Environment

Milk may impair fertility in women . . .

Women who would like but have failed to conceive a child may want to review how big a role dairy products play in their diet, a new study suggests. A team of researchers in the United States and Finland now reports that where per capita milk consumption is highest, women tend to experience the sharpest age-related falloff in fertility.

With the exception of certain northern European populations and their descendants, most adults lose the ability to easily digest lactose, a sugar in milk. Because lactose intolerance discourages high consumption of milk and other dairy goods rich in galactose—a sugar apparently toxic to human eggs—this trait may be beneficial, observe gynecologist Daniel W. Cramer of Harvard Medical School in Boston and his coworkers.

Five years ago, Cramer linked galactose consumption with increased risk of ovarian cancer (SN: 7/22/89, p.52). To look for hints that this sugar might also affect fecundity, his team compared published data from 36 countries on rates of fertility, per capita milk consumption, and hypolactasia — that adult inability to digest lactose. In the Feb. 1 AMERICAN JOURNAL OF EPIDEMIOLOGY, they now report a correlation between high rates of milk consumption and waning fertility, beginning in women just 20 to 24 years old.

The strength of that association — and the rate of fertility decline—grew with each successively older age group studied. In Thailand, for instance — where 98 percent of adults are hypolactasic — average fertility in women 35 to 39 is only 26 percent lower than peak rates (at age 25 to 29). By contrast, in Australia and the United Kingdom, where hypolactasia affects only about 5 percent of adults, average fertility by 35 to 39 is fully 82 percent below peak rates.

Many factors — including marriage customs, divorce rates, contraception use, and individual wealth — affect fertility, the authors concede. However, notes Cramer, the new analysis does offer "demographic confirmation of what we have observed both experimentally, when you feed a mouse high galactose, and clinically, in women with galactosemia [an inability to metabolize galactose]." Women with this disorder who have high concentrations of the sugar in tissue are infertile, he observes.

. . . as lead can in men

Though several studies have demonstrated that high exposures to lead can impair male reproduction, no one has understood precisely how the heavy metal wreaks its havoc. Now, researchers at the University of California, Los Angeles, School of Medicine report that the toxic metal may alter sperm function by suppressing circulating concentrations of the male sex hormone testosterone.

Rebecca Z. Sokol and her coworkers treated mature male rats to regular water or drinking water laced with lead. Rodents exposed to lead received enough to alter serum testosterone concentrations without affecting their apparent health. After 2 to 9 weeks, sperm from each rat were incubated with eggs from females raised on a leadfree diet.

The researchers found no structural abnormalities in sperm from the lead-treated animals. However, these sperm proved about 30 percent less successful at penetrating eggs than did sperm from untreated rats. Even after penetrating an egg, lead-exposed sperm had a more difficult time fostering those initial stages of development in which one cell begins dividing into many.

In the February TOXICOLOGY AND APPLIED PHARMACOLOGY, Sokol's team concludes that by disrupting testosterone's stimulation of the testes, lead appears to trigger a cascade of events that "not only impairs sperm penetrating ability, but also diminishes the ability of lead-exposed sperm to physiologically fertilize the eggs that they have penetrated."

Materials Science

Graffiti begone

Strive to stick to the point, we're told. Sometimes, though, not sticking is the point—at least for anyone trying to get rid of graffiti, develop washable wallpaper, prevent blood cells from clogging an artificial heart, or invent a nonstick surface that would make all of these things possible.

That's exactly what Donald L. Schmidt of Dow Chemical Co. in Midland, Mich., has done. In the March 3 NATURE, his team describes a clear, hard coating made from two linked polymers that repels water and most solvents, does not hold paint, dirt, or tar, and even shrugs off adhesive tape.

The two polymers — a reactive perfluoroalkyl polymeric surfactant and a cross-linking agent—dissolve in water and can be sprayed or brushed onto any surface. They form a thin layer of twisted molecules, "as if you took spinach and regular spaghetti and mixed them up," says Craig A. Burton, who heads research and development of this coating for Minnesota Mining and Manufacturing Co. in St. Paul.

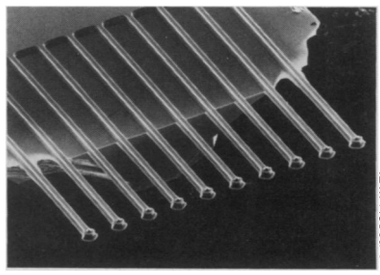
The reactive strand has branches of fluorinated carbon groups that twist to face open air. When heated to temperatures between 60°C and 120°C, the spaghetti-like molecules link together, immobilizing the fluorinated branches and preventing the coating from redissolving in water.

Attraction between positively and negatively charged molecules is one basis for adhesion, says Robert F. Brady Jr. of the U.S. Naval Research Laboratory in Washington, D.C. Fluorine grasps its electrons more tightly than any other atom, he says, "so you can't develop any kind of proton charge that would lead to adhesion." That explains why having fluorine groups near the surface is the key to making the coating nonadhesive.

To enhance the coating's nonstick performance, Schmidt added cosolvents with high boiling points. He also cured the coating under humid conditions. Both techniques result in more gradual drying of the surface. Schmidt thinks this allows the polymer strands to get closer to each other and gives the key fluorine groups more time to twist to the surface.

Because of the coating's smoothness, little friction and no crevices for physical attachment develop. One-step application also proves a plus. Finally, since it is water-based, it releases no toxic fumes when used—a breath of fresh air for manufacturers struggling with stringent pollution regulations.

A supersensitive 'nose on a chip'


IBM Research

Tiny micromechanical levers made with integrated circuit technology can measure the heat generated in chemical reactions to the nearest hundred-thousandth of a degree, making them the world's most sensitive calorimeters.

The aluminum-coated silicon levers bend when heated because these two materials expand by different amounts. The change in position shows how much heat has been absorbed, much as mercury expansion in a thermometer does. Lasers or measurements of changing electrical resistance detect how far the levers have bent, says Christoph E. Gerber, who developed the sensor at the IBM Research Laboratory in Zurich.

If coated with chemicals that react with target molecules to produce heat, the 400-micrometer-long levers can be used to detect many different substances. Hundreds or thousands of these levers, each sensitive to a specific chemical, could be attached to a chip and might one day function as a "supernose" to detect air pollutants, Gerber adds.