for teaching leads him to create new technologies for teaching his students in the lab. Some of those innovations he hopes eventually to roll out to high schools. "Students seem to respond best to activities that interest them," says Hunter. "At the same time, students tend to be more enthusiastic about learning when they are able to measure things themselves, as opposed to being given data to memorize."

Hunter's proposed solution would be a set of wireless sensors that would enable students to measure physical properties on their own. For example, a skier could measure the trajectory of a ski jump, a dancer could measure the velocity of pirouette rotations, a soccer player could measure the force of a kick, and so on.

Hunter's gifts, then, are not only his own ability to conceive and construct innovative solutions to important problems - but also his interest in and ability to inspire students to use their hands, engage their minds, and apply the full breadth of what they know and what they've learned to invent something useful and new.

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