

The Impact Of Plastic On Human Health



*We know that plastic is choking the planet.
But it could be killing us, too.*

In 2019, the European Commission’s Scientific Committee on Health, Environmental and Emerging Risks published a [statement](#) that identified 14 emerging health and environmental issues. Right near the top of that list was plastic waste. The committee emphasized the “urgent” need “for a better assessment of hazard and risk” associated with exposure to plastics of different shapes and forms.

The Facts About Plastic

During World War II, U.S. plastic production [increased by 300 percent](#). Since then, plastic has become ever more ubiquitous, and by 2014, according to market research firm PlasticsEurope, had surpassed [300 million tons produced per year](#). There’s a good reason for that. The wondrous nature of plastic is that it’s lightweight, highly malleable, and resistant to biodegradation. It is widely understood that this last property is the root of what has emerged as one of the most intractable environmental problems as the plastic waste piles up around the globe. What is less understood are the exact reasons why.

Plastic is made up almost entirely of hydrocarbon chains, which are an incredibly stable type of molecular bond. In cases where hydrocarbon chains occur naturally, that stability is a necessary component of an organism’s function and generally forms part of a greater ecosystem. Plastics, however, are synthetic, which means they’re no good as a food source for microorganisms (with at least [one rare exception](#)) and, as we’ve so tragically come to learn, that is a major problem.

On one hand, there’s the obvious issue of what happens to all that accumulated plastic trash. We all know the answer to that one: It turns into giant islands of floating trash, it goes [up into poor turtles’ nostrils](#), and is found in the stomachs of

[beached whales](#). According to a 2022 [study](#) published in the online journal Nature Communications, blue whales could be ingesting as much as 10 million pieces of microplastic every day. According to the World Wide Fund for Nature's [Living Earth 2018 report](#), 90 percent of the world's seabirds have plastic in their stomachs, [a figure that is expected to rise to 99 percent by 2050](#).

Marauding Microplastics

Over the course of several decades, as plastic is exposed to the elements, it begins to decompose into smaller particles. While this process, known as photooxidation, does not affect plastic on a molecular level, it does eventually break it down to its nanoparticles. If you're finding that hard to imagine, picture a grocery bag that's been zapped by a shrink ray: It's the exact same piece of plastic, only now it's microscopic.

On the surface, this result may appear to be a good thing. Out of sight, out of mind, right? If only it were that simple. Plastic may actually be at its most threatening once it has broken down to the point it's invisible to the naked eye because at that point, those little particles can travel a lot faster and further, and into the bodies of animals, including us.

[Research](#) conducted by the State University of New York at Fredonia found a significant amount of microplastics in bottled water. To be precise, 10.4 microplastic particles per one liter of water were recorded in a sample of 259 bottles representing 11 major brands across nine countries, including Aquafina, Dasani, Evian, Nestlé Pure Life and San Pellegrino, reflecting twice the amount of plastic found in a previous study using tap water. Researchers suggested the plastic contamination could have partially come from the bottling process.

Avoiding bottled water and sticking to municipal water won't necessarily solve the problem of ingesting microplastics from drinking water.

[“Substantial amounts of microplastics”](#) were recently found in tap water and rivers throughout South Africa, according to a recent study conducted by scientists from North-West University. Zoologist Henk Bouwman, a member of the research team, explained that the findings were conclusive, but the implications remain unclear. “There is no consensus yet on any health impacts as the science is still in its infancy,” he [told](#) Johannesburg's Daily Maverick. “It might be benign, and it might not be. There are a whole lot of things we don't understand at this

stage.”

This topic was further explored by National Geographic in a [2018 article](#). For the piece, Chelsea Rochman, an ecologist at the University of Toronto, shared her [research](#) that found that fish suffered liver damage from ingesting polythene plastic (the kind plastic bags are made of), while oysters exposed to polystyrene tended to produce fewer eggs and less mobile sperm. But this does not necessarily mean humans will suffer the same effects.

Plastics and Human Health

Given the ubiquitousness of microplastics, it's no surprise that they have infiltrated our bodies too. A breakthrough study [published in 2022](#), using blood donated by members of the general public, found the tiny particles in 80 percent of the samples. A 2023 UK [study](#) found that microplastics can pass through blood vessels to vascular tissue, potentially contributing to damage inside the vein. Other studies have shown that they are present in [our feces](#), [our lungs](#), [our stomachs](#) and, most worryingly, in [placentas](#).

It is not yet clear what effect this infiltration has on human health.

As the National Geographic article's author Elizabeth Royte points out, it's difficult to study the impact of microplastics on human health for a number of reasons. First, there's the simple fact that “people can't be asked to eat plastics for experiments.” Extrapolating the findings from fish experiments doesn't work either, as “plastics and their additives act differently depending on physical and chemical contexts,” as well as the fact that “their characteristics may change as creatures along the food chain consume, metabolize or excrete them.” As a result, notes Royte, “we know virtually nothing about how food processing or cooking affects the toxicity of plastics in aquatic organisms or what level of contamination might hurt us.”

For Rochman, there is no doubt that “there are effects from plastics on animals at nearly all levels of biological organization.” [Studies show](#) that in fish, microplastic pollution (MP) causes structural damage and affects metabolic balance, behavior and fertility. In laboratory mice and rats it causes similar biochemical and structure damage.

OK, so we may not have clear evidence on the direct health impacts of microplastics where human beings are concerned, but what about more

immediate side effects?

For one, there's the fact that microplastics are foreign particles entering our bodies. Inflammation, for instance, is a response triggered by the immune system to this sort of invasion, writes Rachel Adams, a senior lecturer in biomedical science at Cardiff Metropolitan University, in [The Conversation](#). Another cause for concern is that these microparticles act as carriers for other toxins entering the body. Toxic metals like mercury and organic pollutants like pesticides are just two examples of hazardous materials that could enter the body attached to plastic particles. They can slowly accumulate over time in our fatty tissue.

Quantifying Harm

"We do not currently have clear evidence that plastic microparticles in drinking water have a negative effect on health," writes Adams. "But given the effects other particles can have, we urgently need to find out more about plastic microparticles in the body."

John Meeker, professor of environmental health sciences and global public health at the University of Michigan, concurs. "We first need to figure out how best to measure exposure then document whether people are being exposed, and, if so, how much," wrote Meeker over email. In order to do this, he continued, scientists need to determine what environmental factors influence exposure levels and "what aspects of microplastics could be most relevant to toxicity—is it size, shape, chemical makeup or additives used in the plastics, or even toxins picked up by the plastic from its surrounding environment?" Once these factors have been established, we can begin to consider how the body processes these plastics, and what effects the various levels of exposure can have on humans over a period of time.

"Once we have found ways to measure exposure in humans, we will then need to conduct cohort studies in various types of populations to look for associations between exposure and various health endpoints," said Meeker, advising that "these should be done in concert with experimental laboratory studies on toxicity to establish estimates about health risk." Some efforts have begun in this direction. For example, in 2022 California became the first state in the USA to adopt a [state-wide microplastics strategy](#). Among other actions, the state [requires monitoring of microplastics](#) in drinking water and investigate whether it should set a limit on the particles in this water to protect public health.

For the gamblers out there, this lack of scientific certainty at present might seem like an invitation to continue rolling the plastic dice. The potential hazards of microplastic, however, are far from the only cause for concern.

Bothersome BPA and Problematic Phthalates

Modern living has made it so that there's no escaping contact with plastic—and the various extra chemicals it contains. Take [Bisphenol A \(BPA\)](#), which gives plastic its shape and structure, and the [phthalates](#) that make plastic soft and flexible. We end up ingesting a fair amount of these chemicals when plastic comes into contact with our food or [even our skin](#). In turn, this affects our hormone levels, which is why, for the most part, chemicals such as BPA are heavily regulated. There is a growing body of research showing that exposure to industrial chemicals commonly found in plastics may help contribute to [metabolic disorders like obesity and diabetes](#).

Added to this is the concerning fact that an increasing number of these chemicals are being detected in humans. A recent [study](#) conducted by the University of Exeter found traces of BPA in over 80 percent of teenagers. Reporting on the study, The Guardian [explained](#) how BPA mimics estrogen, and in so doing disrupts the endocrine system, which is responsible for regulating metabolism, growth, sexual function and sleep. But as is the case with microplastics, it is difficult to draw conclusive causal links between BPA and these health impacts due to ethical concerns around testing on humans.

Despite this lack of certainty, there's enough cause for concern that governments have responded to this plastic plight. Legislation has been passed in [Australia](#), [Canada](#), the [European Union](#) and the [United States](#) restricting or prohibiting the use of phthalates in certain consumer products. According to a [paper](#) published by the Indian Journal of Occupational and Environmental Medicine, these moves respond to the “variety of adverse outcomes” caused by the chemical, “including increased adiposity and insulin resistance” as well as “decreased levels of sex hormones, and other consequences for the human reproductive system.”

While it's important to understand the health impact of plastic, perhaps a more pressing question is what happens when we tell ourselves that plastic is safe—and continue to produce it in ever greater quantities. According to Statista, a market research firm, global plastic production has grown from [50 to 335 million metric tons over the past four decades](#). Chances are likely that the ultimate consequence

of our plastic consumption will be something far greater, and perhaps direr, than our current scientific understanding is able to predict.

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In Chile, Having A Good Constitution Doesn't Guarantee Social Change



A conversation with Bárbara Navarrete, secretary-general of the Communist Youth of Chile.

“We are a generation totally interested in taking power,” says [Bárbara Navarrete](#), the new secretary-general of the [Communist Youth of Chile](#). This generation came of age with examples such as Gabriel Boric, Chile’s president, who is only 37 years old, and Camila Vallejo, the president’s chief of staff, who is only 35. By constantly engaging in the political arena and reaching the highest levels of the government, people like Boric and Camila—as they are known—“push us to get involved, to take sides,” Navarrete says. Fifty years after the coup that devastated

Chile, people like Navarrete oscillate between hope in a government led by former student leaders (such as Boric and Camila) and devastation at [the defeat of a new constitution](#) in [2022](#). They also have to contend with [the rise of the right wing](#), which now holds offices in the legislature, including the presidency of the Senate.

Navarrete's own story is an example of, in her words, "the crossroads of experiences that affect this new generation in their way of doing politics." Her family directly experienced the consequences of the dictatorship in a peripheral part of Santiago. Born a few years after the end of the dictatorship, Navarrete learned about politics in the [student mobilizations of 2011](#), while she studied at an [important women's school](#) in the city. For nine months, the students took over the school in protest against Chile's private education model. Two political tendencies dominated the school—anarchism and communism; Navarrete opted for the latter.

During her time in the student protests, Navarrete says she saw "clearly the institutional alienation" of her generation. They may have grown up after the dictatorship, but they were surrounded by its institutions (including the coup constitution of 1980). "We felt," she says, "a detachment from laws and institutional culture," and they were left with a feeling of "incomprehension" toward the institutions' legitimacy. This resulted, she says, in "an overwhelming need to change everything, including the constitution."

The Results Are Not Random

Enshrining a new constitution for Chile before the 50th anniversary of the 1973 coup would have been a major achievement. But the draft constitution—produced with immense democratic input—was [defeated](#) in the elections on September 4, 2022. In the aftermath of that election, the government set up a committee of experts to produce a new draft that would be approved by 51 members of a constitutional council ([elected by direct vote](#) on May 7, 2023). The right-wing Republican Party won [35.4 percent of the vote](#), which gave it 23 constitutional council members. The Communist Party of Chile headed a coalition that won the second-most votes, [with 28.6 percent](#).

For Navarrete, the victory of the Republican Party "is neither a surprise nor an isolated event." In the first round of the 2021 presidential elections, the Republican Party's candidate José Antonio Kast [took the lead](#). "The right has

polarized the country,” she said, and it has defined the center-left government of Boric through “caricatures.” A substantial part of Chile, she says, “feels more represented by the positions of the reactionary right” as a result. “This is not a perfect situation,” Navarrete says, but “we can continue to dispute the issues by being present there.”

No Constitution Guarantees Change

“The democratic exercise that is being carried out with respect to the current constitution is, in itself, better than the way the current one was designed,” Navarrete told me, insisting that although constitutional change is important on the road to social change in Chile, it is not the only route. If the draft of the constitution had been approved in September 2022, the material and governmental situation would have altered, “but that, in itself, does not guarantee the transformation of the country,” says Navarrete.

From her point of view, the results of September reflect a profound disagreement or disconnection between the discussions in the constitutional convention—which wrote the rejected draft—and what the left parties had been proposing for the country. The “disconnection” is linked to the nature of the decade-long protest movement and the social agenda that it had tabled. “We ended up convincing ourselves,” Navarrete says, about the lack of this “disconnection,” which was “a mistake that cost us the [electoral approval]” of the new constitution. The gap between the political parties and the social movements has to be closed since it is these movements, she says, which are “the main engine of any transformation of the country.”

Against ‘Denialism’

The Communist Party of Chile is 111 years old. It is part of the government of Boric. This is the fourth time the party is in government; one of the previous times was during the Popular Unity government of President Salvador Allende (1970-73). As Chile goes into a period of commemoration for the 50th anniversary of the coup, Navarrete notes that this would be a good time to reflect on reparations, justice, and a commitment to never return to dictatorship.

The situation in Chile is “fragile,” she says, because there is a growth of “denialism,” the view that nothing really bad happened during the coup and the dictatorship. Laws against denialism [have been rejected](#) by the Chilean parliament. “We cannot allow [this discourse] to advance and consolidate,” says

Navarrete. “As a government, we have a profound responsibility not to romanticize memory or democracy per se, but to value them as the best conditions for developing politics and making the changes that are needed for those most in need.”

On May 28, Luis Silva, an elected constitutional council member and a member of the Republican Party, declared [during an interview with Icare TV](#) that at this historic moment, “a slightly more considered reading” of Augusto Pinochet’s government should be made. “He was a man who knew how to lead the state.”

Regarding these statements, Navarrete alleges that “the right wing believes that based on freedom of expression, all opinions are equally valid.” In contrast, she says, “There is no justification for a genocide of which we were victims as a country and thousands of families. There are people who are still searching for their loved ones.”

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Learning From History, If We Dare



Gary M. Feinman

The New Gilded Age, wars along the Russian border, a global pandemic, battles for women's rights, even the *Titanic*: history does rhyme with the present. Yet as former New York Times columnist Bob Herbert once observed: "If history tells us anything, it's that we never learn from history."

That's something we can realistically change. And if we do, we'll have an easier time addressing the macro and multiple challenges humanity faces, and finding the pathways to necessary compromises and alliances with people across all borders.

But our blinders and misconceptions about the past constrain the knowledge that we have to plan for a better future. Societies don't get much out of living memory because the longer-term ramifications from recent decisions generally remain unsettled, and most of the big problems we face are the cumulative products of decades or centuries of the wrong approach to humanity's histories and transitions. To leverage and learn from humanity's history regarding what fostered sustainability in the past, we need to know the outcomes.

The good news is that through concerted research in history and archaeology, we now know a great deal more about the different paths that people have taken and their outcomes than we did just *fifty* years back. Long-term perspectives on cities, states, and empires are now much fuller and more regionally diverse than was known decades ago. Synthetic, comparative analyses have been undertaken. We now know what worked and what did not.

To draw better inferences and learn from past human histories, it is necessary to challenge three pervasive myths, which fundamentally shape not just what we think about the past, but why so many see history as irrelevant when it comes to guiding the present and shaping the future. Each myth is pervasive and

entrenched as the ideas and presumptions behind them were born and entangled with the roots of the Western tradition of social sciences, baked into the frameworks through which researchers traditionally study the past.

The first myth supposes that humans in their natural state are nasty, brutish, and self-absorbed, only tamed by the power and coercion of the state. Clearly, humans do have the capacity for great selfishness, but as a species, we also are better cooperators with non-kin than any other animal. This seeming paradox is explicable if we recognize that people are not by nature either uniformly cunning or cuddly, but rather humans, past and present, are capable of both cooperation and selfishness depending on context. Our nature is not one-dimensional. Cooperative behavior is situational; we engage when an individual's wants dovetail with their larger social network. Lack of alignment short-circuits cooperation whether the network is large or small.

The first supposition or myth undergirds a broadly held second one—that large premodern societies were universally coercive or despotic in organization. Autocratic governance kept the ever-selfish in line, the argument goes. Ancient Athens and republican Rome generally have been categorically distinguished as the unexplained exception to this presumed premodern path, which came to an end just a few centuries ago when ideas from the Classical era were rediscovered, giving rise to The Enlightenment, when Europeans adopted reason, science, democracy, and more.

The latter scenario became the mid-twentieth-century justification for the third myth, the walling off of modernity from the deeper past. Only after the Enlightenment with rational thought could people organize themselves democratically, in forms of governance where voice, power, and resources were not monopolized by a few.

These three myths underlie the severing of deep history, especially non-Western pasts, from the present. Often in the absence of robust historical information, contemporary observations of non-Western peoples were categorically slotted into imagined pasts that led stage-by-stage to modernist Western presents and futures.

Progressive visions of human history spurred research in history, archaeology, and related disciplines. What we have learned over recent decades does not

conform with those starting myths and expectations. Change was not linear, nor was it uniform from region to region. Likewise, premodern governance was not consistently despotic, especially in the Indigenous Americas. Yet in every global region, how people governed themselves shifted over time.

When it comes to the past, we also know the outcomes. And, in the region where I study, prehispanic Mesoamerica, cities that were governed more collectively with less concentrated power tended to persist as central places longer than those urban settlements that were ruled more autocratically. A similar pattern, albeit less definitive, was also found for a global sample of states and empires. More in-depth study is necessary, but these historical patterns seem worth investigating in other regions and probing further where they have been documented. The role and success of governance and institutions in facing and meeting the challenges of the past unlock a treasure trove of information that just may guide us toward better futures.

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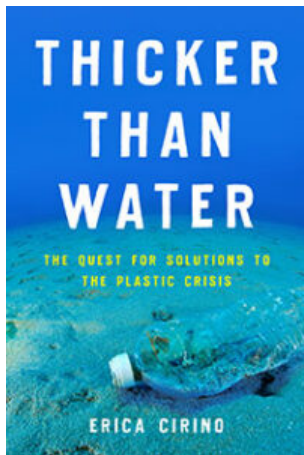
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Nanoplastics Are Entering Our Bodies



Plastic is in the air we breathe, the food we eat, and the water we drink. How does it get there—and what does it mean for human health?

The air is plasticized, and we are no better protected from it outdoors than indoors. Minuscule plastic fibers, fragments, foam, and films are shed from plastic stuff and are perpetually floating into and free-falling down on us from the atmosphere. Rain flushes micro- and nanoplastics out of the sky back to Earth. Plastic-filled snow is accumulating in urban areas like Bremen, Germany, and [remote regions like the Arctic and Swiss Alps](#).

Wind and storms carry particles shed from plastic items and debris through the air for dozens, even hundreds, of miles before depositing them back on Earth. Dongguan, Paris, London, and other metropolises around the world are enveloped in [air that is perpetually permeated by tiny plastic particles](#) small enough to lodge themselves in human lungs.

Toxic Tires

Urban regions are especially full of what scientists believe is one of the most hazardous particulate pollution varieties: synthetic tires' debris. As a result of the normal friction caused by brake pads and asphalt roads, and of weathering and wear, these tires shed plastic fragments, metals, and other toxic materials. Like the plastic used to manufacture consumer items and packaging, synthetic tires contain a manufacturer's proprietary blend of poisons meant to improve a plastic product's appearance and performance.

Tire particles from the billions of cars, trucks, bikes, tractors, and other vehicles moving across the world escape into air, soil, and water bodies. Scientists are just beginning to understand the grave danger: In 2020, researchers in Washington State determined that the presence of 6PPD-quinone, a byproduct of rubber-stabilizing chemical 6PPD, was playing a major factor in a mysterious [long-term die-off of coho salmon in the U.S. Pacific Northwest](#). When Washington's fall rains

heralded spawning salmon's return from sea to stream, the precipitation also washed car tire fragments and other plastic particles into these freshwater ecosystems.

Up to [90 percent of all coho salmon](#) returning to spawn in this region have died—much greater than is considered natural. As the study's lead author, environmental chemist Zhenyu Tian, [explained](#) in a 2020 interview with Oregon Public Broadcasting, 6PPD-quinone appears to be a key culprit: “You put this chemical, this transformation product, into a fish tank, and coho die... really fast.”

Microplastic Inside Human Airways

While other researchers had previously searched for, and detected, microplastic dispersed in indoor and outdoor air, Alvis Vianello, an Italian scientist and associate professor at Aalborg University in Denmark, was the first to do so [using](#) a mannequin emulating human breathing via a mechanical lung system, [publishing his study's results](#) in 2019. (Despite the evidence his research provides—that plastic is getting inside of human bodies and could be harming us—it was not until 2022 that modern health researchers first [confirmed the presence of microplastics in human lungs](#). And as comprehensive health research has ramped up, we are just beginning to understand how having plastic particles around us and in us at all times might be affecting human health.)

Vianello and his colleague Jes Vollertsen, a professor of environmental studies at Aalborg University, explained that they've brought their findings to researchers at their university's hospital for future collaborative research, perhaps searching for plastic inside human cadavers. “We now have enough evidence that we should start looking for microplastic inside human airways,” Vollertsen [said](#). “Until then, it's unclear whether or not we should be worried that we are breathing in plastic.”

When I met Vollertsen in 2019, he had speculated that some of the microplastic we breathe in could be expelled when we exhale. Yet even if that's true, our lungs are indeed holding onto some of the plastic that enters, potentially resulting in damage.

Other researchers, like Joana Correia Prata, DVM, PhD, who [studied microplastics](#) at the University of Aveiro in Portugal, have highlighted the need for systematic research on the [human health effects of breathing in microplastic](#). “[Microplastic]

particles and fibers, depending on their density, size, and shape, can reach the deep lung causing chronic inflammation,” she [said](#). Prata noted that people working in environments with high levels of airborne microplastics, such as those employed in the textile industry, often suffer respiratory problems. The perpetual presence of a comparatively lower amount of microplastics in our homes has not yet been linked to specific ailments.

While they’ve dissected the bodies of countless nonhuman animals [since the 1970s](#), scientists only began exploring human tissues for signs of nano- and microplastic in earnest during the late 2010s and early 2020s. This, despite strong evidence suggesting plastic particles—and the toxins that adhere to them—[permeate our environment](#) and are widespread in our diets. From 2010 to 2020, scientists have [detected](#) microplastic in the bodies of fish and shellfish; in packaged meats, processed foods, beer, sea salt, soft drinks, tap water, and bottled water. There are [tiny plastic particles embedded in conventionally grown fruits and vegetables](#) sold in supermarkets and food stalls.

Petrochemical-Based Plastics, Fertilizers, and Pesticides

As the world rapidly ramped up its production of plastic in the 1950s and ‘60s, two other booms occurred simultaneously: that of the world’s human population and the continued development of industrial agriculture. The latter would feed the former and was made possible thanks to the development of petrochemical-based plastics, fertilizers, and pesticides.

By the late 1950s, farmers struggling to keep up with feeding the world’s growing population welcomed new research papers and bulletins published by agricultural scientists extolling the benefits of using plastic, specifically dark-colored, low-density polyethylene sheets, to boost the yields of growing crops.

Scientists laid out step-by-step instructions on how the plastic sheets should be rolled out over crops to retain water, reducing the need for irrigation, and to control weeds and insects, which couldn’t as easily penetrate plastic-wrapped soil.

This “plasticulture” has become a standard farming practice, transforming the soils humans have long sown from something familiar to something unknown. Crops grown with plastic seem to offer higher yields in the short term, while in the long term, use of plastic in agriculture could create [toxic soils that repel](#)

[water instead of absorbing it](#), a potentially catastrophic problem. This presence of plastic particles in the soil causes increased erosion and dust—as well as the [dissolution of ancient symbiotic relationships](#) between soil microbes, insects, and fungi that help keep plants—and our planet—alive.

From the polluted soils we've created, plants pull in tiny nanoplastic particles through their roots along with the water they need to survive, with serious consequences: An accumulation of nanoplastic particles in a plant's roots diminishes its ability to absorb water, impairing growth and development. Scientists have also found evidence that [nanoplastic may alter a plant's genetic makeup](#) in a manner increasing its disease susceptibility.

Plastic: Part of the Human Diet

Based on the levels of micro- and nanoplastics detected in human diets, it's estimated that [most people unwittingly ingest anywhere from 39,000 to 52,000 bits of microplastic](#) in their diets each year. That number increases by 90,000 microplastic particles for people who regularly consume bottled water, and by 4,000 particles for those who drink water from municipal taps.

In 2018, scientists in Austria detected [microplastic in human stool samples](#) collected from eight volunteers from eight different countries across Europe and Asia. By 2023, scientists had detected the presence of plastic particles in people's [lungs](#), [bloodstreams](#), [veins](#), [placentas](#), [feces](#), [testes/semen](#), and [breast milk](#). And while the long-term health impacts of plastic on the human body are still unknown, it is well understood that plastic has toxic effects on [laboratory animals](#), [marine wildlife](#), and [human cell lines](#).

In a 2022 [study](#), researchers showed that nanoplastics less than 100 nanometers wide can enter the blood and organs of animals and cause inflammation, toxicity, and changes in neurological function.

Clearly, micro- and nanoplastics are getting into us, with at least some escaping through our digestive tracts. We seem to be drinking, eating, and breathing it in.

And [these tiny particles are just one component of plastic's myriad forms of pollution](#). From the moment plastic's fossil fuel ingredients are extracted, to its production, transportation, use, and eventual disposal in landfills, incinerators, and the environment, the plastics pipeline emits toxic chemicals that pollute Earth's air, soils, waters, seas, animals, plants, and human bodies, and releases

greenhouse gases that drive the climate crisis. Most often harmed are already underserved groups, including Black, Brown, Indigenous, rural, poor, and fenceline communities everywhere, driving severe injustice worldwide.

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India Will Pay 70% Of Cost But Micron Will Own 100% Of The Plant—A Curious Business Model



Prabir Purkayastha

The deal with Micron during PM Modi's visit to the United States has made headlines as a major technological breakthrough and a new dawn for India's electronics chip-making industry. Implicit in this hurrah for the Micron deal is that India has [completely missed the bus on the key technologies](#) involved in electronic chip making. And for those who know technology would realize that the Micron deal is only for packaging of the chips, their assembly and testing, a relatively low end of the electronics industry. It does not touch the core technologies of *designing* and *fabrication of* chips, let alone the holy grail of chip-making technology: the lithographic machines that are central to chip fabrication.

The U.S.-India ties had hit a rocky patch, with India refusing to sanction Russia or aligning with the West and G-7 on a "rule-based international order." Where the West makes all the rules. With Prime Minister Modi and President Biden both facing what could be difficult elections soon, they both urgently needed a reset in U.S.-India ties. For India, it is getting technology for critical sectors in India and declaring a new dawn. For Biden, India is part of its *derisking* and long-term plan to *disengage* its industries and market from China.

Late as it already is, the Modi dispensation is finally beginning to understand that technology is not something that, if you have money, you can buy from the global market. It is the closely-held knowledge of companies and countries. Today, it is electronics that drive everything: from the battlefield to artificial intelligence, from your lowly washing machines to the most expensive fighter planes. In the Ukraine war, a few dollars worth of chips are at the core of cheap drones to the most expensive aircraft and missiles. In war, tanks and artillery are also integrated with missiles and drones, shaping the modern battlefield, with radar and satellites providing real-time information to those running the battles. Modern electronic chips are the "brains" of all of this equipment, just as it is in almost any industry and device.

If India has to maintain its autonomy in global affairs, it has to start thinking about the [future of its electronics industry](#). What sits at the heart of the electronics industry is the ability to make the latest generation of chips. If not today, then at least tomorrow. And we need to start today, as we missed the chip-making bus when we decided not to rebuild the chip fabrication plant—the SemiConductor Complex—we had built in Mohali. The plant, a critical component of our self-reliance in electronics, had [mysteriously burnt down in 1989](#).

So what is the Micron deal? Micron is a major manufacturer of memory chips, and it is this realm of business that has made it one of the world's leaders in the semiconductor industry. It would have the necessary credentials if it decided to set up a memory fabrication plant in India, unlike the Foxconn-Vedanta fabrication proposal greeted with a lot of fanfare, where [Foxconn does not have any experience in chip-making](#). But that is not what Micron is offering. It has offered to set up a plant in Gujarat to only “assemble, package and test” chips that Micron has fabricated elsewhere. Micron has such chip fabrication plants in the United States and also in China, whose products, the chips will be packaged and tested in India. So if chip-making was India's goal, it would not be delivered through the Micron deal. What we are getting is the lowest end of the chip-making technology, assembling and testing chips that have been made elsewhere. We are not competing with the United States, China, South Korea, and Japan on chip making but with countries like Malaysia. Malaysia is already streets ahead of us in this area, with about [13 percent of the world's in OSAT outsourcing market](#). Locating such plants in Malaysia and now India would be a part of the de-risking strategy of the U.S. companies, where they shift the low end of the chip production to countries like Malaysia and India while encouraging new high-end chip fabrication to the United States, such as [Micron's \\$100 billion mega-fab](#) in Clay, Washington.

Let us look at the investments involved in setting up the Micron plant and who is footing the bill. The total cost of setting up the plant is estimated to be \$2.75 billion, with the central government providing a 50 percent subsidy and the Gujarat state government throwing in another 20 percent. Micron is investing only 30 percent of the total capital! In other words, Micron will hold 100 percent ownership in a plant costing \$2.75 billion, in which they would have invested would have invested only 0.825 billion! Even industry reports—e.g., *eeNews Europe*—calls this an [“extreme level of subsidy.”](#) In other words, to burnish

Modi's image, tarnished by BJP's loss in Karnataka and the continuing riots in Manipur, this is a part of the public relations exercise that his team is doing. If we look at this deal for getting low-level technology—assembly and testing—we are “subsiding” a leading U.S. manufacturer so that we can assemble and test the chips built in Micron's high-end plants in the United States and China.

India is not the only country providing subsidies for technology and setting up plants. So are the United States and China. The United States has a \$52 billion government kitty for subsidizing chip manufacturing and other core activities. China has a National Fund and another popularly called the Big Fund (National Integrated Circuits Industry Development Investment Fund), both investing \$73 billion in China's chip-making industry. But both these countries are funding the high end of the electronics tech stack, advanced chip making, devices, CAD tools, lithographic machines, etc., virtually nothing (only about 5 percent) in the assembling and testing of chips. Even when they do invest, they do much lower amounts and also as a fraction of the total cost. According to the South China Morning Post, [quoted by Yahoo Finance](#), China gave \$1.75 billion in subsidies to 190 Chinese firms, with China's leading chip fabricator SMIC, receiving roughly about 20 percent of that amount!

There is no question that India, having missed the chip-making bus, needs to ramp up its ambitions and bootstrap a chip-making industry. To do this successfully, it has to have a plan, where to invest and how much to invest, and when to invest. Yes, it has to return to old-fashioned planning, dismissed by BJP-RSS ideologues as “socialism.” And yes, every country plans its science and technology, including how to develop people, the key to technology development. Not one-off shots and driven by which companies come and what they offer. Instead, what is our path forward, and what do we need? And paying 70 percent of the cost while offering our land, cheap labor so that a U.S. company can get 100 percent of the ownership, in a segment where countries like Malaysia are streets ahead of us, is not investing in technology. It is simply a PR exercise.

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Greek Left Leaders Betrayed The Working Class. Conservatives Won A Landslide



The ascendance of the right in Greek politics shows how a left without strong class politics is a losing proposition.

Greece's conservative party New Democracy won another landslide victory in the country's second election in just five weeks, trouncing Syriza, the so-called radical leftist party, by an even wider margin than in the first election. New Democracy finished by almost 23 points ahead of Syriza, a result that allows the conservatives to control 158 seats in the country's 300-seat parliament. Moreover, the result of the June 25 Greek elections makes New Democracy "the most powerful center-right party in all of Europe," as its leader and prime minister for a second consecutive term Kyriakos Mitsotakis aptly noted in the aftermath of his party's historic victory.

Why are the conservatives so popular in debt-ridden Greece, and what lessons can be gained for the left worldwide from the electoral collapse of Syriza? Political scientist and political economist *C. J. Polychroniou* discusses these questions with French-Greek journalist *Alexandra Boutri* in this exclusive interview for *Truthout*.

Alexandra Boutri: Immediately following the results of the Greek parliamentary elections of May 21, which saw the conservative party of New Democracy win by an astonishing 20-point margin over the radical leftist party Syriza, you published

an essay titled [“The Rise and Fall of Greece’s Radical-in-Name-Only Syriza Party.”](#) Well, in the repeat election on June 25, Syriza lost to New Democracy by an even bigger margin. Are you surprised at all by the electoral results? For many people, I suppose, it is still hard to explain the implosion suffered by Alexis Tsipras’s party when only eight years ago it was the governing party.

C. J. Polychroniou: I am not in the least surprised by the even bigger margin that New Democracy won over Syriza. If anything, the only surprising element in the evolution of Greek politics over the past 15 years or so was Syriza’s meteoric rise to power. We know of course that politics is always dynamic, but it’s hard to find another case in contemporary European history where a political party of any ideological orientation rose to power when it was struggling 10 years earlier to win just 4 percent of the vote.

What was even more surprising in this development is that Syriza was hardly a political party per se. It was more of a protest political organization that included many different factions of the Greek left, all under one roof. However, it evolved very quickly once the balance of power started changing in its favor. Within a year or two before its rise to power, Syriza, under the leadership of Alexis Tsipras, transformed itself into an inclusionist populist party after having successfully tapped into the anti-austerity anger that had spread across different segments of the Greek population on account of the notorious bailout programs that had been signed in the aftermath of the outbreak of the Greek/euro crisis by the nation’s two mainstream parties, the socialists (PASOK) and the conservatives (New Democracy) respectively. Yet, it took Alexis Tsipras only a few weeks after coming to power in 2015 to capitulate to the demands of the deeply hated troika of the European Commission, the European Central Bank and the International Monetary Fund, and eventually to sign a third bailout agreement that extended Greece’s status as Germany’s de facto colony.

But Greek voters, especially those on the left, do not in general have short memory or faulty perceptions. Not only did they not forget Syriza’s betrayal, but they also did not miss how incompetent its leadership had been when it came to overall governance. Tsipras and his inner circle aligned themselves with big capital, ignored the working class, squeezed the middle class as much as they could and proceeded with massive privatization schemes — all in order to satisfy the international creditors.

In May 2019, Syriza lost the national elections after having lost both the European and local elections. It paid the price for having become another mainstream party. But what may have sealed its complete downfall was that during the time it was in opposition it engaged for the most part in outrageous, petty politics (such as attacking the prime minister's wife, for example, and saying that the country was being run by a junta!), thus failing miserably to act as the main opposition party. The ruling party's policies went largely unchallenged, and voters could not find in Syriza a convincing alternative consistent with the values of the left.

In light of the above, it is anything but surprising that in both the May and June elections, Syriza suffered big losses even in working-class districts of major urban centers. Indeed, Syriza is the only party of the left in the last 40 or so years to have lost support in the traditional working-class districts of Greece. I am also not surprised at all by the fact that Yanis Varoufakis's MeRA25 party, which was established in 2018, failed to make it into the parliament. Varoufakis may be very popular abroad but remains extremely unpopular with Greek voters of all political persuasions.

However, what is quite surprising to me about these elections is the low voter turnout (slightly over 52 percent), which continues to drop to a new historic low. Not only that, but like in many other parts of the world, the Greek youth is shifting to the right for solutions to today's societal problems. This is a truly discouraging development, and I am not sure what it will take to turn things around. In this context, what is even more disturbing is the fact that far right parties have made a comeback in Greece less than three years after party leaders of Golden Dawn, a neo-Nazi political organization, were convicted of being part of a criminal organization and sent to prison. Three far right parties, with a combined total of nearly 13 percent of the popular vote, have won seats in Greece's next parliament. This was the most shocking surprise of the Greek legislative elections that took place on June 25.

My understanding is that Greek society is fairly conservative and that the party of New Democracy has a rather miserable record when it comes to respecting democratic values and human rights. If this is so, why is Mitsotakis's government so popular?

You are right on both counts. Greek society is indeed quite conservative to this

day and democratic and human rights have received acute blows under Mitsotakis's New Democracy government, which is mainly composed of neoliberal hacks and traditional authoritarian right-wingers. But that's not an odd combination. Ever more increasingly, economic neoliberalism needs political authoritarianism in order to carry out its so-called reforms.

Conservative social orders maintain and reproduce themselves not on their own but rather through the planned execution of specific policies and practices carried out by the ideological apparatuses of the state. In the case of Greece, the media and the church play vital roles in the depoliticization of the public and the reproduction of culturally conservative views and attitudes respectively. Media ownership in Greece is in the hands of a few media magnates (mainly industrialists and shipping tycoons), each of whom owns scores of media outlets even though demand lags way behind supply. For international news, Greek mainstream media rely on foreign sources and partnerships with foreign newspapers. The domestic news tends to be largely sensationalistic in nature and scope, with heavy emphasis on celebrities and lifestyle. Naturally, none of the mainstream media outlets are advocates of a progressive socio-economic agenda. They are all in favor of economic liberalization policies and extol the virtues of the free-market system while their owners maintain deep ties with the state, which of course go beyond the media industry (direct state funding and various forms of indirect subsidies) and extend into their primary business activities. As for the Greek Orthodox Church, which has a strong presence in every geographical region of the country, it has always been close to conservative and right-wing ideologies and practices.

The question, "Why is Mitsotakis's government so popular?" doesn't have a straightforward answer. Most polls indicate that large majorities voted for New Democracy because of perceived better future prospects under a Mitsotakis government. In essence, what this says is that the success of New Democracy is really all about the failure of Syriza as an alternative option. Be that as it may, the next four years are going to be a real challenge for the Mitsotakis government. The European Union rules about government budget deficits (3 percent of GDP) and debt (60 percent) to GDP ratios, which had been suspended since 2020 due to the pandemic will end in 2024. So, austerity will soon again be in full swing throughout Europe, and especially in Greece because of the country's unsustainable debt-to-GDP ratio, which now stands at close to 180 percent. In

sum, it is highly unlikely that Mitsotakis will be able to keep his campaign promises about raising wages, salaries and pensions; reducing further the value-added tax rates; improving the public health care system, which has myriad problems due to lack of proper funding and large-scale inefficiencies; and tackling inequality.

Migration in Europe has become a contested issue, though it is probably accurate to say that it is not a defining issue as it is in the United States. Was immigration an important determinant in the electoral success of New Democracy, given that the Mitsotakis government has taken a tough line on migrants since coming to power in 2019 and pledged ahead of the first election in May 2023 to extend the border wall with Turkey?

It is quite accurate to say that migration is not among the top issues of concern for most European citizens, and thus it is not as prominent a wedge issue as immigration is in the United States. Rising prices, the international situation, energy supply, the environment and climate change were seen by far as the more important national issues facing the European Union, according to [a survey](#) released in June 2023. Here, it is also important to underline for context that “in Europe, immigration accounted for 80 percent of the population growth between 2000 and 2018, while in North America, it constituted 32 percent in that same period,” [according to](#) the International Monetary Fund.

In Greece, survey after survey reveals that citizens regard issues related to the cost of living and the economy in general as most important to them, but issues such as public health and the environment also figure prominently. It is also worth noting that climate change and the destruction of the environment rank in various polls as the most serious problems facing the planet. In [one survey](#) conducted in 2022, only 9 percent of respondents ranked immigration as a major threat to the country. And in [a poll](#) released just a few days before the May 2023 elections, the cost of living, public health and low wages were listed as the most important issues facing Greek citizens, with immigration far down on the list.

Having said that, there is also no doubt that many Greek citizens have approved of Mitsotakis’s tough border policy in reducing the flow of migrants. But perhaps this should not be surprising considering the fact that until several years ago, the overwhelming majority of what the Mitsotakis government calls “illegal” immigrants who arrived into Europe came through Greece. The number of asylum

seekers in the Greek islands has fallen dramatically in the course of the last few years, largely through pushbacks, which have been widely criticized by human rights organizations and extensively covered by the media. Pushbacks are of course illegal under international law. However, insufficient attention has been paid to “push-forwards” by the Turkish Coast Guard and the smuggling of migrants.

Unfortunately, it is the right that has succeeded in enforcing its agenda on migration, just as it has on a host of other issues. The left’s response has been to adopt a softer stance on the specific issue but without really offering a blueprint for a fair and humane immigration system. When he was prime minister, it should be noted, Tsipras opposed taking down the Evros fence at the border between Greece and Turkey. In addition, as opposition leader, he supported the decision of the Mitsotakis government in early 2020 to close the border along the Evros River when Turkey unilaterally opened its borders to Greece to allow many thousands of refugees and migrants to reach the European Union. But most of Syriza’s supporters seem to be against the border fence and in favor of the free movement of migrants.

It is important for the left to strike a balance between national and international solidarity, but that is easier said than done, which is why there have never been specific answers from leftist leaders to queries from working-class people whether countries with high rates of unemployment and low wages can afford to have uncontrolled migratory flows. Indeed, [European data](#) on living conditions showed that in 2022, more than 95 million in the EU were at risk of poverty and social exclusion. Would therefore uncontrolled migrations to Europe improve or cause further deterioration of living conditions in the continent? The truth of the matter is that any leader of a left party eyeing power in today’s Europe would prefer that this question wasn’t asked!

To answer now directly your question, I don’t believe that immigration on its own played a critical role in the electoral success of New Democracy. It may have played a part but only in conjunction with voters’ belief that Mitsotakis is better equipped as prime minister to deal with the pressing economic issues facing the country and its people.

Do the Greek elections offer any lessons for the left in general?

We may have an ontological problem here in the sense that it has become evidently very difficult to define what constitutes left-wing politics in this day and age. There is always of course a structural gap between theory and practice, but it seems that this gap has become increasingly huge in today's political universe. Today's left is having a very hard time convincing voters that it presents a viable alternative to the status quo even though discontent is extremely widespread across the world, with inequality being at the core of the politics of discontent. But if there is anything the case of Greece's Syriza party teaches us it is that a left without class politics is a losing proposition. Historically, left-wing parties have always had strong links with working-class people and communities, but this is no longer the case today. Hence the reason why the working class has embraced right-wing populism.

Secondly, a party of the left cannot become a catch-all party. Indeed, ever since the 1990s, all over Europe, catch-all parties have been weakening. Syriza did not learn this lesson and tried to transform itself into an inclusivist populist party to the point of even seeking to attract voters from the now-defunct neo-Nazi party Golden Dawn. The end result was that it lost the left.

Thirdly, a party of the left needs a distinctive programmatic profile and willingness to fight for viable alternatives while also acknowledging the structural constraints of fully realizing those objectives in the course of just a few years after coming to power.

Finally, a strategy for winning an election must be based on the core values of the left. Lies and empty promises will come back to haunt a left party's leadership and ultimately set back the case for radical change.

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Alexandra Boutri is a freelance journalist and writer. She grew up in France and studied political science at the Sorbonne. She is currently collaborating with C.J. Polychroniou on a book on the Russian Revolution.