Nanotechnology offers hope for treating spinal cord injuries, diabetes, and Parkinson's disease

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Imagine a world where damaged organs in your body—kidneys, liver, heart—can be stimulated to heal themselves. Envision people tragically paralyzed whose injured spinal cords can be repaired. Think about individuals suffering from the debilitating effects of Parkinson's or Alzheimer's relieved of their symptoms – completely and permanently.

Dr. Samuel I. Stupp, director of the Institute of BioNanotechnology in Medicine at Northwestern University, is one of a new breed of scientists combining nanotechnology and biology to enable the body to heal itself -- and who are achieving amazing early results. Dr. Stupp's work suggests that nanotechnology can be used to mobilize the body's own healing abilities to repair or regenerate damaged cells.

In a dramatic demonstration of what nanotechnology might achieve in regenerative medicine, paralyzed lab mice with spinal cord injuries have regained the ability to walk using their hind limbs six weeks after a simple injection of a purpose-designed nanomaterial.

"By injecting molecules that were designed to self-assemble into nanostructures in the spinal tissue, we have been able to rescue and regrow rapidly damaged neurons," said Dr. Stupp at an April 23 session hosted by the Project on Emerging Nanotechnologies. "The nanofibers – thousands of times thinner than a human hair – are the key to not only preventing the formation of harmful scar tissue which inhibits spinal

cord healing, but to stimulating the body into regenerating lost or damaged cells."

Stupp's work hinges on a fundamental area of nanotechnology – self-assembly – that someday should enable medical researchers to tailor and deliver individualized patient treatments in previously unimaginable ways. Stupp and his coworkers designed molecules with the capacity to self-assemble into nanofibers once injected into the body with a syringe. When the nanofibers form they can be immobilized in an area of tissue where it is necessary to activate some biological process, for example saving damaged cells or regenerating needed differentiated cells from stem cells.

This same work also has implications for Parkinson's and Alzheimer's, both diseases in which key brain cells stop working properly.

During his presentation, Dr. Stupp allowed a rare glimpse into ongoing research with collaborators in Mexico and Canada, showing the impressive visual of mice recovering from the symptoms of Parkinson's disease after being exposed to the bioactive nanostructures developed in Stupp's laboratory at Northwestern University. Stupp also showed another nanotechnology achievement in joint work with Jon Lomasney at Northwestern demonstrating the use of nanostructures and proteins to achieve recovery of heart function after an infarction.

"This research provides an early glimpse into the new and exciting places where nanotechnology can take us," said Project on Emerging Nanotechnologies Director David Rejeski at the session, which also served as the release of the new report NanoFrontiers: Visions for the Future of Nanotechnology. "This type of work helps us to see beyond first generation, 'gee-whiz' nanotech applications like better tennis racquets or anti-static fabrics, and reach for an end to human suffering from Parkinson's, heart disease, and even cancer."

A video of Dr. Stupp discussing his groundbreaking research with collaborator John Kessler is available on April 24 at www.nanotechproject.org/114.

Source: Project on Emerging Nanotechnologies