

## Professional Activities

### Research

Research in the Wheeler Group applies high-performance analytical techniques to a diverse series of chemical problems. Dr. Wheeler's specialties are electrochemistry and separations science, but the group routinely uses spectroscopy, mass spectrometry, microcalorimetry and biochemical methods to address questions of clinical, environmental and forensic interest.



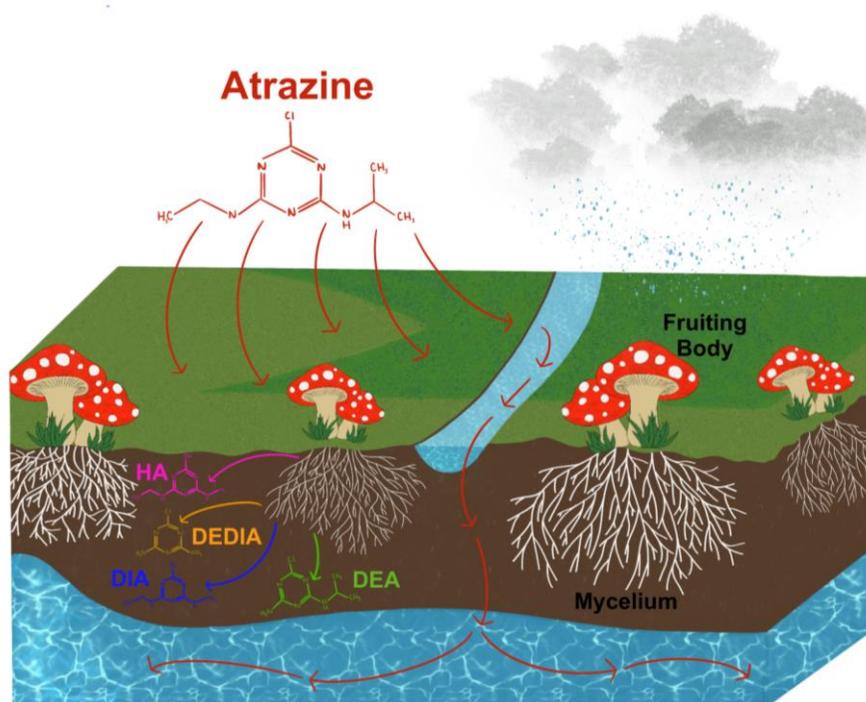
### Biocidal Agents in Personal Care Products

Complex biocide formulations including agents such as polyhexamethyl biguanide (PHMB) are routinely used in multipurpose solutions (MPS) for contact lenses and wound dressings owing to their capacity to prevent bacterial infections. The concentrations of these agents required for efficacy are exceedingly small; in addition, the majority of these agents do not possess strong chromophores, and the combination of sample complexity and biocide polydispersity (e.g., PHMB) create a very challenging problem for separation and quantitation. We have been working with the Food and Drug Administration (FDA) in Silver Spring, MD, ***to develop novel strategies for analysis of commercial MPS formulations, including studies of efficacy, adsorption to lens materials and estimates of human eye exposures*** using a variety of analytical strategies including solid phase extraction (SPE), dynamic light

scattering (DLS), size-exclusion chromatography (SEC) and ultra-pressure liquid chromatography – mass spectrometry (UPLC-MS). Improving our understanding of how the structure of these biocides affects their biological efficacy is paramount in designing safe and effective contact lens treatments as well as other health care products for the future.

### Herbicide Bioremediation Using Mushroom Mycelia

Mushrooms and other fungi have been demonstrated to have the capacity to degrade a diverse cadre of man-made organic chemicals, including herbicides normally toxic to green plants. Since mushrooms do not rely on photosynthetic pathways for energy, they are typically tolerant of common herbicides (e.g., atrazine and 2,4-D) that are used in agricultural settings, and which are frequently associated with contamination of produce, freshwater and groundwater, risking toxic exposures to multiple lifeforms.



**The Wheeler group is investigating a range of common fungi, considering the kinetics of herbicide decomposition and studying the formation of metabolic by-products, as a means of establishing a potential mechanism for soil mycoremediation.** Research on fungal biodegradation most commonly uses pure fungal cultures and laboratory grade solutions of the pollutants in question, so studies in the Wheeler group are aimed at using a fungal inoculum and contaminant dosing solutions that are far more representative of field applications.