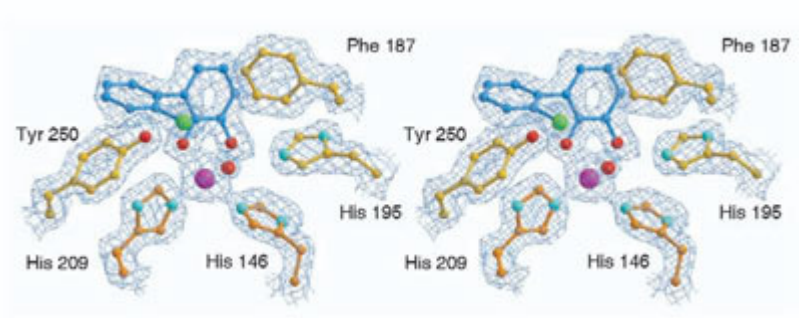
Helping microbes battle pollutants

The environmentalists of the future are microbes that could rid the earth of toxins like PCBs. In a new study, scientists have revealed the details of a 'bottleneck' that prevents some bacteria from converting PCBs—chemicals used to make lubricants and coolants—into smaller, less harmful molecules. The information could lead to improved strategies for using microscopic organisms to eliminate industrial pollutants.

Although the existence of bottlenecks isn't news to researchers, the study describes for the first time the crystal structures of the molecules involved in logjams. The bacteria in the study were a type of *Burkholderia*, one of many microbes that can digest PCBs.



Illustrations of molecules bound to the active site of DHBD.

"These bacteria have recognized PCBs as an alternative food source by being exposed to the chemicals where soil is contaminated," says Jeffrey T. Bolin, of Purdue University in West Lafayette, Indiana and a member of the research team. "They've developed a partial ability to deal with them, and people all over the world are trying to push them to do the job more effectively."

Even though PCBs—short for polychlorinated biphenyls—are no longer produced in the United States, they linger in the environment and accumulate in the food chain. Exposure to PCBs has been linked to neurological and immune system damage in children, as well as cancer in animals.

Just as PCBs will not disappear on their own, they can inhibit the microbes by blocking an enzyme called DHBD. This enzyme is essential for breaking down PCBs, according to findings published in *Nature Structural Biology*.

One problem with using bacteria to break down PCBs is that the chemicals were sold in elaborate mixtures of dozens of compounds from more than 200 variants of the main molecule. Enzymes in the microbes chew away at a cocktail of PCBs until they reach a byproduct they can't digest—the bottleneck.

Using techniques of structural biology, Bolin's group found that at the bottleneck the byproduct binds tightly to the enzyme and "acts like a chemical that inhibits enzymes in drug therapy."

The study was possible because Lindsay D. Eltis, an author of the paper from the University of British Columbia in Vancouver, had developed a way to purify the enzymes that eat PCBs, allowing the researchers to map their crystal structure.