Not knowing about the chemicals in our bodies*

BY MICHELLE MURPHY

Michelle Murphy is a professor of history and women and gender studies at the University of Toronto.

WAYS OF NOT KNOWING

What do we know and not know about chemical exposures and endocrine-disrupting chemicals (EDCs)? We know from national biomonitoring studies that everyone reading this article has within them right now industrially produced and endocrine-disrupting chemicals. We know we are all altered, materially, by the industrially produced chemicals of this era. While our government likes to address us as *Homo economicus*, whose primary purpose is to give value to our national economy, maybe we have become *Homo toxicus*. Where do these chemicals inside us come from? And what do they do? And what would stop you from answering these questions? What roles do science and government policy play in cultivating our capacities to not know?

There are at least four ways of not knowing about industrially produced chemicals and their effects. The first has to do with chemicals themselves. There are tens of thousands of industrially produced chemicals, each with distinctive properties. Moreover, chemicals are commonly beyond our perception—we often cannot see, taste, or smell them. They bioaccumulate in ecosystems, or travel through our water and air, or move across the planet through global logistics chains as consumer items. Further, there is a delay between exposure and, later, when a doctor tells you that cancerous cells have been detected inside you, or a lag between fetal exposure and a diagnosis of asthma. There is an even longer gap when it comes to endocrine-disrupting chemicals. Exposure to these chemicals to an adult body affects a fetus potentially in that body, which shows itself in the children that fetus might someday have. With EDCs, effects can manifest in two, three, or four generations beyond exposure. It can be difficult to know what exposure in the past contributed to an effect in your body now.

What roles do science and government policy play in cultivating our capacities to not know?

Beyond the trickiness of chemicals, there is a blindness built into our instruments and experiments. This is a second way of not knowing. To claim that instruments have built-in blindness is not necessarily a critique. It is true of all instruments. A telescope helps us see things at a great distance, but it does not help us to see something close and small. All instruments perceive some things and not others. Toxicology, the science that gives us so much of our knowledge about chemicals and their effects, has similarly been built on a particular way of seeing. The dose–response curve enshrines the notion that "the dose makes the poison." It is toxicology's job to figure out when a particular chemical arrives at the dose that produces harm.

THE MOUSE IN THE BOX

In the early 20th century, the dose–response curve was built into experiments for understanding the effects chemicals had on bodies. In the classic "mouse in a box" setup, you place a mouse in a chamber, an empty box devoid of variables. Then you introduce one chemical into that box, and increase its dose until you see a response in the mouse. To connect the dots between a specific chemical and a particular bodily response, you have to do the same thing with many mice, so that you can look for the level of a chemical that predictably induces a specific response. This is how scientists figured out the link between lead and lead poisoning. The recognition of this link between single chemicals and predictable responses was something that labour movements and occupational health researchers had to fight hard for. It underwrites some of our first environmental and occupational health legislation.

But this way of researching chemicals only detects some things. The world is not an empty box but a complex environment providing multiple exposures. Moreover, this kind of experiment is set up to look at predictable and regular responses that we can detect during a shorter duration of acute exposure. Maybe the mouse is exposed to a high dose for eight hours. That doesn't tell you much about a lifetime of exposure at a low dose. Endocrine-disrupting chemicals often have their strongest effects at very low doses. They do not fit into the dose–response curve model, and the "mouse in a box" experiment is blind to what EDCs do to bodies. There has been a struggle over the last

The chemicals in our bodies, page 24

* This article is based on talk given at the public forum, "Is Your Body a Toxic Site? Reproductive Health as an Environmental Issue," Toronto, May 15, 2015. The event brought together a scientist, a legal scholar, and a historian of science to discuss what we know and do not know about endocrine-disrupting chemicals.

The chemicals in our bodies continued from page 23

25 years by scientists to legitimate their research into low-dose effects of endocrine disrupters. But it has been the mouse-in-a-box experiment that remains enshrined in our environmental standards.

With an explosion of research into EDCs, we now have more nuanced methods of connecting chemicals and effects. Yet industry lobbies are invested in keeping the way we regulate chemicals and effects confined to mouse-in-a-box detection. Indeed, such experiments are now used to deny low-dose responses, or responses that show themselves across generations, or responses from multiple chemicals. Industry lobbies have created a playbook cribbed from tobacco companies on the strategic production of not-knowing. Much industry-sponsored research into the effects of chemicals is designed to disconnect chemicals and effects.

Perhaps our upcoming election is a moment to dream of and demand a different way … of asking the state to see us not only as *Homo economicus* but also as ecological beings.

PRODUCING UNCERTAINTY AND IGNORANCE

This is the third way of not-knowing: the strategic production of uncertainty and ignorance. The *Canadian Environmental Protection Act* of 1999 is a good illustration. When you hear that this Act does not categorize a chemical as toxic, you might think that the chemical is therefore safe. You might be wrong. For a chemical to qualify as toxic during risk assessment, it is looked at in two ways. First, analysts look at the weight of scientific evidence to see if studies suggest that a chemical produces harm in humans or animals. Second, they look at "exposure." They ask whether Canadians are exposed to a chemical at a rate high enough to cause health problems. How do we know how much we are exposed to a chemical? Typically, we ask industry to report on their own activities. These industry-produced data are then subjected to a set of calculations. After estimating total emissions reported by industries, the assessment calculates the *mean* rate of exposure for *all* Canadians. Even if we know that a chemical has produced severe health effects, if the average rate of exposure for Canadians is lower than the safety standard, the chemical does not count as "toxic."

The category "toxic" is not merely a measure of health effects, then; it is also a technical term of regulation. While some bodies and communities disproportionately experience exposures of a chemical with known health effects, that chemical may not qualify, legally, as a toxic chemical. In Canadian environmental legislation, "toxic" is a political term. There is a strategic not-knowing about what counts as toxic built into the legislation.

This leads me to the fourth way of not-knowing. In the last five years, we have seen an unprecedented destruction of our capacity for environmental science and assessment. The state has been destroying its own ability to collect data and respond to environmental questions. We can look at the omnibus Bill C-38 of 2012, some 450 pages long, which makes roughly 70 changes to different acts across many different agencies. At its core is a suite of changes to environmental legislation, from the *Navigable Waters Act* to the *Environmental Assessment Act*, either cancelling or cutting them or changing the mandate of the state's ability to collect data and respond to environmental concerns. This is a historic shift in our ability to not-know.

In my own research about the environmental history of the Great Lakes and the St. Clair River, I have drawn on important studies at places like the Centre for Inland Waters in Burlington, Ontario. In the 1990s, scientists from the centre undertook internationally famous, ground-breaking research documenting the widespread effects of endocrine-disrupting chemicals on fish, reptiles, and birds in the Great Lakes. The Centre for Inland Waters is one of the many programs that is being dismantled. It has lost something like a third of its scientists, including senior scientists. You cannot find out about research at the centre because there is no website or publicly available knowledge. Even the union of federal scientists, the Professional Institute of the Public Service of Canada (PIPSC), has had a hard time finding out who has been fired at the centre. That is how obscured the activities of federal scientists have become in Canada.

THE STATE OF STATE SCIENCE

We, as a public, are becoming aware that our right to know about state science is weak. It is hard to find out about the research of federal scientists, not just science we want to happen, but also science we might want to critique. Think about the important revelations of secret experiments in residential schools. State science is not just our friend; sometimes it does pernicious things.

Reading this you might think, "OK, that's state scientists." There are still university scientists doing research and with their academic freedom they can study whatever they want. Unfortunately, it is not so rosy. The Canadian Association of University Teachers has gathered statistics showing that university-based research is also under threat. Across the three major federal funding agencies, 100 percent of new funding

requires an industry partnership. In the Natural Sciences and Engineering Research Council of Canada (NSERC), the major funding agency for science in Canada, there has been over a 1,000 percent increase in the funding of projects that are tied to the work of a specific company. In health research, there has been a 61 percent drop in successful grant applications. This is an unprecedented, historically significant, rearrangement of our ability to know about our bodies, our environments, and our communities.

In response, federal scientists are taking to the streets to protest the dismantling of our ability to know. They organized the 2012 Death of Evidence March, which took their protest to Ottawa, and this May, PIPSC, the union that represents professional scientists at the federal level, organized rallies of scientists across the nation in defense of scientific integrity.

We are in a strange and paradoxical moment. On the one hand, there is greater scientific consensus about the pervasive health impacts of endocrine disrupting chemicals. In the 2012 WHO and UN report, scientists conclude that endocrine-disrupting chemicals are a global problem and that states internationally should study and regulate them. Twenty years ago, when the dose–response curve dominated toxicological research, this report was unthinkable. Now, there is an explosion of research into EDCs. On the other hand, the Canadian government is intensifying strategies to produce ignorance about our environment. We know more, while our ability to do the research is being dismantled. Perhaps our upcoming election is a moment to dream of and demand a different way of regulating chemicals in Canada, a different way of asking the state to see us not only as *Homo economicus* but also as ecological beings.

The Cohen report continued from page 22

A NEW ERA OF ACCOUNTABILITY?

As we have seen, this is a government that is not shy about appropriating the notion of *public interest* in serving the wants and desires of *private interests*. This is a government that seeks to systematically dismantle anything even remotely democratic on the one hand, while marketing itself as champions of democracy on the other. Seen in this way, it is hardly surprising that, as Cohen points out, the Harper government held "no consultations with First Nations or stakeholders about Bill C-38" (Cohen 2012, 82). More than undermining the public interest, Bill C-38 sounded the death knell for democratic accountability. Ironically, it was on this very issue that the Harper Conservatives, promising to usher in "a new era of accountability," swept to power in 2006. With the reputation of the Liberal Party left in tatters by the sponsorship scandal, the Harper Conservatives positioned themselves as the "accountable" alternative to the entitled, "natural governing party." None of this would have been possible, of course, had it not been for the investigation of the Gomery commission. It was Justice Gomery who revealed the "culture of entitlement" that existed within the Liberal Party, and it was Stephen Harper who rode the resulting wave of public outrage all the way to 24 Sussex Drive. And yet, as we have seen, this "new era of accountability" never materialized.

[T]his is a government that is not shy about appropriating the notion of *public interest* in serving the wants and desires of *private interests*.

Indeed, whereas Gomery's conception of accountability began with the need to address the increasing concentration of power in the Prime Minister's Office, the Harper government accelerated this very process of centralization. By 2008, it became clear to Gomery that his proposals had fallen into a "black hole of indifference." Is this a portent of things to come for Cohen? Or have his proposals, stale-dated as many of them have become, already suffered the same fate as Gomery's recommendations? If, in fact, the Cohen report has already passed the event horizon, what have we lost? Many are quick to mourn the loss of $37 million in public funds, the final cost the Cohen commission. But these mourners are missing the point. More importantly, we have lost an invaluable store of evidence, sacrificed on the ideological altar of the Harper government. Are sockeye next?

WORKS CITED

Cohen, Bruce I. 2012. Commission of Inquiry into the Decline of Sockeye Salmon in the Fraser River. *The uncertain future of Fraser River sockeye*, vol. 3: *Recommendations—Summary—Process*. Ottawa: Public Works and Government Services Canada.

Fisheries and Oceans Canada (DFO). 2014. Aquaculture: Programs and initiatives. November 19. http://www.dfo-mpo.gc.ca/aquaculture/programs-programmes/index-eng.htm (accessed May 9, 2015).

Watershed Watch Salmon Society. 2015. Cohen report card. http://www.watershed-watch.org/issues/salmon-biodiversity/the-fraser-sockeye-inquiry/cohen-report-tracker/ (accessed May 9, 2015).