RANDOM SAMPLES

edited by CONSTANCE HOLDEN

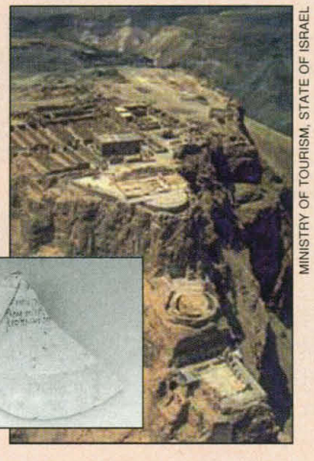
Multiple Sclerosis: A Multigene Disease

While researchers have long known that heredity plays a role in susceptibility to multiple sclerosis—identical twins of people with MS have a 25% chance of getting it, compared to 1 in 1000 for the general population—they've had little success finding a gene responsible for the disease. That led to suspicions that the disorder, in which the body's own immune cells attack the central nervous system, involves several genetic components. Now three comprehensive surveys of the human genome have abundantly verified those suspicions.

In the studies, described in the August *Nature Genetics*, teams in Canada, the U.K., and the United States screened the DNA of a total of 324 sibling pairs, all with MS, looking for regions of unusual chromosomal variation shared between family members with MS. Each team found about 20 such regions. Because so many regions were found to be candidates, the studies help to "settle once and for all whether there is one single MS-susceptibility gene or multiple genes," says Jonathan Haines, a neurobiologist at Massachusetts General Hospital and a lead author of one of the three studies. While one genetic region previously linked to MS—a section of chromosome 6 encoding immune-regulating factors called human leukocyte antigens—was detected in two of the screens, the three teams' findings shared few other regions in common.

The findings of the new studies offer researchers a long list of new genetic regions to trawl. But they also bring scientists closer than ever to understanding the origins of MS, says neurophysiologist Stephen Reingold, vice president for research and medical programs at the National Multiple Sclerosis Society. "Now they can zero in on genes that have a high probability of being involved, and then go to the next level, [which is to] determine what these genes are doing in terms of the proteins they control," Reingold says. "This really takes us forward scientifically and intellectually."

Wine for the king. This piece from a first century B.C. wine amphora, found this year at Masada, Israel, bears the name of King Herod—the first time the Roman client king's full name has been found at the fortress he built there, says archaeologist Ehud Netzer of Hebrew University in Jerusalem. Herod got this wine from Rome. The first two lines of the Latin inscription indicate the origin and date; the third line says "King Herod of Judea." Netzer says that most of the material culture found at Masada to date has been from the Zealots, a Jewish tribe that occupied the mountaintop fortress a century later and threw themselves off the cliff to escape from attacking Romans. There had been "nearly no objects that could definitely be attributed to Herod," says Netzer. But recent finds, including cloth, basketware, and food remains such as nuts and olive pits, come from rooms that had been closed before the Zealots arrived and must date from Herod's time.



MINISTRY OF TOURISM, STATE OF ISRAEL

R. BRUINTJES

Cloudy science. A research aircraft collects data on rainmaking.

Rainmaking

For 50 years researchers have tried bringing rain to parched areas by seeding clouds with crystals of salt or other chemicals. But because of natural rainfall variations, evidence that seeding makes a significant difference has been hard to come by. A 4-year project near the Texas-Mexico border is now aiming to shed some light on this cloudy practice.

To be conducted in a drought-stricken region in the state of Coahuila, Mexico, by scientists from the National Center for Atmospheric Research (NCAR) and several Mexican universities, the experiments are designed to separate the effects of seeding from the weather's natural variability. "You have a big job ahead of you if you don't know how much it was going to rain in the first place," says NCAR's Brant Foote.

Most such efforts seed clouds with tiny crystals of silver iodide, which speed the formation of ice crystals that ultimately fall as rain. But for the ice to form, at least part of the cloud must have freezing temperatures. The Mexican field trials involve a system said to be more effective for warm clouds: airplane-borne flares that release salt particles as they burn. The salt attracts water and forms large droplets, which fall to earth.

To see whether this effort really does wring extra rain from clouds, the researchers will monitor cloud droplet size and concentration with lasers. They will also observe clouds with advanced radar to see whether the seeded clouds develop differently from ordinary clouds.

Peter Hobbs, an atmospheric scientist at the University of Washington, commends the effort to collect meaningful data, but says unless the results are dramatic, the 4-year project may not be long enough. "Most cloud-seeding experiments have claimed an increase of 10% or 15% over normal rainfall," he says. "To really measure a change like that takes 5 to 10 years."

But Roeloff Bruintjes of NCAR expects the project to be useful in any case. "People around the world are putting millions of dollars into cloud seeding," he says. "If we can add scientific rigor to the field we are doing a great service."

Troubled Italian Space Agency Gets New Chief

The debt-ridden Italian Space Agency, plagued by charges of waste and mismanagement since its founding in 1988, is getting a new head. On 26 July, Sergio De Julio, an engineer from Calabria University who has long-standing political ties to Research Minister Luigi Berlinguer, was nominated as the new chair. He will take over from Silvano Casini, who was appointed special administrator with a 1-year mandate in June 1995 and is likely to be kept on as director general.

De Julio, an expert in innovation and informatics who obtained his Ph.D. from the University of California, Los Angeles, has his work cut out for him. On top of long-term planning and priority-setting, he must figure out how to get the agency, which is $650 million in debt, back in the black. The government had planned to reorganize

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the agency and pass a new law governing it (*Science*, 28 June, p. 1867), but so far, no overhaul or new law is in sight.

Grassroots Search For Primes...

Using only their PCs and the Internet, hundreds of amateur and professional programmers and mathematicians are vying to break the world's record—set 3 years ago by a Cray supercomputer—for the largest known prime number.

A prime number is one that can only be divided by itself and 1. The largest known prime is one of the so-called Mersenne primes, which have the form $2^q - 1$, with q also being a prime. Paul Gage and David Slowinski of Cray Research Inc. discovered the 33rd Mersenne prime in 1993—$2^{859433} - 1$, which is 258,716 digits long (*Science*, 7 January 1994, p. 27).

"The Great Internet Mersenne Prime Search," launched in January by George Woltman, a programmer in Orlando, Florida, is now trying to top that mark. At the project's Web site (http://ourworld.compuserve.com/homepages/justforfun/prime.htm), participants download software that runs when their PCs are idle, along with ranges of numbers to test. Woltman wrote the software, which is in assembly language—the raw code that the computer reads—for maximum efficiency. It combines two methods: the Lucas-Lehmer test, which determines whether a number is prime, and another method that finds factors. "It's impressively fast," says Slowinski, who's helping out by checking null results against his own.

LUKE WELSH

Prime devotion. Cryptographer Landon Noll's license plate bears the exponent of the 26th known Mersenne prime, which he discovered in 1979.

Woltman and his co-organizers hope to crunch all potential Mersenne primes with q up to 2,630,000 by the end of 2000—a task, they say, that "will require millions of computer hours." For example, it would take 210 hours for someone with a 133-MHz Pentium to test a potential prime with q equal to 2,630,000. People with slower 486 computers are trawling lower numbers for overlooked Mersennes.

Nearly 300 volunteers have joined the search, says Woltman, and he hopes to recruit at least 200 more. How many Mersennes can they expect to find? "Personally, I'd say one or two," says co-organizer Luke Welsh of Mountain View, California, a co-discoverer of the 29th Mersenne. But, he adds, "it's just as interesting to know there's nothing there."

...Or for E.T.

Don't have enough power to hunt Mersennes? You can still volunteer your PC for another distributed project: SETI@home, in which data from the Search for Extraterrestrial Intelligence (SETI) will be sent to members of the general public for crunching on their home PCs.

Astronomer Woody Sullivan of the University of Washington, Seattle, who unveiled the project last month at the Fifth International Conference on Bioastronomy in Capri, Italy, says the idea is "to uniquely involve the public" in the search by distributing data from SETI radio telescopes, as well as software to parse patterns within that data, via the Internet to anyone who asks for it. The software would automatically run when the participating machine is in screen-saver mode. After a chunk of data has been analyzed for patterns of repetitive signals—the supposed hallmark of intelligent life—a report will automatically be sent back to the SETI@home server at the University of California, Berkeley.

The radio data will be collected by Serendip IV, a piggyback system on the 300-meter radio telescope at Arecibo, Puerto Rico, that will start scanning nearly 168 million radio channels later this year. If 50,000 participants sign on to SETI@home, the computing power will be equivalent to a substantial fraction of a typical supercomputer but cost only about $500,000, say SETI organizers, who hope to elicit the money from high-tech firms.

Organizers want to get the 2-year project under way by mid-1997. "Of course, we will keep track of which data has been analyzed on which computer," says Sullivan, "so people would get credit for a possible discovery."

Nanotube Pipe Cleaners

In the nanotechnology world, where less is always more, big achievements continue to come in ever smaller packages. The latest, described on page 782 of this issue, is a collection of the world's tiniest wires and cables encased in plastic. The wires, as few as 6 angstroms across and up to 100 nanometers in length, are so small that more than 15 could fit inside a typical carbon nanotube.

To make their subnanowires, a Cornell University group led by chemist Francis DiSalvo, along with Jim Elman at Eastman Kodak in Rochester, New York, started with grains of a compound containing rows of molybdenum and selenium atoms separated by rows of lithium atoms. The scientists first dissolved the grains in a solvent, vinylene carbonate, which is the building block of the plastic PVC (polyvinyl chloride). The solvent bound to the lithium, setting the other rows free. Then the researchers added a polymerizing agent which caused vinylene carbonate molecules to link together into spaghettilike chains. Because these formed before the tiny wires could clump together, the result was a block of PVC laced with ultrasmall wires. To make the wires clump into cables, the scientists merely increased the concentration of metallic grains in their solution.

At present, tapping these vanishingly small strands for technological applications—such as wiring up nanosized transistors—"remains a difficult problem" because researchers can't manipulate the wires individually yet, says DiSalvo. But the wires may help physicists study how the electrical conductivity of metal changes as wires shrink to the size of molecules. "This is a wide-open question," says Gerhard Wegner, a polymer chemist at the Max Planck Institute for Polymer Chemistry in Mainz, Germany. DiSalvo says the group hopes also to test whether the wires impart strength to their plastics.

U.S. Medalists Prescribe Tech Strategies

What should be done to retain U.S. preeminence in science and technology? The winners of this year's presidential National Medals of Technology shared some answers at a 25 July luncheon held by the Department of Commerce:

- "It's time for industry to recognize that we need new technologies, not just continuous improvements of existing products."—Chemist Stephanie Kwolek, inventor of Kevlar.
- Revise federal trade rules to "level the playing field against our foreign competitors."—Helicopter pioneer Charles Kaman.
- "Fund more basic research."—Physicist and semiconductor innovator Peter Rose.
- "More enthusiastic teachers. ... They are the ones who can make science exciting." —James Morgan, CEO of Applied Materials Inc.
- "Convince students that it's worthwhile to go into science."—Robert Gussin, vice president for R&D at Johnson & Johnson.

But while U.S. scientists want the United States to stay in first place, a Roper poll released at the luncheon suggests the public isn't aiming so high. Only 7% of respondents think the United States now leads the world in science; and 20 years from now, 54% say they would be satisfied if Uncle Sam ranked somewhere in the top third. Another 21% would settle for being in the middle of the pack.