Smoking moms pass carcinogen to infants

Cigarettes are one craving that doctors have long said pregnant women shouldn't indulge. Now, expectant mothers have yet another reason to heed that advice. According to a new study, pregnant women who smoke transmit a potent cancer-causing substance to their babies.

In urine samples collected from newborn infants of mothers who smoked during pregnancy, researchers at the University of Minnesota Cancer Center in Minneapolis detected compounds that the body produces in breaking down nicotine-derived nitrosaminoketone (NNK). That chemical, found only in tobacco, induces a variety of cancers in rodents.

Chemist Stephen S. Hecht presented the findings this week at a Boston meeting of the American Chemical Society.

According to a study in the May 1990 AMERICAN JOURNAL OF PUBLIC HEALTH, 61 percent of women who smoke continue to do so during pregnancy. Epidemiological studies have linked smoking to low birth weight and developmental problems, Hecht says. What health effects NNK might have on a developing fetus have yet to be determined. Nevertheless, he says, "we feel this presents an unacceptable risk to the fetus. It's another reason for expectant mothers to quit smoking."

Urine samples from 48 infants were collected by doctors in Düsseldorf, Germany, and sent to the Minnesota researchers. Of the 31 infants whose mothers smoked during pregnancy, 22 had NNK metabolites called NNAL and NNAL-Gluc in their urine. In contrast, none of the 17 infants whose mothers were nonsmokers produced these substances.

The urine of the smokers' newborn also contained nicotine and one of its breakdown products. Nicotine is addictive but is not known to be carcinogenic.

The nine smokers in the study whose infants did not appear to produce the NNK metabolites smoked less than the other study participants, Hecht says. The results signal that "if [pregnant women] can't quit, they ought to smoke less."

The new findings "provide the first direct evidence that a tobacco-specific carcinogen from maternal smoking passes the placenta into the human fetus—and in a considerable amount," says Lucy M. Anderson of the National Cancer Institute in Frederick, Md.

Previous studies showed that NNK metabolites themselves don't readily cross to a fetus. While their concentration in the babies' urine was only about one-tenth that in their mothers', their presence indicates "the human fetus has a well-developed capacity to metabolize a tobacco-specific carcinogen," Anderson says.

Last year, Hecht and his colleagues reported that people exposed to environmental, or secondhand, smoke also absorb and process NNK (SN: 9/20/97, p. 188). The infants in the current research produced a urine concentration of NNK metabolites that is about three times that measured in urine of people breathing secondhand smoke.

Scientists' awareness of NNK's carcinogenic effects on fetuses comes from animal studies. The offspring of female hamsters exposed to NNK develop tumors readily. In mice, however, NNK seems less potent. "We have no idea where the human falls in this [range]," Anderson says.

Hecht worries that exposure to NNK in the womb might predispose infants to cancer later in life. The substance induces cancers by causing mutations in DNA. Because the cells of a fetus are rapidly dividing, DNA changes that occur early might propagate widely. Then again, Hecht notes, the enzymes required to induce cancer in adults may not yet be present in a developing fetus.

The method used in the Minnesota study offers a new way to explore the effects of smoking and other behaviors during pregnancy, says Anderson. "Simple, old-fashioned epidemiological studies have not shown a strong correlation between childhood cancers and maternal smoking. We have to look at it in a more sophisticated way." —*C. Wu*

A sound way to take the sea's temperature?

Oceanographers in 1992 thought they had a good strategy for seeing whether the Pacific Ocean was warming. The team of researchers planned to lower transmitters into the deep sea and measure how long it took pulses of sound to reach submerged receivers far away. Because sound travels faster in warm water than in cold, this method, called acoustic thermometry, could provide a precise method of taking the ocean's temperature, they reasoned. The proposal, however, raised a howl of protests from environmentalists who worried that the loud noises would harm marine mammals.

After years of delay and substantial changes in the plans, the acoustic thermometry team now reports the first results from its $40 million research program. "This technique works and seems to work well," says Peter F. Worcester, principal investigator for the Acoustic Thermometry of Ocean Climate (ATOC) project and a researcher at the Scripps Institution of Oceanography in La Jolla, Calif. "There is no question that we've shown it is a good technique for measuring large-scale ocean temperatures."

In separate experiments, biologists say that the sound transmissions have had little effect on nearby whales and elephant seals.

The ATOC team installed its first transmitter on the Pioneer Seamount, about 100 kilometers southwest of San Francisco, at a depth of 939 meters. The device emits a 195-decibel rumble that gets picked up by a network of Navy sound receivers positioned around the Pacific and by underwater microphones near Hawaii, Christmas Island, and New Zealand.

Under an agreement with environmental groups, the ATOC team gave control of the California transmitter to marine biologists so they could run experiments to determine whether the sounds alter animal behavior. Although the transmissions were not ideal for measuring ocean temperature, the data collected over a 15-month period show that the thermometry technique is even better than expected, says Worcester.

The system measured the hour-long journey of sound traveling 5,000 km across the Pacific with a precision of 20 milliseconds, says Worcester. That translates into temperature measurements with a precision of .005°C to .01°C along the path of the sound, enough to discern a greenhouse warming signal within a decade, he says.

In the Aug. 28 SCIENCE, the researchers report that the technique can also yield important information in short-term experiments. By analyzing seasonal changes in sound travel times, the ATOC group calculated how much the ocean warms in summer and cools in winter.

Others have estimated this variation using a satellite instrument that tracks changes in the height of the ocean surface. As water warms, it expands. The satellite team assumed that temperature changes accounted for most variation in ocean height. The ATOC team, however, found that temperature could explain only about half of the height fluctuation. Other factors—such as ocean currents—also play major roles in forcing sea level up and down, says the ATOC team.

Despite their success, the thermometry researchers end their California experiment this year. They will not try to extend the test because they lack the resources to go through another contentious permitting process, says Worcester. A second transmitter, located off the island of Kauai, started transmitting thermometry signals last month and will operate through the end of 1999. The ATOC group is currently deciding whether to try to extend that experiment.

Adam S. Frankel, a bioacoustic researcher at Cornell University, has studied humpback whales near the ATOC transmitter. Researchers have detected only minor changes in behavior, he says. "Nobody that I know of working with the ATOC program has had any result that would cause concern." —*R. Monastersky*