Biomedicine

Vitamins may reduce neural tube defects

Mothers-to-be have long been advised that good nutrition can boost their chances of producing a healthy baby. Now research suggests that multivitamin use before and after conception may help protect the fetus from certain kinds of birth defects.

The researchers warn, however, that "caution must be exercised in the interpretation of our results." Vitamin users may generally lead healthier lifestyles than nonusers, they note. Further study is needed to find out whether vitamin use alone – or some other factor – is preventing the defects.

The study, published in the Dec. 2 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, showed fewer neural tube defects among babies born to women who had started taking vitamins at least three months before conception. The most common neural tube defects are spina bifida, an incomplete closing of the bone casing that protects the spinal cord, and anencephaly, a condition in which babies lack major parts of the brain.

Joseph Mulinare and his colleagues at the Atlanta-based Centers for Disease Control looked at 347 neural-tube-defect cases, babies born from 1968 to 1980 who were registered with an Atlanta birth defect program. The 2,829 control cases were babies without birth defects born during the same period. Mothers were interviewed by telephone regarding their multivitamin use through the third month of pregnancy. The researchers found vitamin users ran less than half the risk of having a defective baby compared with nonusers.

In an accompanying editorial, Lewis B. Holmes of Massachusetts General Hospital in Boston calls the finding an "exciting possibility." But he echoes the reservations voiced by the authors, saying, "Such a simple solution is almost too good to be true."

Silicone breast implants on trial

A Food and Drug Administration (FDA) advisory panel has voted against banning silicone breast implants, at least for now. The advisory group convened Nov. 23 after the Public Citizen Health Research Group (HRG) urged it to ban the implants.

HRG, a consumer group based in Washington, D.C., says the implants may cause cancer, citing animal studies done by silicone manufacturer Dow Corning Corp. In those studies, 23 percent of female rats implanted with silicone developed cancer.

FDA's panel weighed testimony and research presented at its meeting and concluded that current information does not clearly establish a hazard to humans. "It is unlikely that the types of tumors seen in rats would occur in humans," the panel said. The group did recommend that women considering implants "be advised of the possible risks," and suggested FDA set up a patient registry to keep track of possible ill effects of the implants. The panel will meet again in January to consider any new data and discuss the issue further.

Each year, about 130,000 women in the United States get the implants, according to FDA estimates. About 85 percent of the procedures are done to enlarge healthy breasts.

Dow officials contend the implants are safe, a view backed by the American Society of Plastic and Reconstructive Surgeons (ASPRS). "Women with breast implants have been followed for up to 25 years, and the type of cancer found in the study of rodents has never been reported in this population," says ASPRS President George Reading of Rochester, N.Y.

HRG Director Sidney M. Wolfe argues that the average follow-up on silicone implants has been only 10 to 12 years, not long enough for cancer to develop in some cases. He says researchers have shown in humans that silicone leaches out of its implant bag into surrounding tissue, raising concerns about cancer development in other parts of the body.

Chemistry

For unheard-of success, just add water

There is a joke that describes a theoretician as one who says, "Yes, it works in practice, but will it work in theory?" Sometimes, even practical chemists find something that contradicts previous experience so strongly that they spend a lot of time trying to make an experiment agree with theory rather than accepting what they see. That happened to two chemists at the California Institute of Technology in Pasadena, who discovered an unexpected and important chemical reaction for making polymers.

Plastics, paints and other polymers with special electronic or chemical properties are at the forefront of the materials revolution. But making polymers to order in an economical fashion can be extremely difficult because the metallic catalysts required in many such reactions can be destroyed or inhibited by many different molecules.

For instance, water and oxygen are almost always the enemy of metal-catalyzed, or "organometallic," reactions and so must be rigorously excluded from the reaction vessel. Nevertheless, Bruce M. Novak and Robert H. Grubbs discovered to their surprise that a reaction that previously would work only in the absence of water or oxygen could be made to work in water in an open container.

While testing a ruthenium-based molecule as a catalyst, Novak and Grubbs started by removing water and oxygen from the reaction mixture. When the reaction took too long, they attributed this to trace amounts of water and oxygen, as is usually the case. But the harder they worked to remove these molecules, the longer the reaction took. Finally, the two chemists thought of adding a little water, and the beneficial effects were "dramatic," Novak says. "It's amazing how long it took to sort it out."

Adding a little water was good, and adding more turned out to be even better, Novak says. This led to the thought – highly unusual in organometallic chemistry – of running the reaction in water itself. It worked fine, they report in the Oct. 26 JOURNAL OF THE AMERICAN CHEMICAL SOCIETY.

Their water-based reaction is important for the painting and coatings industry, Novak says. Anytime you have to evaporate a solvent to get a coat to harden, "from an economic and environmental point of view you want to use water" as the solvent, he says. Novak and Grubbs say they have had "quite a response" from companies interested in using the technique.

The process also allows researchers to create paints with special properties, such as conductivity or high-temperature stability, by adding extra chemical groups that hang off the polymer chain like trinkets on a charm bracelet.

In the type of reaction they modified, called ring-opening metathesis polymerization or ROMP, it has been very difficult to add side chemical groups for the same reason water and oxygen had to be excluded – the catalyst reacted too easily with the side rings and became deactivated, Novak says. "The same changes you make to stabilize the catalyst to a side group stabilize it to water," he says.

It's not entirely clear why the modified ROMP reaction works so well, but it seems that water actually works as a catalyst alongside the ruthenium, and that, for some reason, the ruthenium acts specifically on the polymer bonds and not on side groups or oxygen atoms, Novak says. For industry, one additional benefit of this specificity is that the catalyst isn't deactivated by reacting with the trace impurities that are expensive to remove from the original chemical ingredients used in a reaction. All of this adds up to a form of organometallic chemistry of interest both to scientists and to those who want to apply it. "Too often before," Novak says, "we would come up with a very beautiful catalyst and industry would say, 'Nice work, but we can't use this practically.'"