Link between common environmental contaminant and rapid breast cancer growth

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Studies by researchers at Dominican University of California show that breast cancer cells become increasingly aggressive the longer they are exposed to small concentrations of cadmium, a heavy metal commonly found in cosmetics, food, water and air particles.

The study by Maggie Louie, associate professor of biochemistry, shows exposure to cadmium for prolonged periods of time can cause the progression of breast cancer to become more aggressive. Her findings will be presented Monday, April 23, at the annual meeting of the American Society for Biochemistry and Molecular Biology, held in conjunction with the Experimental Biology 2012 conference in San Diego.

Breast cancer results from the abnormal growth of the cells in the mammary gland. The normal growth of mammary gland epithelial cells is modulated by the circulating levels of estrogen, a hormone produced by the ovaries. The activity of estrogen is stimulated by the estrogen receptor (ER). Heavy metals such as cadmium can act as endocrine disruptors and mimic estrogen, thereby disrupting the hormone dependent pathways.

While other studies have shown links between acute cadmium exposure and activation of the ER, Louie's study is one of few to focus on chronic cadmium exposure. "The relationship between cancer and chronic exposures at low levels is important to understand because most people are not exposed to high levels of heavy metals, unless they work in
manufacturing plants that deal with such metals," Louie said.

She continued: "Unfortunately, cadmium is all around us - it is in our food, our water, our makeup and our air. Understanding the role that cadmium plays in the progression of breast cancer is extremely important in order to find better ways to prevent the disease from advancing. Ninety percent of cancer deaths are associated with the cancer spreading to other parts of the body. If we can prevent the tumor from spreading, we have a better chance of treating cancer."

Taken together, the findings of Louie's new study and a handful of others published in recent years show that cadmium plays a significant role in the development of breast cancer. However, Louie's research is unique in that it focuses on prolonged exposure rather than acute exposure at the cellular level. The study indicates that chronic exposure to cadmium can contribute to the development of more malignant characteristics in breast cancer cells.

"Many of us are exposed to very low levels of cadmium from the environment on a daily basis, and our research shows that even small concentrations of this metal at prolonged exposures can cause breast cancer cell growth."

Cadmium is produced mainly as a byproduct from mining, smelting and refining sulfidic ores of zinc, lead and copper. Rocks mined to produce phosphate fertilizers also contain varying amounts of cadmium. Cadmium also is found in rechargeable batteries and cigarette smoke. Cadmium enters the body through consumption of contaminated food, water or inhalation of cigarette smoke.

Louie's preliminary data show an increase in the ability of breast cancer cells to migrate and invade through the extracellular matrix with prolonged cadmium exposure. The extracellular matrix is the outer
barrier of an organ or tissue. Increased invasive and migration abilities are characteristic of cancer cells' ability to spread. Louie discovered that MCF-7 cells chronically exposed to cadmium express higher levels of SDF-1, a protein associated with tumor invasion and metastasis.

How specific proteins, including SDF-1, contribute to the aggressive characteristics of the cadmium exposed cells requires further research, and understanding their role in cadmium-induced carcinogenesis will provide further insights to how heavy metals contribute to breast cancer progression.

Provided by American Society for Biochemistry and Molecular Biology

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