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Slipping through the Cracks: Why is the U.S. Environmental Protection Agency Not Funding Extramural Research on Chemicals in Our Environment?

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One hundred million unique chemicals have been produced in the past 60 years, at a rate of about 10 million per year in the past decade.[1] The United States Toxic Substances Control Act is ill-equipped to properly evaluate whether significant environmental concerns are associated with this flood of chemicals into our marketplace. As a consequence, chemicals continue to be approved for commercial use, although their environmental impacts are unknown. In addition, the U.S. Food and Drug Administration has an equally challenging process, and as a consequence cannot properly evaluate the potential adverse effects of the enormous number of pharmaceuticals and personal care products (PPCPs) released into the environment. In fact, it is well documented that waters below wastewater treatment plants contain hundreds to thousands of PPCPs that can cause fish intersex and possibly other unknown effects.[2] Importantly, once adverse ecological or human health impacts of approved chemicals are observed, removal of chemicals from the marketplace is contentious and often takes years to decades.

The U.S. Environmental Protection Agency's (EPA) mission is to protect human health and the environment. Since the 1980s there has been a steady decline in the funding for extramural research by EPA, largely due to Congressional pressure to reduce their base funding. During the 1990s and early 2000s the primary EPA source of funding for extramural research was the Science to Achieve Results (STAR) program. Its funding peaked in 2001 at 1.3% of the EPA's budget and is now at ∼0.5% of their budget (Figure 1). The internal EPA ecosystem research funding has also been decreasing for many years. Virtually no extramural research funding at the EPA exists for the ecological impacts of chemicals; rather, most funds are directed toward human health and, more recently, climate change. In 2003, the National Academy of Science recommended the STAR budget be 15−20% of the EPA's Office of Research and Development budget.[3] That recommendation has been ignored despite the impressive productivity of the STAR program with hundreds of peer-reviewed publications, countless fellowships for graduate students, and health and ecosystem benefits.

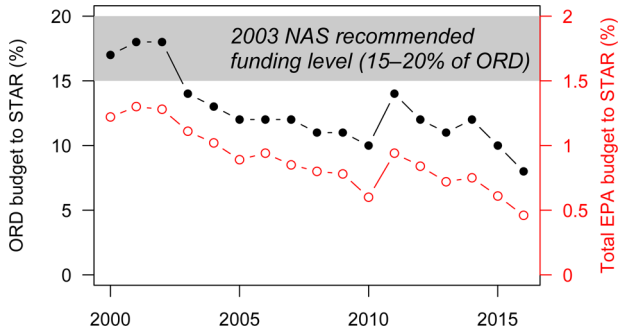

Figure 1. Decline in extramural funds (Science to Achieve Results (STAR)) awarded by EPA as a fraction of total budget (red open symbols) and budget allocated to the Office of Research and Development (black closed symbols).

The growing gap in the evaluation of the impacts of chemical contaminants on the environment is not being filled by the U.S. Department of Agriculture (USDA) or the National Science Foundation (NSF) either. The USDA often funds ecosystem research on the beneficial effects of agrochemicals (e.g., pesticides, fertilizers, and pharmaceuticals) on food production, but seldom funds studies on nontarget or adverse effects of agrochemicals. Meanwhile, for years, NSF program managers

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have asserted it is the responsibility of other federal agencies, namely the EPA, to fund ecotoxicological research. Consequently, it was not surprising when Bernhardt et al.[4] revealed that less than 3% of the total number of NSF grants address the environmental effects of chemicals.

The anemic federal funding for research on the effects of chemicals on ecosystems in the U.S. has resulted in <1% of all papers published in respected ecological journals over the last 25 years focus on chemical effects on the environment.[4] Bernhardt et al. state "our lack of knowledge about how synthetic chemicals alter ecological processes represents a critical blindspot in the rapidly developing field of global ecology.".[4] Even more troubling is that chemical exposures are increasingly accompanied by other common stressors, such as habitat degradation, altered flows, elevated nutrients, invasive species, new pathogens, and climate change. Historically, ecologists and ecotoxicologists rarely collaborated despite the crucial need to do so to better understand the impacts of chemicals on the environment. As Gessner and Tlili[1] wrote, "Integrating ecological principles into the design and implementation of ecotoxicological research is essential for assessing and predicting contaminant impacts on biological communities and ecosystems". The lack of collaboration may also be due from the failure of funding agencies to promote this research. There is much to be learned about the environmental effects of thousands of common chemicals, but even more so, about their interactions with co-occurring stressors.[4] All of these threats, in the midst of greater than expected impacts from climate change, dictate that the effects of chemicals in air, water, soil, plants, and wildlife be understood by scientists, the public, and regulators.

If the U.S. wishes to be a world-leader in research on the effects of chemicals in the environment, federal agencies must increase their support of research on chemical contaminants. A failure by U.S. federal agencies to support innovative research on the effects of chemicals and their interactions with more well-funded stressors (e.g., nutrients, invasives, and climate change) seems naïve. We call on the EPA,NSF, and Congress to begin an interagency funded research program to establish the effects of the millions of chemicals on our environment.

One way to deal with the overwhelming number of new chemicals entering our environment is for academia to again be a research partner as they were in the early years of the EPA when environmental extramural funding and cooperative agreements existed. Coordination among academic, government, and industry partners would improve the evaluation of effects of chemicals on the environment. The highly successful Cooperative Research Centres program in Australia (crca.asn.au) has linked these three sectors to provide cutting edge, applied research that benefits all involved. Academia is not worried about profit, is less bureaucratic, and more nimble than industry or government. This approach would (1) provide novel approaches to study chemicals, (2) reduce perceived bias associated with industry evaluating the safety of the chemicals,[5] which provides external validation of chemical safety decision making, and 3) increase the number of chemicals whose safety is evaluated. Moreover, the competitive grants process should result in innovative approaches to chemical management, which can improve the efficiency and effectiveness of chemical evaluation, as compared to the status quo. This increased funding is essential to protect and restore our ecosystems. Our growing exposure to chemical and nonchemical stressors has greatly increased human and ecological risk. In general, as risk increases so does the need for steps to prevent damage to our valuable collective resources. An increased U.S. investment in research on the environmental consequences of chemical contaminants is necessary to help protect our national and global ecosystems, their services and public health.

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Notes

The authors declare no competing financial interest.

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