

## Technology becomes us

Elizabeth Casey/For the Times-Standard

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Admit it: Blurring the line between computers and humans causes a shiver to slip down your spine. It's a little weird to think that mankind might one day resemble The Borg from the popular Star Trek series. But with the advent of new technology to address some of man's greatest challenges, from artificial limbs to pacemakers, and despite the discomfort this might cause, we're headed there.

Granted, it's an understatement to say that if parts of human beings become machines, it will change what it means to be human and in ways few of us can fathom completely. But is this necessarily a bad thing? The work being done in biophysics labs across the world has noble aims: Help mankind fight diseases. Help people live healthier and longer lives. Help babies worldwide make it past the age of five.

Take for instance the fact that we, (as in, very bright people with lots of letters after their names) in fully equipped labs, are trying to figure out how to make cells of the human body into transistors--the "on and off switches" that conduct microscopically small voltages (or not), depending on their Boolean state of either a one or a zero, and which make the circuits of every electrical device work. Yep, those things. Scientists want to make transistors out of cells so that cells can be directed, perform added functions, and ultimately behave better, maybe even heal themselves.

Yes, this is the new technology. Technology that's designed to do what conventional medicine can't. Technology fused with our biology. Future applications could include teaching healthy cells how to attack intruder cancer cells without damaging the host. Or using single-cell, self-powered bots to traverse a person's insides, diagnose disease, and send high-resolution photos back to a surgeon at a computer. The basis behind much of the biophysics work being done is to answer a common dilemma, to find a way to un-write the ravages of diseases, to serve man.

Physicist Ranjit Pati, in an article on ScienceDaily.com, is said to be exploring how to turn molecules into transistors. The problem with conventional silicon transistors and the way they are currently fabricated is that you can only fit so many of them into such a tiny space. A computer chip is roughly the size of a postage stamp and in a 90 nanometer design, contains around 125 million transistors. There is only so much space available. And the smaller you go, the more problems result.

But Pati “developed a computer model of an organometallic molecule firmly bound between two gold electrodes.” When current was applied to the model, everything behaved normally up to 142 microamps, but when he applied higher voltages, something strange happened. The voltage suddenly dropped in a phenomenon known as negative differential resistance. The pattern of the electrons spinning around the nucleus, once in an orderly fashion, degraded, and the electrons were “forced into a different equilibrium, a process known as 'quantum phase transition.’”

The molecule demonstrated two phases. The article asks, “Why is this important? A molecule that can exhibit two different phases when subjected to electric fields has promise as a switch: one phase is the “zero” and the other the “one,” which form the foundation of digital electronics.”

So the molecule is behaving like a transistor. And, if Pati's real-world experiments are successful, he'll have invented a chip with more than a trillion transistors.

Consider the work being done by the biomedical engineer William Craelius, who has invented an artificial hand that uses existing nerve pathways to manipulate “individual computer-driven mechanical fingers.” As a firm believer in and inventor of bionic technologies, he feels that with transistor sizes dropping regularly, electrical devices can be made much smaller. So small, in fact, they can reside in the body. So with an arm replacement, the communication signals required between the brain and existing nerves could be coordinated by a small device, perhaps injected under the skin. This is the direction in which the technology is heading.

Whatever way we each feel about the union of man with machine, it's clear that we're heading toward a much more intimate relationship with our technology than many of us imagined. Although much good can come from these emerging technologies, they do cause discomfort for many people. It's weird to think that we could be part machine someday. But despite the challenges we'll face with re-

addressing what it means to be human, if and when we merge with machines, the positives will hopefully eclipse the negatives.

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