Biomedicine

Kathy A. Fackelmann reports from Tucson, Ariz., at the annual meeting of the Teratology Society

Closing in on neural tube defects

Pregnant women who supplement their diets with folic acid, a B vitamin, can reduce their risk of delivering a baby with a neural tube defect, a malformation of the spinal cord. Yet researchers admit they still don't know how folic acid exerts its protective effect.

A new study may provide some clues. Muin J. Khoury and M.J. Adams Jr. at the Centers for Disease Control and Prevention in Atlanta and their colleagues decided to take a look at frozen blood samples obtained from pregnant women whose developing fetuses were being checked for the presence of a neural tube defect. The team wanted to see what differences, if any, existed in the blood taken from women who had delivered a baby with the defect and those who bore a healthy infant.

The team soon homed in on an amino acid called methylmalonic acid, or MMA. They discovered that women who had the highest concentrations of MMA in their bloodstreams had the greatest risk of delivering an infant with a neural tube defect. In fact, women with the highest concentrations of this chemical had a 13-fold greater risk of bearing a child with this defect than women whose blood contained the lowest concentrations of MMA, he adds.

If other researchers confirm the link between MMA and neural tube defects, the finding may help scientists figure out what goes wrong during the development of infants born with the condition. Indeed, Adams notes that MMA and folic acid are involved with methylation, the addition of methyl groups to an amino acid. He wonders if a neural tube defect results when this methylation process goes awry in the fetus.

For now, that theory remains unproven. "This whole finding is preliminary at this point. We really don't know what it means," Khoury says.

Polluted air, low protein = infertility

New research suggests that exposure to a common air pollutant reduces the pregnancy rate in mice fed a protein-deficient diet.

Jarnail Singh and Linda M. Cheatum of Stillman College in Tuscaloosa, Ala., began their experiment with the knowledge that carbon monoxide is a ubiquitous indoor and outdoor air pollutant. The researchers speculated that inhaling low levels of this gas could lead to fertility problems in women eating a low-protein diet.

For ethical reasons, they couldn't test that theory on humans, so the team turned to mice. The researchers fed one group of female mice laboratory chow containing 16 percent protein and another group a diet containing 8 percent protein. Some mice in each group were exposed to carbon monoxide (at concentrations of 65 parts per million for six hours per day, five days a week). The remaining mice in each group inhaled air that contained no carbon monoxide. Before being split up into groups, all the female mice had mated with male mice.

The Stillman team found that mice fed the high-protein diet and who inhaled the clean air had a pregnancy rate of 82 percent. Mice that ate the same diet but inhaled carbon monoxide had a similar pregnancy rate. However, when put on the low-protein diet, the pregnancy rate of the mice exposed to carbon monoxide plummeted to 18 percent. In contrast, mice that consumed less protein but inhaled normal air had a pregnancy rate of 45 percent.

Although adequate amounts of protein are required to maintain a pregnancy, mice who inhaled carbon monoxide appeared to have more trouble getting pregnant, Singh says.

Does this finding apply to women who breathe polluted air? Further study must answer that question, Singh admits. However, he says the carbon monoxide theory is plausible and may account in part for the rising U.S. infertility rate.

Environment

Limiting rice's role in global warming

Cultivation of rice, the only major grain used almost exclusively for food, results in the emission of some 14 percent of the methane – a major greenhouse gas – caused by human activities (SN: 5/18/91, p.310). If the planet's population grows to 8 billion, as some demographers predict may occur within 30 years, the number of rice consumers might exceed 5 billion, says Heinz-Ulrich Neue of the International Rice Research Institute in Manila, the Philippines.

But the soil chemist says rice farmers should be able to feed the masses without upsetting the climate if agronomists apply themselves to refining the methane-mitigation strategies he outlines in the July/August BioScience.

Though farmers can grow rice on relatively dry uplands, the highest yields – of grain and methane – result from its cultivation under water. Neue therefore focuses on methane-minimization techniques applicable to wetlands, such as managing precisely when farmers flood – or drain – their fields. Similarly, though resource-poor farmers tend to fertilize their fields with fresh organic matter, such as straw and green manure, Neue points to new research indicating that composted organic material could dramatically reduce a rice field's methane emissions. So too might a switch to other specific types of chemical fertilizers – ones broken down by soil microbes that compete with the bacteria that produce methane.

Many poorer parts of the world rely on rice as a dietary staple. Even if rising incomes allow some rice-based societies to diversify their diet, Neue predicts annual rice production must still climb 47 percent by 2020. That estimate is conservative, he adds, since this would merely maintain the "already inadequate" nutrition for hundreds of millions of people.

Carpets as reservoirs of PAH-lution

As concern about environmental carcinogens grows, researchers are attempting to home in on major sources of exposure. John W. Roberts, a Seattle-based consulting engineer, and his colleagues believe they have stumbled onto what may prove one of the less obvious reservoirs: residential carpets.

At the 6th International Conference on Indoor Air Quality and Climate, held this week in Helsinki, Finland, Roberts reported his team's analysis of data from a recent EPA study of eight homes in Columbus, Ohio. Dust vacuumed from carpets at each home contained detectable levels of seven potentially carcinogenic polycyclic aromatic hydrocarbons (PAHs) – including benzo(a)pyrene, chrysene, and benz(a)anthracene.

Though these combustion pollutants occur in trace amounts throughout the environment, in six of the studied homes PAH levels in carpets equaled or exceeded – in some cases by up to 20-fold – PAH levels in yard soil. At those homes, average carpet-dust PAH concentrations ranged from 1.3 to 12.1 parts per million (ppm). The other two homes were far more heavily polluted – indoors and out. However, Roberts notes, total PAH levels inside even the less contaminated homes far exceeded the 1 ppm limit requiring cleanup of residential soil at hazardous waste sites in Washington state. (At present, there is no uniform federal limit for PAH contamination.)

No obvious trend linked severity of indoor PAH contamination with cigarette smoking or use of a fireplace. Because PAH concentrations in dust in outside doormats did "correlate strongly" with levels in carpet dust, Roberts now suspects residents tracked the pollutants in on their shoes.

Rugs shield chemicals from the sunlight, moisture, and microbes that can foster their breakdown in soil. That's why Roberts – who has long studied pollutant buildup in carpet dust (SN: 8/11/90, p.86) – favors the bare-floor look. Carpet lovers can limit buildup by placing commercial doormats at all entries, removing shoes at the door, and vacuuming, he says.