

# Researcher looks for new ways to keep a dirty situation clean

July 15 2010

---

It may sound counterintuitive, but LSU Associate Professor of Chemistry Robert Cook has made a career out of studying the ways organic materials found in the environment, including soils, can either get dirty or stay clean. In fact, the National Science Foundation, or NSF, was so impressed with his efforts that the funding institute awarded Cook one of its most prestigious awards - the NSF CAREER award.

"One of the biggest questions we ask ourselves is how the world works, and where humans fit into that scenario," said Cook. "Our impact on the health of soil, and the impact of unhealthy soil on society, are definitely intertwined."

According to Cook, our world has both a growing and a shrinking problem: while the population of the world is growing, the amount of available land per person is shrinking. In fact, he said that from 1900 to 2000, that ratio shrunk by a factor of four, which is a significant change.

"As the world shrinks, we face less and less fertile soil available, which is difficult because obviously people must eat. People then use [fertilizers](#), herbicides, pesticides, etc., which work in theory but bring lots and lots of problems," said Cook. "Consider a pharmaceutical drug ad: think about how many possible side effects they list. Now, consider the fact that those are only human side effects ... what might happen to bugs, fish and so on? A healthy environment is essential to have for a healthy human population."

The problem stems from the fact that pesticides and other chemicals become "bioavailable" once released. They become non-specific in nature, and can harm anything that comes into contact with it, including soil, [water supplies](#), animals and even people. Dispersed pesticides associate with a range of environmental components, including humic matter, the [organic matter](#) within soils that gives soil and local water a brown color. The humic matter then acts as a transporter within the environment, making the pollutant no longer localized.

"My research group, through the CAREER grant, is trying to determine the role humic materials play in the dispersal of pollutants, and we're particularly focused on the interactions of humic matter with cell membrane and, in turn, the role of humic matter in this 'drug delivery system,'" said Cook.

They use Fluorescence Spectroscopy and Magnetic Resonance Spectroscopy, or MRS, which is a close cousin to the MRI, a magnetic resonance technique used in medicine and healthcare, to look at how humic matter perturbs the cell membrane at the molecular level.

"We're trying to develop a fundamental understanding, and then move to more specific discoveries from there," he said.

Other specific issues Cook's group investigates with the support of the CAREER grant include:

- "Chemical editing": trying to remove different components from the humic matter, such as aromatics, carbohydrates and hydrophobic elements, to see how these compounds react;
- Fluorine tagging: according to Cook, fluorine-containing organic compounds are rarely found in nature but are common in

pesticides. Because fluorine "steals" electrons from other parts of a molecule, it can be traced using MRS. This allows the researchers to see specific details about [pollutant](#) sorption, including how deep these chemicals penetrate into the membrane;

- And "in vivo" MRS monitoring of living organisms and how humic matter and associated pesticides perturb the energy cycle with these organisms.

In addition to the lab and field research conducted by Cook and his group, there is also an extensive educational outreach aspect to Cook's CAREER award. This outreach component is an ongoing service-learning program involving students in Baton Rouge public high schools. Originally, the group partnered with Lee High, but now that the school is no longer open, Cook has established a new relationship with McKinley High School.

The goal of this outreach is to convince students that going to college is a real option, and even beyond that, a degree and a job in a scientific field - or any career path - is a viable choice for them. At the start of the semester, high school freshmen are given a task of reading science-based and environmentally-focused articles found in the mainstream media. Students in Cook's 4000-level course are tasked with reading peer-reviewed literature on the same topic. Then, they all begin to meet, typically in the library at the high school. University students help to put the mainstream media articles into context for the high school students.

"It's a 'pay it forward' concept that we're trying to bring home here," said Cook. "This reminds university students that their education isn't a gift - it is a privilege - and that the state supports their studies through programs like TOPS. They should, therefore, expect to give something back." Cook would eventually like to see the outreach program grow so

that the high school freshmen would help junior high students, then the junior high students would work with elementary school pupils, and so on.

"Both the CAREER award-funded research and the service-learning component have been very successful so far, and we see it expanding in the future," said Cook. "In the long run, it's important to remember that the health of the environment is tied inextricably to the health of our society. If we can understand more about how pollutants spread through soil - dirt for short -and then the environment as a whole, we'll be that much closer to finding ways to clean it up. Also, through education, we may be able to avoid the soil pollution problem in the first place."

Provided by Louisiana State University

Citation: Researcher looks for new ways to keep a dirty situation clean (2010, July 15) retrieved 19 April 2024 from <https://phys.org/news/2010-07-ways-dirty-situation.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.