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News

The University of Texas Health Science Center at Dallas
5323 Harry Hines Boulevard Dallas, Texas 75235 (214)688-3404

CONTACT: Ann Williams
Office: 214/688-3404
Home: 214/375-6043

****Radiation biologist works to protect fetus from chromosome damage.**

DALLAS--Protection of the fetus -- in many cases before the mother is aware of its existence -- has been the thrust of Dr. Mary Esther Gaulden's work. The first two weeks after conception is the "most sensitive part of the whole life cycle," says the radiation biologist.

Gaulden is associate professor of Radiology and chairman of the Graduate Program in Radiological Sciences at The University of Texas Health Science Center at Dallas. In addition, she serves as adjunct professor of Environmental Sciences at The University of Texas at Dallas.

"The first two weeks of pregnancy, when the mother doesn't know she is pregnant, is the worst possible time for low-dose radiation," she says. "If you produce with a small amount of radiation a viable change in one chromosome, a mutation that is a small deletion of part of a chromosome, there is a good probability of knocking out genes that affect the central nervous system. And the earlier you produce a mutant cell, the more cells in the baby are derived from that mutant cell."

The researcher has recently become interested also in the effects that known chemical mutagens (agents that cause genetic change) have on the conceptus. "A lot of women are on a lot of different medications. Some of them have been implicated as teratogenic (causing birth defects) in humans. Some drugs cause more risk than X-rays," she said. In addition to just a defect in the fetus, some drugs may also be mutagens, causing changes that may be passed on to the baby's offspring.

"People fear radiation because they don't know anything about it, can't see it, taste it, hear it, smell it...Some chemicals may be more dangerous than a small amount of radiation, but there's no mystique -- you can see them and smell them," says Gaulden.

She is now studying the effects of chemicals on the neuroblasts from grasshopper eggs, which she is developing as a mutagen test system.

The neuroblasts of grasshopper embryos are known to respond to mutagens in similar ways to the mammalian embryo. After studying mutagens, Gaulden will look at compounds that have been implicated as teratogens. While many carcinogens (cancer-causing agents) have been studied, the researcher laments the fact that there has been much less study of the effects of chemicals on the fetus.

Nuclear magnetic resonance is one of the newest advances in diagnostic tools. Asked whether a pregnant woman should be exposed to NMR, Gaulden replied that she has not seen any evidence that NMR is a mutagen. "A magnetic field could affect nerve growth, but we don't know. I think it should be used with caution. We are going to use the grasshopper embryo to test for NMR effects on chromosomes."

(over)

Gaulden now does a lot of consultation with physicians on the use of X-ray during pregnancy. "Every week I get calls from several women. They have had a chest X-ray. Should they get an abortion? I tell them 'No.' Or they have had a couple of bite-wing films at the dentist. There is no way that could affect the fetus if the machine is working properly," she says. The fetus must receive direct beam X-ray to be affected.

"The probability is very low of gross developmental abnormality with exposure to less than 10 rads. A fetus is much more likely to have a subtle abnormality -- either carcinogenesis or a higher probability of a subtle effect on the structure or function of the central nervous system. The neuroblasts (nerve cell parent bodies) responsible for forming the CNS develop very early," said Gaulden.

A gene can become an oncogene (cancer-causing gene) by only one base change. And one photon of radiation can induce one base change in DNA. There are thousands of photons per rad, or single unit of radiation. On the average, one chest film is 0.1 rad.

"In the absence of radiation or chemical mutagens, there is a two to three percent risk with every pregnancy of some malformation at birth plus a three to five percent risk of some abnormality later in life. So there is a maximum risk of eight percent with every pregnancy. The patient really wants to know how much additional risk there is from radiation exposure. It's a risk driving on the freeway, but a couple having a baby don't want any extra risks."

Together with the late Dr. Ed Christensen, radiologist at Parkland Memorial Hospital and professor of Radiology at UTHSCD, she began a pre-X-ray screening program at Parkland for women of child-bearing age that has become the prototype for such screening nationwide.

They began postponing elective abdominal X-rays or nuclear medicine procedures in any girl or woman who could possibly be pregnant. In emergency X-rays that were essential, they often did one film instead of a series.

In a follow-up of 500 women whose X-rays were postponed, they found that five percent of the women were indeed pregnant at the time. The researchers also concluded that the quality of medical care was not adversely affected by the delay.

When they presented their findings at the Radiological Society of North America, the question was raised whether this type of screening was cost-effective. "My answer was 'If you're going to prevent some abnormality in these children -- even just a few -- it is cost-effective. The mentally defective cost money, not to mention the emotional cost to the family. Screening may also prevent a malpractice suit against the physician," says Gaulden.

At Parkland the staff uses a "double sieve" approach in screening out possible pregnancies in women from 12 to 45. The clerk asks, "When was your last period? Could you possibly be pregnant?" The radiologist repeats the questions. If it has been more than 10 days since the woman's last period began and she could possibly be pregnant, elective abdominal X-rays are postponed until after her next period. Taking "the pill" or having an IUD are not taken as proof of infertility.

Gaulden quotes American geneticist Bentley Glass as an expression of her motivation for research: "Just as every child must have the right to full educational opportunity and a sound nutrition, so every child has the inalienable right to a sound heritage."

For her work in the protection of children from the effects of radiation and for her efforts in encouraging women in medical and scientific careers and in the rights of women in general, Gaulden was presented a Women Helping Women Award April 20 at the Women's Center of Dallas Sixth Annual Awards Reception.

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