MedicalXpress

Common chemicals may act together to increase cancer risk, study finds

July 21 2015

Common environmental chemicals assumed to be safe at low doses may act separately or together to disrupt human tissues in ways that eventually lead to cancer, according to a task force of nearly 200 scientists from 28 countries, including one from Oregon State University.

In a nearly three-year investigation of the state of knowledge about environmentally influenced cancers, the scientists studied low-dose effects of 85 common chemicals not considered to be carcinogenic to humans.

The researchers reviewed the actions of these chemicals against a long list of mechanisms that are important for cancer development. Drawing on hundreds of laboratory studies, large databases of cancer information, and models that predict cancer development, they compared the chemicals' biological activity patterns to 11 known cancer "hallmarks" - distinctive patterns of cellular and genetic disruption associated with early development of tumors.

The chemicals included bisphenol A (BPA), used in plastic food and beverage containers; rotenone, a broad-spectrum insecticide; paraquat, an agricultural herbicide; and triclosan, an antibacterial agent used in soaps and cosmetics.

In their survey, the researchers learned that 50 of the 85 chemicals had been shown to disrupt functioning of cells in ways that correlated with

known early patterns of cancer, even at the low, presumably benign levels at which most people are exposed.

For 13 of them, the researchers found evidence of a dose-response threshold - a level of exposure at which a chemical is considered toxic by regulators. For 22, there was no toxicity information at all.

"Our findings also suggest these molecules may be acting in synergy to increase cancer activity," said William Bisson, an assistant professor and cancer researcher at OSU and a team leader on the study. "For example, EDTA, a metal-ion-binding compound used in manufacturing and medicine, interferes with the body's repair of damaged genes.

"EDTA doesn't cause genetic mutations itself," said Bisson, "but if you're exposed to it along with some substance that is mutagenic, it enhances the effect because it disrupts DNA repair, a key layer of cancer defense."

Bisson said the main purpose of this study was to highlight gaps in knowledge of environmentally influenced cancers and to set forth a research agenda for the next few years. He added that more research is still necessary to assess early exposure and to understand early stages of cancer development.

The study is part of the Halifax Project, sponsored by the Canadian nonprofit organization Getting to Know Cancer. The organization's mission is to advance scientific knowledge about cancer linked to environmental exposures. The team's findings are published in a series of papers in a special issue of the journal Carcinogenesis.

Bisson is an expert on computational chemical genomics - the modeling of biochemical molecular interactions in cancer processes - in OSU's College of Agricultural Sciences. For this study, he worked on the teams

that investigated how cancers overpower the host's immune system, trigger chronic inflammatory processes, and interact with the adjacent microenvironment.

He also led the project's cross-validation effort, which combed the cancer literature for evidence that a chemical's activity within one hallmark might promote carcinogenic activity in others.

Traditional risk assessment, Bisson said, has historically focused on a quest for single chemicals and single modes of action - approaches that may underestimate cancer risk. This study takes a different tack, examining the interplay over time of independent molecular processes triggered by low-dose exposures to chemicals.

"Cancer is a disease of diseases," said Bisson. "It follows multi-step development patterns, and in most cases it has a long latency period. It has to be tackled from an angle that considers the complexity of these patterns.

"A better understanding of what's driving things to the point where they get uncontrollable will be key for the development of effective strategies for prevention and early detection."

Provided by Oregon State University