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# How Pesticides Can Cause Parkinson's

Foreign chemicals may prevent the brain from disposing of its own toxic waste

By Melinda Wenner Moyer | Friday, July 19, 2013

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Many studies over the past decade have pointed to pesticides as a potential cause of Parkinson's disease, a neurodegenerative condition that impairs motor function and afflicts a million Americans. Yet scientists have not had a good idea of how these chemicals harm the brain. A recent study suggests a possible answer: pesticides may inhibit a biochemical pathway that normally protects dopaminergic neurons, the brain cells selectively attacked by the disease. Preliminary research also indicates that this pathway plays a role in Parkinson's even when pesticides are not involved, providing an exciting new target for drug development.

Past studies have shown that a pesticide called benomyl, which lingers in the environment despite having been banned in the U.S. in 2001 because of health concerns, inhibits the chemical activity of aldehyde dehydrogenase (ALDH) in the liver. Researchers at the University of California, Los Angeles, U.C. Berkeley, the California Institute of Technology and the Greater Los Angeles Veterans Affairs Medical Center wondered whether the pesticide might also affect levels of ALDH in the brain. ALDH's job is to break down DOPAL, a naturally forming toxic chemical, rendering it harmless.



To find out, the researchers exposed different types of human brain cells—and, later, whole zebra fish—to benomyl. They found that it "killed almost half of the dopamine neurons while leaving all other neurons tested intact," according to lead author and U.C.L.A. neurologist Jeff Bronstein. When they zeroed in on the affected cells, they confirmed that the benomyl was indeed inhibiting the activity of ALDH, which in turn spurred the toxic accumulation of DOPAL. Interestingly, when the scientists lowered DOPAL levels using a different technique, benomyl did not harm the dopamine neurons, a finding that suggests that the pesticide kills these neurons specifically because it allows DOPAL to build up.

Because other pesticides also inhibit ALDH activity, Bronstein speculates that this pathway could help explain the link between Parkinson's and pesticides in general. What is more, research has identified high DOPAL activity in the brain of Parkinson's patients who have not been highly exposed to pesticides, so it is possible that this biochemical cascade is involved in the disease process regardless of its cause. If that is true, then drugs that block or clear DOPAL from the brain could prove to be promising treatments for Parkinson's.