Determining Identities and Abundances of Pharmaceuticals in Soils From Local Watersheds

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More than 3 billion individual prescriptions were filled in 2006 for various drugs – in the United States alone. This makes America one of the most medicated societies on Earth. The human body does not metabolize any drug with 100% efficiency. This means that much of the original drug passes through our system unchanged and is thus able to re-enter local surface waters, primarily via treated and untreated sewage effluent. This then is a mechanism by which pharmaceuticals can build-up in the environment and have potentially toxic effects on organisms, especially since the potential exists for multiple classes of drugs to be present in the same waters.

Pharmaceuticals are small organic molecules that span a large range in polarity and aqueous solubility. There are several places these molecules can partition: in the water, in the soils and sediments, in biota, and/or on suspended particles. This project will use liquid chromatography-mass spectrometer (LC-MS) to determine the identity and abundances of several pharmaceuticals likely to be present in the soils of local watersheds. In 2003, Tennessee had the nation's highest number of prescriptions filled per capita (16.5), making the surface and ground waters of the Tennessee Valley particularly prone to pharmaceutical build-up. The presence and persistence of pharmaceuticals in aquatic ecosystems have the potential to negatively impact all species including bacteria, planktons, plants, and fish. With a knowledge of which drugs and how much are present, it becomes possible to assess the potential ecotoxicological effects of their presence by comparing to controlled systems. This project will thus be a joint effort with colleagues in the UTC Department of Environmental Science.

The student engaged in this project will learn very classic analytical techniques and laboratory practices. Liquid chromatography continues to be one of the leading techniques found in industry and academia today, due to it's ability to separate and quantify abundances of diverse molecules.