Joint Effort

Lakeshore Foundation and the University of Alabama at Birmingham (UAB) are developing a world-class research program in rehabilitative science—the Lakeshore Foundation/UAB Research that links Lakeshore's programs for people with physically disabling conditions and the UAB School of Health Professions' research expertise.

Funded by a $2-million investment from Lakeshore Foundation, the collaborative will establish the Lakeshore Foundation Endowed Chair in the UAB School of Health Professions. A nationwide search will be conducted to recruit a leading expert in rehabilitative science to hold that endowed chair and serve as director of the research collaborative.

Rehabilitative science encompasses basic and applied aspects of health services, social sciences, and engineering as they relate to restoring human functional capacity and improving people's interaction with the surrounding environment.

According to Lakeshore Foundation President Jeff Underwood, "For years professionals from around the world have been telling us of the great need for this type of research and the significant opportunity Lakeshore could play in this field. It made perfect sense to us to sit down with UAB, one of the leading research institutions in this country."

The collaborative may be the first of its kind between a major academic research university and an organization that serves people with disabilities by providing physical activity, sport, and education. The research collaborative will identify, develop, validate, and apply new programs and technologies having a positive impact on the lives of people with physically disabling conditions.

Lakeshore Foundation offers a wide range of fitness, recreation, athletic, and educational programs for people with conditions such as spinal-cord injuries, cerebral palsy, multiple sclerosis, stroke, amputation, and visual impairment. It also serves those with arthritis, diabetes, chronic pain, cardiac conditions, and many other related disorders. The foundation also provides fitness, recreation, and sports activities to severely injured military personnel through its Lima Foxtrot programs.

UAB has an established history of multidisciplinary research initiatives and a strong track record of obtaining grant funding from the National Institutes of Health (NIH) and other federal agencies. The School of Health Professions (SHP) houses several disciplines key to the research collaborative, including physical and occupational therapy, nutrition science, and health administration. In addition, the UAB School of Engineering partners with SHP to develop more effective prosthetic devices and environmental designs that better the lives of individuals with chronic conditions and enable individuals to live as independently as possible.

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Breakthrough on Spinal Scar Tissue

Researchers have developed an improved version of an enzyme that eats away the dense scar tissue that forms when the central nervous system (CNS) is damaged. By digesting the tissue that blocks regrowth of damaged nerves, the improved enzyme—and new system for delivering it—could facilitate spinal-cord regeneration and recovery from serious CNS injuries, according to a news release from Georgia Institute of Technology.

The enzyme, chrondroitinase ABC (chABC), must be supplied to the damaged area for at least two weeks following injury to fully degrade scar tissue. But the enzyme functions poorly at body temperature and must therefore be repeatedly injected or infused into the body.

In a paper published November 2 in the early edition of the journal *Proceedings of the National Academy of Sciences (PNAS)*, researchers describe how they eliminated the thermal sensitivity of chABC and developed a delivery system that allowed the enzyme to be active for weeks without implanted catheters and pumps. This work was supported by the National Institutes of Health (NIH).

The paper's lead author was Ravi Bellamkonda, a professor in the Wallace H. Coulter Department of Biomedical Engineering at Georgia Tech and Emory University.

At physiological body temperature, chABC loses half of its enzymatic activity within one hour and remaining functionality within three to five days. To thermostabilize the enzymes, Bellamkonda, Emory University cell biology associate professor Robert McKeon, and Georgia Tech graduate student Hyun-Jung Lee mixed the enzyme with the sugar trehalose. The result: The enzyme's activity was stabilized at internal body temperature for up to four weeks during in-vitro tests.

The researchers then used a lipid microtube-hydrogel scaffold system to deliver the thermostabilized enzymes into animals via a single injection. The scaffold provided sustained delivery of the enzyme for two weeks, with the microtubes enabling slow release and the hydrogel localizing the tubes to the lesion site. This delivery system also allowed the enzyme to diffuse deeper into the tissue than did catheter delivery.

In animal studies, the enzyme's ability to digest the scar was retained for two weeks postinjury, and the scar remained significantly degraded at the lesion site for at least six weeks.

The researchers also observed enhanced axonal sprouting and recovery of nerve function at the injury site when the thermostabilized enzyme was delivered.

The delivery system also enabled the combination of therapies. Animals treated with thermostabilized chABC in combination with sustained delivery of neurotrophin-3 (a protein growth factor that helps to support the survival and differentiation of neurons) showed significant improvement in locomotor function and enhanced growth of sensory axons and sprouting of fibers for the neurotransmitter serotonin.

"These results bring us a step closer to repairing spinal-cord injuries, which require multiple steps including minimizing the extent of secondary injury, bridging the lesion, overcoming inhibition due to scar, and stimulating nerve growth," adds Bellamkonda, who is also deputy director of research for GTEC, a regenerative medicine center based at Georgia Tech and Emory University, and a Georgia Cancer Coalition Distinguished Cancer Scholar.

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