

# Community

## Prosthetic arms and legs 'feel'

DURHAM, NC—Prosthetic arms and legs that "feel" are helping amputees walk and grasp better at Duke University Medical Center.

Using a process called "sensory feedback" Duke professors James H. McElhaney and Frank W. Clippinger implant electrical devices in the stumps of amputees to let them know how much pressure is being exerted on an artificial limb.

The process works like this: Physicians place a radio receiver in the amputee's stump, connecting it to a peripheral nerve. Biomechanical engineers place sensors that detect force or pressure in the artificial limb. This pressure is transmitted to the implanted radio receiver, which in turn sends a signal to the brain, allowing the amputee to feel as if he has a foot or hand.

"The process gives the person a sense of pressure on the artificial hand or foot, to which he can react to

move the prosthetic limb, enabling him to walk or to hold something," said McElhaney, professor of biomedical engineering and chairman of Duke's biomedical engineering department.

"The implant picks up radio waves that stimulate nerves on the surface of the stump," he said. "So by applying pressure on the artificial limb, the amputee creates a sensation similar to what he would feel if the limb were normal. How much sensation depends on the location of the electrode and the frequency of voltage."

Sensory feedback is different from myoelectric technology, another system used to activate prosthetic limbs. Myoelectric prostheses respond to muscle contractions in the stump that give off electric signals that activate a battery-powered motor.

"The amputee must watch the

myoelectric arm or leg to find out what it is doing," McElhaney said. "With sensory feedback, he can actually feel what is happening."

In a paper recently submitted to "Annals," an international biomedical engineering journal, McElhaney and Clippinger, professor of orthopaedic surgery and director of Duke Rehabilitation Services, wrote, "A major problem in lower limb amputees is the perception of the position and configuration of their prosthetic legs...In place of the multitude of sensations associated with the use of a normal leg, the amputee must learn to interpret subtle variations in stump pressure, balance and visual cues."

"Tasks that were simple and coordinated prior to the amputation are now difficult and ungraceful. Particular difficulties are associated with walking on soft sand, rough and

uneven terrain and in poorly lighted areas where visual feedback is unavailable. Sensory feedback is useful for prosthetic limbs to provide both position and force information."

McElhaney said sensory feedback in a prosthetic hand allows the amputee not only to grasp an object, but also to ascertain how hard or soft it is.

Sensory feedback is still in the research stage and is not available to, or suitable for all amputees, he said. So far, 32 carefully chosen amputees have participated in the research project at Duke.

Benefits of sensory feedback include improved lifestyle, balanced and prosthetic handling. But there are drawbacks. The procedure involves elective surgery and is expensive to install and maintain.

"There is a question of whether this process benefits the amputee

sufficiently for the trouble he must go through to enjoy it," the professor said. "I think that many people who have had amputations are reluctant to have any more surgery. And cost is a consideration relation to benefits."

McElhaney and Clippinger hope their research will lead to a less expensive process that uses computer chips, a process that could have widespread use.

"We have already demonstrated quite clearly that one can make an external connection with the peripheral nervous system that can be interpreted by the brain in the same way that any other sensation is interpreted," McElhaney said.

The professors are also working on a proposal to develop a micro-processed control system that would respond to voice commands from a

quadruplegic. The voice command would activate an electrode array to simulate muscles in the quadruplegic's arm, for example, so he could perform such simple tasks as feeding himself.

Sensory feedback might also have non-prosthetic uses for the future, McElhaney said. "It might be used for situations in which a person would have to react to some sensor-derived stimulus and would need the ability to perceive and digest information quickly. For example, if the fighter pilot of a spaceship were linked to sensors in the ship's control system, he would feel what the ship was doing much more quickly than he could perceive it by visual means."

McElhaney said multiple-channel sensors with micro circuits might provide sensations that people don't normally get.

## Downtown development seminar

Main Street: National Town Meeting, a conference on downtown revitalization, will offer civic, government, preservation and arts representatives an opportunity to explore emerging issues and innovative policies in economic development Sept. 4-6 in Winston-Salem.

The National Town meeting is co-sponsored by the National Main Street Center in National Trust for Historic Preservation and the N.C. Arts Council, a division of the N.C. Department of Cultural Resources.

The conference will focus on small-city development with more than 30 concurrent sessions. The sessions are divided into four tracks, with two focusing on the day-to-day management of downtowns and the long-range planning required to make central business districts attractive and viable. These session topics will include promoting Main Street business recruitment, parking management reusing old buildings, centralized retail management and tourism. The two other tracks will highlight

ways to utilize, develop and management cultural facilities and assets. From theaters to green spaces, from multi-use facilities to festivals, the sessions will examine how to plan, finance, design and manage successful projects.

Anyone with an interest in the community is invited. Among those expected to attend are Main Street project managers and state coordinators, business and civic leaders, local elected and appointed officials, state government representatives, community developers and planners, chamber of commerce executives, preservationists and representatives of state and community arts agencies.

The National Main Street Center is a program of the National Trust established in 1980 to stimulate downtown revitalization within the context of historic preservation. The Center provides direct technical assistance to states and communities interested in local development. The Center also conducts research, produces

slide shows and videotapes about specific revitalization issues, produces publications and reports on revitalization and serves as a clearinghouse for information on small-city redevelopment issues.

The N.C. Arts Council provides grants and services to artists, arts organizations and arts supports in the state. The Council's mission is to enrich the cultural life of the state by nurturing and supporting excellence of the arts and by providing opportunities for early North Carolinian to experience the arts.

The registration deadline for the National Town Meeting is Aug. 15. The registration fee is \$200, or \$150 for National Main Street Network members. For more information, or to register, write the National Main Street Center, National Trust for Historic Preservation, 1785 Massachusetts Ave., N.W., Washington, D.C. 20036. Brochures on the National Town Meeting are available from the N.C. Arts Council, Raleigh, N.C.

## Fall registration set

Registration for Fall Quarter classes at College of The Albemarle for both day and evening students will begin on Thursday, July 31, continuing through Friday, August 8.

The student development and business offices at the college will be open each day, Monday through Thursday, from 8:30 a.m. until 8 p.m., according to Mary Louise Brown, COA registrar. She said Friday hours will be from 8:30 a.m. until 4 p.m.

Brown said all new and returning students should complete their registration as soon as possible. The first two days of the period have been set aside to accommodate returning stu-

dents. On Thursday, those whose last names begin with letters A through M will be processed. Those with last names beginning with letters N through Z will be registered on Friday.

The registrar said those students who are unable to register during the prescribed week will still have an opportunity to enroll after classes begin on Monday, September 8. "We will continue late registration through September 12," Brown said.

Registration at the Dare County Center will take place on Wednesday and Thursday, May 27 and 28 between 8:30 a.m. and 4 p.m., and from 5 p.m. until 7:30 p.m. each day.



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