

Birth control vaccines

Most vaccinations prime a person's immune system to fight an infectious disease. But clinical trials are under way around the world on a novel immunization procedure aimed at preventing unwanted pregnancies. The vaccine in clinical trials creates temporary infertility by targeting antibodies against a hormone crucial to pregnancy. However, biotechnology may produce a wide variety of potential antifertility vaccines.

"Vaccines are under development for at least eight of the many possible points where the reproductive cycle can be intercepted," says G. P. Talwar, director of India's National Institute of Immunology at Jawaharal Nehru University in New Delhi. The most extensive work so far involves vaccines made of a subunit of the hormone human chorionic gonadotropin (beta-hCG). Four hCG vaccines are now in clinical trials. The hCG hormone is thought to signal the ovaries to sustain a gland called the corpus luteum during a pregnancy. In some of Talwar's work, beta-hCG is linked to tetanus toxoid in order to increase its overall immunity-stimulating potency while also producing immunity to tetanus.

Safety (phase I) trials of the hCG vaccine have been completed in six cities, Talwar says. No side effects, including menstrual abnormalities, were observed. Antibody levels gradually dropped during seven to 16 months and normal fertility returned. However, subjects showed a wide disparity in the levels of hCG antibodies produced, so the scientists are using a variety of techniques to increase the response. These include adding extra substances, called adjuvants, to the vaccine and adding another protein subunit to lock the beta-hCG into the optimal conformation. Biotechnology procedures are being used to isolate the beta-hCG gene and to insert the gene into viruses already used as vaccines.

Scientists are attempting to create birth control vaccines using each of four other reproductive hormones. In addition, they are searching for components of the sperm and egg surface that may be good targets for antibody attack. "We are using monoclonal antibodies to identify the targets and then fishing out the genes," Talwar says. In animals, monoclonal antibodies to reproductive hormones have been used to terminate pregnancies without interfering with fertility.

Kramer vs. Kramer in real life

In about 10 percent of divorces involving children, the father is awarded custody. How do these families get along? Richard Ades Warshak of the University of Texas Health Science Center at Dallas has analyzed 28 studies of father-custody families. In general, father-custody and mother-custody families face the same problems, such as distress at the parents' separation, and they react in similar ways.

In seven studies that directly compared children in father-custody and mother-custody homes, none of a wide range of features of psychological development was attributable solely to the sex of the custodial parent. Warshak says, "Not one [study] supported the stereotypical view that custodial fathers are incapable of adequately rearing their children."

However, Warshak emphasizes one consistent difference between mother-custody and father-custody families. "A consensus of results indicates more favorable outcomes for boys in father-custody homes and girls in mother-custody homes," Warshak says. Although not discounting the importance of mother-son and father-daughter relationships, he says the studies indicate more problematic behavior between custodial parents and school-age children of the opposite sex. He suggests that in custody decisions, some weight should be given to the child's sex, although it should be considered as only one of many factors that influence a child's postdivorce adjustment.

Coping too well?

After the polio epidemics that swept the country in the '40s and '50s, some survivors gradually regained function; others were left in wheelchairs or dependent on respirators. But whatever the level of function after recovery, all were told that it would remain stable. Now, more and more polio survivors are reporting new symptoms, including weakness, pain and respiratory problems, grouped under the name post-polio sequelae (PPS). Part of the explanation may lie in the ways survivors have coped with an unaccommodating world.

Poliovirus paralyzes by killing motor neurons. But the "orphaned" muscle can regain function if neighboring nerve axons sprout into the denervated territory. The multi-sprouted axons carry a heavier-than-normal work load, and, says M. Mazher Jaweed of Philadelphia's Thomas Jefferson University, animal studies show the nerves are vulnerable to damage if the muscles are overworked.

Says Richard Bruno of Felician College in Lodi, N.J., "Twenty-five years ago these people were told, 'Use it or lose it.'" And in their attempts to overcome the psychological and physical pressures of the nondisabled world — the stares as well as the stairs — many polio survivors pushed themselves to their limits. Jaweed's work, Bruno says, provides evidence that the accumulated years of overexertion may have damaged the nerve sprouts and brought a return of weakness or paralysis.

Most polio survivors are employed and involved in society, Bruno says. But coping with a society that made few adaptations to their needs left many with time-conscious, hard-driven, "Type A" personalities. Animal studies have shown that the combination of stress and overexertion speeds muscle degeneration; now Bruno reports that his just-completed survey of more than 700 PPS sufferers shows that for 75 percent, stress was associated with the onset of muscle weakness.

Bruno plans to study whether progressive relaxation training has value for polio survivors. Although they can still exercise, "We tell these people they have to be a little Zen-like," he says.

Being and nothingness

How many animals aren't there, and what don't they look like?

Comparative zoologists, paleontologists and a chemist convened last week to ponder a conundrum set by Einstein: Did God have a choice in creation? Or, to put it in evolutionary terms, does natural selection work on randomly occurring forms, or is the pattern-generating system itself limited?

Monsters "are a very good example of the internal rules of morphology," says Pere Alberch of Harvard University. Two-headed monsters, for instance, occur (if rarely) in many species; in a random system, three-headed ones should be as likely, says Alberch, but "you never find them." The relative profusion of the two-headed and the dearth of the three-headed variety reflect not only limits at the level of gene or organism, he says, but also constraints on the types of possible patterns.

To R. D. K. Thomas of Franklin and Marshall College in Lancaster, Pa., evolutionary convergences also indicate the limits of the possible. To investigate structural possibilities and constraints, Thomas and W.-E. Reif of West Germany's Tübingen University defined a "skeleton space" made up of seven structural variables such as internal or external skeleton and rigid or flexible materials. Once they eliminated nonsensical combinations, the number of design combinations was reduced to fewer than 1,000. Of those, Thomas says, more than half are abundantly represented and fewer than one-third are rare. This suggests, Thomas says, that "the number of shapes is not only finite, but has been nearly fully exploited."