Ideas on the Edge

When Metal Makes No Scents

TRACE METALS IN LAKES CAN TURN OFF A SENSE THAT FISH DEPEND ON FOR SURVIVAL. RESEARCHER GREG PYLE IS EXPLORING THE HOW AND WHY.

GREGORY PYLE

"Yum, supper's ready." "Wow, she's interesting!" "Uh oh, better put out that cigarette!"

This is how our brain responds—countless times every day—to the steady stream of signals from our nose.

The signals are generated when traces of chemicals in the air—from a steak, say, or perfume, or gasoline—bind with special tissues in our noses and spark a tiny electrical burst. The bursts are transmitted to the brain, where they're interpreted and translated into vital nutritional, sexual and survival information about what's going on around us.

Aquatic animals—both fishes and crustaceans—rely on a similar interaction between sensory tissues and water-borne chemicals to gather information from their environment. Yes—fish have a sense of smell. In fact, because so many substances dissolve easily in water, it's an even more effective medium than air for carrying olfactory information. But trace amounts of metals from mine tailings and other industrial sources damage the

sensory tissues of these creatures. And the result can be a dangerous inability to sense food, potential mates or predators.

Dr. Gregory Pyle is looking at how and why it happens. And in doing so, he's laying the groundwork for new environmental practices—and a new way of benchmarking environmental impacts. Working with equipment funded in part by the Ontario Innovation Trust, Dr. Pyle and his colleagues have found, for example, that fish embryos exposed to metals produce adults with a permanently damaged sense of smell. Fish that have already hatched, however, can recover from exposure in a couple of weeks. The implication: mining companies could make a real difference by avoiding the release of metals during spawning periods—only about a week a year.

RESEARCH THAT MATTERS

REAL-WORLD BENEFITS FOR ONTARIANS:

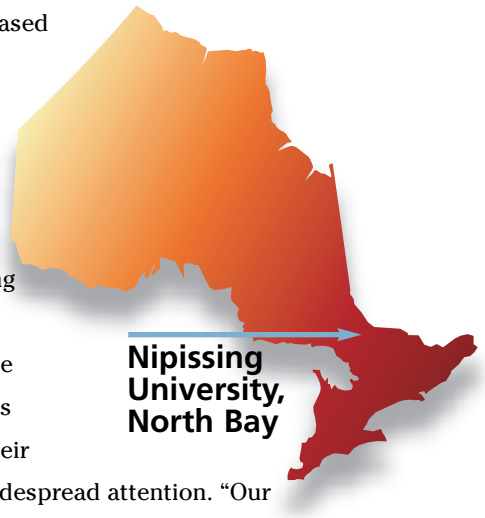
- preservation of ecosystem assets potentially vital to fishing, forestry and recreation
- global leadership in aquatic environmental science

A SIMPLE TRANSPARENT MAZE WITH A SCENT SOURCE AT ONE END HELPS SCIENTISTS MEASURE DAMAGE TO A FISH'S OLFACTORY TISSUE.

Even more significantly, Dr. Pyle's research may soon provide scientists worldwide with a new and better way to measure the potential environmental impact of the many industries that contaminate water with trace metals. The current yardstick is based on extensive studies of the amount of damage various levels and types of trace metals can cause when they bind to the gill of aquatic animals. Exposures beyond certain thresholds have been shown to be toxic, and those thresholds can be used to set regulatory limits on industry.

Gills, however, comprise different kinds of tissue used to perform several different tasks, and trace metals bind to and affect those tissues in various ways. The result is that the gill-based standard can be very complex to apply. "But olfactory tissue," explains Dr. Pyle, "only has one purpose. And we think that helps circumvent all of the confounding factors that make it difficult to make predictions with the gill-based model."

Dr. Pyle and his team have spent several years gathering data on a new, simpler "chemosensory-based" model for assessing and regulating metal contamination. They're the only lab in the world that's been working on it, but their efforts are now gaining widespread attention. "Our model is starting to attract interest from environmental regulators in Australia, New Zealand and the United States," reports Dr. Pyle.



It may take a few years more, but a made-in-Ontario environmental standard may soon be having a global impact.

Project: Aquatic Ecotoxicology Laboratory
Institution: Nipissing University*
Research Sector: Life Sciences
Principal Investigator: Gregory Pyle
Trust Investment: $166,646
CFI Investment: $166,646
Total research investment from all sources: $418,203

*AS OF FALL 2008, DR. PYLE IS ASSOCIATE PROFESSOR CANADA RESEARCH CHAIR IN ENVIRONMENTAL BIOTECHNOLOGY AND ECOTOXICOLOGY, DEPARTMENT OF BIOLOGY, LAKEHEAD UNIVERSITY.

Ontario Innovation Trust

MaRS Centre, Heritage Building
101 College Street, Suite HL20
Toronto, ON M5G 1L7
416-977-9188 Fax: 416-977-9460
innovation@oit.on.ca
www.oit.on.ca

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.