Environment

Sexually transmitted anticancer drugs

Cyclophosphamide, a widely used anticancer and immunosuppressive drug, not only can be shared between sexual partners via a male's semen but also may endanger a very early-term embryo, according to an animal study conducted at McGill University in Montreal. Administering the drug to male rats just a few hours prior to mating doubled the rate of pre-implantation embryo losses relative to rats not receiving the drug, according to a report by Barbara Hales, Susan Smith and Bernard Robaire in the July TOXICOLOGY AND APPLIED PHARMACOLOGY. Since human embryos implant in the uterine wall within a week of conception, Hales says, a woman might miscarry even before she knew she was pregnant.

The rats' one-time dose of cyclophosphamide was high, the researchers acknowledge — comparable to about 50 times the dose a human might receive if taking the drug daily. However, Hales notes, in some instances humans are given a single, large dose of this drug. And in those cases, she says, the human dose might be comparable to what was used in this study.

Follow-up work in this area has concentrated on looking for reproductive hazards that might be associated with chronic, low-dose paternal exposure to the drug. So far, the effects — which can be severe — seem to depend on when in the sperm's development exposure to the chemical occurred. However, the primary hazard associated with chronic exposures seems to show up later in the pregnancy. In some cases, Hales says, "up to 80 percent of the *implanted* embryos die."

Grace guilty of tainting Woburn water

Two years ago, a low-cost epidemiologic survey conducted by the residents of Woburn, Mass. (under the guidance of researchers at the Harvard University School of Public Health in Boston) showed that Woburn's leukemia rate was 2.4 times the national average. The risk of leukemia was highest, according to the researchers, in homes receiving the largest proportion of their drinking water from two city wells that previously had been shown to be heavily contaminated with toxic chemicals, including chloroform and trichloroethylene — known carcinogens (SN:2/18/84,p.104). There was also an elevated risk of certain birth defects among those whose homes got more than 20 percent of their drinking water from the two wells.

On July 28 a Boston jury found W.R. Grace & Co. of New York City guilty of contaminating those wells with chemical wastes. The Chicago-based Beatrice Cos. was cleared of charges that its hazardous wastes also contaminated the well water.

The case was brought by the families of seven leukemia victims (six of whom died) and of children with several other illnesses. These families charged that the diseases resulted from the water's chemical contamination. Still to be determined by the jury is whether there is sufficient evidence to link the observed contamination with the plaintiffs' health claims.

W.R. Grace's only response to the initial jury finding was a formal statement saying it was "disappointed" but confident it would be "fully vindicated during the next phase [of the trial] which will deal with the medical aspects."

Africa: Then came the locusts

After being plagued by a 20-year parching drought (SN:5/4/85,p.282), Africa got some temporary relief this year. But the rains that came also made conditions ripe for a return of the Senegalese grasshopper; by March its swarms were reaching plague proportions. With help from the United Nations' Food and Agricultural Organization, the grasshoppers were recently brought under control. Then came the locusts. For the first time in 50 years, all four of Africa's main locust pests are swarming at once, attacking crops down the entire length of the continent.

Mathematics

Bowling averages in your spare time

If you think bowling a perfect score of 300 is hard, try figuring out how many different ways a bowler can roll, say, a 147, or for that matter, any other score. Starting at zero, the first case is easy to compute. A hopelessly incompetent bowler can score a zero in only one way — by missing all 10 pins with both balls in each of 10 tries. There are 20 ways to record a one: You can knock over one pin with your first or second ball in any one of the 10 frames. But for larger scores, the calculations get more complicated, and the number of possibilities escalates rapidly.

Now the numbers are known, courtesy of mathematicians Curtis N. Cooper and Robert E. Kennedy of Central Missouri State University in Warrensburg. Both bowl regularly, and they decided to spend some spare time working out the appropriate figures. Because of the complex scoring system used in 10-pin bowling, says Kennedy, "it turned out to be a tricky mathematical problem."

Out of about 5.7 billion billion possible games, the striking results show that there are more ways to bowl a 77 than any other score. That score comes up 172,542,309,343,731,946 times. In contrast, there are only 51,701,385,089,887 ways to bowl a 147, merely 1,526,313,637 ways to reach 200, and of course, only one way to score a 300. When all possible scores are added together and then divided by the total number of possible games, the mean score comes to an "awful" 80.

"This won't help you bowl any better," says Cooper, "but it may make you feel better about your own score."

In search of special Smiths

Curious properties sometimes lurk within seemingly undistinguished numbers. Several years ago, mathematician Albert Wilansky of Lehigh University in Bethlehem, Pa., during a conversation with his brother-in-law, noticed that his brother-in-law's telephone number had a remarkable property. The number 4,937,775, being a composite number, can be expressed as the product of prime numbers: $3 \times 5 \times 5 \times 65,837$. Interestingly, when the digits of the original number are added together, the result (42) equals the sum of the digits in the prime factors $(3 + 5 + 5 + 6 + 5 + 8 + 3 + 7 = 42)$. This discovery marked the birth of "Smith" numbers, named for Wilansky's brother-in-law.

A few people are now beginning to explore the characteristics of Smith numbers. Are there an infinite number of them? Are there patterns that allow certain such numbers to be found easily? And of course, there is a never-ending quest to find the largest known Smith number. "This is a brand new subject," says Samuel Yates, a retired computer programmer supervisor now living in Delray Beach, Fla. Yates has been very active in this search.

The smallest Smith number is 4 because the number's factors, 2×2, when added together also equal 4. The next one is 22, then comes 27, and so on. Overall, there are 376 Smith numbers between zero and 10,000. About 3,300 Smith numbers lie between zero and 100,000.

Yates has found special patterns of digits that automatically produce Smith numbers, although these methods do not generate every possible Smith number. Working with large prime numbers, Yates and others have also managed to create very large Smith numbers. Yates holds the record with a number that is more than 2.5 million digits long.

Recently, Wayne L. McDaniel of the University of Missouri at St. Louis managed to prove that there are an infinite number of Smith numbers. But many questions remain. Yates, for example, is studying the role of numbers that consist of long strings of ones.

What good are Smith numbers? Yates doesn't have an answer yet. So far, the pursuit itself seems reward enough.