



## Editorial: Assessing impact



Researchers, universities, governments and the public often do not agree on how to measure the success of the research enterprise. Most often, we look at input and output measures: numbers

and values of grants received, numbers of publications in peer reviewed journals or scholarly books and number of graduate students mentored. Once we move past input and output measures, there is little agreement on how to assess the impact of research, scholarship and creative endeavors.

We know, for example, that research supported through the YLC-CURA and Brock Research Institute for Youth Studies has influenced program development by social service agencies and public organizations in St. Catharines. Research through the Cool Climate Oenology and Viticulture Institute has changed viticultural practices – improving the quality of grapes and wines and the way in which terroir is identified in the Niagara region – thus expanding marketing opportunities for wineries. Research in Community Health will impact the management of food-borne diseases in rural Honduras. The scholarship of Brock's faculty members and graduate students colleagues has an impact on the intellectual, economic, social and political world in which we live.

However, we need to find ways of identifying, assessing and acknowledging these impacts. To assist us in this, next month we will forward a survey to all faculty members asking for their assistance in identifying how their (or their colleagues') research, scholarship and creativity has impacted human health, health policy or community development or the intellectual, social, cultural, environmental or educational sphere. We will profile the work of these researchers in future issues of *Research Reporter* and *Brock Research*.

### Dr. Michael Owen

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## Hot Sweaty Sex: Investigating the ins and outs of human chemical communication

Dr. Cameron Muir's neuroscience course is famous for being stressful – at least on one day for one unlucky individual. In a novel take on the idea of the pop quiz, Dr. Muir picks a student at random to give the whole lecture without warning. If that sounds unfair, there's a twist: The student has to spit in a cup beforehand, and once afterwards as well.

Spitting in a cup probably doesn't make the experience any less gut-wrenching, but as it turns out, that's the whole point. In our saliva are traces of the hormone cortisol, whose level correlates with stress. Muir measures the cortisol levels of the unwitting test subject and then delivers the real lesson for the day by showing the class how those levels skyrocket over the course of the hour-long lecture. Call it active learning.

Measuring hormones and drawing links to behaviour is Muir's specialty. Humans communicate verbally and through gestures and facial expressions, but Muir is interested in the possibility of a third language: chemicals. Specifically, he investigates the release of sex hormones such as testosterone and estradiol in body fluids like saliva and sweat, and concurrently the effect of reception of these hormones in other people.

Muir became interested in chemical communication while studying mice. The presence of an unfamiliar male mouse will cause a female to spontaneously abort an early pregnancy, a phenomenon known as the Bruce effect. Muir explains, "If she invests in pregnancy and has a litter, he'll

just eat them and reinseminate her."

Spontaneous abortion, then, is an involuntary physiological response designed to avoid wasting her effort and resources. Actually, Muir found that rather than having the whole male mouse over for dinner, all that was really needed was the presence of his urine; pregnancies could be aborted just by painting male urine on the female's nose. Eventually, he was able to show more specifically that it was the presence of the steroid hormone estradiol in the urine that was the culprit.

In the end, perhaps, this finding shouldn't be surprising, since it's an artificial dose of estradiol in the birth control pill that furnishes our most reliable contraceptive short of abstinence. But it got Muir thinking about something more interesting: If transmitted hormones can exert such a potent effect in mice, is it possible that we ourselves use them less obtrusively to communicate in certain ways?

Pursuing this question, Muir has collected pilot

data that suggest that testosterone is emitted in male underarm sweat during sexual activity, but not during exercise. This is especially interesting in light of the fact that testosterone is known in medical practice to be a female aphrodisiac.

"In fact," he explains, "the amount of testosterone I found in underarm secretions is very close to the amount that doctors will prescribe to women to enhance their libido.

"You've heard the term hot sweaty



"... if you're a male and you want future reproductive opportunities, it pays to dose a female with testosterone through a bit of sweat from your underarms."

Dr. Cameron Muir

~ cont'd.

sex... in an embrace, women are typically shorter than men, the nose goes somewhere near the underarm region. So if you take an evolutionary perspective on this, if you're a male and you want future reproductive opportunities, it pays to dose a female with testosterone through a bit of sweat from your underarms.

"We'd like to look at saliva as well because we kiss - a big long drawn-out wet kiss - and there's a lot of steroid hormones in saliva."

Perhaps this idea could explain why for humans the mouth doubles as a secondary sexual organ - a fact we take for granted, but for which, when you think about it, there has until now been no obvious reason.

Dr. Muir plans to flesh out his preliminary work by assaying

the hormone content of sweat and saliva in varying contexts in men and correlating these results with behavioural effects in women.

For the time being he is concentrating on body fluids and transdermal absorption, but airborne chemical messengers are also a fascinating possibility - that is, the elusive human pheromone. It could turn out that when we embrace, we're saying more than we expect. Then again, perhaps we're just saying it in a different way.

Dr. Muir's research is funded by NSERC and by a collaboration with CIDtech Research in Cambridge, Ontario.

~ by Giles Holland

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## Raging Hormones: crabby crayfish teach Brock biologist about serotonin and human aggression

Ask anyone in the Department of Biology what Dr. Joffre Mercier studies, and you usually hear one word: crayfish. A typical reaction might then be to wonder why anyone would want to spend a career researching such peculiar-looking creatures. But that would miss the point: it's not what crayfish look like that Mercier finds so exciting, but rather what goes on inside them, and what they can teach us about ourselves.

Mercier explains, "I'm interested in the neural basis of behaviour - trying to relate the activities of nerve cells to the resulting behaviour. How does the nervous system allow us to do the things that we do? The advantage to working with crayfish is that they have very small nervous systems; our own nervous system has about a hundred billion nerve cells, but crayfish can have less than a hundred thousand. So, there's a much greater opportunity to identify individual nerve cells."

Crayfish have been used as model organisms by neurobiologists for over a century. Sigmund Freud chose crayfish and other invertebrate species not only for their physical simplicity, but also to avoid the ethical conundrums of working with human subjects. Today, the use of crayfish continues to allow Mercier to pose questions that analogize well to human neurobiology, but that would be intractable if dealing with humans directly.

Specifically, Mercier is interested in synaptic modulation. "Nerve cells can generate electrical signals, and ultimately they communicate with muscle cells, resulting in behaviour. Nerve cells can also release chemicals, and those chemicals will modulate the electrical signalling in the next cell."

Mercier has spent the last fifteen years studying how certain hormones, such as octopamine and serotonin, act as neuromodulatory messengers in crayfish. He has learned how these modulators work in crayfish biology. Now he plans to broaden his research by using behavioural experiments to ask where and when those modulators are produced in the first place.

"No one's actually ever shown what environmental stimuli trigger secretion of these hormones," says Mercier. This is where the pugnacious nature of his subjects comes in handy. "Crayfish and lobsters - they like to fight. If you put two of

them together, they will immediately fight, and one of them becomes dominant. We'd like to get at the hormones that are secreted when they fight. We would like to find out whether there are some differences in the ability of dominant or submissive creatures to release these hormones."

Aggressive situations can be simulated for crayfish simply by placing them next to a reflective surface. Dominant crayfish mistake their reflection for a rival, and will rear up and charge at it. In addition to aggression, Mercier will also investigate hormonal responses to water temperature and oxygenation.

Since the advent of Prozac over a decade ago, the hormone and neurotransmitter serotonin has seen headlines for its role in human behaviour. Eventually, what Mercier learns about serotonin and its role in aggression in crayfish could provide important insights into the role of serotonin in human aggression.

"The more you learn about one animal's behaviour, about their neural anatomy," says Mercier, "the more tools you have to ask further interesting questions. There's great benefit to spending a lifetime studying one animal, because that's when you can really put things together at a higher level."

With this in mind, Mercier's excitement about the simple crayfish can be infectious. He has reached a point where he can apply the foundations laid in the first half of his career to bigger and better questions to come in the second half with the ultimate aim of filling in a piece of the puzzle of the human organism itself.

Dr. Mercier's research is funded by NSERC.

~ by Giles Holland

Giles Holland is a graduate of Physics and Political Science at Brock and is part of the 2005 NSERC SPARK Program (Students Promoting Awareness of Research Knowledge).



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