

Ideas on the Edge

Healing in the Garden of the Body

UNIVERSITY OF TORONTO
RESEARCHER MOLLY SHOICHET IS
CULTIVATING HOPE FOR VICTIMS
OF SPINAL AND BRAIN INJURY.

Agriculture is the metaphor that Dr. Molly Shoichet—cautiously—uses to describe her research. “If you’re trying to grow a certain crop, you need the soil and the right nutrients. Then you plant the seeds, and with the right environment you can grow it.”

But when the “crop” is new brain or spinal tissue,

and when you have to create your own versions of both soil and seed, and when the environment is as complex as the human body...well, it’s not so simple.

Dr. Shoichet is working at the University of Toronto on the frontiers of a field known as tissue engineering or regenerative medicine. Her research may one day enable surgeons to place a microscopic three-dimensional matrix or “scaffolding”—think of it as “soil”—in a damaged section of brain or spinal cord, and then infuse it with stem cells—“seeds”—that will grow into a fresh crop of healthy nerve tissue that restores full function.

The images of seed and soil in some ways describe the two main thrusts of Dr. Shoichet’s research. To get the right crop, you have to start with the right seed. In



MOLLY SHOICHET

Project: Engineering Neural Tissue
Institution: University of Toronto
Research Sector: Engineering/Health Sector
Principal Investigator: Molly Shoichet
Trust Investment: \$319,190
CFI Investment: \$319,190
Total research investment from all sources: \$826,587

RESEARCH THAT MATTERS
 REAL-WORLD BENEFITS FOR ONTARIANS:
 • effective therapies for brain and spinal injuries

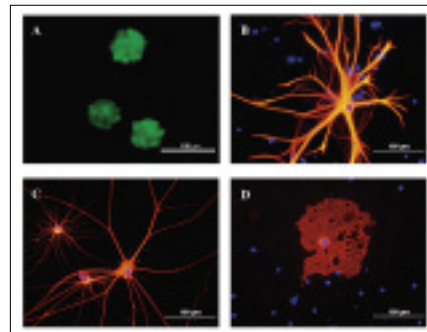
In this case, that means “progenitor” stem cells. Undifferentiated stem cells have the capacity to turn into any kind of tissue; “progenitor” cells are one step up the development ladder, with the capacity to grow into a particular kind of tissue—in this case, nerve tissue.

But seeds, as any gardener will tell you, are just the beginning. The environment has to be right as well: the structure of the soil, the necessary nutrients, the right quantities of water and sun. Explains Dr. Shoichet: “We’re asking ourselves what substances need to be present or added so that the cells survive and grow, and how to make pathways for them to grow along.”

The challenges are immense, the questions legion. What factors turn progenitor cells into particular kinds of neural tissue: say, neurons that process and transmit information versus oligodendrocytes that wrap them in a protective sheath? What kind of material is best for creating the scaffolding that guides growing neural tissue? (Dr. Shoichet is looking at a range of natural and synthetic polymers.) How can we keep the

body’s immune system from rejecting the harvest of new growth? And the list goes on.

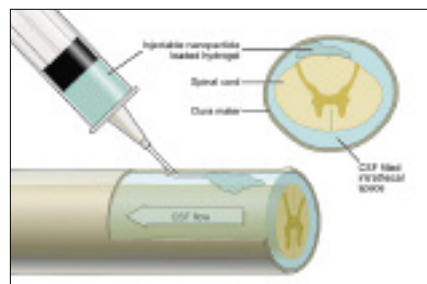
“It turns out that the brain and spinal cord are probably the most complex organs in the body,” she says with a rueful laugh. “When I first got into this field, I



VERSATILE “SEEDS:” A SINGLE VARIETY OF STEM CELLS (UPPER LEFT) CAN GROW INTO SEVERAL DIFFERENT KINDS OF NERVE CELLS.

thought, ‘Great! There aren’t too many people working in this area.’ But as I’ve learned more and more about it, I’ve discovered the reason.”

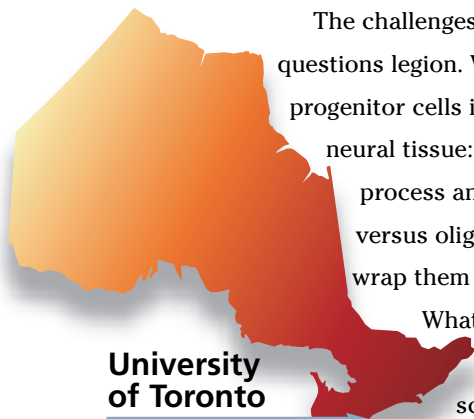
The tangled thicket of issues in regenerative medicine demands an interdisciplinary approach; Dr. Shoichet, whose background is in chemistry and



HOW TO KEEP STEM CELLS FROM BEING CARRIED AWAY FROM AN INJURY BY SPINAL FLUID? A NANO-ENGINEERED GEL.

engineering, works closely with cell biologists, neuroscientists and surgeons. She sees their collaborative efforts leading to step-by-step improvements in restoring function after a brain or spinal injury. She won’t even speculate on how long it will be before paraplegics can walk away from their wheelchairs. But she’s hopeful, even optimistic.

“We’re not there yet, but I can see it in the future. And that’s very motivating, very exciting.”



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Infrastructure for Innovation About the Ontario Innovation Trust

The Ontario Innovation Trust was created in 1999 by the Government of Ontario to invest in research equipment and facilities at Ontario’s universities, colleges, hospitals and other non-profit research institutions. The Trust is governed by a volunteer Board of Directors, according to the terms of a Trust agreement established by the Ontario government. A small permanent staff looks after day-to-day operations.

Since its inception, the Trust has committed almost \$843 million to strengthen Ontario’s position in the global marketplace of ideas. This represents more than a third of the \$2.44 billion in total funding that has been invested in Trust-supported projects.