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RADAR

Artificial Strongman

Plastic muscles may be the key to the factories of the future.

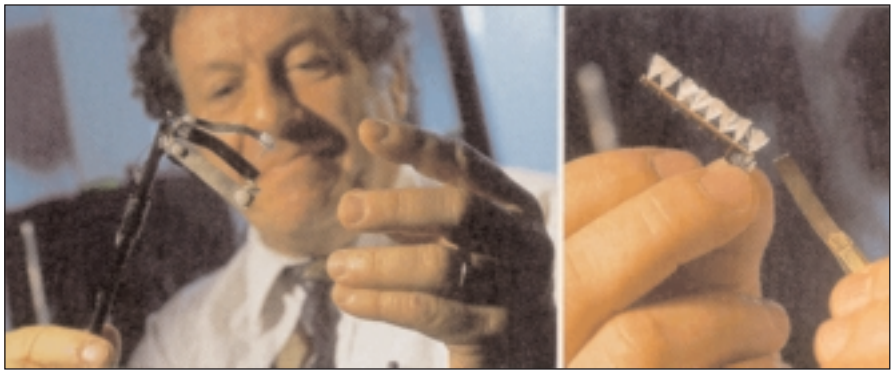
BY SHELBY G. SPIRES

They're not just a relic of the smokestack generation. Next- generation plastics are powering everything from home stereo components to artificial limbs.

Electroactive polymers (EAPs) use a layered matrix of carbon and plastics to mimic human muscle. Ron Pelrine of SRI International and Yoseph Bar-Cohen of the Jet Propulsion Laboratory are developing the emerging technology. In a process similar to the workings of human muscles, EAPs can expand and contract with electrical current; this movement, in turn, can move mechanical arms and legs, and close robotic hands. The artificial muscle is already more than just a lab experiment. NASA has chosen it to play a minor role in space exploration with the launch of an asteroid probe in 2002. Plastic muscles will work as wipers on the Mu Space Engineering nanorover's camera.

Outer space isn't the only place plastics will produce benefits. The JPL and SRI researchers are working to make the three-layered plastic goo into something more beneficial to this planet. The plastic matrix could be embedded in shoes or other clothing to use the movement of the body for generating power. Your motion would create electrical current. This current could power cell phones, PDAs, or next-generation technology.

Because muscles, be they human or plastic, are "scale invariant, independent of size or mass," as Pelrine notes, their applications are diverse. Pelrine sees a day when the plastic matrix will be used to make flexible yet rigid flaps to control high-speed aircraft and unmanned space vehicles.



PLASTICMAN Yoseph Bar-Cohen's EAPs could repair damaged human limbs.

Closer at hand for the technology is a role in miniature speaker units for home entertainment. Like the artificial muscle, the speaker is based on the layered-matrix principle. Speakers built using this technology could be very small yet produce a roomful of sound with little distortion.

Others look to a time when the flexible, strong material will replace human limbs, though most researchers see that day as far in the future. The plastic muscles are liable to make it to Mars and back before we terrans take advantage of them. "Decades from now," Bar-Cohen says, "EAP may be used to replace damaged human muscles, leading to a bionic human. While it is a futuristic objective, efforts are under way to address more modest challenges."

Detmar Straub, an expert in technology innovation at Georgia State University, says someday plastic muscles could be used to build entire factories, but complementary technologies still have many hurdles to leap. "There are whole factories in Japan manufacturing autos where a handful of people run the machinery," he says. "Will an innovation like this make that more of a reality across the globe? Perhaps, but there are whole sciences that need to be developed before that happens."

Bar-Cohen says, "We still have a long way to go toward meeting the challenge that I posed to the science and engineering community: to develop an EAP-actuated robotic hand that can win against a human in an arm-wrestling match. Of course, the benefit of winning the challenge is enormous for physically impaired persons. A remarkable contribution of the EAP field would be to one day see a handicapped person jogging to the grocery store."