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COVER STORY

Our plastics, our selves

What's plastic doing to our bodies? This all-female team is investigating.

By **Eve Andrews** on Feb 6, 2019

When I arrive at the marina in Victoria on a late-July morning, the sky and water are complementary shades of azure, and there is not one cloud in the sky — a Pacific Northwestern idyll. On the deck of the 72-foot shiny-bright *Sea Dragon*, moored here in the island capital of British Columbia for just one day, are four young women, part of the crew of the research voyage "eXXpedition." They're hauling heavy buckets of black sludge up to the deck from the ocean floor, their labor set to a tinny radio serenade of Drake and Selena Gomez.

The team will meticulously pack the sludge — actually wet sand from the harbor floor — into little glass jars like you would some fresh vegetables you planned to pickle. These jars will be added to a library of sand, water, and air samples that they've collected over the past six weeks from across the North Pacific. They'll ship some of those samples off to Plymouth, England, to be analyzed by eXXpedition's marine scientist Imogen Napper. The idea is that by cataloging this library, she and the team will begin to get a better sense of what kind of plastic is out there in the ocean.

One thing they already know, because they've seen it every day for weeks: There is a whole lot of it. The *Sea Dragon*, with an all-woman crew of 14 aboard, launched from Hawaii in mid-June, traversing a part of the North Pacific Gyre known as the "Great Pacific Garbage Patch," a swirling mass of trash the size of two Texases. The name conjures the image of great islands of refuse gently bumping up against each other, like a *Waterworld* made of old tires and sandwich bags. But, as eXXpedition founder Emily Penn tells me as we sway a bit on deck, it's really more of a plastic soup, trillions of little bits and particles seasoning a million square miles of ocean.

Meg Tapp (left), Laura Leiva, and Imogen Napper collect samples from the floor of the marina in Victoria, B.C. Eve Andrews / Grist

"When we sailed into the southern edge of the Gyre, we started to see a piece of plastic over the side of the boat every 10 seconds — a cigarette lighter, a bottle, some sort of container," she said. Her skin is tanned and her hair is bleached from weeks in Pacific sun, and as she describes the voyage, she's dodging the spray of some deck-hosing that's going on around us: "Then when you wake up the next morning, and it's still going, and wake up seven days later, and it's *still* going, and you're 800 miles from the nearest human being — it's that relentlessness that's just so overwhelming."

With this voyage, the eXXpedition is trying to make sense of that relentlessness. The women, a mix of scientists, sailors, writers, and activists, collected those samples of plastic from the air, water, and ocean floor to be analyzed not just in Napper's lab but in others across the world. The point is that this problem is far larger than one very large patch in the North Pacific — plastic is found throughout all the oceans, in fish, in turtles, in shellfish, everywhere.

The samples that eXXpedition collected will help us understand how plastic might pick up other pollutants, like pesticides and industrial waste, and transfer them to humans through the food chain. In parallel with that work, the team also wrote about its experiences to raise awareness, and began developing ideas for both policy and technology to address this giant plastic dilemma.

One major mystery within that dilemma: what all these bits of plastic might be doing to us. For every tidbit of understanding we gain about the health consequences of chemicals released by plastics, there remains a Gyre-sized quantity of unknowns. But a growing body of evidence suggests some chemicals commonly found in many plastics are associated with everything from breast and prostate cancer, to underdeveloped genitalia and low sperm count in men, to obesity.

You've probably already heard about compounds like bisphenol A, which seeps into food and drinks from plastic bottles and canned-food liners — and has been tentatively linked to breast cancer and prostate cancer. That's just one. There are many others. Some are merely suspected to be bad for human health; others are known to be dangerous.

"So often when we talk about environmental problems we hear about things that are happening somewhere else, to somebody else, at some point in the future," Penn wrote in the U.N. Chronicle magazine in 2014. "You and I already have a body burden, a chemical footprint that we will never get rid of."

In particular, some of the substances that stick to plastics, seep out of them, or are released when they decay are endocrine-disrupting chemicals (EDCs), meaning that they interfere with the normal function of hormones in the human body. Some may contribute to cancer. They may also cross from a pregnant woman's body into her fetus, potentially changing the way a baby develops.

It's that last potential consequence of plastic junk that made Penn decide to found eXXpedition as an all-women's endeavor. Men get these chemicals inside them as well, of course. "For women," she said, "it felt like it was a greater significance because we're passing them on to the next generation."

Emily Penn, far left, talks with eXXpedition crew members Elise Chappell, Becca Finlayson, Meg Tapp, and Sarah Michler. Grist / Eve Andrews

All of us live with those compounds. You can't live on this planet and not come into contact with the indelible dusting of plastic that covers it. We know it's everywhere, but we don't know nearly everything about what it does or how we've been changed by it. Penn and her team plan to help us find out.

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The scientific exploration of the hormonal effects of compounds in plastics dates back to July 1991, when physician and biologist Ana Soto traveled to Wisconsin to attend a conference on the potential effects of chemical exposure on human sexual development. She had been invited because her lab had made an important, impromptu discovery two years earlier: The suppliers of a plastic tube that Soto and her colleague Carlos Sonnenschein used in their lab had changed the tube's formula, in order to make it stronger. The researchers then noticed that the nutrient mixture they stored in these new tubes was causing cells in their test cultures to proliferate when they hadn't before. Soto and Sonnenschein eventually figured out the cells were responding to a compound leaching from the new tubes, nonylphenol, as if it were the natural sex hormone estrogen.

This was the first compound in plastic ever identified as an "endocrine disruptor," a term Soto and 20 other researchers introduced at the conference to refer to synthetic chemicals that interfere with hormone signals.

Your endocrine system includes glands like your thyroid, pancreas, and sex organs which release hormones that attach to receptors on the cells of your brain and organs, instructing your body how to behave or how to turn food into energy. In particular, these hormones coordinate growth and development. If you interfere with the activity of a hormone just a little bit, you can make big changes in how the body develops.

Exposure to sex hormones in the wrong quantity and at the wrong time may increase the likelihood that a person could one day develop cancer. Once Soto and her colleagues discovered what nonylphenol was doing, they suspected that it and other compounds that acted like sex hormones could also increase a person's risk of cancer.

The best evidence to support that suspicion was a large, unintended human experiment involving diethylstilbestrol (DES), a synthetic estrogen prescribed to women from the 1940s through the 1960s to prevent miscarriages. It was eventually proven to be ineffective at preventing miscarriages, but tragically effective in producing babies who would grow up to develop vaginal cancer as adults. The incidence of vaginal cancer in women exposed to DES before birth was as much as 40 times higher than that of the rest of the population. (That said, it was still just a small risk: Only about 0.1 percent of DES-exposed babies went on to develop vaginal cancer.) Their rate of breast cancer was also about twice as high.