Determining Identities and Abundances of Pharmaceuticals in the Southern Ocean

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It is well established that pharmaceuticals and their metabolites can build up in the environment. 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. Combined with the fact that almost all rivers ultimately drain into the world's oceans, this then is a mechanism by which pharmaceuticals can build-up in the ocean environment and have potentially toxic effects on organisms. We know that pharmacists are often very careful about not allowing a patient to simultaneously take two different drugs that could negatively interfere with each other. This same concern is not often considered when it comes to organisms present in the environment where countless different drugs ultimately collect.

This project will utilize liquid chromatography-mass spectrometry (LC-MS) to determine the identity and abundances of several pharmaceuticals that may be present in the Southern Ocean. Because this is considered a fairly "pristine" area, detection of contaminants there could be useful for modelling ocean current patterns. 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.