

OPINION

# We are all plastic people now, in ways we can't see – and can no longer ignore

Our global plastics problem has been steadily growing for decades, polluting the planet in obvious ways. Less obvious are the microplastics that we eat and breathe, and the impacts they have on our health. I experimented on myself to find out more

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**RICK SMITH**

SPECIAL TO THE GLOBE AND MAIL

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A chemically treated and filtered stool sample from Rick Smith awaits inspection under a microscope at a lab in Rochester, N.Y., this past February. Learn more in this video about Mr. Smith's experiment to find out how much microplastic would end up in his body.

THE GLOBE AND MAIL

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*Rick Smith is the executive director of [the Broadbent Institute](#) and co-author of *Slow Death by Rubber Duck, an examination of toxic chemicals in people.**

For most of us, the COVID-19 pandemic is a terrible disruption to our lives and livelihoods. For the plastics industry, it would seem, it's an opportunity to be exploited.

With a brazenness that would make even Joe Exotic of *Tiger King* fame blush, the plastics industry has been using this time of heightened public concern for hygiene to argue that single-use plastics are the healthiest choice. Fashioning itself as a champion of consumer safety and worker rights, the industry has recently persuaded some U.S. cities and states to reverse bans on plastic bags, and has sought to position recyclable shopping bags as germ-ridden biohazards. Their argument isn't in the slightest bit subtle and can be boiled down to the title of a recent column circulated on one of the industry's many lobbying websites: "The War on Plastic Makes the Virus Worse."

Coronavirus or no, the plastics industry is determined to gain ground. When Dustin Hoffman's character was told in the 1967 classic movie *The Graduate* that there was "a great future in plastics," global production of the stuff was a meagre 25 million tonnes a year. Today, that number has risen to about 400 million tonnes per year, and is projected to double again in the next two decades. Amazingly, half of all plastics ever made have been produced in the past 13 years.

If the magnitude of increased plastic production is eye-popping, the resulting mountain of waste is even more so. Nearly one-half of all the plastics produced every year are for single use. Often, as in the case of fast food take-out containers, this use lasts for only a few minutes. In addition, it's estimated that up to a trillion plastic bags and about half a trillion disposable water bottles are used globally

every year, and in the United States alone, an estimated 500 million plastic straws are used each day. Less than 10 per cent of plastics are recycled, meaning the vast majority winds up discarded in landfills or dumped in the environment.

Some people – such as U.S. President Donald Trump, for instance – care little about any of this. The President’s re-election website proudly sells packs of plastic “Trump”-monogrammed straws because “liberal paper straws don’t work.” But a great many other people, thankfully, are indeed concerned. The United Nations recently declared that plastics pollution is the “second-most ominous threat to the global environment, after climate change.”

In February, the Canadian government’s “Draft Science Assessment of Plastic Pollution” stated that there are “growing concerns that plastic pollution may adversely impact the health of the environment and humans.”

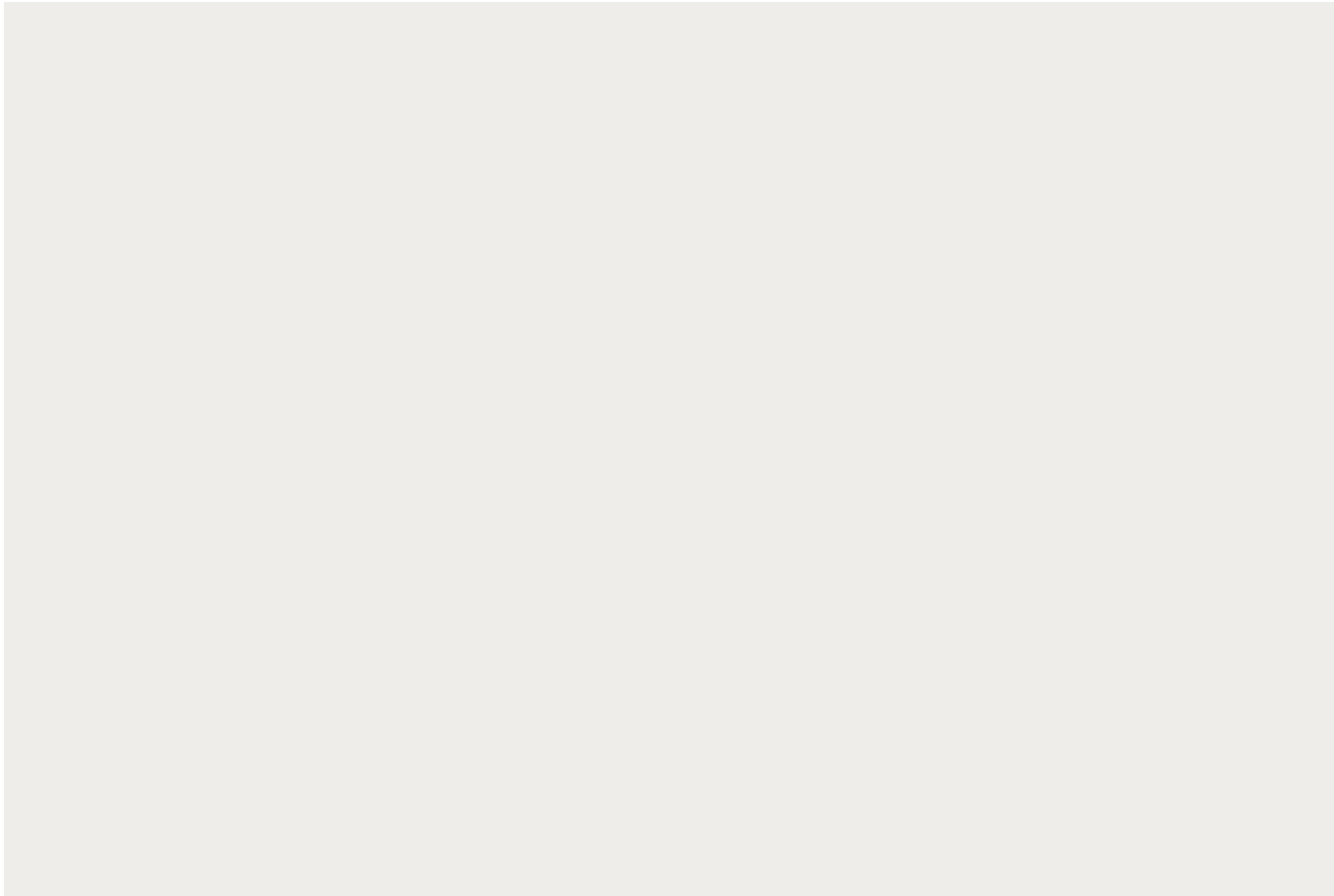
The visibility of plastic litter is impossible to ignore. The images are heart-wrenching: sea turtles with discarded plastic straws clogging their noses; whales found dead, their stomachs packed full of plastic grocery bags. Unless we change course, it is estimated the oceans could have more plastic than fish by 2050.

All of this is awful. And, just as much as the planet is, our bodies, too, are a host for countless plastic particles. But whereas the damage done to nature is obvious, it’s less clear what ingesting plastics is doing to us.

What if the biggest problem with plastic is not what we can see, but what we can’t see?

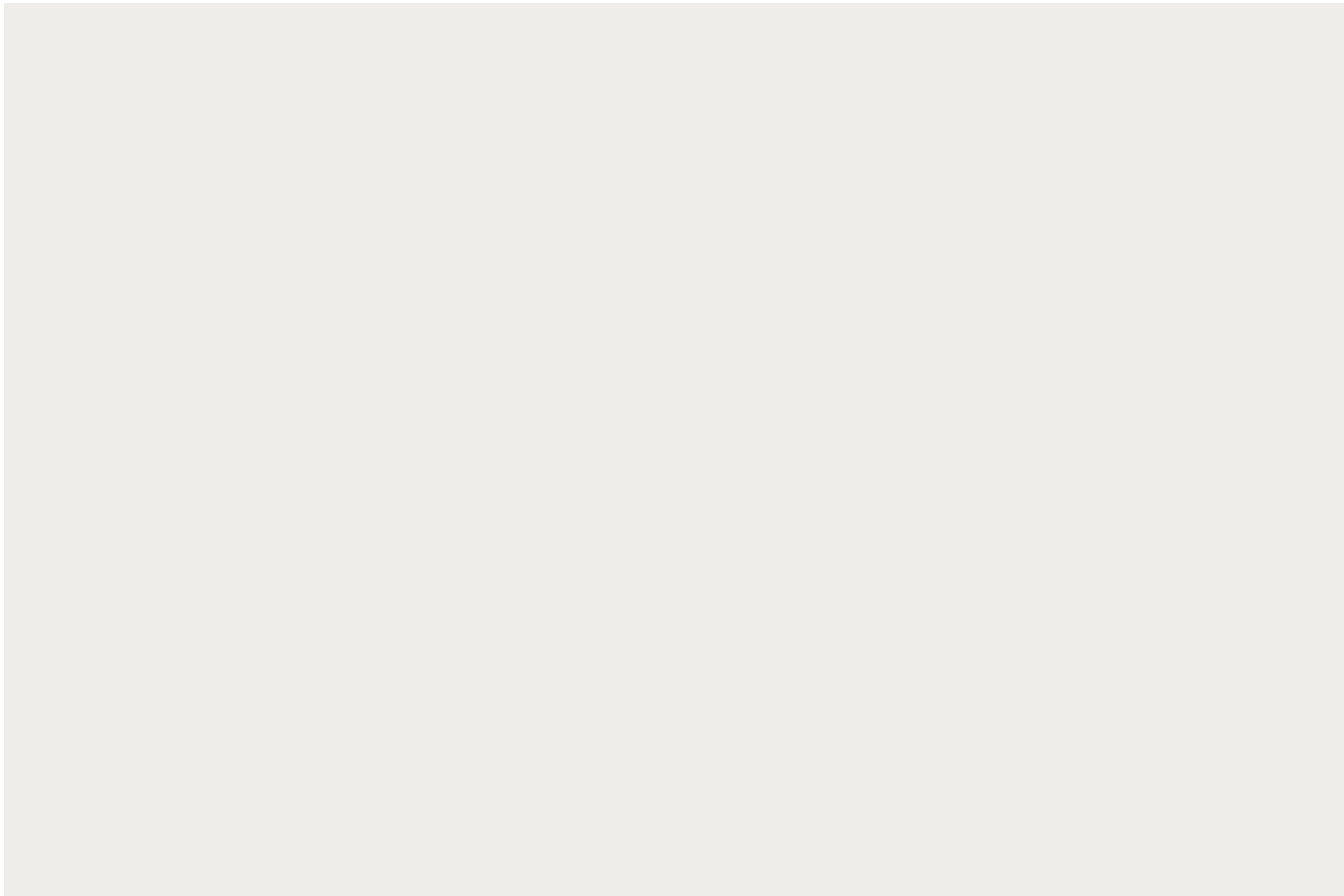
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Plastic waste and other garbage piles up on shore in the Costa del Este neighbourhood in Panama City this past June 8, World Oceans Day. About 400 million metric tons of plastic waste is produced globally every year.

LUIS ACOSTA/AFP VIA GETTY IMAGES/AFP/GETTY IMAGES



Waste is reaching some of the most obscure parts of the planet. This 2019 photo shows a baby turtle on a plastic container on Henderson Island, an uninhabited part of the South Pacific's Pitcairn archipelago. Ocean currents that carry waste from thousands of kilometres away have left it with one of the highest concentrations of plastic pollution on Earth.

IAIN MCGREGOR/STUFF/AFP/GETTY IMAGES/AFP/GETTY IMAGES

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### **FROM MACRO TO MICRO**

The scale of Plast-Ex, one of the premier plastics industry trade fairs held each year at the cavernous Toronto Congress Centre, was something to behold. Perusing the hundreds of exhibitors of plastics processing equipment, packaging and consumer items, the crowd was large and upbeat: Plenty of deals were being done. Noticeably absent, however, was any significant reflection of the roiling debate on plastics pollution occurring outside the exhibit hall. In fact, one of the very few downcast people I spoke with was a salesperson for a company trying to market a new type of non-toxic, plant-based plastic. Apparently, he was having a difficult time getting any uptake.

It was at Plast-Ex that I first met Joe Hruska, the vice-president of sustainability for the Canadian Plastics Industry Association. With a lengthy career that dates back to the creation of the Blue Box, Mr. Hruska is now the industry's lead for all things environmental. "Yes, we're very high on plastics," he said. "Plastics are essential to our health and well-being, not just in Canada but around the world."

Mr. Hruska's got a point, of course. It's certainly true that plastics have made many parts of our lives easier. Plastics make cars and planes lighter. They make building construction more robust. They make IV bags in hospitals functional and they make the laptop computer that I'm writing on at the moment portable enough to bring to my local coffee shop.

As Sherri Mason – a Penn State University professor of chemistry and a leading researcher on plastic pollution – explained to me, one of plastic's most useful attributes lies at the core of the current challenge. "Plastics are sturdy and extremely resistant to degradation," she said. "Micro-organisms don't have a way of

breaking the molecular bonds of plastics, which is what you have to do to get any energy out of what you eat.”

So because microbes – the planet’s tiny engines of decomposition – find the stuff distasteful, it turns out that plastic never truly disintegrates. Through the action of sunlight and waves over a long period of time, it just keeps getting shredded into smaller and smaller bits. The result, as scientists are only just beginning to understand, is that much of the plastic in the environment is invisible: Over the past few decades, it’s been rendered into an enormous collection of tiny micro- and nano-sized fragments and fibres.

Although the research is only just beginning, Peter Ross, a widely published marine biologist based in Vancouver, told me bluntly: “It’s safe to say that microplastics are everywhere. They’ve been found at the North Pole, the South Pole, from the highest mountain peaks to the deep trenches of our oceans, from air to water to land, urban environments, agricultural environments, remote environments. And they’re in every species we’ve looked at.”

While many of these microplastics are certainly derived from discarded plastic waste, others come from less obvious sources. Garth Covernton, a researcher at the University of Victoria, used the term “stealth microplastics” to describe their sometimes mysterious and unanticipated origins. “They come from things that we don’t even think about,” he said. For example: “I was using a Sharpie marker to label some samples in the lab, and when I put them under the microscope, I realized that there were all these polyester particles on them that came from the marker itself.”



Another major culprit is the plastic fibres in our clothing: about 60 per cent (and rapidly growing) of current clothing material globally, according to Kelly Drennan, sustainability advocate and founder of Fashion Takes Action. “Like fast food, polyester fast fashion is cheap, disposable and not very good for us,” she explained. Plastic clothing produces an enormous amount of pollution to make. As we wear it, the fibres slough off and wind up in household dust. When we wash it, the fibres get flushed down the drain into nearby lakes, rivers and oceans. By some estimates, it is these fibres that make up most of the microplastic problem.

Microfibres are so prevalent that any research lab working in this area goes to extraordinary lengths to eliminate them lest they contaminate their samples. Chelsea Rochman, a biologist at the University of Toronto, told me that when her students come into the lab, “there’s a breezeway where they need to hang their fleeces, fuzzy scarves and hats, and there’s a rack of cotton lab coats they put on over their clothing.” In addition to this, there’s a HEPA filter inside the lab, and counters and floors are wiped down every day.

When I asked Mr. Hruska from the plastics industry what he thinks about the developing research on microplastics, his answer was clear: “You can’t hold the material accountable.”

“This is a people-behaviour thing,” he said, reflecting the industry’s long-held talking point that if we could all just get better at recycling, there would be no need to talk about more significant changes to current plastic use.

According to the scientists I spoke with for this column, however, it is indeed concerning that the world is marinating in microplastics and we are in desperate need of a better understanding of the situation. Among the many unanswered questions, one looms the largest: Are humans absorbing microplastics, and if so, what are the health implications?

STORY CONTINUES BELOW ADVERTISEMENT

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Mr. Smith sips from a plastic water bottle. He's experimented on himself to see how common pollutants, including microplastics, have ended up in his body.

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### **RUBBER DUCKS AND PLASTIC PEOPLE**

I've been interested in plastics and the chemicals they contain for a long time. Just over a decade ago, Bruce Lourie and I wrote a book called *Slow Death by Rubber Duck*, which told the story of common pollutants in everyday life. In order to make the story authentic and as engaging as possible, we decided to test our own blood and urine for some of these common toxins. Not satisfied with stopping there, we actually experimented on ourselves, to find out whether the use of certain household products would measurably affect the levels of chemicals – including plasticizing chemicals – in our bodies. For example, we analyzed the extent to which we could increase our levels of bisphenol A (BPA) by handling cash register receipts. (BPA is a common component of certain types of plastics and coatings, and cash register receipts are slathered with high levels of the compound.) Our experiment showed that BPA is easily absorbed through the skin and that our levels of the chemical rose substantially after touching receipts for just a few minutes.

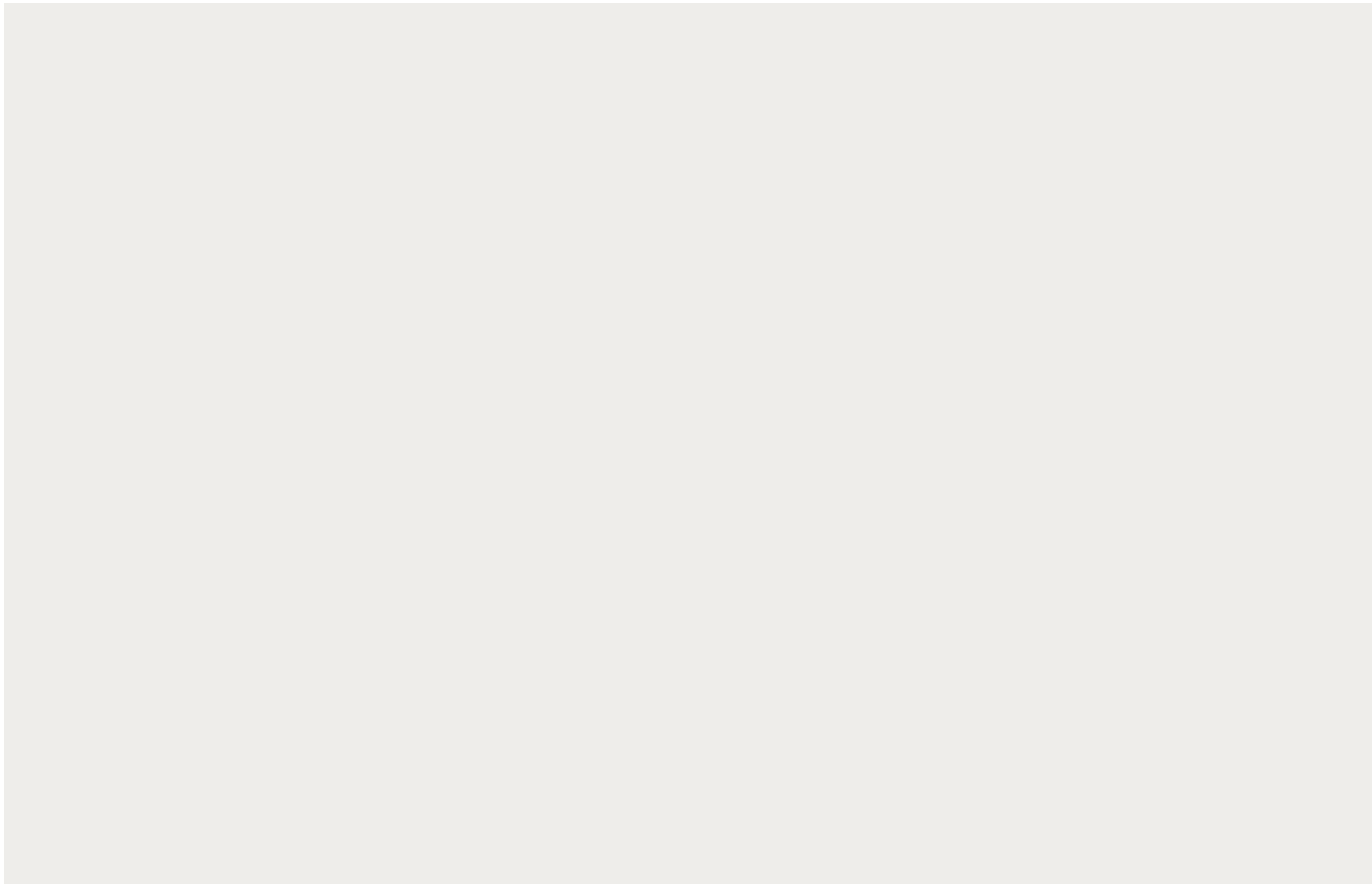
Mr. Lourie and I conducted more than a dozen similar experiments that pointed to worrisome levels of toxins in our and, by extension, most people's bodies. All of the

chemicals we found are a serious health hazard and are being increasingly linked to common human ailments ranging from breast and prostate cancer, to developmental delays in children, to obesity and diabetes. One of the puzzling things that we noticed throughout all of our experimentation is that we could never get our levels of plasticizing chemicals to zero – even though we avoided using certain types of plastics around the house. Could this have been because we all carry measurable amounts of plastic bits in us all the time? If so, they may act as countless microscopic pollution point sources, slowly leaching their chemical ingredients into our bodies over the course of our lives.

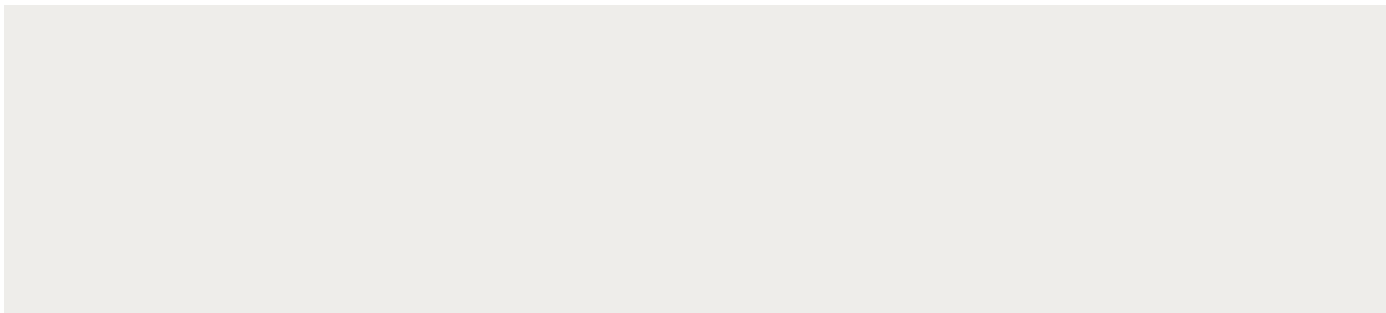
I wanted to investigate this question in a direct and personal way. So about a year ago, I started to mull over the possibility of testing my own body for microplastics. To date, the only study showing microplastics in humans was released in September, 2019, and it examined a tiny group – only eight people – none of whom lived outside Europe or Asia. Microplastics were found in all of them.

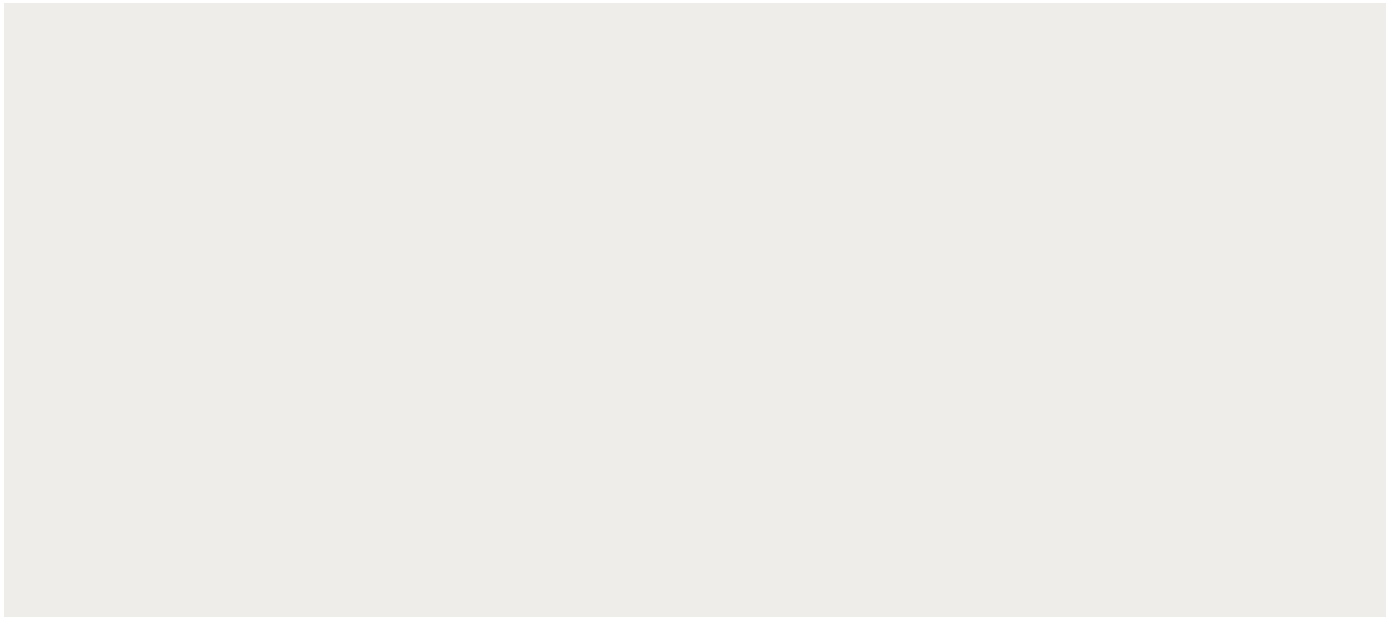
I started looking for labs that might be interested in collaborating with me on this ground-breaking work, the first time such experimentation would be tried in North America. Through colleagues, I was put in touch with experts Christy Tyler and Nathan Eddingsaas, researchers at the Rochester Institute of Technology. We worked together to design an experiment that would not only test me for microplastics, but also see whether a change in behaviour might affect my personal microplastic load.

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From the mesh bag of tea, to ketchup and mustard bottles to a bowl of instant soup, everything Mr. Smith ate on this January night was packaged in some form of plastic.





As he ate the packaged food for several nights, he'd use sterilized glass jars to collect stool samples. Here, Mr. Smith confers with associate professors Nathan Eddingsaas, left, and Christy Tyler, right, as they examine the results at New York state's Rochester Institute of Technology.

PHOTOS: FRED LUM/THE GLOBE AND MAIL/THE GLOBE AND MAIL

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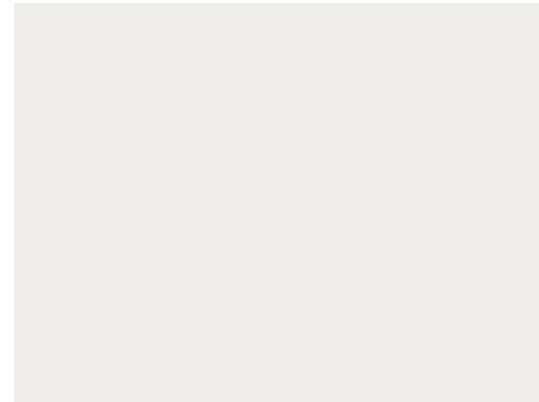
### **FIBRES AND FRAGMENTS**

I'm going to spare you the more graphic details, but let me briefly describe what I did. Over the course of six days in January, I collected a stool sample from myself each day, and each sample was deposited in a jar with a preservative. The first two samples were from days when I was living and eating as I normally do. On the days I took the next four samples, I did a variety of things to try to crank up my ingestion of plastic microparticles to see whether the effects could be measured.

I didn't do anything outlandish – or even beyond the daily experience of most Canadians. Based on a few recent scientific studies, I engaged in activities that might result in microplastics entering my body. I ate food that had been shrink-wrapped in plastic and cooked it with bottled water (possibly one of the most important sources of microplastics in our daily lives). I heated my meals in plastic containers in the microwave. My coffee was prepared in a Keurig machine (which involves the boiling water being pushed through plastic) and my tea was brewed in microplastic-spewing nylon tea bags.

To add to my potential microplastic load, I chose foods that had recently been shown to contain microplastics such mussels and canned fish. I left my victuals out on my kitchen counter for up to four hours before consuming them. Over the three days of the experiment, I also made sure to wear the new fuzzy black fleece I'd received for Christmas and went out of my way to put on other clothing that was laced with plastic. The reason for all of this? Recent evidence has shown that more airborne microparticles and microfibrils from household dust can fall on food than the microplastics contained in the food to begin with.

Once the Rochester lab received my samples, they set to work. Over the course of several weeks, the organic material in my samples was digested away, the remnants carefully filtered through a tiny sieve and picked through under a microscope. Visible particles were analyzed with a Fourier-



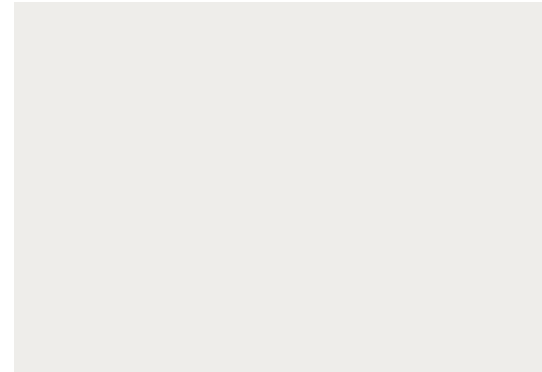
transform infrared spectrometer (FTIR), a machine that measures the spectrum of a particle's infrared absorption and allows researchers to determine what type of plastic it is made of.

Dr. Eddingsaas prepares to analyze one of the stool samples.

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When I left Toronto to drive down to Rochester for the big “reveal,” Dr. Tyler and Dr. Eddingsaas and their graduate students hadn't finished their analysis yet. It was only when I arrived at the lab that they told me the results: The experiment had worked. “We found microplastics in you, and more fibres were observed in the later samples,” Dr. Eddingsaas said as he leaned over his microscope. “The FTIR analysis confirmed that some of them were PET (a common polyester used in clothing), polystyrene and acrylic derivatives.”

Looking through the microscope, I saw a considerable amount of material that turned out to be cellulose – the tough cell walls of the plants in my diet that the peroxide couldn't break down. But mixed in with this whitish material were tiny fibres, a few still retaining their original colour. Based on their shape, these polyester and acrylic microplastics could only have originated from clothing. Did my new black polyester fibres fall from my fleece into the meal I was



Mr. Smith looks through the microscope as chemistry student Olivia Martin observes.

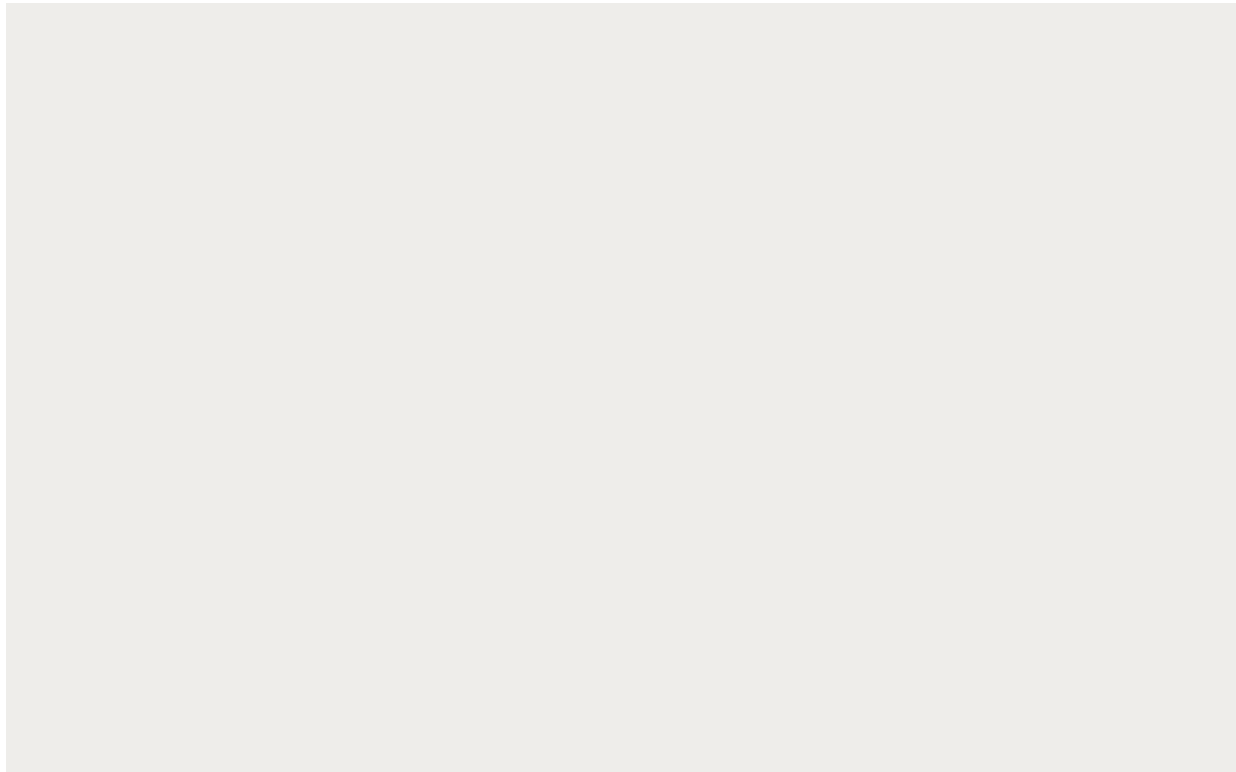
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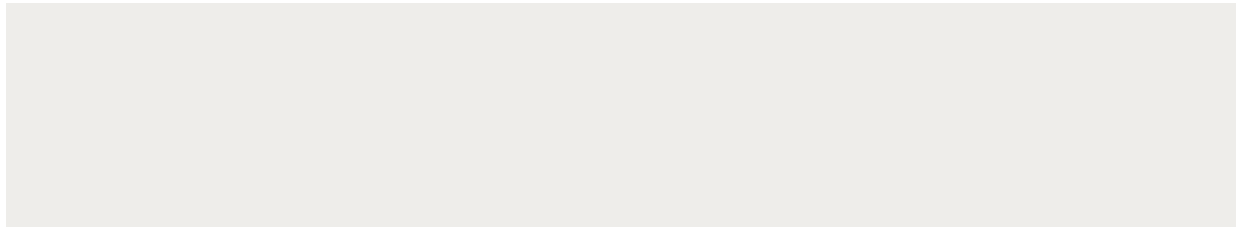


eating? Maybe. In terms of the polystyrene, this material is common in food packaging, meaning these fragments likely originated from my plastic-infused diet.

The results also demonstrated that over the course of the last four days of the experiment (when I kept increasing my exposure to plastic), the microparticle count in my body also increased, revealing that the amount of plastic used around the house had a direct impact on my body. Given that people's bodies take in environmental pollutants in similar ways, it's safe to say that anyone who was near increased levels of plastic would suffer the same effect.

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Microscope images of a processed stool sample, as seen under white and black light. The bright objects visible under the black light are plastic particles. Because plastic will fluoresce under black light, this is one technique to detect even the tiniest plastic fibres and fragments.

NATHAN EDDINGSAAS/HANDOUT

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### **WHEN THE ENVIRONMENT GETS PERSONAL**

So now we know: I have microplastics in me.

What does that mean for my health? As Dr. Tyler told me: “Although this was a small experiment and focused only on plastics in the ‘micro’ range, the results clearly show that plastic particles from the environment are in the food that we eat and travel through our bodies.

“In many ways,” she said, “this raises many more questions than it answers and more research is needed as soon as possible.”

What scientists already know about the potential health effects of having imbedded plastic particles throughout our bodies is cause for serious concern. A September, 2019, editorial in the American College of Physicians’ Annals of Internal Medicine made clear that particles of a certain size can pass through the gut lining and into

our bloodstreams and may deposit themselves in organs that clean and filter our circulatory system – such as the liver, spleen and lymph nodes. Scientists have already shown that ingestion of microplastics by a range of species under lab conditions leads to reduced appetite, energy and reproduction. And plastics contain toxic chemicals such as flame retardants, phthalates and BPA, as well as absorbing toxins – such as pesticides – on their surface. With current calculations of the average human’s yearly ingestion of microplastics being in the hundreds of thousands of particles, and one recent estimate showing that countless tonnes of microplastic particles shower down on us every day in precipitation and dust, that could easily mean a lot of damaging chemical exposure.

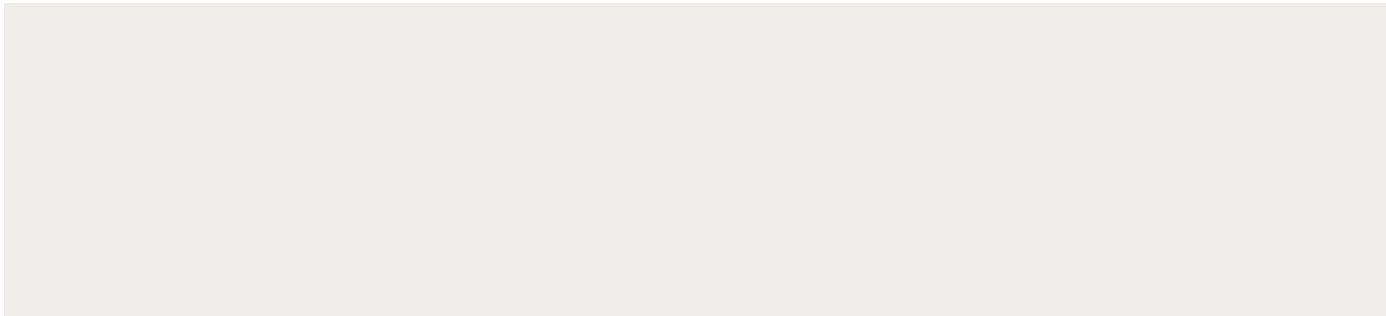
As public debates go, the one surrounding plastics has considerable momentum. Unlike climate change, where attitudes are wildly different between conservative and progressive voters, recent polling has shown that support for progress on plastics is high right across the political spectrum. Tim Gray – executive director of Environmental Defence Canada, one of the leading environmental organizations engaged in solving the plastic problem – says he thinks this is because the “issue seems to most people ... [to be] eminently solvable.” “It’s dumb as a bag of hammers to be taking virtually all of this high-value material and throwing it in landfills and the environment,” he told me. In addition, he said, people feel like they’ve been sold a bill of goods. “The one thing they’ve been doing that they’ve been told helps the planet – the Blue Box – turns out largely to be useless.”

My guess is that the existing public support for action on plastics is only going to get more turbo-charged by the new microplastics science. As Mr. Lourie, a long-

standing Canadian leader in environmental policy and my co-author on *Slow Death by Rubber Duck*, has observed: “At the end of the day, many people don’t really care about the environment outside of their own lives. What people are really concerned about is what affects them, their families, their kids, their own bodies.” Mr. Lourie says he thinks the plastics debate is now where the discussion around shutting down coal plants in Ontario was in the early 2000s: Everything is about to change. “Once it becomes broadly known that plastics are a threat to human health, that we’re inhaling and swallowing them every day, that they may be wreaking havoc in our bodies, that’s going to be the turning point on the plastics issue globally.”

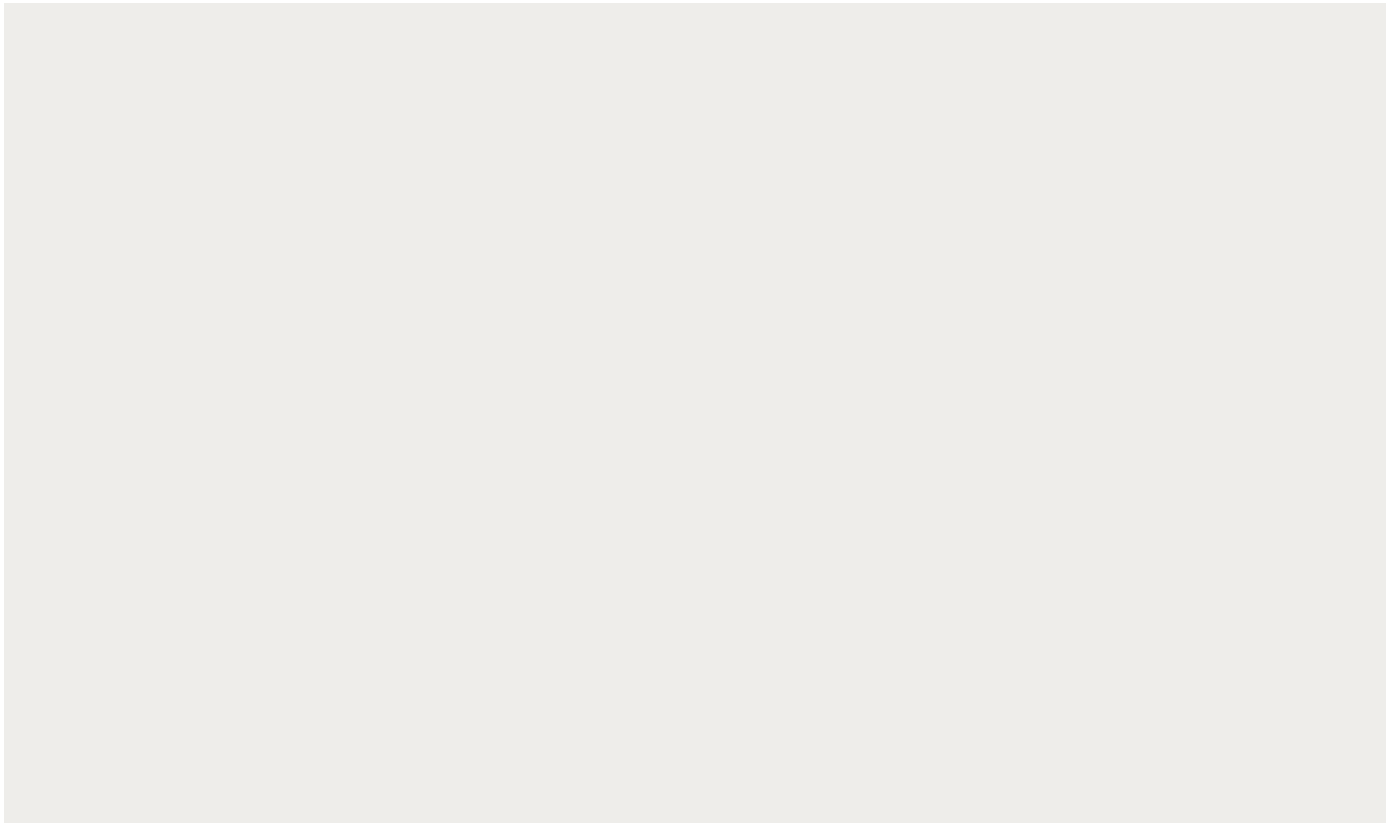
And if the COVID-19 pandemic demonstrates anything, it is how quickly and decisively our society will react when it becomes clear that human health is at risk.

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The driver of a jeepney, a style of bus ubiquitous in the Philippines, installs plastic sheets to keep riders apart in Quezon City earlier this month. The COVID-19 pandemic has increased demand for plastic sanitary items like screens, masks and gloves.

ELOISA LOPEZ/REUTERS/REUTERS



A man shreds plastic bags to be made into road pavers at a factory in Thailand's Chiang Mai province. Thailand introduced a ban on single-use plastic bags at major retailers earlier this year, but plastic use has been even higher than usual due to the pandemic-related surge in home deliveries.

LILLIAN SUWANRUMPHA/AFP VIA GETTY IMAGES/AFP/GETTY IMAGES

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### **SCIENCE FICTION AND SCIENCE FACT**

The notion of microplastics is so new that it's currently a favourite storyline in science fiction. During the writing of this column, I happened to be watching the most recent season of the long-running British show *Doctor Who* with my younger son. In this particular episode, a malevolent strain of alien bacteria invades the Earth and starts consuming birds, people and other creatures with explosive effect. The reason? The bacteria thrive on eating plastic and, like a giant intergalactic dinner bell, the elevated level of microplastics in Earth's environment and its inhabitants attracts the germs from the other side of the universe.

I asked some of the scientists I spoke with what keeps them up at night about this issue. Their answers were only slightly less dramatic than the *Doctor Who* episode. Dr. Ross, the marine biologist, wondered whether microplastics may now be a permanent part of our ecosystem. With more familiar types of pollution, he told me, the chemicals eventually settle out into sediments in fresh water and oceans and don't bother us much again. But microplastics seem to behave differently.

“Because they’re buoyant, I’m concerned we may see microplastic fibres float around like a cloud and remain in suspension in the food web and the water column for centuries,” he said.

Phoebe Stapleton, an assistant professor at New Jersey’s Rutgers University, has recently shown that rat mothers are able to pass on to their fetuses microplastic particles that they’ve inhaled. Many of these tiny plastic particles are small enough that, once they’re in an animal’s body, they could pass from the gut or lungs into the bloodstream. From there, we simply don’t know what effect they might have. One horrifying possibility, Dr. Stapleton told me, is they could “get sealed into the brain area.” She explained that there is a window in early fetal development before the brain becomes protected through the creation of the “blood-brain barrier” (a network of cells that shields the brain from any pathogens that may be circulating in our bodies). So if a fetus gets filled up with microparticles from the mother and the blood-brain barrier forms after that, humans and other creatures may be stuck with tiny plastic particles in their heads and bodies that lack the enzymes to break the particles down. Dr. Stapleton and Penn State’s Dr. Mason wonder whether there could be a link here with Alzheimer’s. “Plastics are a great insulating material,” Dr. Mason told me. “Our brains transmit messages through electric impulses that move between one neuron and another. What if there’s a piece of plastic in the way that prevents that transmission from occurring?”

“We’ve been exposed to these particles since before we were born,” she said. “What is the impact of these tiny toxic time capsules?”

At a time in history when the warnings of scientists – about climate change, pandemics and plastics – often go unheeded until it's too late, we need to make sure that microplastics are the exception to this rule and take the warnings seriously. The plastics industry, of course, is going to fight any changes tooth and nail. In response to the Canadian government's recent announcement that it was proceeding to declare plastics “toxic” (the first step in regulatory action under our country's pollution laws), an industry spokesperson fretted that this might “be used as a reason by some campaigners to encourage people to stop using plastics.” This, of course, is exactly what needs to happen. Contrary to the industry's cynical use of the pandemic to argue that plastics are good for human health, the rapidly developing science points to the opposite conclusion. We're drowning in the stuff. And it's time to drain the plastic swamp.

When rock star Pete Townshend sang the lyric “I was born with a plastic spoon in my mouth,” I'm pretty sure it was meant to be a commentary about class as opposed to environmental destruction. But it was prescient nonetheless. These days, rich and poor, urban and rural, young and old are all surrounded by plastic every day. And the implications are only now becoming clear.

Though I'm one of the first people in the world to find plastic in me, I'm afraid I won't be the last.

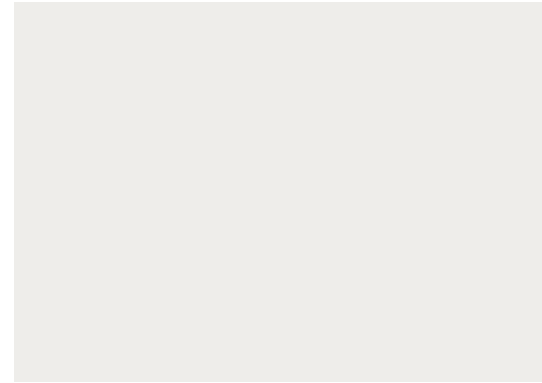
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## Notes on my plastic menu



JAN. 10

- **Dinner:** Noodles from plastic bowl, two veggie hotdogs with cheese (both plastic-wrapped), mint tea from nylon tea bag



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JAN. 11

- **Breakfast:** Oatmeal prepared with bottled water, coffee
- **Lunch:** Macaroni microwaved in plastic, kale salad (plastic-wrapped), mint tea
- **Dinner:** Instant noodles, Noodle soup in plastic bowl, smoked mussels, crackers (plastic-wrapped)

JAN. 12

- **Breakfast:** Oatmeal, coffee, mint tea
- **Lunch:** Instant noodles, canned fish, cheese (plastic-wrapped), coffee, kale salad

OTHER EXPERIMENTAL NOTES

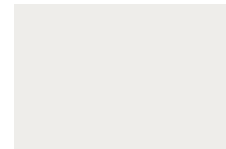
- 11 litres of Nestlé Pure Life bottled water consumed directly or used in the preparation of food, tea and coffee
- Seven cups of coffee prepared using plastic K-cups
- Nine cups of tea consumed prepared using nylon tea bags
- Food and drink left out uncovered for up to four hours before consumption
- New fleece hoodie with 100-per-cent polyester lining, and other clothes with plastic fabrics, worn throughout the experiment
- In total, 0.8 kilograms plastic waste produced

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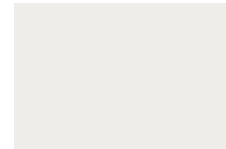
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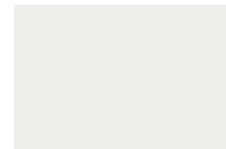
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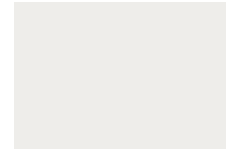
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