

16.1: Environmental Toxicology

Environmental Toxicology

Environmental Toxicology is the multidisciplinary study of the effects of manmade and natural chemicals on health and the environment. This includes the study of the effects of chemicals on organisms in their natural environments and in the ecosystems to which they belong.

Branches of Environmental Toxicology

Environmental Toxicology covers a wide range of interdisciplinary studies, as illustrated in Figure 1:

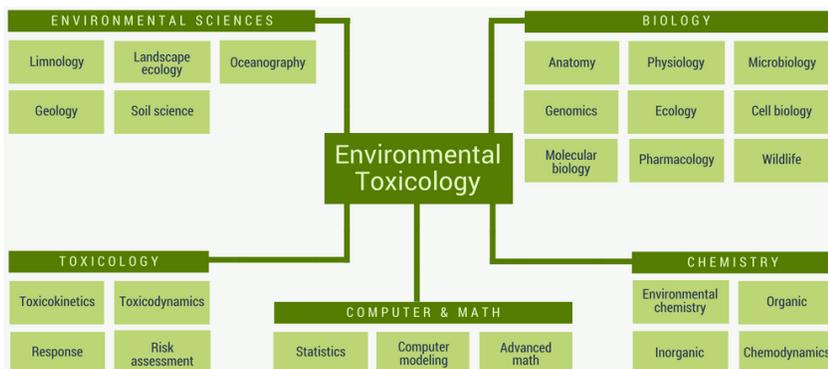


Figure 16.1.1 Environmental Toxicology interdisciplinary core (not comprehensive)
(Image Source: Adapted from Wikipedia under the Creative Commons Attribution-ShareAlike 3.0 License)

Scope of Work and Study

Environmental toxicologists work in academia, companies, government agencies, and elsewhere. The work can include laboratory studies, computer modeling, and work "in the field." It is not unusual for an environmental toxicologist to also have training in other areas—for example, public health, environmental chemistry, and pharmacology.

Some examples of what Environmental Toxicologists study include:

- The effects of a chemical or other substance at various concentrations on various species.
- Whether a chemical or other substance can bioaccumulate (increase over time) in animals or other organisms. This is important for human exposures if the bioaccumulation occurs in animals that are part of the human food chain, such as fish.
- Emerging issues such as the study of the sources and effects of microplastics that could become part of the human food chain.

Learn more about microplastics

- U.S. EPA "Toxicological Threats of Plastic" - <https://www.epa.gov/trash-free-waters/toxicological-threats-plastic>
- GreenFacts "Marine Litter" - <https://www.greenfacts.org/en/marine-litter/index.htm#1>
- European Chemicals Agency "Microplastics" - <https://echa.europa.eu/hot-topics/microplastics>



Figure 16.1.2 Microplastics are plastic debris less than five millimeters in length
(Image Source: National Ocean Service, National Oceanic and Atmospheric Administration. [Original image](#))

Another emerging global issue is the health of bees. In the news in recent years are terms like the Colony Collapse Disorder (CCD), pesticides like the neonicotinoid pesticides (also called neonicotinoids), and parasites that only reproduce in bee colonies. About 75% of all flowering plants rely on animal pollinators and about one-third of our food production is dependent on animal pollinators. The general declining health of honeybees and other bees is thought to be related to complex interactions among multiple stressors, including pesticides and parasites, and stressors like poor nutrition due to declining foraging habitats, bee management practices, and a lack of genetic diversity.

Neonicotinoids have been a focus of international attention and their mode of action is on the central nervous system of insects. Neonicotinoids are highly toxic to honeybees and also native bees like bumble bees and blue orchard bees, and sub-lethal levels can affect foraging and the ability to reproduce. Further, neonicotinoids can be persistent in the environment, and can be absorbed by plants and found in pollen and nectar.

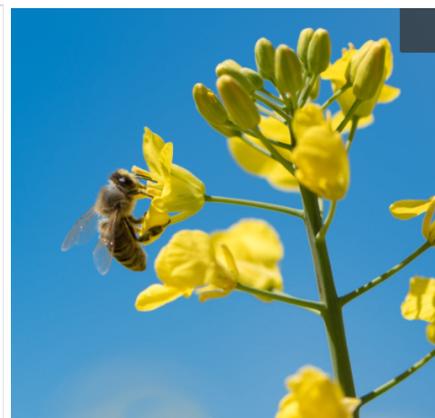


Figure 16.1.3 A honeybee gathers pollen from a flower
(Image Source: iStock Photos, ©)

Learn more about pollinators

- U.S. Fish and Wildlife Service "Pollinators" - <https://www.fws.gov/Pollinators/>
- U.S. Department of Agriculture, Forest Service "Pollinators" - <https://www.fs.fed.us/wildflowers/pollinators/index.shtml>
- U.S. EPA "Pollinator Health Concerns" - <https://www.epa.gov/pollinator-protection/pollinator-health-concerns>
- European Commission "The EU Approach to Tackle Pollinator Decline" - http://ec.europa.eu/environment/nature/conservation/species/pollinators/index_en.htm
- European Food Safety Authority "Bees Under Siege: Making Sense of Multiple Stressors" - <https://www.youtube.com/watch?v=ZVKJNc0tBDM&feature=youtu.be&list=PLGDygn1aAEEbWUxOz08FjrtBQpLiC5DOB>
- Xerces Society for Invertebrate Conservation "Neonicotinoids and Bees" - <http://xerces.org/neonicotinoids-and-bees/>

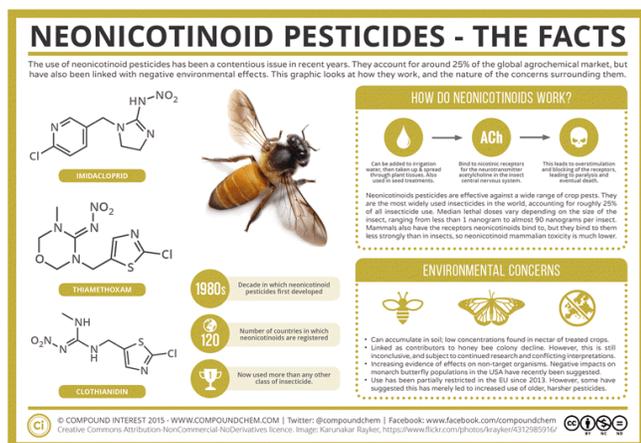


Figure 16.1.4 Neonicotinoid Pesticides

(Image Source: Compound Interest, © 2015 - used under Creative Commons Attribution-NonCommercial-NoDerivatives license. Bee image captured by Karunakar Rayker. [Original Image](#), [Original Infographic](#))

Knowledge Check

1) The interdisciplinary core ("branches") of environmental toxicology includes:

- Environmental sciences; physics; toxicology; chemistry; biology
- Environmental sciences; engineering; toxicology; biology; computer and math
- Environmental sciences; computer and math; toxicology; biology; law
- Environmental sciences; biology; toxicology; chemistry; computer and math

Answer

Environmental sciences; biology; toxicology; chemistry; computer and math - **This is the correct answer.**

The interdisciplinary core ("branches") of environmental toxicology includes environmental sciences; biology; toxicology; chemistry; computer and math.

2) Which issues in environmental toxicology relate to the human food supply?

- Bioaccumulation of substances in fish
- Effects of neonicotinic pesticides on bees
- Both the bioaccumulation of substances in fish and effects of neonicotinic pesticides on bees

Answer

Both the bioaccumulation of substances in fish and effects of neonicotinic pesticides on bees - **This is the correct answer.**

Both the bioaccumulation of substances in fish and effects of neonicotinic pesticides on bees relate to the human food supply.

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