Institute in Walnut Creek, California.

Over the past few weeks, Collins and Morgan have tried to mend fences. Most foreign groups are satisfied that they have been included now, according to Rosenthal, and Collins announced at the meeting here that the international teams have given their support. The Europeans and at least one Japanese group—a team led by Yoshiyuki Sakaki of Tokyo University—have signed up for the "working draft" concept and agreed, like other participants, to daily release of the DNA sequence they generate.

Speaking as "operating manager and field marshal" of the U.S. and British sequencers, Collins said that the major centers' performance in 1998 indicated they had enough capacity to produce a fivefold-redundant working draft human genome by next year. He noted that about 10% of the human genome has now been sequenced in final form and 7% more in draft, and boasted that the collaboration has met all of its milestones, "without exception." The project, Collins added, will be "more important than the splitting of the atom or going to the moon."

Collins, Richard Gibbs, director of the genome center at Baylor College of Medicine in Houston, Texas, and Marco Marra of Washington University in St. Louis described the logistics of the new strategy in some detail for an audience of several hundred scientists gathered here. The new plan will require tight coordination to sustain the rapid pace of sequencing, Collins explained. The five largest human genome centers, calling themselves the G-5, have agreed to use as their source material a clone repository at Washington University managed by John McPherson; it will also serve as a method of allocating the work.

Teams have been invited to choose the chromosomes they prefer to analyze, but each choice includes performance goals. Gregory Schuler of the National Center for Biotechnology Information recorded an initial chromosome list last week (see table) and plans to track each center's progress. These assignment could change, though. Members of the G-5 confer by phone every week, and the full consortium will review progress every 3 months. If a member stumbles, assignments (and funding) may be reallocated.

Genome scientists have never attempted a collaboration of this scale or rigor before, and it's not clear how well it will go. As Collins said, he and others are watching with "white knuckles." Several problems still lurk at the edges. One open question is whether the new automated capillary electrophoresis sequencing machines that the centers are now installing will increase the rate of output, as the users are hoping. The MegaBACE capillary machines made by Molecular Dynamics performed reasonably well in tests at the Sanger Centre but did not get praise from others at last week's meeting. Nor did the new Perkin-Elmer 3700 capillary devices, which will form the core of Celera's sequencing operation. Three major labs (Massachusetts Institute of Technology, Washington University, and Sanger) reported that the new 3700 machines—although they demand less human tending—have proved not much more efficient than their predecessor, the 377, which they were meant to outperform dramatically. Even so, MIT has ordered 115 of the Perkin-Elmer machines and Washington University an initial batch of 27.

Two more important issues also remain unresolved: how to measure the quality of a lab's output and how to get from the draft sequence to the fully finished version in 2003. Gibbs said that the G-5 teams have settled on a "provisional" quality index that uses software called "Phred" to count the number of acceptable bases per unit of DNA sequence produced. A final index will be established this summer. But the decision on how to finish the genome is "still in flux," according to Gibbs. He said it may not make sense to try to fill all the gaps in the working draft by reanalyzing previously sequenced clones. It may be more efficient, Gibbs suggested, to start afresh with new clones. At this point, Gibbs said, "we're not really sure" what the best tactic will be.

That's a puzzle the sequencers hope to solve over the next year—in their spare time.

–ELIOT MARSHALL

CREDIT: WILLIAM PHILPOTT/AP

PLANETARY SCIENCE

A New Look at the Martian Landscape

Mars is 100 million kilometers away, but in at least one respect, we now know it better than our own familiar Earth. On page 1495 of this issue, planetary scientists present a precise map of martian topography, accurate around the planet to within 13 meters of elevation; some parts of Earth are known only to 100 meters or more. "We now have a definitive picture of the shape of the whole planet," says David Smith of the Goddard Space Flight Center in Greenbelt, Maryland, principal investigator of the instrument, called the Mars Orbiter Laser Altimeter (MOLA), that gathered the data from its perch aboard the Mars Global Surveyor spacecraft.

Thanks to MOLA, a diverse array of martian features has now snapped into sharper focus, including the polar ice caps and the plateaus and lowlands that hint at the processes that shaped the planet. "MOLA's maps allow you to settle issues once and for all that have been contested in Mars geology for 25 years," says Jeff Moore, a planetary geologist with the

ScienceScope

Embryo Taboo Broken? President Bill Clinton may not be eager to receive it, but his National Bioethics Advisory Commission (NBAC) is ready to give him some provocative advice on human stem cell research. NBAC's draft recommendations—which hit the press last week—advise the government to end rules that now prevent federally funded researchers from deriving versatile stem cells from human embryos.

NBAC's opinion—likely to stir protest from antiabortionists—calls for a limited repeal of the current ban on embryonic stem cell research on grounds that it may be "unjust or unfair" in blocking potential medical benefits. NBAC aims to approve final recommendations in late June.

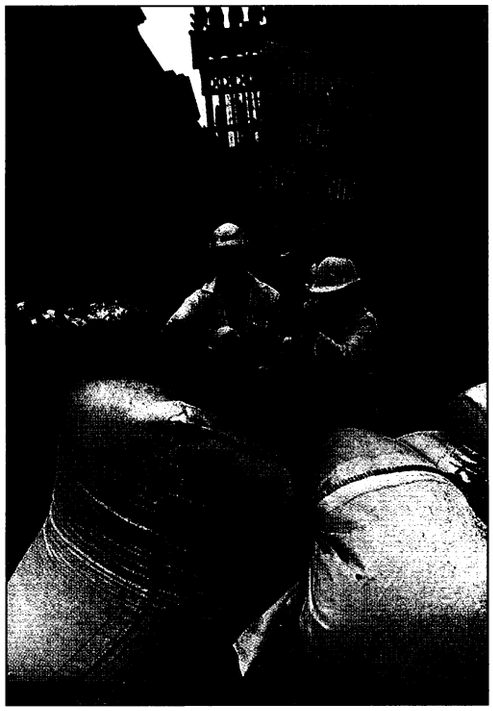
Spy Threat A new report has ratcheted up the pressure on programs that bring thousands of foreign scientists to the United States. This week, a House panel led by Christopher Cox (R–CA) released a long-awaited report concluding that China has used the exchanges to gather intelligence on U.S. nuclear weapons and supercomputers. It recommends that five agencies scrutinize the security risks and report to Congress by 1 July. Meanwhile, the National Academy of Sciences, the National Science Foundation, and the American Physical Society have warned against clamping down too tightly on exchanges, which some lawmakers want banned (*Science*, 7 May, p. 882).

Cox

Less Ravenous ITER Europe, Japan, and Russia continue to pursue a cheaper alternative to the moribund $10 billion International Thermonuclear Experimental Reactor (ITER). Last year, a U.S. pullout dashed hopes for the original fusion megaproject (*Science*, 9 October 1998, p. 209). This week, a new working group was to meet in Tokyo to begin mapping out a plan, sometimes called "ITER Light," that would run half the original cost or less.

Japanese officials say the ITER parties have ruled out the idea of scattering experiments among existing facilities. That means the panel will ponder a host of questions, such as a reactor's scale, cost, and location. It is not clear what combination will win out: "We don't know the positions of the other parties," says Hiroshi Kishimoto, director of Japan's Atomic Energy Research Institute and working group co-chair. The panel has until year's end to hammer out recommendations.

Despite a small number of GM food products having been available in shops for several years, the issue didn't explode into the public consciousness until last summer's reports of the now-discredited research suggesting that GM potatoes stunted growth and suppressed the immune system in rats (*Science*, 21 May, p. 1247). At the time, the inept handling by previous governments of the crisis surrounding the apparent spread of bovine spongiform encephalopathy, or "mad cow disease," from infected animals to humans had already made the British public doubt the government's ability to protect consumers from potentially hazardous products.



Bean dump. Anti-GM activists deposit GM soya outside Tony Blair's Downing Street home.

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Keen not to see the British biotechnology industry undermined by the barrage of negative coverage, Prime Minister Tony Blair set up a ministerial committee on biotechnology policy headed by Jack Cunningham, minister for the Cabinet Office. The ministerial committee ordered a review of the country's regulatory framework in December, and last week's announcement was the outcome of that review. Addressing the House of Commons, Cunningham said the new commissions would strengthen the existing regulatory system.

At the moment, any applications to plant experimental GM crops or sell GM foods are examined by the Advisory Committee on Releases to the Environment (ACRE) and the Advisory Committee on Novel Foods and Processes, which make their decisions on the basis of science only. Critics have long said that the case-by-case approach of these committees did not provide a strategic, long-term outlook for dealing with the issue of GM crops and food. The new commissions—to be called the Human Genetics Commission and the Agriculture and Environment Biotechnology Commission—are designed to plug that gap. The precise role of the commissions has not been revealed, but they will identify gaps in regulation and advise government on policy: the Human Genetics Commission focusing on the long-term implications of genetic technologies for human health; the agriculture commission on the impact of GM crops on farming and biodiversity. Government strategy on the introduction of GM foods will fall under the purview of the new Food Standards Agency, created last year.

Jenny Maplestone, technical liaison officer of the British Plant Breeders Society—a trade association—welcomed the new commissions. "There is a huge amount of emotion and little fact," she says. "The commissions can put the debate on a sound scientific footing." Sandy Thomas, director of the Nuffield Council on Bioethics, agrees that the commissions may well act as a focus for debate, but she is not convinced they will restore public confidence. "These commissions need to be seen to be as independent as possible, but already there have been editorials saying that they are just another quango ["quango" suggests a committee in the government's pocket]," she says. But John Berringer, dean of science at the University of Bristol and chair of ACRE, welcomes the agriculture commission, saying it should fill the gap between science and public policy. "Such a body has been needed for a long time." But he adds, "it is not clear how it will work."

What's more, even as government ministers were preparing to release their recommendations, the British Medical Association (BMA) published its own decidedly anti-GM report. The BMA, concerned about health issues such as allergenicity, called for a moratorium on planting GM crops until there is a scientific consensus on the long-term effects of GM products. In its report, the BMA also said that if GM foodstuffs, such as soya, are sold to the public, they should be separated from non-GM foods and clearly labeled.

John Durant, professor of the public understanding of science at Imperial College London, believes that giving consumers the choice of whether to eat GM foods is one

ScienceScope

Jacques in the Box Jacques Crozemarie, once one of France's most powerful biomedical science funders, is fighting to stay out of prison.

This week, the former president of the Association for Cancer Research (ARC), a charity based near Paris, went on trial for forgery and other charges stemming from allegations that Crozemarie siphoned off millions of dollars in ARC funds via sweetheart contracts with suppliers (*Science*, 18 October 1996, p. 336). He and 25 other defendants have pleaded innocent. If found guilty, Crozemarie and some other defendants could get up to 5 years in prison and be ordered to pay as much as $800,000 in fines.

The trial has been eagerly awaited by current ARC president Michel Lucas, the investigator who exposed alleged irregularities in the charity's books, then took over after Crozemarie's arrest in June 1996. As part of his campaign to restore ARC's credibility, Lucas is making sure potential donors can follow the trial's every twist: The organization has set up a toll-free hotline that will regularly update callers on the proceedings, which are expected to last into July.

Lab-Bench Diplomacy Scientists from India and the United States are working to ease tensions between the countries since India's nuclear tests last summer.

Last week, two dozen researchers from both nations gathered behind closed doors in Bangalore, India, to discuss hot topics such as weapons monitoring and disarmament. The 3-day summit was organized by the Committee on International Security and Arms Control (CISAC) of the National Academy of Sciences in Washington and the National Institute of Advanced Studies in Bangalore. Although CISAC has sponsored similar meetings of the minds in Russia and China, this was its first in India.

Participants wouldn't discuss details, but the "free, frank discussions helped both sides better understand each other's positions," says CISAC chair John Holdren of Harvard University. Both sides hailed the rap session as a "second track" of diplomacy that complements ongoing government talks. Organizers plan to hold a second get-together within a year.

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