

Biodegradable implant for broken bones

A newly patented polymer undergoing animal tests shows promise as a biodegradable "bone plate"—an internal splintlike brace—to hold broken bones together until they heal. At present, many compound fractures and limb breaks at other than a bone's midshaft have to be supported with a screwed-on internal stainless steel plate for 12 weeks, or until a bone mends, explains Deger C. Tunc, principal scientist in the orthopedic division of Johnson & Johnson Products Inc.'s research center in North Brunswick, N.J. Since steel plates don't degrade, follow-up surgery is eventually required to remove the plate and screws. But according to Tunc, the new polymeric material remains strong and rigid for at least 12 weeks, then slowly decomposes into lactic acid, a chemical that occurs naturally in the body.

Polymers are molecules made by linking a chain of identical subunits. The substance in Tunc's study is made by linking lactide monomers into a much longer "polylactide" polymer than had ever been achieved before. To do this required calculating, through computer modeling, the precise combination of processing characteristics—such as polymerizing temperature and ratio of catalyst to monomer—that would minimize unused monomer, Tunc says.

The new molecule's added length and "molecular weight" contribute not only to its greater strength but also to its slow dissolution. Previous polylactide implants degraded so rapidly that within four weeks or so they had totally lost any value as a support, Tunc says. Implants of the new material, tested in dogs, lasted far longer: 20 percent of the polymer's breakdown products still remained two- and-a-half years after implant, Tunc says. Tests in both dogs and rabbits failed to indicate any toxicity or irritation associated with the body's breakdown and elimination of the implants, he reports. Pending Food and Drug Administration approval, Tunc says, Johnson & Johnson may initiate human tests of the implant material later this year.

Measuring nicotine in the air . . .

Chemists have developed a new nicotine trap to quantify the levels of tobacco smoke a nonsmoker might breathe. According to S. Katharine Hammond of the University of Massachusetts Medical Center in Worcester, since tobacco "is the only important source of nicotine," its concentrations in air can be used as a proportional gauge of more toxic tobacco-smoke constituents. Because most existing air samplers of smoke measure compounds—like carbon monoxide—that could result from sources other than cigarettes, Hammond says, "we may have the most specific test for passive smoking thus far developed." Passive smoking is the breathing in of cigarette smoke by nonsmokers.

The nicotine air-sampling system, developed by Hammond and her colleagues, can measure 0.2 micrograms of the compound per cubic meter of air. It relies on a pair of treated filters—one to catch particulates, the other gas-phase nicotine. Any nicotine in air pumped through the system will be bound to the filters for later quantification using gas chromatography. Ironically, her data show, "low-nicotine" cigarettes contribute as much nicotine into the air as regular ones do.

. . . and in urine

A quick, low-cost, high-pressure gas chromatography test for identifying nicotine in urine has been developed for State Farm Insurance Co. to help detect "cheaters"—smokers who apply for low-cost health insurance by claiming they don't smoke. According to its developer, David Bailey, head of the chemistry department at Illinois Wesleyan University in Bloomington, this test can identify whether an individual has

smoked in the past 24 to 36 hours. Bailey expects it to be used as an unannounced addition to the normal battery of medical tests required of all new insurance applicants.

To date it has been tested on more than 600 urine samples without giving a single false positive identification, Bailey reports. At full speed the system can analyze 200 samples daily—about four times more than alternative nicotine-in-urine tests. And with further refinement Bailey expects the test to cut the technician processing time per sample in half again, to about 45 seconds.

Passive smokers can relax: Bailey says the detection limit on his system of 100 micrograms of nicotine per liter of urine is less sensitive, by a factor of 10, than what would be needed to find nicotine in the urine of nonsmokers who live or work with even heavy smokers.

Infant dioxin exposures reported high

Nursing mothers in Western industrial nations are inadvertently passing on to their children a toxic-chemical legacy—high levels of 2, 3, 7, 8-TCDD, the most toxic form of dioxin, according to new calculations by a team of researchers from five institutions in the United States and Canada.

They extrapolated their figures from the mean concentrations of TCDD that they and others, including the Environmental Protection Agency, recently measured in body fat from more than 1,100 people from widely scattered areas of North America. The researchers estimate that, through the fat in breast milk, nursing infants may be acquiring 1,300 times the daily dioxin exposure levels that the Atlanta-based Centers for Disease Control (CDC) has recommended as being potentially acceptable for the general population. This apparent dose to infants is so high, according to study coordinator Arnold Schecter of the State University of New York at Binghamton, that children nursed for a year may be starting their lives with 18 times the *lifetime* exposure CDC considers potentially allowable (i.e., leading to an estimated 1 excess cancer per 1 million persons exposed).

Even more dramatic are the actual dioxin-in-breast-milk concentrations that the researchers have just measured in four samples acquired during the early 1970s in what was then South Vietnam. These milk samples, until recently stored in a freezer at Harvard University, are contaminated with 2 to 6.5 parts per trillion TCDD in fat. Like their chemical cousins, the furans and polychlorinated biphenyls (PCBs), dioxins are stored in fat once they enter the body. They remain in the body until that fat is either burned or shed to a nursing infant via breast milk.

The Vietnamese breast milk measurements suggest that even after the wartime spraying of dioxin-contaminated herbicides (such as Agent Orange) ended, Vietnamese infants were potentially acquiring—in each year of breast feeding—at least 100 to 400 times CDC's estimated allowable lifetime dioxin dose, according to the researchers.

Schecter and his colleagues from Harvard Medical School in Boston, the University of Nebraska in Lincoln, the University of Rochester (N.Y.) Medical Center and the Ottawa-based Health and Welfare Canada, caution that because the toxicity of dioxin in humans is still so poorly known, they cannot speculate on whether the dioxin levels they have calculated for breast milk warrant advocating that Western mothers forgo breast feeding. However, Schecter says, these new data do appear to justify the development of a well-controlled health-effects study comparing dioxin in North and South Vietnam—which their data indicate are probably the world's least and most dioxin-contaminated populations, respectively (SN: 7/13/85, p. 26).