

Fetal Exposure To Toxins Could Be Behind Rise In Asthma

ScienceDaily (Oct. 11, 2005)

ITHACA, N.Y. -- Exposure of developing fetuses and newborns to low levels of environmental toxins such as lead, mercury and dioxin, as well as nicotine and ethanol, could be behind the recent sharp rises in asthma, allergies and autoimmune disorders like lupus, says a Cornell University researcher.

The real dangers from environmental toxins most likely occur early in life, said Rod Dietert, professor of immunotoxicology at Cornell's College of Veterinary Medicine, presenting a paper on the topic Oct. 4 at the 14th Immunotoxicology Summer School Conference in Lyon, France. However, most laboratory studies look at the health effects of the toxins on adult animals.

"We are deluding ourselves to think that adult data are going to allow us to understand the risks of perinatal exposures," said Dietert, referring to the period close to the time of birth. "Right now, we underestimate health risks that are occurring due to early exposure."

He advocates a more detailed two-generation screening in which information on toxins and their impact on immune systems is recorded not only for the adult mother but also for her offspring. It had been previously thought that adult-exposure safety testing when coupled with superficial two-generational tests could predict the health risks for adults as well as fetuses and children. But it is now clear that current safety testing lacks the ability to detect many early life immunotoxic changes, including those leading to allergy and autoimmunity -- an immune state in which antibodies are formed against a person's own body tissues.

One issue resulting from early exposure to environmental toxins and drugs involves two types of immune system helper cells: T helper 1 (Th1) and Th2. Th1 cells are involved in countering cancer and they attack pathogens, from viruses to intracellular bacteria that get inside cells. Th2 cells promote release of some antibodies to counter such extracellular pathogens as bacteria and parasites. However, Th2 cell responses can result in the overproduction of antibodies called IgE antibodies, which are implicated in producing allergic responses. Throughout pregnancy, both the fetus and mother have inhibited Th1 responses to prevent a fetal-maternal mutual immune attack that would lead to miscarriage. As soon as the baby is born, however, a healthy infant's immune system quickly increases Th1 capacity so that levels are roughly balanced with those of Th2.

"Exposure to certain drugs and chemicals in the last trimester can really mess things up," said Dietert. There is some evidence that low doses of lead, mercury, ethanol or drugs like dexamethasone (a common steroid) can permanently keep an immune system in a late gestational Th2-promoting stage that is out of balance for responses later in life. Yet, the same low doses of these agents do not impair an adult immune system, Dietert said.

"I think this goes a long way toward explaining the epidemic rises in allergies and autoimmune disorders," said Dietert. When an infant's immune system remains biased toward Th2 responses because of toxin exposure and never matures its own Th1 capacity, the baby develops a higher risk, not only for asthma and allergies during childhood but also for autoimmune diseases and comprised antiviral and anticancer responses in later life.

In his talk, Dietert pointed out the types of errors that can occur by relying on adult-safety data only. For example, far lower doses of toxins induce chemical changes in a fetus's immune system compared with an adult's, and exposure to these toxins during the perinatal period produces a broader number of effects than in adults.

Dietert outlined seven windows during development when exposure to low levels of toxins can have long-term impacts and are not modeled in the adult. For example, lead can interfere with immune-dependent reproductive development; dioxin or nicotine around birth can prevent the crucial maturation steps of certain immune cells, called dendritic cells; and ethanol can impair the ability of immune cells called macrophages to mature in response to lung surfactant proteins that are produced just before birth.

The American Chemistry Council, the U.S. Department of Agriculture and the National Institute of Environmental Health Sciences funded the study.

Adapted from materials provided by [Cornell University](#).