

Science AMA Series: Ask the Society of Environmental Toxicology and Chemistry (SETAC) anything about Pharmaceuticals in the environment!

SETAC_{NorthAmerica}¹ and *r/ScienceAMAs*¹

¹Affiliation not available

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Abstract

The Society of Environmental Toxicology and Chemistry (SETAC) is hosting the SETAC North America 38th annual meeting this week and we have tied this AMA to a specific session, “Pharmaceuticals in the environment: Potential environmental and human health impacts.” Experts from across academia, government and industry are here to answer questions on this topic. The research being presented at our meeting will cover topics such as how fish react when a variety of medicines get through wastewater treatment and into their environment, to what levels of detection in water is risky to human health, to how veterinary medicines given to cattle get into the environment, among others. Please do note that we are asking members of the society who represent researchers from a variety of disciplines and sectors; the answers are not official SETAC positions. We encourage discussion and debate! Just please keep it professional. For more information on SETAC see <http://www.setac.org> Post your question and the organizers of the conference will find someone to answer it as soon as possible. Answers to questions will be most active during the session break at 10AM-11AM EST and immediately following 12PM-2PM EST, ending at 2PM EST.

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SETAC_NORTH_AMERICA [R/SCIENCE](#)

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Animal Alternatives - My shampoo bottle says not tested on animals, which is great! But, what about pharmaceuticals? Can you open my blind eyes to the volume of animals being tested on/with and what happens to their bodies once their purpose has been 'served'? I'd really like for the generally educated, such as myself, to have a better understanding of how the cycle flows and effects our environment...

[ancientgnome](#)

As it stands there are no reasonable or practical alternatives to testing pharmaceuticals in the complexity of a living thing. However, for other products there are a great number of people working hard to ensure we do have alternative testing methods in the future.

Do pharmaceuticals get into the environment more from improper disposal or by "passing through" patients taking medicine?

[recentfish](#)

Collecting unused medicines for proper disposal is good stewardship, but the majority of the pharmaceuticals enter the environment by "passing through." Bear in mind, it's not only humans taking pharmaceuticals; agricultural use of pharmaceuticals is massive.

Greetings - I understand that some medicines do their job and are passed through the system as-is

medium, provided that the original author and source are credited.



and some are metabolized into other things and passed after the body changes them.

Do scientists test for the metabolites when they are looking for pharmaceuticals in the environment?

I know it depends on the individual substance, but in general, which is more potentially dangerous, the stuff that changes or the stuff that stays the same?

For the potentially harmful substances, how long does it take for them to break down in the environment?

For substances that are either potentially most dangerous, durable, or perhaps expensive, would it make sense (this is gross -sorry) to collect the urine of people taking those medicines and purify them out, or at least dispose of them more safely?

Thanks for your time.

[genericusername4197](#)

In general, we are looking at the parent molecule. In the approval process for drugs, consideration is given to drugs that are metabolized in humans and animals at greater than 10%. If the metabolites are a significant amount, it will need to be addressed.

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[genericusername4197](#)

We're back to this question, because it's loaded. Do scientists test for metabolites..? They test for metabolites they know about and for what they can identify. Changes vs. stays the same..? You answered that - it depends on the individual substance. This is the same answer for the break down question. The time it takes an amount of a substance to break down in half (or 50%) is called half-life, which is substance specific. The measure of the potential of a substance to build up in organisms is referred to as "bioconcentration" or "bioaccumulation." For organic substances like most pharmaceuticals, it could be informed by the solubility of the substance.

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Good question,

Point by point:

You are correct!

A common approach in env. tox. is to look for metabolites or identify metabolites of known pharmacological products.

This is very hard to answer, but we do know that some compounds become more active after certain metabolic pathways. But this is very variable and depends on the design of the parent molecule as you've already pointed out. There is no definitive answer. However, as a rule of thumb, metabolites tend to be more water soluble and are as such cleared faster from the organism through the kidneys and as such the "area under the curve" burden becomes smaller.

This is also really dependent on the compound, some substances are immediately consumed by environmental bacteria. Halogenated pharmaceuticals are usually more stable due to the stronger bonds in such molecules. A readily biodegradable substance is completely consumed within a day or so. A persistent one may never degrade in a biotic environment such as a lake and needs either direct sunlight and free radical reactions to degrade.

This is definitely being done for certain types of radioligands already and there is no reason to believe that there is not other situations where this might be beneficial.

Thanks for your great questions!

If you see him, tell your president Dr. Maier to give his water treatment class some extra credit on today's test since he is missing it for the conference! And the tox class too!

[otterfied](#)

We see him right now, and will convey the message. Maybe if you post some compelling questions, we can put the heavy on him for the extra credit.

Hi and thanks for joining us today!

Could you all give us the current state of knowledge on EE2 from hormonal contraception as an environmental contaminant?

[PHealthy](#)

We understand quite a bit EE2. There have been broad watershed level monitoring studies to look at

concentrations; numerous fish studies. The research indicates that generally, the concentrations being found are not significant enough to cause negative effects to fish or humans. The future risk is being tracked.

When we do find EE2, which is quite potent, it is a huge red flag because it can trigger changes in wildlife, but most of the time it isn't detected. There is a study out there that shows that at 5 parts per trillion, it can cause fish population collapse.

Hi, thanks for coming to talk to us about your work!

I was wondering, do pharmaceuticals that get dumped into the environment worsen the growing problem of anti-biotic resistant bacteria?

[PapaNachos](#)

We don't know. There is a lot of regulatory investigation in Europe and numerous studies being conducted, but the results are not conclusive. There are studies that show linkage between introducing presence of antibacterials to aquatic environments and resistance, but it cannot be quantified.

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[PapaNachos](#)

Most likely not a big contributor compared to conventional sources of antibiotics. Bacteria also has a unique ability to trade antimicrobial resistance genes across species and habitats. Any gene that is.

Are only downstream communities vulnerable to this or does the flow of these chemicals expand "sideways" or even back upstream somehow?

[dumnezero](#)

It depends on the hydrology model (how the stream flows) and this can be exasperated by extreme weather conditions.

How much of a risk are birth control pills and what can be done?

[-lestat-](#)

We've answered this question above, and will tackle the follow-up on the session break.