#95 What Microplastics Are Doing to the Brain, Body, and Reproductive Systems

Posted on September 20th 2024 (about 19 hours)

POLLUTION

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SUMMARY

TIMELINE

TRANSCRIPTION

Every week, you're consuming the equivalent of a credit card in plastic without even realizing it. And it's all due to microplastics.

It gets worse—those microplastics you're consuming aren't just bits of plastic. They're laced with **toxic chemicals like BPA, BPS, and phthalates**, which are designed to make plastics stronger but wreak havoc on your body. These chemicals are notorious for disrupting hormones, altering metabolism, and increasing the risk of everything from infertility to heart disease.

How do these microplastics end up inside us? We consume them daily through bottled water, packaged foods, and even fresh produce, while breathing in plastic particles from urban air. But they don't just leave—they accumulate in critical organs, from the lungs to the brain. This pervasive presence begs a frightening question: are these plastics silently contributing to chronic diseases or altering the way our bodies function at a cellular level?

In this episode and accompanying show notes, we're breaking down how these tiny invaders are impacting your health, from brain function to reproductive issues, and what you can do to limit your exposure.

Some highlights from this episode:

- 00:03:59

  Why exclusively drinking bottled water could increase your microplastic intake by up to 90,000 particles per year

- 00:07:07

  Why consuming food or drinks heated in plastic increases BPA exposure up to 55x

- 00:08:07

  How microwaving food in plastic containers can release over 4 million microplastic particles into a meal in just 3 minutes

- 00:08:18

  Why microwavable popcorn is a major source of PFAS (AKA, forever chemicals)

- 00:21:15

  How consuming canned soup daily for 5 days affects urinary BPA levels

- 00:26:38

  The likely link between BPA & autism spectrum disorder

- 00:33:46

  Why the brain may bioaccumulate plastic at 10-20x the rate of other organs

- 00:34:17

  The strong correlation between brain microplastic levels & neurodegenerative disease

- 00:34:50

  Why the growing amount of microplastic in human brains (50% more from 2016 to 2024) is cause for concern

- 00:43:56

  How drinking from an aluminum can lined with BPA can increase blood pressure in just a few hours

- 00:50:31

  Why you should never drink Topo Chico sparkling water

- 00:53:02

  The only water filtration method that removes up to 99% of microplastic particles

- 00:57:14

Why disposable coffee cups are a major source of BPA exposure

- 00:58:14

  How salt adds 7,000 microplastic particles to your diet every year

- 00:59:18

  How to reduce microplastics in indoor air

- 01:00:52

  How to alter your wardrobe to reduce microplastic exposure

- 01:02:32

  Why handling receipts a major source of BPA exposure — especially after using hand sanitizer

- 01:06:28

  Why sulforaphane could increase BPA, BPS, & phthalate excretion

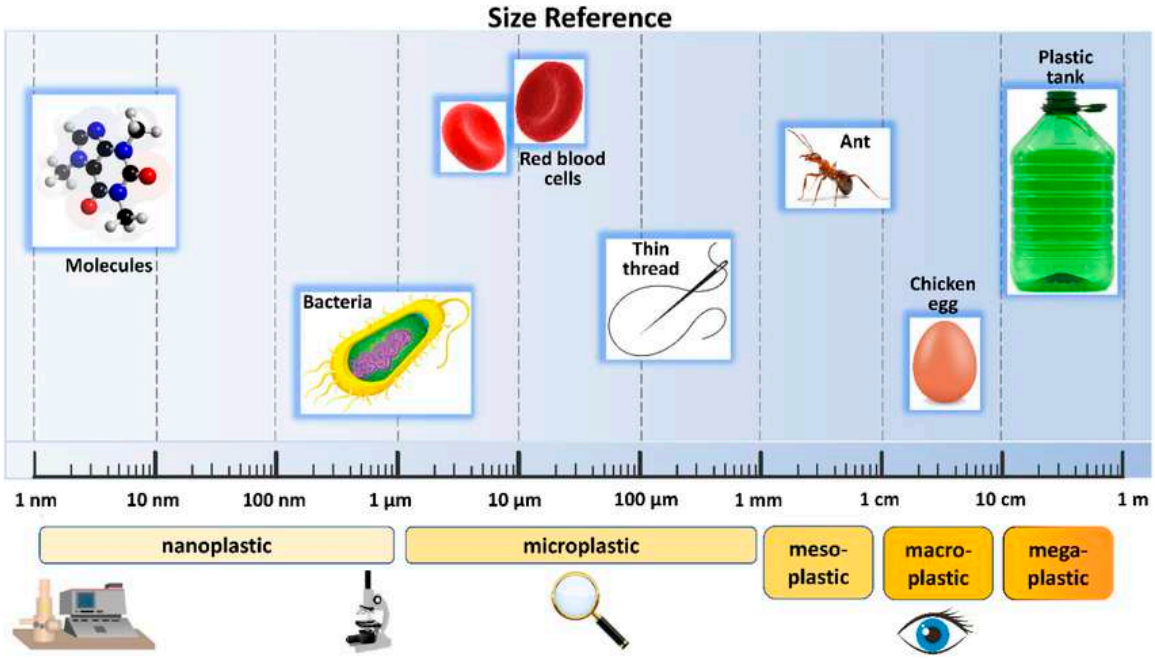
- 01:10:15

  Are microplastic-associated chemicals excreted through sweat?

View Full Timeline →

How we're exposed to microplastics and their associated chemicals

Microplastics are everywhere—and they're smaller than you think. Some are as large as a grain of rice, but others are so tiny, they're a thousand times smaller than a grain of sand. These tiny particles come from the slow breakdown of larger plastics or are intentionally added to products like cosmetics and synthetic clothing. The scary part? **We're constantly exposed through everyday activities like eating, drinking, and even breathing**.



Microplastics in aquatic systems, a comprehensive review: origination, accumulation, impact, and removal technologies - RSC Advances (RSC Publishing)

It's hard to grasp the scale—up to 120,000 microplastic particles enter your body each year through things as routine as drinking water or eating food. But it doesn't stop there: seafood, fruits, vegetables, and even baby bottles shed these particles into your system. Tap water alone can contain up to 1.2 million microplastics annually, and if you rely on bottled water, you could be consuming up to 90,000 more microplastic particles each year just from the packaging breakdown.

Here are some other sources of microplastics exposure encountered in everyday life:

- **Food (total):** 488,000 to 577,000 particles per year
- **Salt:** 5,000 to 7,000
- **Fish:** 5,000 to 12,000
- **Vegetables:** 29,600 to 95,500
- **Fruits:** 448,000 to 462,000
- **Drinking water:** 220,000 to 1.2 million particles per year
- **Air: (total)**: 210,000 to 2.51 million particles per year
- **Outdoor air:** 46,000 to 210,000
- **Indoor air:** 160,000 to 2.3 million

Plastics are often infused with chemicals such as BPA, BPS, phthalates, and PFAS to enhance durability and flexibility. These chemicals may come with significant health

risks.

BPA & BPS: These compounds act like estrogen in the body, disrupting hormones and affecting everything from fertility to brain function. A study in the journal _Hypertension _revealed that consuming beverages from BPA-lined cans can spike blood pressure in just a few hours.

Phthalates: These chemicals are used to make plastics more flexible. They've been linked to endocrine disruption, reproductive issues, and developmental problems in children. High phthalate levels correlate with decreased testosterone levels in men.

PFAS: Per- and polyfluoroalkyl substances, also known as "forever chemicals", resist breaking down in the environment and accumulate in our bodies over time. They're used to make products resistant to water, oil, and stains and can be found in non-stick cookware, water-repellent clothing, and food packaging. PFAS exposure is linked to immune system suppression, thyroid dysfunction, and an elevated risk of certain cancers.

What's even more alarming is how easily these chemicals leach out of plastics, especially when heated or in contact with acidic or fatty foods. **That hot takeout container, the water bottle left in your car, or even your daily coffee cup**—all can expose you to microplastics and chemicals like BPA. Heating plastic is particularly dangerous: one study found that heating polycarbonate bottles to just 100°C can increase BPA release by up to 55 times. And it's not just bottles—microwaving food in plastic containers can release over 4 million microplastic particles in just three minutes.

The problem extends beyond contaminated food and water—microplastics are also present in the air, entering our respiratory system. We inhale enough microplastic particles each week to equal the weight of a credit card, and these can become lodged deep in the lungs. Microplastics enter the atmosphere through several routes:

Clothing: Synthetic textiles—polyester, nylon, and acrylic—are a key contributor to airborne microplastics. Each wash sheds microfibers that pollute waterways and oceans, but they also turn into airborne particles we inhale, especially when handling laundry. Indoor dryers, if not properly vented, recirculate these fibers into our living spaces, and venting outdoors simply disperses the microplastics into the environment, amplifying the problem.

Shoes and tires: Another major source of airborne microplastics comes from tire wear and the degradation of synthetic shoe soles. Every time we drive, walk, or run, **tiny particles of rubber and plastic are worn away and released into the air,** becoming part of the dust we inhale. In urban areas with heavy traffic, this is a significant source of microplastic exposure. What's more alarming is that air pollution, including microplastics, is increasingly being linked to neurodegenerative diseases like Alzheimer's.

Microplastics and chemicals bioaccumulate in our body

Microplastics don't just pass through our bodies—they accumulate in critical areas like our lungs, livers, kidneys, bloodstream, and even our brains. In recent years, microplastics have been detected in a variety of human tissues.

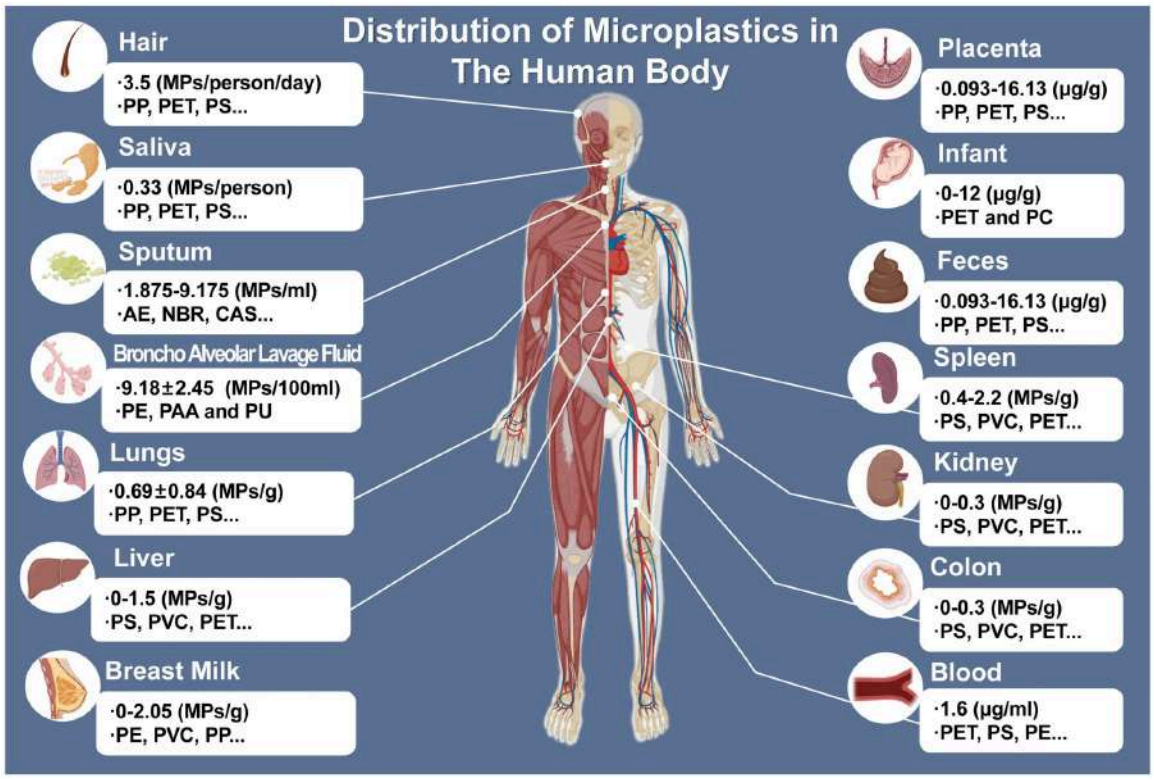
Lungs: A 2022 study found microplastics in the lung tissue of every surgical patient examined—even those without significant environmental exposures beyond daily life. The plastics detected included polyethylene, polypropylene, and PET, the same materials in everyday items like bags and bottles. These microplastics can cause inflammation and oxidative stress, leading to respiratory problems such as asthma and COPD. Even more concerning, the study revealed that microplastics can reach the lower lungs, bypassing the body's natural defenses, suggesting inhalation is a more significant risk than previously thought.

Liver: Research indicates that liver cells exposed to microplastics suffer mitochondrial damage and oxidative stress, both linked to conditions like non-alcoholic fatty liver disease. A notable study comparing cirrhotic and healthy livers found significantly more microplastics in diseased tissue, suggesting that these particles could be actively contributing to the progression of liver disease, rather than merely accumulating passively.

Brain: Microplastics have been found to cross the blood-brain barrier, which is meant to shield the brain from harmful substances. Once there, they activate microglial cells, triggering neuroinflammation that may contribute to diseases like Alzheimer's and Parkinson's. In mice, exposure to microplastics increased pro-inflammatory cytokines in the brain and led to behavioral changes, suggesting neurological impairment.

Reproductive system: Microplastics have been detected in human placentas, both on the maternal and fetal sides, as well as in the amniotic membranes. This means microplastics can cross the placental barrier, potentially exposing developing fetuses during crucial stages of growth. In men, microplastics have been detected in testicular tissue, sperm, and even the blood-testis barrier. Animal studies show that exposure leads to lower sperm count, reduced motility, and abnormal sperm morphology.

Bloodstream: The bloodstream is one of the most efficient pathways for microplastics to travel to organs like the brain. A 2022 study published in Environment International detected microplastics in the blood of 80% of participants, with concentrations averaging 1.6 micrograms per milliliter. This groundbreaking finding shows that microplastics can enter the body through various routes—such as inhalation or ingestion—and circulate, depositing in critical organs and tissues.



Human Microplastics Exposure and Potential Health Risks to Target Organs by Different Routes: A Review. Curr Pollution Rep 9, 468–485 (2023)

What are the health consequences of microplastics?

The mere presence of microplastics in the body wouldn't be so concerning if there weren't actually health consequences of exposure. Unfortunately, microplastics and their associated chemicals have been shown to affect many areas of the body.

Endocrine disruption

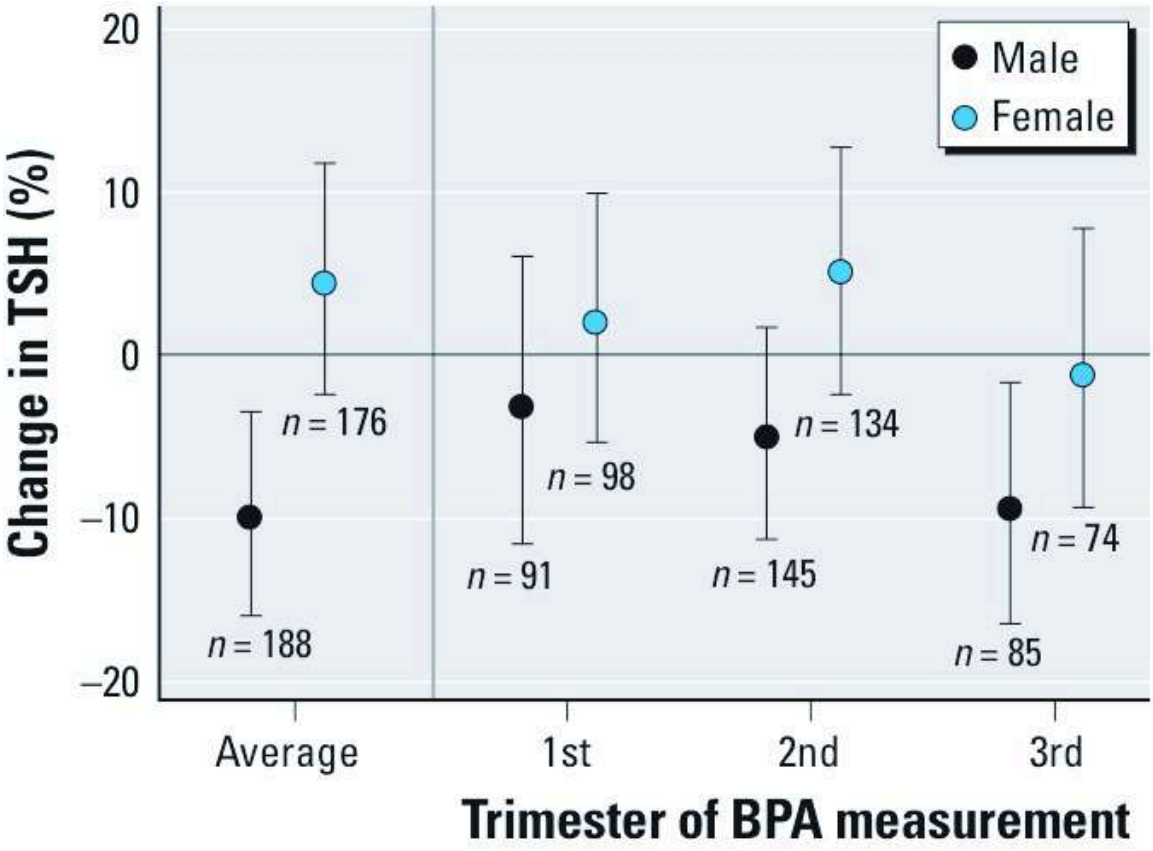
The endocrine system is interconnected with almost every bodily function, so disruptions can lead to a cascade of health problems, from infertility and metabolic issues to cognitive impairments and a higher risk of cancer. The potential for widespread impact is undeniable.

- **BPA and BPS are endocrine-disrupting chemicals that mimic the body's natural hormones,** acting as xenoestrogens by binding to estrogen receptors. When they attach to these receptors, they can either activate or block normal estrogenic functions, leading to abnormal hormone signaling that affects everything from reproductive health to brain development. One study found that higher urinary BPA levels were associated with lower testosterone and altered estrogen metabolism.
- **DEHP, a common type of phthalate, disrupts the hypothalamic-pituitary-gonadal (HPG) axis,** the body's hormone regulation system. This disruption lowers testosterone and estradiol levels, affecting reproductive health, muscle mass, bone density, and mood.
- **BPA and phthalates can interfere with thyroid hormone receptors,** disrupting T3 and T4 levels, which are crucial for energy, metabolism, and cognitive function. The result? Symptoms like fatigue, weight gain, and cognitive impairment due to hormone imbalances.

Observational studies and studies in humans and animals have shown that:

- Higher urinary BPA levels during pregnancy are associated with altered hormone levels and thyroid function in children of mothers.
- Consuming canned soup daily increased urinary BPA levels; this was associated with a reduction in testosterone levels and altered thyroid function in adults.
- Chronically exposing male rodents to BPA reduced their sperm quality; female rats exposed to BPA had disrupted ovarian function, an earlier onset of puberty, and irregular estrous cycles.
- Exposing pregnant mice to BPA was associated with behavioral changes in their offspring including increased anxiety and altered social interactions.

- Animals exposed to microplastics and BPA had lower levels of TSH, T3, and T4. They also experienced symptoms including weight gain and lethargy.



Maternal urinary bisphenol a during pregnancy and maternal and neonatal thyroid function in the CHAMACOS study. Environ Health Perspect. 2013

Pregnancy and Development

The endocrine system is tightly interconnected with reproductive health. As such, the endocrine-disrupting effects of microplastics and their associated chemicals have wide-ranging effects on pregnancy, sexual function, and childhood development.

- One study revealed that higher BPA levels in pregnant women's urine were linked to slower growth in their baby boys during early childhood, suggesting that BPA interferes with estrogen signaling in the placenta, possibly explaining the boys' delayed growth.
- Elevated phthalate levels during pregnancy are linked to a significant shortening of anogenital distance (AGD) in male infants, a key reproductive health marker. A shorter AGD is associated with birth defects like

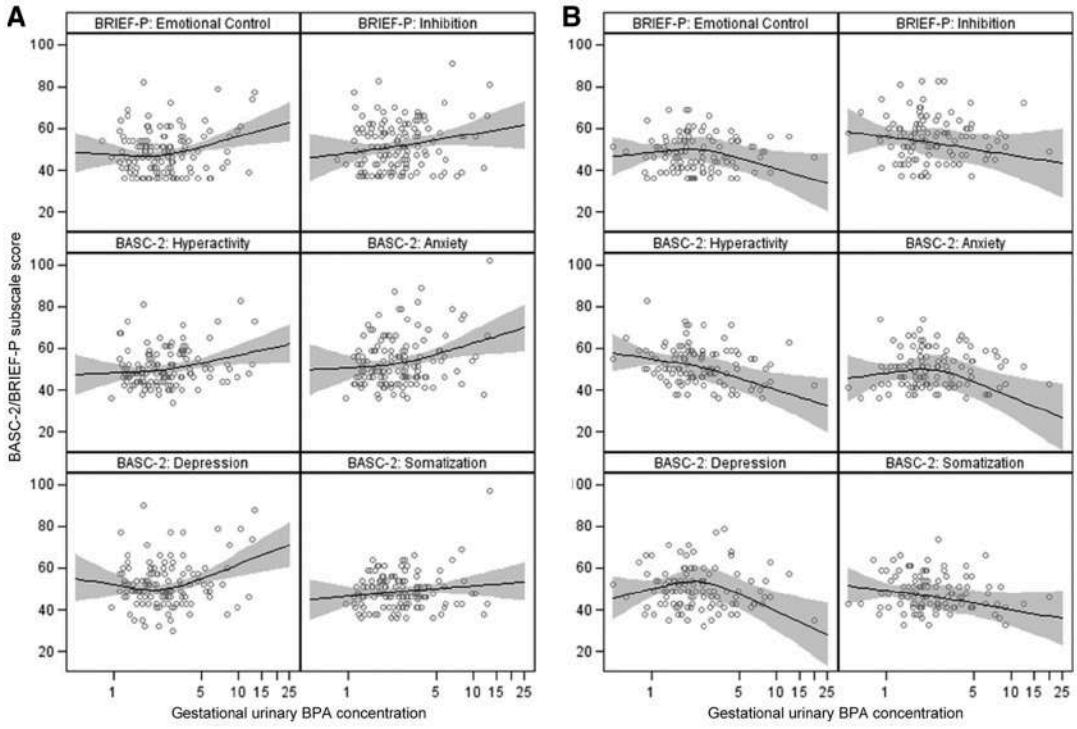
hypospadias and undescended testicles, both of which increase the risk of infertility and testicular cancer.

- Phthalates, acting as anti-androgens, block testosterone during crucial windows of fetal development, affecting the male reproductive system even at low exposure levels.
- Men exposed to higher levels of phthalates also experience reduced sperm quality and lower testosterone, further impacting fertility.
- In women, higher phthalate exposure is associated with menstrual irregularities and an increased risk of endometriosis, a painful and fertility-threatening condition. Phthalates disrupt estrogen pathways, affecting reproductive health in similar ways

Autism spectrum disorder (ASD)

Multiple human observational studies suggest a connection between maternal BPA levels and an increased risk of neurodevelopmental disorders, including ASD.

- A study by Harvard School of Public Health found that higher BPA levels in pregnant women were linked to behavioral problems in their children, especially boys. These included anxiety, aggression, and impaired social skills—symptoms that overlap with ASD.
- Higher maternal BPA exposure during pregnancy was associated with poorer neurodevelopment, particularly in boys. While not specifically diagnosing autism, the behavioral effects aligned with traits seen in children with ASD.
- A meta-analysis supported these findings, showing that prenatal BPA exposure increases the risk of behavioral issues like hyperactivity and inattention, common in children with autism.



Impact of Early-Life Bisphenol A Exposure on Behavior and Executive Function in Children. Pediatrics November 2011

Animal studies add to the concern. In rodents, BPA exposure during pregnancy leads to social deficits,, heightened anxiety, and structural brain changes in regions like the prefrontal cortex and hippocampus—the same areas affected in autism.

The issue isn't just prenatal BPA exposure—children with ASD have difficulty metabolizing BPA, causing it to build up in their systems, particularly in its active form, free BPA. **This prolonged exposure may continue to affect brain development throughout childhood.** Estrogen receptors, which play a vital role in cognition and social behavior, are impacted by this buildup. Researchers suspect that impaired BPA metabolism in kids with autism may disrupt key brain functions, potentially explaining some of the cognitive and behavioral challenges observed in ASD.

This creates a two-fold problem: first, maternal BPA exposure affects brain development in utero, and then prolonged exposure in children who can't efficiently metabolize BPA amplifies the impact!

Other neurodevelopmental disorders

Prenatal exposure to BPA has been linked to an increased risk of behavioral disorders like ADHD, anxiety, and depression in children. This isn't just a vague

correlation—research shows that BPA interferes with two critical neurotransmitter systems: dopamine and serotonin, both of which are essential for regulating mood, attention, and cognitive function. Serotonin, in particular, plays a crucial role during early brain development by helping neurons grow and connect properly. **When BPA disrupts this system, it alters the formation of key brain regions like the cerebellum,** which is vital for coordination and cognitive processing.

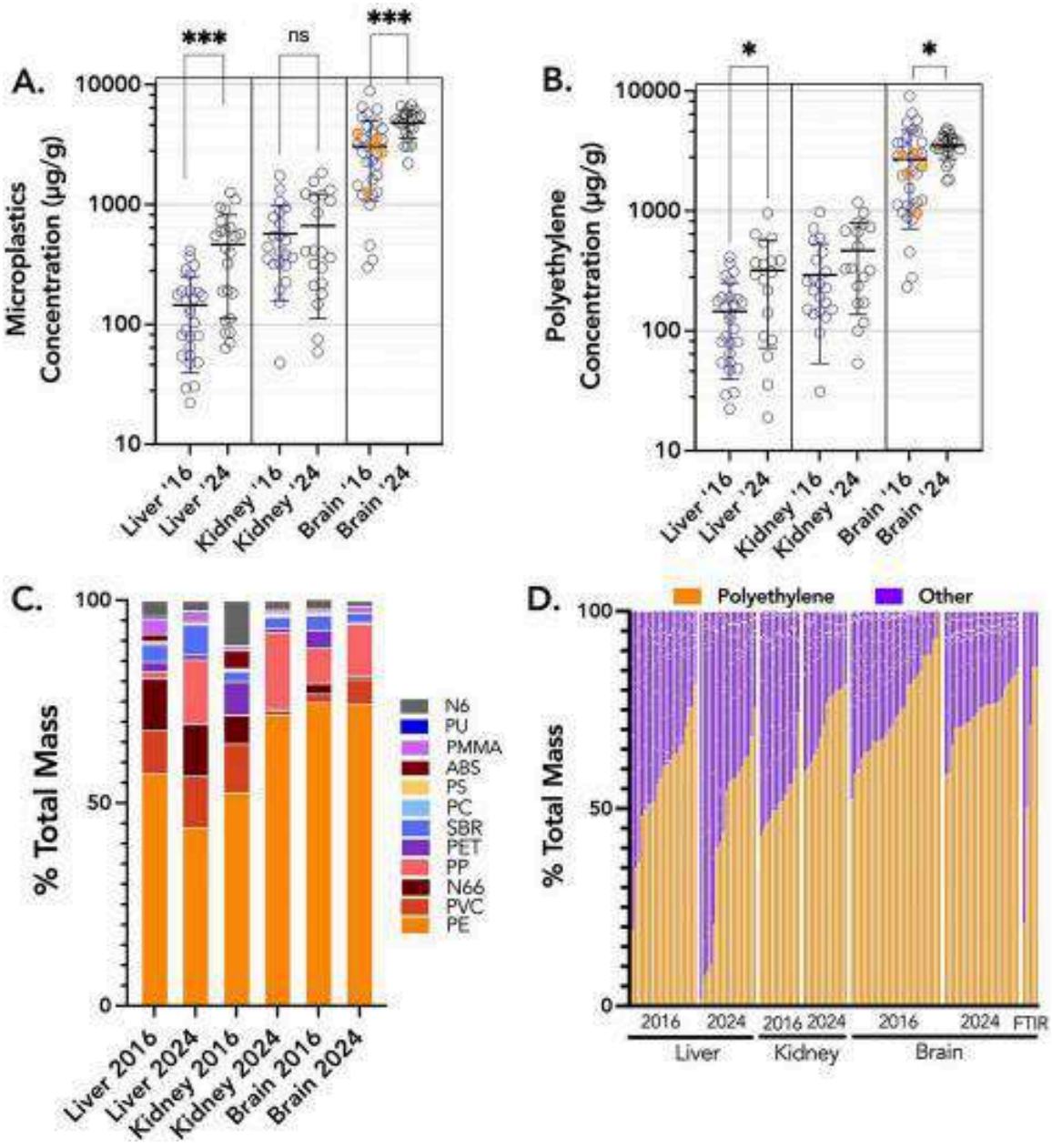
Moreover, BPA doesn't just stop at neurotransmitter disruption. It also induces oxidative stress, generating harmful free radicals that can damage brain cells and impair their ability to communicate through synaptic plasticity—an essential process for learning and adapting. The oxidative stress further triggers inflammation, amplifying damage to developing neurons.

Microplastics cross the blood-brain barrier

Microplastics are finding their way past one of the body's strongest defenses—the blood-brain barrier—and into the brain itself. Polystyrene microplastics accumulate in critical areas of the brain like the hippocampus and prefrontal cortex, regions that govern memory, learning, and emotions.

Once lodged in the brain, these microplastics don't just sit passively—**they actively contribute to inflammation.** The brain responds by producing high levels of pro-inflammatory cytokines like TNF-alpha and IL-6, which are linked to chronic inflammation. Over time, this inflammation is a key contributor to neurodegenerative diseases such as Alzheimer's and Parkinson's, and can even accelerate cognitive decline.

- Human studies are now confirming the presence of microplastics in brain tissue at alarming levels. One study found that human brain samples contained 10 to 20 times more microplastics than other organs.
- Among the brain samples studied, 12 were from individuals who had died with dementia, including Alzheimer's disease. These samples contained up to 10 times more plastic by weight compared to those from people without dementia.
- These human brain samples from 2024 had about 50% more plastic than similar samples dating back to 2016.



Bioaccumulation of Microplastics in Decedent Human Brains Assessed by Pyrolysis Gas Chromatography-Mass Spectrometry. Res Sq [Preprint]. 2024

This trend mirrors the rising levels of microplastics found in the environment, suggesting that as environmental plastic pollution increases, so too does the plastic accumulating in human tissues—including the brain.

The implications are that we could be looking at higher risks of neurodegenerative diseases, cognitive impairments, and even neurodevelopmental issues if exposure starts early in life.

Infertility and puberty

Females

BPA's impact on fertility is more alarming than most people realize. Even if you're not actively trying to conceive, BPA could be quietly undermining your reproductive health, making it harder to ovulate consistently and prepare your body for pregnancy later on.

- One particularly compelling study on women undergoing IVF found that those with higher levels of BPA in their urine had half as many viable eggs compared to women with lower BPA exposure. This means that BPA, a chemical found in common household plastics, **could directly reduce a woman's chances of conception by 50%.**
- **BPA also disrupts the delicate hormonal balance that is crucial for ovulation,** interfering with both estrogen and progesterone—two hormones that regulate your menstrual cycle and ensure regular ovulation.
- BPA can affect the uterine lining and make it harder for a fertilized egg to implant. One study showed that women with higher BPA levels had lower implantation success during IVF, which makes it clear that this isn't just a hypothetical concern.

BPA's estrogen-mimicking properties are causing girls to hit puberty earlier than ever before. By mimicking estrogen, BPA disrupts the body's natural hormonal balance, speeding up the timeline for puberty in a way that can have far-reaching consequences. The early onset of puberty not only increases the time the body is exposed to estrogen—raising the risk for hormone-related cancers—but also affects emotional and psychological well-being during a crucial developmental period.

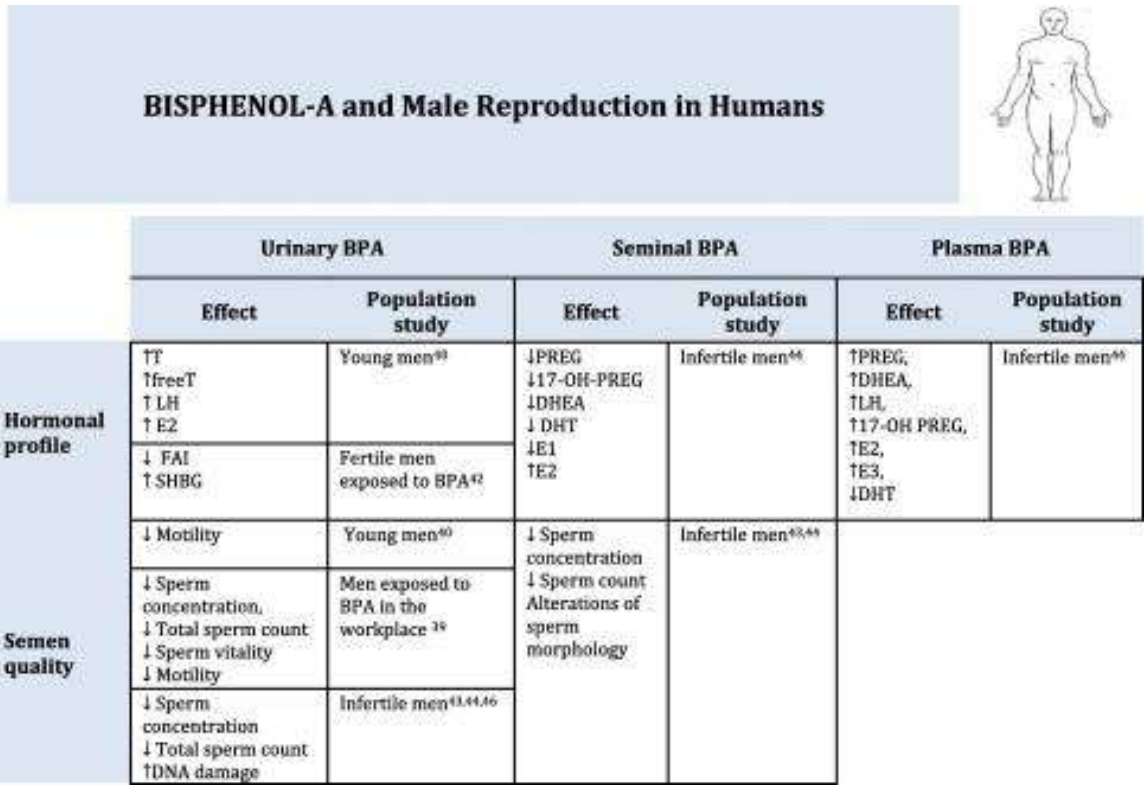
Exposure to BPA during vulnerable periods of development—such as in the womb, during infancy, or in early childhood—is associated with earlier onset of puberty in girls. A 2016 study found that girls with higher prenatal BPA exposure showed earlier signs of breast development and had their first menstrual period (menarche) at a younger age.

Males

BPA isn't just an issue for women's reproductive health—**it's drastically reducing male fertility, too.** Testosterone is essential not only for male reproductive health but also for overall well-being. When BPA gets into the body, it acts like estrogen,

interfering with the endocrine system and throwing off the delicate hormonal balance men need for proper sperm production and quality. And BPA is just part of a bigger picture—microplastics are making this issue even worse, amplifying the risks to male reproductive health.

- In a 2020 study. researchers found that men with elevated BPA levels had lower testosterone and, unsurprisingly, significant reductions in sperm quality. This includes lower sperm count, reduced motility, and even physical abnormalities in sperm structure.
- A study analyzing semen from 40 young, healthy men—the demographic you'd expect to have peak reproductive health—revealed that every sample contained microplastics. On average, each sample had two plastic particles, with sizes between 0.7 and 7 micrometers. The most common plastic? Polystyrene, which is found in packaging and food containers, made up 31% of the particles.



BISPHENOL-A and Male Reproduction in Humans

	Urinary BPA		Seminal BPA		Plasma BPA	
	Effect	**Population study**	**Effect**	**Population study**	**Effect**	**Population study**
Hormonal profile	↑T ↑freeT ↑ LH ↑ E2	Young men[93]	↓PREG ↓17-OH-PREG ↓DHEA ↓ DHT ↓E1 ↑E2	Infertile men[44]	↑PREG, ↑DHEA, ↑LH, ↑17-OH PREG, ↑E2, ↑E3, ↓DHT	Infertile men[45]
	↓ FAI ↑ SHBG	Fertile men exposed to BPA[42]				
Semen quality	↓ Motility	Young men[40]	↓ Sperm concentration ↓ Sperm count Alterations of sperm morphology	Infertile men[43,44]		
	↓ Sperm concentration, ↓ Total sperm count ↓ Sperm vitality ↓ Motility	Men exposed to BPA in the workplace [39]				
	↓ Sperm concentration ↓ Total sperm count ↑DNA damage	Infertile men[43,44,46]				

"Bisphenol a: an emerging threat to male fertility". Reprod Biol Endocrinol. 2019

Cardiovascular disease

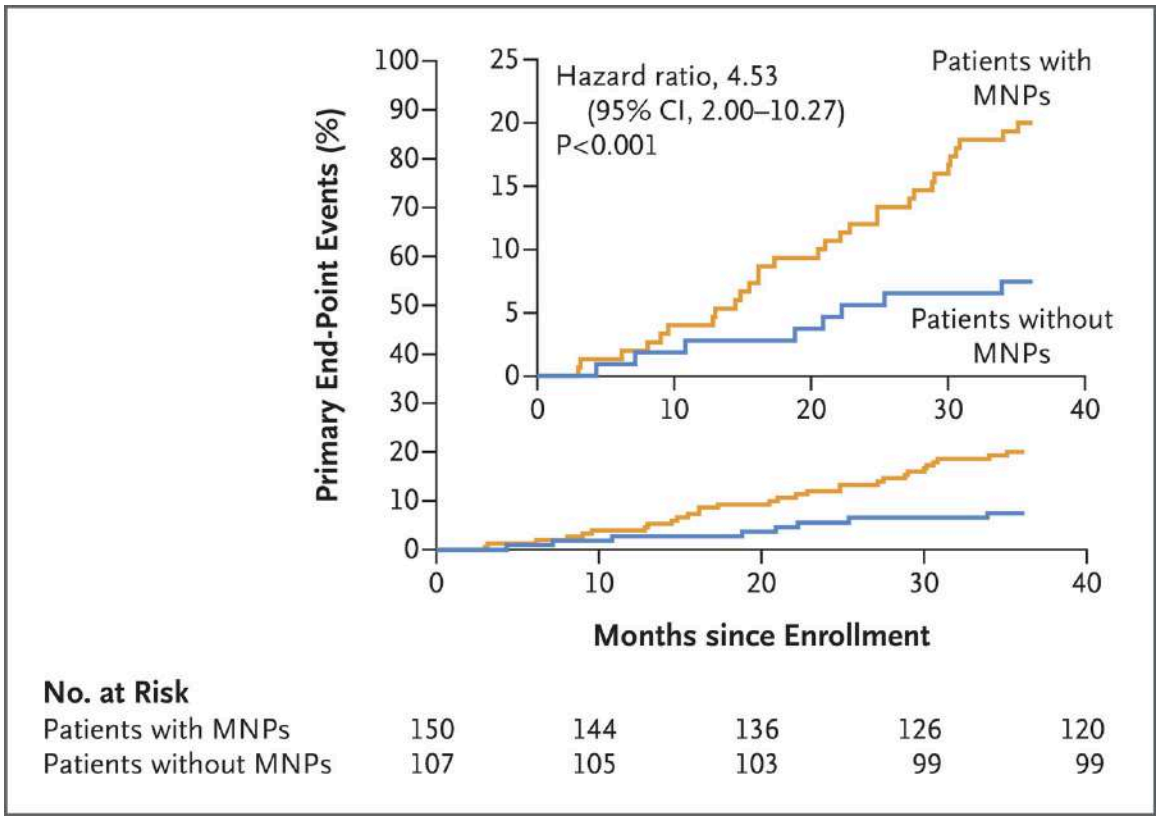
There's growing evidence that microplastics and their associated chemicals—like BPA and phthalates— also have significant impacts on the heart and blood vessels.

BPA and phthalates

- Acute exposure to BPA disrupts calcium signaling by inhibiting voltage-gated calcium channels in heart cells, which impairs the heart's ability to contract effectively. This not only affects heart rate but can also lead to abnormal activity in the heart muscle, raising the risk of arrhythmias or other cardiac dysfunctions.
- BPA's impact isn't the same across the board—men and women are affected differently. BPA's ability to mimic estrogen, a hormone crucial to heart function, means that women may experience more severe heart-related effects. Estrogen plays a protective role in cardiovascular health, and BPA's interference with this system may explain why the chemical's cardiac impacts seem to be more pronounced in women.
- Animal studies have shown that exposure to a phthalate metabolite called DEHP decreases coronary blood flow and impairs the heart's contractile function, which directly suppresses the heart's ability to function properly.

Microplastics

- A study published in the New England Journal of Medicine found that patients with microplastics lodged in their arterial walls were 4.5 times more likely to experience a major cardiovascular event, like a heart attack or stroke, within three years compared to those without these particles. In fact, microplastics were detected in 58.4% of patients undergoing surgery for carotid artery disease, suggesting that long-term exposure to these particles could be a significant yet often overlooked risk factor for cardiovascular disease.
- A randomized controlled trial showed that participants who drank from BPA-lined cans experienced a 4.5 mmHg spike in systolic blood pressure within hours. Even more concerning, repeated exposure to BPA—found in everyday plastics—can lead to chronic hypertension, which is a major risk factor for heart disease and stroke.
- A study analyzing data from over 9,000 participants found that those with the highest levels of BPA in their urine were 1.76 times more likely to die from cardiovascular disease over a 9-year period. The risk was especially pronounced in women, who were 2.8 times more likely to die from cardiovascular-related causes if they had high BPA exposure.



Microplastics and Nanoplastics in Atheromas and Cardiovascular Events. N Engl J Med. 2024

The way microplastics contribute to this risk is two-fold. First, they promote chronic inflammation, which is a key driver of atherosclerosis—the buildup of plaque in the arteries. This inflammation accelerates plaque formation, narrowing arteries and increasing the likelihood of blockages that can lead to heart attacks or strokes. Second, **microplastics can carry harmful chemicals like BPA and phthalates directly into arterial walls,** compounding the damage by promoting plaque formation.

Cancer

One of the key concerns with microplastics is not just the particles themselves, but the chemicals they carry, including phthalates and BPA—both of which are endocrine disruptors. Because these substances interfere with our hormonal systems, there could be an effect on cancer risk.

Let's start with phthalates

- A large-scale 2022 study from Denmark followed nearly 1.3 million children over two decades and found that childhood exposure to phthalates was

associated with a 20% higher risk of developing cancer.. The study revealed even more alarming risks for specific cancers: **children with phthalate exposure had almost a three-fold higher rate of osteosarcoma (a bone cancer) and were twice as likely to develop lymphoma (a blood cancer).**
- A meta-analysis pulling data from nine case-control studies and involving over 7,800 participants across multiple countries found that specific phthalate metabolites were **positively associated with breast cancer risk.**

Now let's talk about BPA

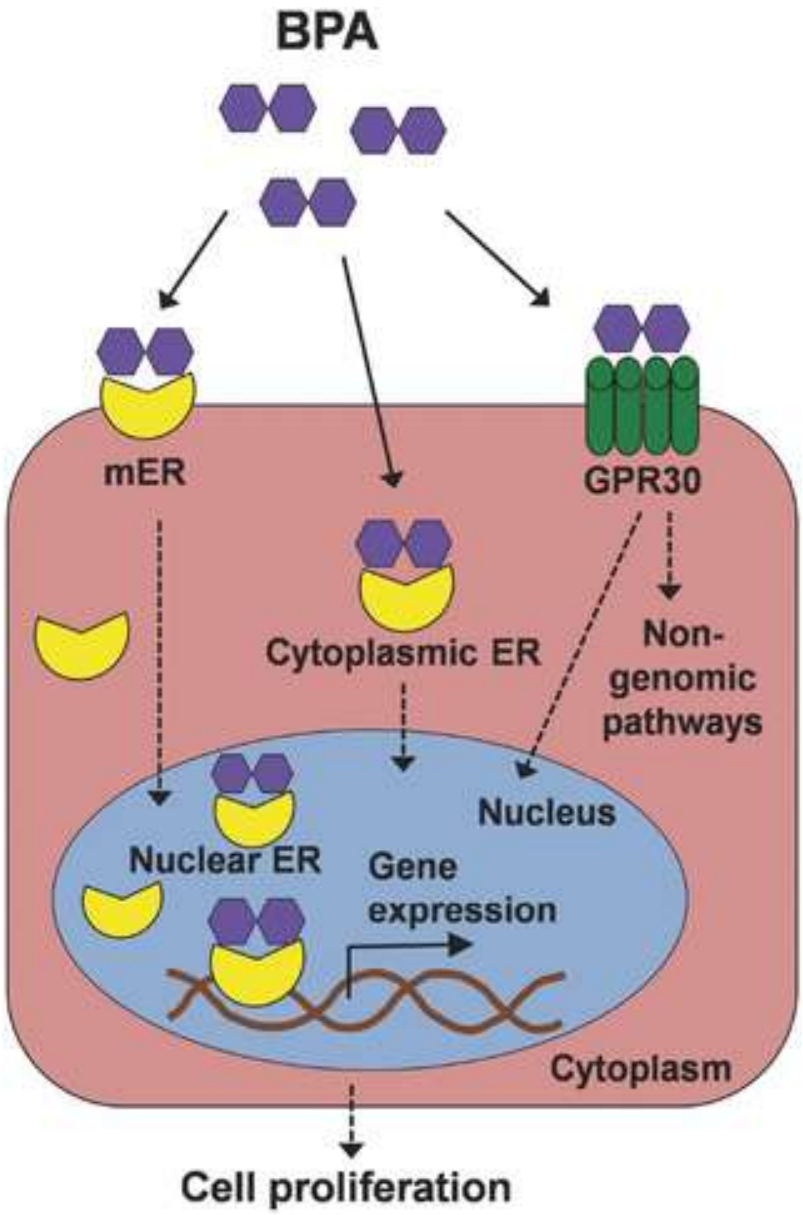
BPA's estrogen-mimicking properties could make long-term exposure a hidden risk factor for breast cancer, especially for women with higher genetic or lifestyle risks.

- At low doses, BPA can promote the growth of estrogen-sensitive breast cancer cells in laboratory settings.

The concern grows when you factor in microplastics, which can act as carriers for chemicals like BPA, phthalates, and heavy metals.

- Microplastics have been detected in human tumor tissues, including in a study of lung cancer patients, where researchers found plastic particles lodged in the tumor itself.

This all suggests that microplastics could potentially influence cancer development or progression by causing chronic inflammation or transporting harmful chemicals directly to tumor sites. **While we don't yet know if microplastics cause cancer directly,** their ability to infiltrate tumor environments and deliver harmful chemicals like BPA raises serious concerns about their role in exacerbating cancer risk.



Low-Dose Bisphenol A Exposure: A Seemingly Instigating Carcinogenic Effect on Breast Cancer. Adv Sci (Weinh). 2016

Mitigation Strategies

It's clear that microplastics are here to stay. With that being said, there are ways to reduce our exposure to these health-harming chemicals.

Drinking water

The water you drink could be exposing you to a hidden cocktail of harmful chemicals, even if you avoid plastic bottles. While it's a smart choice to minimize drinking water from plastic bottles and cans—since both can leach microplastics

and chemicals like BPA into your water—the issue goes deeper. Even if you're choosing water packaged in glass, which avoids these plastic-related chemicals, there's a more insidious concern: the quality of the water itself, especially when it comes to *carbonated* water.

PFAS are increasingly being detected in drinking water, including bottled varieties. So, even the healthiest-sounding choice, like carbonated water in glass bottles, may not be as safe as it seems when PFAS contamination is involved. This highlights the importance of considering both the packaging and the water quality itself.

A 2020 Consumer Reports third-party analysis of several popular brands of sparkling water uncovered some eye-opening findings—all carbonated water tested fell below legal limits for heavy metals, and none had arsenic levels above the recommended maximum of 3 parts per billion. But many products had measurable amounts of PFAS. Of note:

- Topo Chico topped the list with PFAS levels at 9.76 parts per trillion (ppt).
- Perrier registered a PFAS level of 1.1 ppt.
- San Pelligrino had a PFAS level of 0.31 ppt.

LOWER TOTAL PFAS LEVELS

CARBONATED BRANDS	TOTAL PFAS (PARTS PER TRILLION)
Sparkling Ice Black Raspberry Sparkling Water	Not Detected
Spindrift Raspberry Lime Sparkling Water	0.19
Sanpellegrino Natural Sparkling Mineral Water	0.31
Dasani Black Cherry Sparkling Water	0.37
Schweppes Lemon Lime Sparkling Water Beverage	0.58

TOTAL PFAS OVER 1 PPT

Perrier Natural Sparkling Mineral Water	1.1
La Croix Natural Sparkling Water	1.16
Canada Dry Lemon Lime Sparkling Seltzer Water	1.24
Poland Spring Zesty Lime Sparkling Water	1.66
Bubly Blackberry Sparkling Water	2.24
Polar Natural Seltzer Water	6.41
Topo Chico Natural Mineral Water	9.76

What's Really in Your Bottled Water? - Consumer Reports

How can you ensure that the water you're consuming is safe? **By taking control of water quality in your own home.**

For those concerned about microplastics and contaminants, reverse osmosis (RO) filters are one of the most effective solutions, removing 99.9% of particles from water.

These systems also go beyond microplastics, filtering out heavy metals, bacteria, and dangerous chemicals like PFAS, making them a comprehensive choice for safe drinking water.

But these filters **also strip out essential minerals and trace elements like calcium, magnesium, potassium, and zinc, which are vital for bone strength, nerve**

function, and overall health. Many RO systems now come with remineralization filters that add these minerals back into the water, or you can easily use mineral drops to restore what's lost. RO-purified water is versatile and can be used to wash your produce, helping to remove microplastics and other contaminants that may be present on fruits and vegetables, offering another layer of protection against exposure.

Food

When it comes to what we eat, there are also things we can do to limit microplastic and chemical exposure.

- **Opting for fresh food and avoiding plastic packaging** can significantly cut your exposure to microplastics and toxic chemicals like BPA: Packaged foods are typically wrapped in plastics that can shed microplastics and leach harmful substances like BPA into the food.
- **Fresh produce, meats, and bulk items** are far less likely to carry these risks, making them a healthier choice.
- **Reducing your intake of canned foods is another critical step:** Cans are often lined with BPA or BPS, which are known to leach into the food, especially when exposed to heat or acidic contents. Glass packaging is a safer alternative and doesn't carry the same risks.
- **Plastic containers are a major source of chemical leaching,** especially when used to heat food. Even when labeled "microwave-safe," plastic can still release toxins when exposed to heat: Switch to glass, stainless steel, or ceramic containers for a healthier alternative.
- **Avoid disposable coffee and tea cups:** Most paper cups are lined with a thin layer of plastic to prevent leaks, but when you pour a hot beverage into them, the heat can cause the plastic to break down and release chemicals like BPA into your drink. In fact, hot liquids can cause plastic leaching up to 55 times higher than cold ones.
- **Bring your own reusable to-go mug:** Many coffee shops will fill your travel mug, and some even offer discounts for doing so.

A final note on BPA-free products: While they sound safer, they're often just as dangerous. Manufacturers frequently replace BPA with BPS or other compounds that behave similarly in the body, disrupting hormones and potentially causing adverse effects on fetal development, brain health, and cardiovascular function. The term "BPA-free" doesn't mean "free from all toxic chemicals."

Salt

Consuming salt—especially sea salt—can significantly increase your microplastic exposure.

- Estimates suggest that salt intake can add around 7,000 microplastic particles to your diet annually: A study found that sea salts contain anywhere from 550 to 681 microplastic particles per kilogram, making them some of the most contaminated salts available.
- Rock salts, like Morton's iodized salt and pink Himalayan salt, still contain some microplastics, but the levels are much lower compared to sea salts and lake salts. If you want to reduce your microplastic intake, opting for rock or mined salts is a simple and effective step.

Air

Reducing the amount of microplastics we inhale in the air we breathe is crucial, and fortunately, there are practical steps we can take to minimize this risk.

- **High-Efficiency Particulate Air (HEPA) filters** offer a powerful solution for removing airborne microplastics, especially in indoor environments where exposure is high: These filters can trap particles as small as 0.3 microns, which includes the majority of airborne microplastics.
- **Many vacuum cleaners now come with HEPA filters,** enabling them to effectively capture microplastics from floors, carpets, and upholstery: Vacuuming regularly with a HEPA-equipped vacuum cleaner not only removes these particles but also prevents them from being recirculated into the air.
- **In combination, a HEPA air purifier and HEPA vacuum cleaner** can significantly improve indoor air quality by reducing the number of microplastics in the home, particularly in spaces with synthetic materials.

Clothing

Our clothing is a hidden source of microplastics, but switching to natural fibers can help minimize their environmental impact.

- **Synthetic fabrics like polyester, nylon, and acrylic** are widely used in fashion due to their durability and affordability, but they shed microplastic fibers into the air we breathe and the water we wash them in.

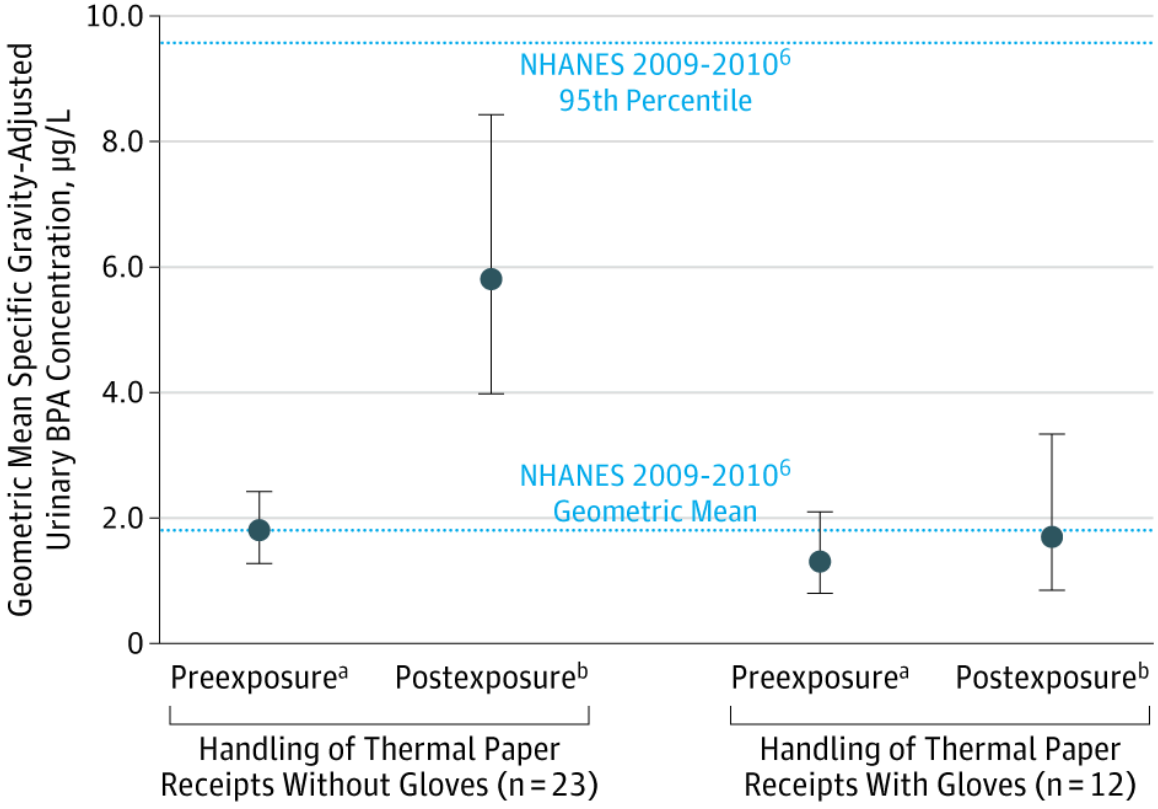
- **By choosing garments made from 100% natural fibers such as cotton, linen, hemp, or wool,** you can avoid contributing to this pollution. Even blended fabrics can still release microplastics.
- For those who want to continue wearing synthetic fabrics, **installing a microfiber filter on your washing machine** is one of the most effective methods to catch microplastics released during washing.
- If installing a filter isn't an option, **you can use products like the** Guppyfriend laundry bag**, which traps microplastics while washing synthetic garments.** This solution is simple, cost-effective, and can drastically reduce the microplastic pollution coming from your wardrobe.

Skin absorption

Microplastics and chemicals like BPA can enter our bodies through the skin, and one common source might surprise you: thermal paper receipts. These receipts, which we encounter daily at supermarkets, gas stations, and ATMs, **often contain BPA, a chemical used in the thermal printing process as a color developer.** When you handle these receipts, BPA can transfer onto your skin and potentially enter your bloodstream. While skin absorption isn't as significant as ingestion or inhalation, it's still a pathway worth considering, especially given how frequently we come into contact with these receipts.

Certain products, like lotions, sunscreens, or hand sanitizers, can significantly increase the skin's absorption of BPA. These products enhance skin permeability, allowing more BPA to pass through. Studies have shown that using hand sanitizer before handling receipts can dramatically boost BPA absorption.

The solution: Opt for digital receipts when possible, which many retailers now offer. This simple step reduces your exposure to BPA while cutting down on paper waste. If you handle receipts regularly at work, such as in retail or food service, consider wearing nitrile gloves. These gloves provide an effective barrier against BPA and other chemicals, unlike latex gloves, which may not offer the same level of protection.



Handling of thermal receipts as a source of exposure to bisphenol A. JAMA. 2014

Excretion methods

Our bodies are equipped to handle chemicals like BPA and phthalates, but their constant exposure and the persistence of compounds like PFAS create a serious burden. Once chemicals like BPA, BPS, and phthalates enter the body, the liver quickly processes them through Phase II detoxification, converting them into water-soluble forms that can be excreted through urine. For example, **BPA is cleared within about six hours, while phthalates can take 12 to 24 hours to be eliminated.**

The situation becomes even more troubling with PFAS, often called "forever chemicals," **because they have a half-life of two to five years.** These compounds accumulate in the liver, kidneys, and other organs, and are incredibly difficult to eliminate, sticking around in the body for years. On top of that, microplastics—particularly nanoplastics—can enter the bloodstream and potentially accumulate in organs and tissues. While larger microplastic particles are often excreted through feces, we still don't fully understand how nanoplastics are processed or the long-term health effects of their accumulation.

So, how do we help our bodies clear out chemicals like BPA, BPS, and phthalates more efficiently? In part, by using our body's natural detoxification systems.

Sulforaphane

Sulforaphane is a powerful molecule found in broccoli sprouts that activates the body's natural detoxification pathways through the Nrf2 pathway. Nrf2 serves as a master regulator, controlling the production of key enzymes like glutathione S-transferases and UDP-glucuronosyltransferases, which bind to harmful chemicals, making them more water-soluble for excretion via urine. This detox process is particularly relevant for clearing toxins like BPA, BPS, and phthalates, which we're exposed to regularly. Animal research shows that sulforaphane can dramatically increase detox enzyme activity in rodents exposed to BPA, reducing their overall toxicity levels.

In humans, the evidence for sulforaphane's detoxifying benefits is strong in other areas. Studies show that it can boost the excretion of toxins such as benzene and acrolein, which we encounter through air pollution and food, by up to 60%. To maximize these detox benefits, adding broccoli sprouts—which can contain 100 times more sulforaphane than mature broccoli—or high-quality sulforaphane supplements to your diet could be a valuable strategy.

Fiber

Fiber-rich foods have the unique ability to bind to lipophilic chemicals, such as BPA and phthalates, in the gastrointestinal tract, reducing their absorption into the bloodstream and promoting their excretion through feces. Animal studies have supported this mechanism, showing that higher fiber intake is linked to increased fecal excretion of these compounds.

There's also emerging evidence that fiber might help with the excretion of microplastics. Since some microplastics can become trapped in the gut, fiber could encapsulate and help eliminate them through regular bowel movements. Essentially, a fiber-rich diet may help sweep microplastic particles from the body, reducing their potential to cause long-term harm. **Including whole grains, legumes, fruits, and vegetables in your diet not only provides essential nutrients but may also play a role in clearing both toxic chemicals and microplastics from the gut.**

Sweat

While most toxins like BPA and phthalates are eliminated through urine, **studies show that sweat contains trace amounts of these harmful substances as well.** In one study, researchers found phthalates in the sweat of participants, suggesting that regular sweating, whether through physical activity or sauna use, can aid in the removal of some of these toxins. That said, sweating is less effective for PFAS, which are resistant to breakdown and have long half-lives in the body.

As we wrap up our deep dive into the pervasive issue of microplastics and their associated chemicals, it's clear that this is not just an environmental crisis—it's a significant human health challenge.

These microscopic particles infiltrate our bodies, accumulating in vital organs, disrupting hormonal balance, impairing fertility, and posing serious risks to our neurological and cardiovascular systems. The health implications span multiple biological levels, making it essential to address the issue head-on.

However, there's a constructive path forward. By educating ourselves and making informed decisions—like implementing water filtration systems, choosing fresh foods over those packaged in plastic, selecting natural fiber clothing, and supporting our body's detox pathways through nutrition and lifestyle practices—we can actively reduce our exposure to microplastics and their harmful chemicals.

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