**THE FUTURE OF ROBOTICS**

**RISER**

**A FULLY IMMERSIVE REHAB ROBOT**

**BIRTHPLACE:** University of British Columbia  
**OCCUPATION:** Rehabilitation  
**WHY WE NEED IT:** Today's physical-therapy equipment for balance requires stroke victims to have enough strength to stand on their own, but that puts them at risk of more falls and injuries.

**HOW IT WORKS:** The Riser (Robot for Interactive Sensory Experiences and Rehabilitation) is the only rehab system that can simulate a wide range of unstable situations while fully supporting a patient's body weight to help them regain their sense of balance after a stroke. Supported by a back brace, a patient stands on a Wii-board-like platform that can move in six directions. Virtual reality goggles work in sync with the platform to guide users through different simulated activities, such as riding up an escalator or washing dishes. Patients can gradually attempt more challenging balancing acts to speed up their recovery.

The platform is also a powerful research tool in the quest to better understand the neurobiology of balance. When a patient stands on the platform and experiences a recording of his previous head-electrode activity to his scalp, the scientists observe how different brain regions are responding to the experience.

**ON THE JOB BY:** 2015

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**RAVEN 2**

**A ROBOTIC SURGEON THAT DOES THE WORK OF TWO DOCTORS**

**BIRTHPLACE:** University of Washington and University of California at Santa Cruz  
**OCCUPATION:** Remote controlled surgeon

**WHY WE NEED IT:** Wounded soldiers, disaster victims and people who live in rural areas are rarely within reach of top-notch surgeons and medical centers. An inventor, Jacob Rosen, puts it this way: "There is a doctor who's done the surgery once in his lifetime standing next to you, or an expert halfway around the world. Who do you choose?"

**HOW IT WORKS:** The Raven surgical system is the first to allow two surgeons to remotely operate together on a patient. One surgeon could sit at a console in, say, Los Angeles, watching on a computer screen as the robotic arm he's manipulating with a joystick deftly slices into a patient lying on an operating table in North Dakota. Meanwhile, another surgeon at a console in New York wields the second set of robot arms. Rosen, a computer engineer at the University of California at Santa Cruz, designed software that allows surgeons to seamlessly operate the four arms without colliding them.

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**CARDIOARM**

**THE SLINKEST SURGICAL TOOL**

**BIRTHPLACE:** Cardiobotics and Carnegie Mellon University  
**OCCUPATION:** Surgical assistant: conducts minimally invasive heart surgery

**WHY WE NEED IT:** Heart surgery means slicing the chest, breaking the sternum, and spaying the ribs; recovery can take months.

**HOW IT WORKS:** Carnegie Mellon University engineer Howie Choset's snake-shaped surgeon is only a centimeter long and weighs less than three ounces, yet it's packed with motors and joints that give it 102 degrees of freedom, letting it deftly wrap itself around organs and work through intestines, bronchial tubes and other pathways used during endoscopic surgery. Its unprecedented flexibility, along with a tiny camera head, makes it easy to slice remotely using a joystick. "Make a quarter-inch turn one way, move an inch, make a quarter-inch turn another way, and boom—you're behind the heart," says Choset, the co-founder of Cardiobotics, Inc. In February the robot performed a diagnostic procedure on a patient who otherwise would have required a surgeon to split her breastbone, which would have taken months onto recovery.

**ON THE JOB BY:** 2012

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**TAIZO**

**THE RICHARD SIMMONS OF ROBOTS**

**BIRTHPLACE:** National Institute of Advanced Industrial Science and Technology, Japan  
**OCCUPATION:** Workout instructor

**WHY WE NEED IT:** Exercise can help senior citizens live longer, healthier lives, but their growing ranks will soon outnumber qualified fitness instructors.

**HOW IT WORKS:** This two-foot-tall robot looks more like a miniature snowman than a personal trainer but in 15 minutes can make a sweat as flexible as a yoga mat. Taizo helps lead simple exercise classes in Japan, mostly from a chair for the convenience of its seated students. Among its repertoire of 30 exercises, Taizo can stretch his arms wide and bend down to touch his toes. And although the robot is in great shape, it's not limitless—after two straight hours of exercise, its batteries need recharging. Special motion allows the little guy to perform slow, methodical motions that are easy to imitate and help followers avoid muscle strain. Futurist designer General Robotics began selling the robot's $10,000 frame to scientists for research.

**ON THE JOB BY:** Next year