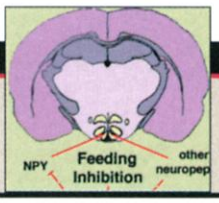
PAGE 2298
Flap over France's BSL-4 lab



2299
Potent appetite suppressor

HUMAN GENOME

Rival Genome Sequencers Celebrate a Milestone Together

With pomp and ceremony, including a trumpet flourish, President Clinton strode into the East Room of the White House on 26 June to announce that molecular biologists have generated "the most wondrous map ever produced by humankind"—a nearly complete readout of the 3.1 or so billion nucleotides in the human genome. Two scientific groups, one private and the other public, have reached a turning point in this work, the president said, and he wanted to celebrate an "epic-making triumph of science and reason."

The room was packed with research managers, senators, ambassadors, reporters, and a few famous scientists. At one point, the president paused to pay tribute to James Watson, co-discoverer of DNA's double-helix structure, seated near the back. Britain's Prime Minister Tony Blair took part in the events from London, appearing in a satellite broadcast on two giant video screens and predicting that genome-based studies will lead to "a revolution in medical science whose implications will far surpass even the discovery of antibiotics." Government leaders in Paris and Tokyo also held press conferences to honor local scientists who contributed data.

The White House ceremony was more than a celebration; it was also designed to heal a split in the research community. The ceremony brought together leaders of the rival public and private groups in a kind of truce, cooling off a competition that had grown intense in recent months. Clinton appeared on the podium flanked by Francis Collins, director of the U.S. National Human Genome Research Institute, representing 16 centers in the public effort, and J. Craig Venter, president of Celera Genomics of Rockville, Maryland, the company that last year began sequencing the entire human genome on its own. The two groups had talked of working together to complete the genome, but negotiations broke down in acrimony in February (*Science*, 10 March, p. 1723).

Facing the cameras this week, the two praised one another. Collins, speaking first, expressed "personal gratitude" to Venter for his "openness in the cooperative planning process that led to this joint announcement." Venter spoke of the "tremendous effort" by the international team, adding that "I'd also like to personally thank Francis for his direct actions in working with me to foster cooperation in the genome community. …"

Coming together. Ari Patrinos (center) orchestrated a joint announcement by J. Craig Venter (left) and Francis Collins.

As reporters learned afterward, this display of harmony came about because a third leader—Ari Patrinos, chief of genome research at the Department of Energy—intervened. Upset about how the rivalry might detract from the scientific achievement, Patrinos invited Collins and Venter to a "secret meeting" at his house. "I've known both of these guys for a long time—as scientists and as friends," he says. They met for the first time on Sunday, 7 May, but didn't make much progress. They continued talks over beer and pizza at several meetings, finally reaching an agreement on 21 June on details for the press conference.

Although Patrinos apparently got an army of genome researchers to march in step, Celera set the pace. Celera reached its corporate milestone—assembling the raw human genome data it produced, representing 99% of the genome, into an ordered sequence—long before the public group reached its own objective. Tony White, chief executive officer of Celera's financial parent firm—PE Biosystems Corp. of Norwalk, Connecticut—said the announcement was held up until 26 June because "it took several weeks to orchestrate the dance."

The public consortium didn't quite reach the objective it set for itself—producing 90% of a draft genome (in which the average DNA sequence is 99.9% complete) by the spring of 2000 (see p. 2304). Collins noted that the public draft is only 85% assembled. "You could say we're still 5% short," he acknowledges, but adds that with 97% of the genome covered by clones whose location is known, "we are substantially ahead of where we expected to be at this time."

Collins estimated that the cost to produce the public draft genome (not counting related research or building costs) will be about $300 million in total, of which roughly $150 million will be paid by his agency. The public consortium will finish the draft this year, then produce a polished human genome (99.99% complete) by 2003 or sooner, while moving on to sequence other organisms, including the rat and mouse. Venter declined to discuss costs, other than to say Celera's human genome effort required 27 million DNA sequencing "reads" at less than $2 each.

Celera has not changed its policies on data release or patenting. Academic researchers who agree to use Celera's data for noncommercial purposes will be permitted free access to its raw human genome data with some minimal annotation, but not its detailed annotation of gene function and structure. Venter says the company has already filed "about two dozen unique gene patents" and will file more.

It's not clear at this writing how substantive the cooperation between Celera and the public consortium will be. Collins, for one, said the current truce amounted to "coordination, not collaboration." For now, the public and private teams are planning to produce independent scientific papers on the sequence data and, after that, to annotate the data independently. Collins explains that he doesn't expect Celera to share such information publicly because to do so would require giving away proprietary information. But the public

CREDIT: R. KOZAK

consortium and Celera are expecting to hold a joint conference next year to share information on their different methods of sequencing the genome. Eric Lander, director of the Whitehead Institute/MIT Center for Genome Research in Cambridge, Massachusetts, called this an "exciting" prospect, because the approaches were "complementary," producing "two different looks" at the genome.

No one can say at this time where or when any of the data will be published. Patrinos hopes it will appear "back to back" in the same journal this fall. But Venter, who's closer to having results in publishable form, says he has no idea where the manuscript will go: "We haven't decided yet."

The scientists did agree on one thing, though: The president was right when he said that "today's historic achievement is only a starting point. There is much hard work yet to be done." –ELIOT MARSHALL

PLANETARY SCIENCE

Making a Splash With a Hint of Mars Water

It began as a whisper on the Web a week ago Monday evening, grew to a noisy torrent of media babble by Wednesday, and on Thursday morning crashed onto the front pages. Moving at the light-speed pace of modern media, a wave of chatter about water and therefore possible life on Mars swept a paper at *Science* into headline news a week before its scheduled publication.

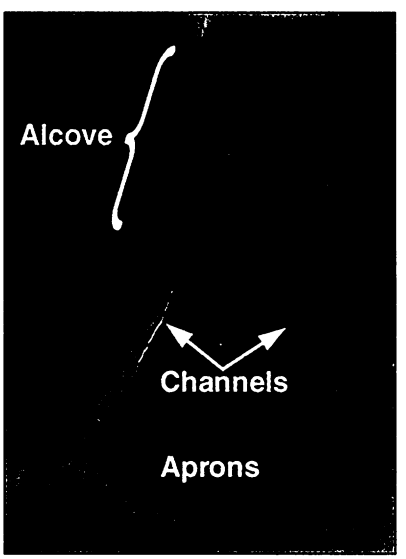
The paper, on page 2330 of this issue, features high-resolution pictures of muddy-looking gullies on the sides of martian craters, suggesting the prospect of liquid water on, or at least near, the surface of the planet. That prospect has thrilled planetary scientists who have been scouring a seemingly bone-dry planet for 30 years. "It's the smoking gun that says there's liquid water and Mars has all the requirements for life," astrobiologist Bruce Jakosky of the University of Colorado, Boulder, told a packed NASA press conference last Thursday, at which the paper was released early. Not so fast, caution a number of planetary scientists. "I'm skeptical just because of how difficult it is to have liquid water on or near the surface of Mars," longtime Mars geologist Michael Carr of the U.S. Geological Survey (USGS) in Menlo Park, California, told the press conference. "It's just simply too cold, incredibly cold." Carr and others are already coming up with alternative explanations for the rivulet-ridden piles of debris that exclude stores of liquid water and therefore readily accessible life.

Opening the press conference, planetary geologist Michael Malin of Malin Space Science Systems Inc. (MSSS) in San Diego warned that "the actual science may pale before the science fiction that has been written." The fiction grew out of an accurate, if vague, item on the independent watchdog Web site, NASA Watch (www.nasawatch.com), late afternoon on 19 June. It reported, apparently from sources in the astrobiology community, that NASA had briefed the White House (presidential science adviser Neal Lane, as it turned out) on a major discovery involving water on Mars. Other Web sites added details through Tuesday, 20 June; *USA Today* put a Web-sourced story at the top of its front page Wednesday morning. The information gleaned anonymously from NASA headquarters personnel and researchers around the country ranged from on target—signs of recent spring activity—to unlikely: ponds and even the possibility of geysers. Although no reporters appeared to have seen the paper (by Malin and his MSSS colleague Kenneth Edgett), *Science* decided to stem the flow of misinformation by releasing it.

Fiction aside, the reality proved enticing enough. The evidence for water flowing on the surface of Mars comes from Malin's high-resolution camera orbiting the planet on Mars Global Surveyor for the past 2 years. In about 200 of the 65,000 images returned so far, Malin and Edgett found places where water appears to have emerged from a crater wall or valley side. All the sites are above 30° latitude, mostly in the southern hemisphere. It looks as though the emerging water ate away at these steep slopes, the water and debris flowing down to form a channel-riddled pile or apron. "Had this been seen on Earth, there would be no question water is associated with it," said Malin. And these "aproned alcoves" are so devoid of impact cratering and other ravages of time that they must be "very, very young," said Edgett. They could have been active yesterday, he said, but conceded that, given the difficulties of gauging time on Mars, they could be as old as 1 million or 2 million years.

No one doubts that a fluid emerging from the martian rock formed these stunningly Earth-like features. And, by analogy with Earth, the likely fluid is water draining from an aquifer—a permeable, water-filled layer of rock—cut by a crater or valley. "That water has to be kept warm somehow," said Malin. "I don't know how. There has to be some geothermal component" to the warming. Because there are no volcanic heat sources apparent, as are found at Yellowstone or in Iceland, Malin considers the possibility that "our idea of what [the inside of] Mars is like thermally is all wrong."

However liquid water makes it as far as a crater wall, Malin and Edgett then draw on the warmth of sunlight to explain an oddity of the geographical distribution of seep sites. They find that sites occur about two and a half times more often on pole-facing slopes—the most shadowed and therefore coldest surfaces at a given latitude—than they do on warmer, equator-facing slopes. They argue that the sun's warmth on equator-facing slopes keeps aquifer water flowing out of the surface by rapidly evaporating it, avoiding any obvious erosion. On colder, pole-facing slopes, the water freezes to form an icy barrier. That barrier eventually breaks, perhaps after pressure builds in the aquifer, wasting away the wall face and releasing a burst of pent-up liquid water to form the aprons.



A leaky Mars? Springlike seeps (0.5 km across) may dot the Red Planet.

CREDIT: NASA/JPL/MSSS

This scenario of continuously liquid water doesn't sit well with some planetary scientists. "It's simply not credible to create a near-surface aquifer" on Mars, says planetary scientist Stephen Clifford of the Lunar and Planetary Institute in Houston. The surface of Mars is so cold—on average –70° to –100°C—and the internal fires of the planet