Prime time for supercomputers

How do you put a new supercomputer through its paces to ensure that it's not making any mistakes? One way is to let it look for gigantic prime numbers. Such a test recently led to the largest prime yet discovered — a 65,050-digit number that, when written out, would fill almost eight pages of this magazine.

The number is the 30th known example of a Mersenne prime, a number divisible only by 1 and itself and written in the form $2^p - 1$, where the exponent p is also a prime number. For instance, 127 is a Mersenne number for which the exponent is 7. The record prime number's exponent is 216,091.

The accidental discovery occurred on a new, $10 million Cray X-MP supercomputer being tested at Chevron Geosciences Co. in Houston. Using a special computer program that checks for Mersenne primes while giving the computer a good workout, Chevron engineers happened to select a starting number that worked out. The supercomputer took about three hours to complete the 1.5 trillion calculations involved.

"It's really a hit-or-miss thing," says David Slowinski of Cray Research, Inc., in Minneapolis. Slowinski wrote the prime-finding program used at Chevron. "Everybody's surprised when you get one," he says. "There's always luck involved."

But the discovery had to be verified. That task fell to Stephen K. McGrogan of Elxsi in San Jose, Calif. Using one of his company's computers and his own program for checking for prime numbers, McGrogan took nine days of computer time to confirm the discovery.

What isn't clear is whether other Mersenne primes lurk in the gaps between those now known. The 29th Mersenne prime was also discovered by accident using a Cray supercomputer. "One of the things that I'm doing is a systematic search through lower number space to determine if any have fallen through the cracks," says McGrogan. Furthermore, he's developing an algorithm that may significantly speed up the process of testing for prime numbers.

Slowinski, in his spare time, is also tinkering with his prime-finding program. His fourth version of the program is now 30 times faster than the original. A version for the new Cray-2 supercomputer, a significantly faster machine than the Cray X-MP, is in the works.

For the 10 or 20 players who chase after Mersenne primes, the pursuit seems to be a kind of "insanity," says McGrogan. For the Chevron engineers, the prime-finding program is a good test before their new supercomputer takes on its real job of analyzing geological data collected during oil exploration. — *I. Peterson*

Toward a 'magic bullet' for melanoma

The potent toxin that causes diphtheria is now being targeted against malignant cells to provide a potentially powerful weapon against melanoma, an often deadly form of cancer. John R. Murphy of Boston University Medical Center described his unpublished results this week in Bethesda, Md., at the meeting of the National Institutes of Health Recombinant DNA Advisory Committee (RAC).

Murphy and his colleagues have produced a hybrid protein that is a modified diphtheria toxin. The new protein remains a potent killer of cells, but through protein engineering (see p. 204) the scientists have altered its target selection. They removed the part of the gene responsible for the binding of toxin to diphtheria-sensitive cells and attached a synthetic gene for a hormone called *alpha*-melanocyte stimulating hormone (MSH). Receptors for MSH occur on skin cells called melanocytes. When these cells grow unchecked, malignant melanoma results.

The hybrid gene was moved into the laboratory bacterium *Escherichia coli* to produce hybrid protein. Murphy reports that this remodeled toxin kills human malignant melanoma cells growing in laboratory culture. Yet the protein does not harm other laboratory-grown cells that are very sensitive to diphtheria toxin but lack MSH receptors. In fact, Murphy and his colleagues found that injecting guinea pigs with a dose 1,000 times the lethal dose of diphtheria toxin caused no observable ill effects.

While much testing remains to be done before such a hybrid toxin is used clinically, the scientists on RAC are enthusiastic. "This is a real triumph for molecular biology," says Bernard Davis of Harvard Medical School. "It's [a] 'magic bullet' with a vengeance."

Next, Murphy plans to construct another hybrid protein, a diphtheria toxin that binds to receptors for interleukin-2 on white blood cell membranes. This chimeric toxin is expected to be useful for killing the activated T cells responsible for rejection of organ transplants as well as for certain forms of leukemia and autoimmune disease. RAC unanimously approved the proposed research with a moderately stringent level of safety requirements. — *J.A. Miller*

Diet allowances to slim down?

If Americans really are what they eat, there could be a nationwide identity crisis until the National Academy of Sciences decides whether it will recommend lowering the levels of some vitamins and minerals needed to maintain health. According to the Sept. 23 New York Times, the Academy's committee on dietary allowances has drafted a report proposing reduction of the recommended dietary allowances for vitamins A, C and B6, magnesium, iron and zinc. The same report calls for an increase in the daily allowance for calcium, The Times said. The recommended dietary allowances are used to design food stamp and institutional menu programs and to determine nutritional labeling in food processing.

Because of the broad implications, some nutritional experts quoted by The Times were dismayed by the suggested changes. Committee chair Henry Kamin, a professor of biochemistry at Duke University, in Durham, N.C., refused this week to confirm or deny the allowance figures attributed to the committee report by the newspaper. He told SCIENCE NEWS that the report, scheduled for completion in November, is still in the Academy's standard review process. Part of that process is review by the Academy's food and nutrition board. Board chair Kurt J. Isselbacher, chief of the gastroenterology and nutrition unit at Massachusetts General Hospital, called the controversy over the report "premature."

"The point is there is no final report yet, and all the allowances are still under discussion," he said in a telephone interview. "It's conceivable there may be no change, or there may be a lowering or raising of values. We want values that can be defended or justified by the Academy."

The Academy has revised the guidelines every four or five years since they debuted in 1943. —*D. D. Edwards*

Block releases diet report

Eat, drink and be merry — but always in moderation. There were no surprises in the second edition of dietary guidelines released this week by Secretary of Agriculture John R. Block. Consistent with the department's first such report, issued in 1980, the updated version warns Americans to avoid too much fat, sugar, sodium and alcohol in their diets. But the revised report also condemns harmful dietary habits that have received recent public attention, such as driving while drunk and the use of vomiting to lose weight.

Written by nutrition scientists on the department's Dietary Guidelines Advisory Committee, "Nutrition and Your Health: Dietary Guidelines for Americans" does not define specific nutritional levels for the ideal diet. Instead the guidelines emphasize eating a variety of foods and maintaining a proper weight. □