Chemical Cocktail
by Brandon Keim
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From Prozac to perfumes, pharmaceuticals and personal care products (PPCPs) are discharged down household drains in agrochemical-comparable quantities. Often their ingredients survive sewage treatment and enter our streams and rivers, and sometimes they return through our faucets. What will this largely unregulated cocktail of dimly understood compounds do to our environment? What will it do to us? Nobody knows, but a growing number of scientists demand more research and more precaution, warning that the effects could be gradual rather than acute, mistaken as 'natural' until it's too late.

The search for discharged PPCPs started only recently, triggered by a United States Geological Survey study and a 1999 article co-authored by EPA chemist Christian Daughton. "Scientists looked at the same small select group of pollutants for decades," explains Daughton. "Anything that humans use has the potential to be a pollutant."

The USGS study, released in 2002, found PPCPs – and many other previously unacknowledged pollutants – from sea to shining sea. Eighty percent of 139 urban waterways in 30 states were contaminated; of 95 targeted compounds, they found 82, with as many as 38 occurring in a single stream. The findings were sobering.

Detecting individual compounds at low concentrations is a laborious and time-consuming task, often requiring scientists to develop new methods of analysis. In a sense, finding PPCPs is less an issue of their presence than our ability to measure them.

"There are 10,000 synthetic organic compounds that we use in our daily lives and industry," says USGS scientist Michael Meyer, "and we're just looking at a small fraction of them."

While little is known about PPCP presence, their actual effects are understood even less.

Some PPCPs, including birth control pills and certain soaps, are endocrine disruptors, which can impair hormonal and reproductive processes. Antidepressants like Prozac can wreak reproductive havoc in fish and crustaceans, as can high blood pressure drugs. Musks used in perfume are highly toxic, and anti-epileptic drugs – which have been found in drinking water – can trigger cell death in developing human brains. How such compounds work in combination is anyone's guess.

But while these biological possibilities are recognized, scientists have yet to identify the effects of PPCPs on aquatic ecosystems and human beings. Only in the last two years, says Daughton, has research on effects been published, and even that is skimpy. Such measurements are especially difficult. Impacts are likely to be subtle – and often we don't know what to look for.

"Very few chemical stressors have just one effect. They have effects on all sorts of pathways in organisms, because pathways are all interconnected," says Daughton. "That's why it's almost impossible to predict what types of effects you might find."

Current US regulations on PPCPs are inadequate. They emphasize acute toxicity, rather than the low but pervasive concentrations found in sewer discharge. They also overlook regional variations in concentration – some compounds may be diffuse on average, but intense in particular locales. In coming years, more regulation may be suggested, but both the lobbying power of chemical manufacturers and the limitations of our monitoring capabilities make that a distant possibility.

"It's amazing how little scientists know," says Daughton. "That's the takeaway lesson."

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