BIOMEDICINE

Prenatal stress and its health effects

If female rats are psychologically or physiologically stressed during pregnancy, their offspring may experience cleft palate, harelip or aberrant sexual behavior, two studies have found. And it looks as if the female offspring of stressed pregnant rats incur more reproductive abnormalities than do the female offspring of nonstressed pregnant rats, reports Lorraine Roth Herrenkohl of Temple University in the Nov. 30 SCIENCE.

Herrenkohl subjected 18 pregnant rats to the stress of heat, restraint and bright light. Eighteen pregnant rats served as controls. Several dozen offspring from each group were then mated and examined for various reproductive abnormalities. Twice as many prenatally stressed females as prenatally nonstressed females failed to become pregnant. Three times more stressed than nonstressed females had miscarriages. Prenatally stressed females also had significantly longer pregnancies and fewer live young than the prenatally nonstressed females.

There is also evidence that maternal stress during pregnancy can adversely affect the health of human offspring. For instance, women under excessive stress have more complications of pregnancy, labor and delivery than do those who are not overly stressed. If women feel intense grief, fear or anxiety during the last three months of pregnancy, their offspring are more prone to irritability, hyperactivity and feeding problems than are children born to women who did not experience such emotions.

Old and cold: Hypothermia in the aged

Winter is fraught with hazards for the elderly and with recent fuel shortages, a new winter problem is becoming increasingly common. Accidental hypothermia, defined as a core body temperature less than 95 degrees F that is the result of exposure to cold, is not only a medical problem among the elderly, but one of social policy as well. In an effort to draw attention to the problem, Nicholas Rango of Columbia University testified at a recent special hearing of the Senate Special Committee on Aging on "Energy and the Aged."

Physiologically and socially, Rango said, the aged are most vulnerable to accidental hypothermia. Many elderly persons lose the ability to sense cold, and many have disabilities that prevent them from taking action against the cold. In addition, more elderly are likely to be poor and to live in inadequately heated and insulated housing, with insufficient warm clothes.

Official statistics on hypothermia deaths underestimate this hard-to-diagnose problem, and Rango urged immediate action both in studying the problem and helping to prevent it.

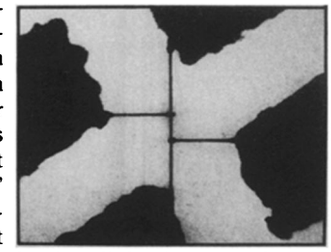
TB vaccine shoots down sperm

Scientists are working hard to devise both effective and safe male contraceptives, but so far they have failed to meet the challenge. Steroid hormones, for instance, pack a wallop against sperm, but they also knock out male libido. And while immunization against sperm antigens, such as LDH-X, looks promising (SN: 2/10/73, p. 93), researchers are still not able to produce an immune response potent enough for clinical use.

Now a novel immunological approach to blocking sperm without affecting libido is reported in the November PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES by G. P. Talwar and co-workers of the All India Institute of Medical Sciences in New Delhi: shots into the testicles of the tuberculosis vaccine bacillus Calmette-Guérin. So far the vaccine has worked admirably in primates and other mammals. It primes their immune systems to attack sperm-producing cells as something foreign, and sperm production then ceases. The researchers are not yet sure whether the effects are reversible.

TECHNOLOGY

Microscopic superconducting bridges



Far smaller than a human-nerve fiber: That's how scientists at IBM's Thomas J. Watson Research Center in Yorktown Heights, N.Y., describe their new development—the world's smallest electronic-circuit elements. These "nanobridges" are thin strips of superconducting niobium metal that function as weakly superconducting links between larger, micrometer-sized regions of superconducting niobium thin films. Robert B. Laibowitz and colleagues at IBM have reliably produced and tested bridges as small as 40 nanometers (billionths of a meter) wide, 30 nm thick and 120 nm long.

The nanobridges exhibit what is known as the Josephson effect. It describes how a sufficiently small, weak link in a superconducting circuit can function as if it were a good superconductor by permitting a "supercurrent of electron pairs" to flow between connecting superconductors with no voltage difference across the bridge. In addition, when electromagnetic radiation is applied to bridges exhibiting the Josephson effect, a direct current forms at equally spaced voltage intervals. Josephson devices are being looked at as a future alternative to semiconductor microcircuits in computers.

Through studies of the Josephson effect in their nanobridges, the IBM team collected the first experimental data for niobium on the "quasiparticle diffusion length" — a fundamental superconductivity characteristic that indicates how short a bridge must be for heating not to affect its characteristics when it is switched from a superconducting to a normal mode. Tests of the shortest bridge showed no heating-dependent behavior, proving that size is an important factor in a nanobridge's superconducting behavior, the researchers say.

The niobium bridges — able to switch on in a mere 13 picoseconds (trillionths of a second)—exhibit complex resistivity, the researchers find. They attribute this to the granularity of the material, believing that individual grains of niobium become superconducting first. As the material is further chilled, long-range coupling between grains causes the entire bridge to become superconducting.

Pollution: Electrifying evidence

"We're taking an established technique and stretching its limits," says Muriel Robinette, a geological engineer at the University of Idaho, in describing her use of electrical probes to detect and monitor groundwater pollution. Clean groundwater does not conduct electricity well, she says, but as the proportion of dissolved solids—often an indicator of pollution—increases, so generally does its conductivity.

Though one must still drill wells to confirm contamination, Robinette's technique inexpensively cuts down the guesswork associated with it. Steel stakes, generally two to deliver the current and two to receive it, are pounded one foot into the soil. The drop in current as it migrates to a receiver stake is a function of geology and water quality, Robinette says. One can map differentials over a region by forcing the current deeper (increasing distance between stakes) or by altering the array's configuration. Validated in field trials, the technique will now be tested, under a Nuclear Regulatory Commission contract, as a probe of groundwater contamination by uranium mill-tailings ponds. And the Environmental Protection Agency is considering a national program to track possible groundwater contamination for hazardous-waste dumps.