Can science break its plastic addiction?

Enlarge / There is no shortage of plastic in your average science lab.

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Lucy Gilliam has an infectious passion for environmental action. Today, she works in Brussels on environmental transport policy. But in the early 2000s, she was a molecular microbiologist in Hertfordshire. Like many in her field, Gilliam went through a lot of disposable plastics. It had become a normal part of 21st-century science, as everyday as coffee and overtime.

Gilliam was, in her words, a “super high user” of the sort of plastic, ultra-sterilized filter pipettes that could only be used once. Just as so many of us do in our domestic lives, she found she was working with what anti-pollution campaigners call a “produce, use, discard” model. The pipettes would pile up, and all that plastic waste just seemed wrong to her.

Science’s environmental impact had begun to worry her. It wasn’t just a matter of plastics. She also wanted to know why there weren’t solar panels on the roof of the new lab building, for example, and why flying to conferences was seen more as a perk than a problem. “I used to bitch about it over coffee all the time,” Gilliam tells me. “How can it be that we’re researching climate science, and people are flying all

over the place? We should be a beacon.”

She tried to initiate recycling programs, with some success. She invited the suppliers in to discuss the issue and worked out ways the research teams could at least return the boxes pipettes came in for re-use, even if the pipettes themselves would still be used and discarded. It felt like a battle, though. Sensing that progress was likely to be slow, she started to ask herself where exactly she could make change happen, and moved to work in environmental policy.

The field of scientific research is one of the more hidden users of disposable plastics, with the biomedical sciences a particularly high-volume offender: plastic petri dishes, bottles of various shapes and sizes, several types of gloves, a dizzying array of pipettes and pipette tips, a horde of sample tubes and vials. They have all become an everyday part of scientific research. Most of us will never even see such equipment, but we all still rely on it. Without it, we wouldn’t have the knowledge, technologies, products, and medicines we all use. It is vital to 21st-century lives, but it is also extremely polluting.

In 2015, researchers at the University of Exeter weighed up their bioscience department’s annual plastic waste and extrapolated that biomedical and agricultural labs worldwide could be responsible for 5.5 million tonnes of lab plastic waste a year. To put that in context, they pointed out that it’s equal to 83% of the plastic recycled worldwide in 2012.

The problem with plastic is that it is so durable; it won’t decompose. We throw it in the rubbish, it stays there. It is thought that there may now be more Lego people on Earth than actual people, and these minifigs will outlive us all. When plastic products like these minifigs—or pipettes, bottles or drinking straws—do eventually break down, they stick around as small, almost invisible fragments called microplastics, which also come from cosmetics and clothing fibers. A 2017 study

found microplastics in 81% of tap water samples globally. In the past few years, in mountain ranges in the USA and France, researchers even found microplastics in rain. They have recently been found in the Arctic, too.

Modern science has grown up with disposable plastics, but times are changing. This autumn, the first wave of young people to follow the Swedish climate activist Greta Thunberg and go on "school strike for the climate" started undergraduate degrees. Universities can expect these young people to bring fresh and sometimes challenging questions about how scientific research is conducted. At the same time, many of those from Generation Z (those born from the mid-1990s onwards) are now starting PhDs, and millennials (born from the early 1980s) are leading more and more labs. As more universities challenge themselves to eradicate disposable plastics, as well as to go zero-carbon, in the next few years or decades, scientific waste is increasingly being put under the microscope.

Enlarge / Cleaning, still kinda plastic-reliant. *Credit: © Daniel Stier at Twenty Twenty and Miren Marañón at East*

Photographic for Mosaic.

In a sign of how far things have moved on since Gilliam left her career in research, last November the University of Leeds pledged to go single-use-plastic-free by 2023. Recently, UCL has announced it will follow suit, with the only slightly less ambitious target of 2024. These new policies won't just banish disposable coffee cups from campus, but a lot of everyday scientific equipment, too.

Lucy Stuart, sustainability project officer at Leeds, says that the reaction among researchers has been mixed, but they are gradually making progress. "For us, as a university, we are here to inspire the next generation," she says. "Also, we are a research-based institution that is creating groundbreaking innovation every day, so we didn't want to say the solutions aren't possible, because we are the people that help create those solutions."

The ambitious target has helped focus everyone's attention, as has the clear sign that it has support all the way through the institution from the top of university management down. However, "We don't want to implement top-down policies," Stuart emphasizes. "We want individual researchers and employees to take ownership and look at the problem within their area, and then make a change."

Elsewhere, many scientists are already pushing ahead on their own initiative. When David Kuntin, a biomedical researcher at the University of York, was discussing plastic waste with his lab mates, he soon found he wasn't the only one who had noticed how much they were getting through.

"Using plastics on a daily basis—in science, it is kind of impossible to avoid nowadays. And someone just said, 'Oh, we could fill a room after a week!' and it got us discussing what we could do."

One reason lab plastics are such a sticky problem is that they

can get contaminated with the biological or chemical matter being researched; you can’t simply put them in the campus recycling bins with your coffee cup. Usually, lab waste plastics are bagged and autoclaved—an energy- and water-hungry sterilization process—before being sent to landfill. But, Kuntin says, not all plastic waste is too contaminated to recycle. Rather than simply classing everything as hazardous, straight off, he and his colleagues did an audit of the plastic they used to see what they could decontaminate.

“The contamination we deal with is probably less dangerous than a mouldy tin of beans you might have in your recycling after a few weeks,” Kuntin says. So, just as the team had learned that they had to wash their tins of beans before they put them in the council recycling bin, they learned ways to decontaminate their lab waste, too.

They developed a “decontamination station” with a 24-hour soak in a high-level disinfectant, followed by a rinse for chemical decontamination. They also looked at the plastics they were buying to pick ones that would be easier to recycle. As a result of these measures, they’ve reduced the plastic they were previously sending to landfill by about a tonne a year.

“That’s 20 workers, 20 of us,” he says, sounding as if he still doesn’t quite believe that so few researchers could pile up so much waste. “We used a tonne of plastic that we can recycle.” They worked out it was enough to fill 110 bathtubs. And because they have also cut down how much equipment has to be autoclaved, they are saving energy and water, too.

“I think as scientists, we need to be responsible about what we’re doing,” Kuntin tells me. Not least, he says, because it is public money they are spending. “You can’t, with a clean conscience, just be using a tonne of plastic.”

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