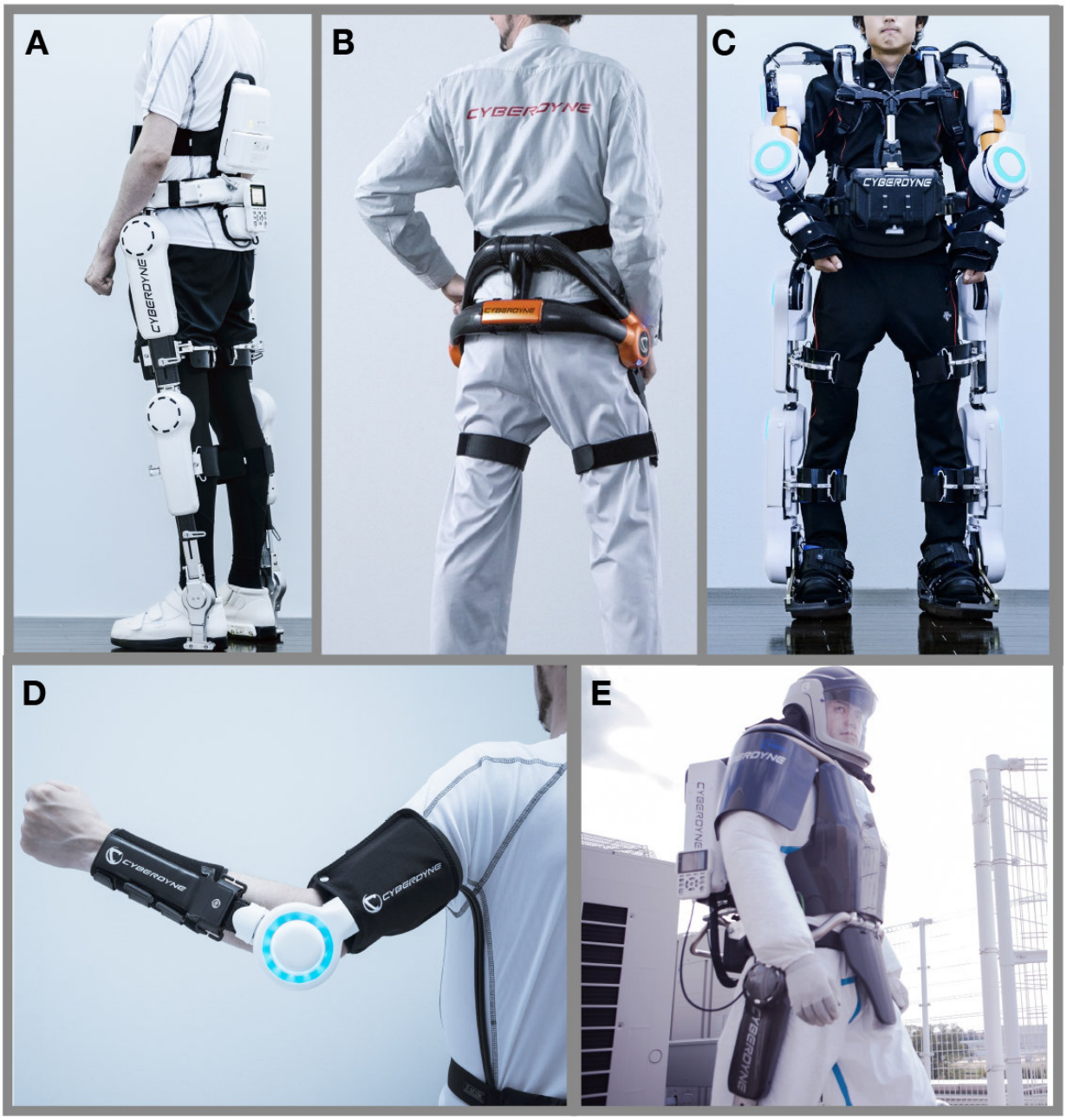
Researchers suggest exoskeletal technology has evolved to embrace the spirit of exoskeletons in science fiction

April 26 2018, by Bob Yirka



CYBERDYNE's new brain-controlled exoskeletal technology, called Medical HAL (Hybrid voluntary and autonomous control Assistive Limb) Credit: Sankai and Sakurai, *Sci. Robot*. 3, eaat3912 (2018)

A pair of researchers affiliated with the University of Tsukuba and

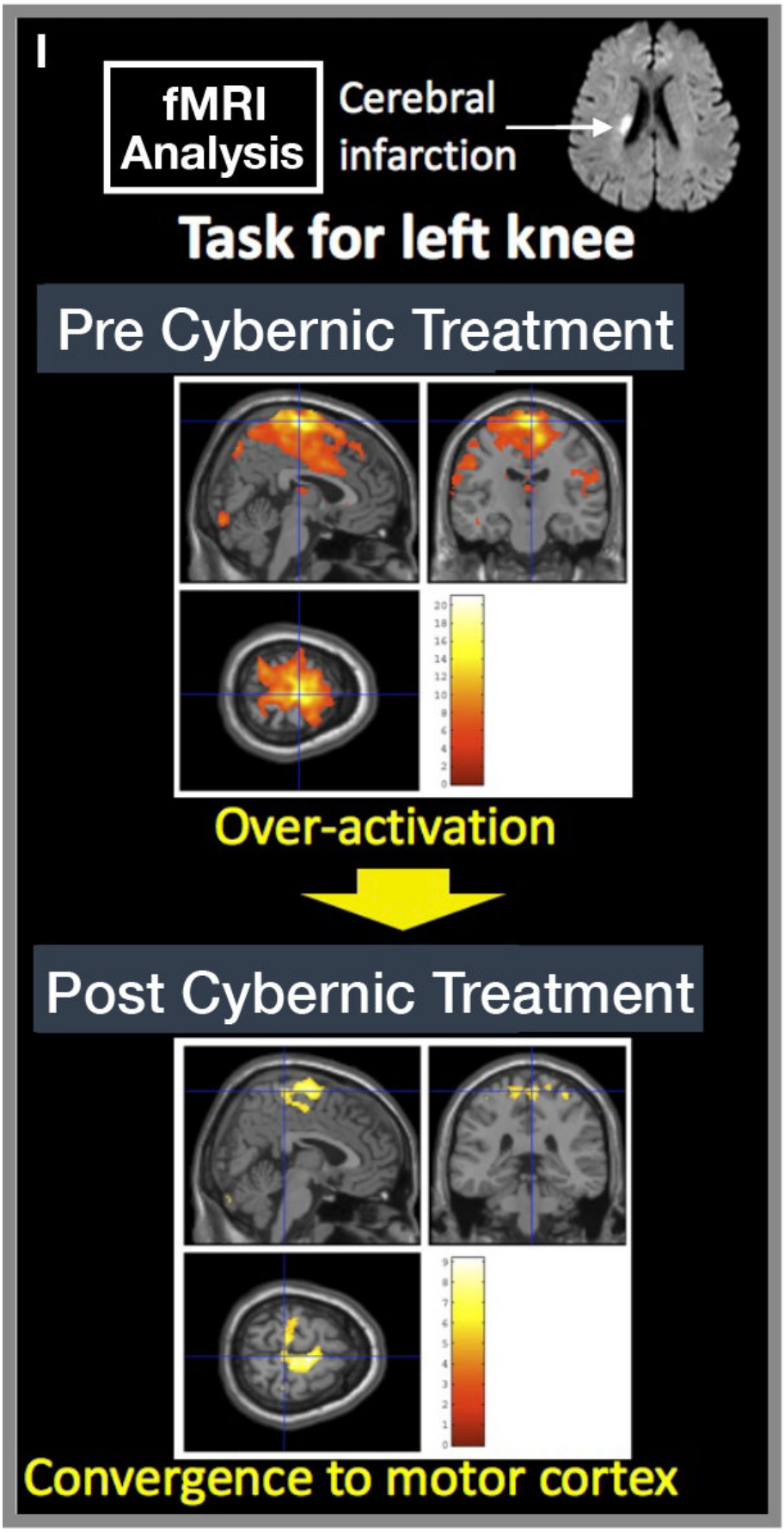
Cyberdyne are suggesting exoskeletal technology has evolved to complement science fiction. In their paper published in the journal *Science Robotics*, Yoshiyuki Sankai and Takeru Sakurai offer a Focus piece outlining the current state of exoskeletal research.

Exoskeletons, like those used by characters in movies like Pacific Rim, have become popular in modern science fiction—they are typically used to extend the abilities of able-bodied people. But, Sankai and Sakurai argue, real-world implementations have actually progressed beyond what most people realize. There is one major difference, however. In real life, exoskeletal technology is much more focused on assisting those with spinal or brain injuries—the goal is to restore some or all of the mobility users have lost.

The researchers highlight what they call hybrid voluntary and autonomous control assistive limbs, or more easily, Medical HAL. Such technology, they contend, actually surpasses some of the features seen in the movies. Real-world exoskeletons, for example, are generally outfitted with sensors that pick up neurological signals—they are controlled by the brain, rather than the hands or feet. Such exoskeletons, they further note, are part of a new wave of technology called cybernics, which fuses robotic systems and human functional abilities. One important difference, they note, between Medical HAL and sci-fi exoskeletons is size. In real life, researchers try hard to minimize size to make exoskeletons less noticeable and intrusive. They also add features such as gravity mitigation techniques, because people with spinal or brain injuries generally have limited muscle mass. Also, they note, one very important feature of Medical HAL is the ability to personalize a given exoskeleton to the person who will be using it.

Medical HAL. Credit: Prof. Sankai, Universityof Tsukuba / CYBERDYNE Inc.

Sankai and Sakurai note also that Medical HAL offers additional assistance to users by providing a new form of physical therapy. One medical trial, they note, found that 75 percent of patients tested showed improvements in walking ability after using an exoskeleton. Another trial found that patients with a progressive muscular disease saw an increase in the number of steps they were able to take.


I
fMRI Analysis
Cerebral infarction
Task for left knee
Pre Cybernic Treatment
Over-activation
Post Cybernic Treatment
Convergence to motor cortex

Differences in the active areas of the brain of a person with cerebral infarction before and after use of HAL's cybernics system. Credit: Sankai and Sakurai, *Sci. Robot.* 3, eaat3912 (2018)

More information: Yoshiyuki Sankai et al. Exoskeletal cyborg-type robot, *Science Robotics* (2018). DOI: 10.1126/scirobotics.aat3912

Abstract
The scope of research on exoskeletal cyborg-type robots has progressed far beyond mechanisms for maneuvering piloted mecha as imagined by science fiction, and cybernics—the fusion of humans, robots, and information systems—is shaping the way toward novel methods of medical care.