Research project tackles 'regeneration' gap

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Researchers at the McKnight Brain Institute of the University of Florida have initiated a project to treat human brain and other diseases by plundering the secrets of regeneration from creatures with remarkable powers of self-renewal, such as salamanders, newts, starfish and flatworms.

Fueled by about $6 million in private donations, university support and state matching funds, "The Regeneration Project" will connect scientists who work with adult human stem cells — the building blocks of self-renewal that exist within our brain, bone marrow and blood — with scientists who study how tissues and limbs develop in a variety of organisms.

"A salamander can be injured to the point that it loses its limbs or part of its spinal column, yet a few weeks later you'll see it scurrying across your lanai," said project leader Dennis A. Steindler, Ph.D., executive director of UF's Evelyn F. and William L. McKnight Brain Institute. "The Regeneration Project will focus on unlocking the mysteries in living, simple organisms that sustain successful tissue and organ regeneration following injury and disease, and then applying this knowledge toward encouraging repair in the more complex human, where regeneration is not so simple."

Steindler said the project will involve researchers from far-ranging disciplines, including scientists who study how vertebrate development began millions of years ago as well as scientists who are trying to treat blindness by influencing the activity of stem cells in the human eye. In

terms of brain diseases, scientists may look at ways to mobilize and reinforce the body's own supply of adult stem cells to protect against or fight Alzheimer's and Parkinson's diseases, cancer, multiple sclerosis and traumatic injury.

The project has received support from two private gifts — from Jon and Beverly Thompson of Sanibel, Fla., and from the Thomas H. Maren Foundation, based in Gainesville — and from the UF Office of Research. Initial funding will help provide fellowships for young scientists who will bridge the gaps between the different labs and investigators involved in regeneration research.

"The fellows will be the glue that holds this broad group of scientists together," said Steindler, a professor of neuroscience at the UF College of Medicine. "We will begin a process of sharing ideas and designing experiments to answer questions about growth in simple systems that can then be applied to more complex tissue reconstruction needed in human organisms."

Although human organ systems such as the liver are quite capable of regeneration, the brain has only a small quantity of adult stems cells to fight disease or injuries. Similarly, the body has limited capacity to repair injured limbs or spinal cords. Regeneration researchers seek to strengthen the body's inherent healing powers.

"We are bringing together the best of the developmental biology world with the best of the stem cell world and starting the conversation, with the focus on how to get regeneration to work in a mammal," said Edward Scott, Ph.D., a professor of molecular genetics and director of the Program in Stem Cell Biology at the College of Medicine. "Essentially, our body can heal itself, and that's why many of us live to be 80. But we can't do things like grow an arm or finger as we did in the early stages of our development. We want to learn how to turn those systems back on in

people."

Recently, studies have shown humans possess some of the same genes and communication pathways used by some of nature's most remarkably regenerative animals.

Already, UF McKnight Brain Institute scientists have discovered more than 100 genes associated with all major human neurological diseases in a simple marine snail, as well as more than 600 genes that control development. In the realm of adult human stem cells, Brain Institute researchers have shown ordinary human brain cells can generate new brain tissue in mice and produce large amounts of new brain cells in culture for use as possible replacements for dead or injured cells.

The UF project is "bold" because it takes a comprehensive view of regenerative medicine, according to Arlene Y. Chiu, Ph.D., director for scientific activities at the California Institute for Regenerative Medicine.

"We are all excited by the great potential of stem cells to repair damage and return function," Chiu said. "It remains a great mystery, however, why some organisms are able to renew tissues, organs and even restore whole limbs while other related animals are not. Even within a single organism, we find that some tissues have a far more robust ability to replenish and replace cells than others. Yet we do not understand the bases for these differences."

The Regeneration Project will shortly begin establishing its think tank of international scientists, Steindler said.

Source: University of Florida