

Research Links Cadmium to Breast Cancer Cell Growth

The study shows exposure to cadmium for prolonged periods of time can promote the development of aggressive cancer characteristics, including increased cell growth and an increased ability for the breast cancer cells to migrate and invade.

The research was conducted by Dr. Maggie Louie, associate professor of biochemistry in [Dominican's Department of Natural Sciences and Mathematics](#), along with her graduate student, Esmeralda Ponce, and former undergraduate student Natalie Aquino. The findings are published this week in the peer-reviewed journal PLOS ONE.

“Our data suggest that chronic cadmium exposure significantly alters the molecular dynamics of cells,” Louie said.

The relationship between cancer and chronic exposures to low levels of cadmium is important to understand because many of us are exposed to cadmium on a daily basis.

“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 disease progression- including the ability of cancer cells to spread,” Louie said.

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

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. Heavy metals such as cadmium can act as endocrine disruptors and mimic estrogen, thereby disrupting the hormone dependent pathways.

Earlier studies have shown links between acute cadmium exposure and activation of the estrogen receptor. Louie notes that her study is the first to demonstrate that chronic cadmium exposure promotes the acquisition of more aggressive cancer phenotypes (growth, migration and invasion).

In order to understand the impact of chronic cadmium exposures at the molecular level, Louie developed a series of cadmium exposed breast cancer cell lines. These lines were exposed to low concentrations of cadmium for more than six months.

Louie's data show that prolonged cadmium exposure increases the ability of breast cancer cells to migrate and invade through the extracellular matrix — characteristics of more advanced stage cancers. 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 breast cancer cells chronically exposed to cadmium express higher levels of SDF-1, a protein associated with tumor invasion and metastasis.

Louie has received two National Institutes of Health (NIH) grants to study cadmium's relationship with breast cancer. Research supported by the first grant demonstrated that acute

cadmium exposure stimulates breast cancer cell growth and activates estrogen receptor regulated gene expression. These findings were published in 2010 in the peer-reviewed journal, *Molecular Endocrinology*.

[CLICK HERE TO READ THE STUDY](#)

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