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Yesterday's Science Fiction—Today's Medical Breakthrough

Most Sci-Fi movies have at least one robot that has physical limbs that can perform complex physical tasks with human-like dexterity. Perhaps the most famous and complex artificial being was played by Arnold Schwarzenegger in the 1984 movie *The Terminator*. The human-looking robot that Schwarzenegger played in the movie had a full metal prosthetic structure, a supercomputer brain, artificial flesh, and a sensory sensitive outer skin. It also had an unshakable vent on killing anyone that stood in the way of it completing its mission. I am reasonably certain that the artificial human in this movie will remain fiction for at least the foreseeable future.

The movie prop that was attached to Luke Skywalker's body, after his arm was cut off by Darth Vader in the Star Wars movie *The Empire Strikes Back*, was pure fiction when that movie was released back in 1980. What was once bioengineering fiction is today's medical breakthrough. The DEKA Luke Arm (Photo 1) is FDA (U.S. Food and Drug Administration) approved. What makes this prosthetic so amazing is that its physical movements are controlled by its wearer's mind, just like Luke Skywalker's in the movie.

What was pure fiction 35 years ago now exists. A person wearing this prosthetic can mentally tell his lower arm, wrist, hand, and fingers where to move and what to grip and pick up. The arm might look heavy but it's actually about the same weight as the arm it is designed to functionally mimic.

Not only can it pick up an easy-to-crush piece of fruit, it can also handle heavy tasks like operating power tools. With it a wearer can also perform complex movements that include the light touch needed to pick up a key and then go straight

on to a movement that demands more pressure like unlocking a door. In each situation the wearer is able to control exactly how much force the fingers are applying to accomplish the task without crushing what it needs to hold.

So how did the scientists and



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The DEKA Luke Arm's movements are controlled by its wearer's mind.

technologists at DEKA engage a person's mind to control the Luke arm? As long as there have been amputations doctors have dealt with a phenomenon called the phantom limb syndrome. Here many amputees feel like they are able to move a limb that no longer exists. This happens because the brains of amputees are still transmitting electrical signals in the direction of the missing limb. They are also receiving some phantom sensory feedback from the limb such as an itch that is impossible to scratch.

To control the Luke arm, EMG (electromyogram) electrodes are placed on the wearer's arm above the point of amputation. These EMG sensors pick up the electrical signals that the brain is trying to send to the phantom arm, then these signals are interpreted by the Luke arm's computer and passed along to all

the appropriate motorized joints in the arm, wrist, hand, and fingers to accomplish the tasks the person's brain is requesting.

At this point in time these sensors, which are the mind control part of the system, are not able to transmit all the needed information to control every action. So the scientists and technologists at DEKA had to include a number of wireless switches that are controlled by the movement of the amputee's feet. It is reasonable to expect future generations of this technology will soon control every phase of movement using only the wearer's mind.

The development of the Luke arm was funded by DARPA (U.S. Defense Advanced Research Projects Agency). It was built by DEKA (Dean Kamen), a research and development corporation that was founded in 1982 by Dean Kamen, the inventor of the Segway electric scooter. You can

learn more about DEKA online at: www.dekaresearch.com

Researching the Facts

Across the continuum of technology (examples: submarines, weapons, cellphones), so many things we take for granted today existed first in the mind of a science fiction writer:

1. Your mission, if your teacher assigns it, is to identify new and old technology that first appeared in comics, books, or movies years before it existed in the real world.

2. Can you write science fiction? Select one of the items identified in question 1 and describe how you feel it will change in the next 50 years. ©

Alan Pierce, Ed.D., CSIT, is a technology education consultant. Visit www.technologytoday.us for past columns and teacher resources.