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In this issue

2 Robots and the rest of us
Robots may be all machine, but they take many of their design cues from familiar biological models, demonstrates Emil Petriu.
by Tim Lougheed

4 At the curious interface of art and cell research
The playfully inquisitive Andrew Pelling is breaking ground on how mechanical forces help forecast the fate of living cells.
by Tony Martins

6 Discrimination shouldn't run in the family
Genetic discrimination could be the newest threat to human rights. Errol Mendes wants Canada to adopt new rules for genetic testing.
by Matthew Bonsall

8 Proceed with caution: Why technology should undergo in-depth analysis
In the quest for more sophisticated technology, Rocci Luppicini argues that without forethought, we're ultimately risking the future of the planet—and humanity itself.
by Dana Yates

10 Under the hood of DNA
What drives genes to do what they do? Mads Kaern is using synthetic biology to look "under the hood" of gene expression—and to open the door to revolutionary new medical treatments.
by Harold Eastman

12 More human than human: Preparing for a post-human future
On the threshold of advances in genetics, neurotechnology and robotics that promise fundamental changes to us, Marc Saner believes that the clouds of a perfect storm between science and humanity's future are forming on the horizon.
by Sean Rushton

14 The progress isn't over until the paperwork is done
We may look forward to implants that can alter the standards of human performance, but Ian Kerr warns that these innovations could impose ethical and social costs.
by Tim Lougheed

16 Separating science fiction from fact in nanotechnology's future
Nanotechnology's promise is in danger of being hijacked by hype. José López uses science-fiction metaphors to deliver a reality check.
by Matthew Bonsall

18 The hip: An essential articulation
Isabelle Catelas aims to develop new approaches to extend the lifespan of joint implants and facilitate bone regeneration.
by Martine Batanian

20 Who do we think we are?
Georg Northoff's international team takes a comprehensive approach to unravelling the mysteries of the self.
by Tony Martins

22 The China Challenge
University of Ottawa Press

Robots

and the rest of us

by Tim Lougheed

Just as we now spend a large part of our lives interacting with electronic equipment that helps us communicate with one another, we will soon be interacting with robots and learning how to communicate with them.

If Lewis Carroll had been more mechanically inclined, *Alice in Wonderland* would likely have resembled a trip through **Emil Petriu**'s laboratory in the University's School of Electrical Engineering and Computer Science. All around the lab are scattered the carcasses of automated wheelchairs, vacuum cleaners and lawnmowers, along with the skeletons of would-be humanoid robots.

Meanwhile, Petriu eagerly shows off one of his latest purchases, which is far from high-tech. He holds an anatomically correct model of a human skull, complete with a spring-loaded jaw that authentically replicates the movement of the lower face.

This feature is what appeals to him as he plans to mount a set of actuators on various parts of the skull surface, which will then be covered with an elastic skin. The goal is a mechanical yet highly lifelike face, capable of representing human expressions ranging from surprise to anger.

Petriu and his colleagues are at the forefront of an emerging society that will be populated not just by people, but also by machines—and combinations of both. They are hard at work designing some of the fundamental mechatronics elements that will usher in this development, such as intricate prosthetic limbs and sensors that can convey large amounts of information through a sense of touch.

"We are using biology as our source of inspiration, noting that human beings are most comfortable interacting with devices that move and respond the same way we do," the professor says. Nevertheless, Petriu sets aside the worst fears of science-fiction writers, insisting that we will always be able to tell even the most lifelike robots from human beings. Nor does he even believe that robots need to look like human beings. Instead, they must be user-friendly in some important ways.

For instance, a prosthetic hand may be able to replicate all the functions of the original, but if it feels cold, it will never seem like an adequate replacement. Petriu suggests that it would be relatively simple to warm up the surface of the prosthesis to match our skin temperature, and so make it feel more like a part of the body.

A similar consideration will apply for the robots that are expected to be put into service for nursing or home-care assistance. If a robot has to come into physical contact with a person, the interaction will be much more comfortable if their "skin" is warm to our touch.

Petriu makes a similar case about providing a robot with a detailed face, regardless of how little the rest of the machine might resemble a person. He cites no less an authority than Charles Darwin as one of the first scientists to identify the primary value of facial expression for interpersonal communication. A field that later created a formal coding system to link various expressions with particular combinations of muscles. This same system provides the basis for programming the movements of the artificial skin over Petriu's newly acquired test skull, so that the resulting expressions strike us as familiar and authentic.

Petriu considers this step a major leap toward incorporating robots into networking technologies that are shaping how we socialize. "Our society is becoming more and more disconnected," he suggests, pointing to a new generation of individuals who spend much of their time socializing without actually being in the presence of other people. If those individuals find that they miss the physical companionship of others, the presence of a robot could meet this need—without any of the complications of a typical human relationship. "We are, after all, still social beings," Petriu observes.

In fact, Petriu believes, this relationship may ultimately become a symbiotic one—with robots acquiring new human-like capabilities, even as we obtain new services from them. Such an idea may seem surprising, or even disturbing, for those of us who still inhabit a largely robot-free social sphere, but from Petriu's cyborg-society vantage point, it makes perfect sense.

"You can do this work theoretically, but you get a different perspective," he says. "We have real things here, real problems. In trying to solve them, you wind up making real contributions." RP

"we are using biology as our source of inspiration."

– emil petriu