16.5-kilometer-per-second dash through the gas and dust continually blown off a comet nucleus was an afterthought. Complicating matters, its star tracker, the spacecraft's only means of orienting itself, failed in 1999. With its camera jury-rigged as a replacement, "the encounter did not go the way we expected," said project manager Marc Rayman of JPL: "It went perfectly." By sheer luck, the spacecraft dodged a massive dust jet to return analyses of ions in the comet's hazy coma of dust and gas, infrared spectra of the nucleus, and black-and-white pictures sharper than any of comet Halley returned by a flotilla of spacecraft in 1986.

These detailed images revealed a terrain of diverse features. Each end of the nucleus has plateaus. A smooth, brighter plain at the center is emitting at least three columnar jets where the sun's heat is excavating a saddle-shaped depression. In addition, fractures crisscross the comet, several of them right in the thin neck of the bowling pin, according to planetary geologist Laurence Soderblom of the U.S. Geological Survey in Flagstaff, Arizona. "It's quite possible" Borrelly could break in two, either at the center or at the neck, he says. The way Borrelly seems to rotate would keep the jetting saddle continually illuminated while the comet is near the sun, adds comet specialist Donald Yeomans of JPL, hastening erosion at that spot. Eventually, the nucleus might even break into many pieces and vanish, just as comet LINEAR did in July 2000.

Deep Space 1 will meet a less spectacular end: In November, after more strenuous testing of its ion engine, its controllers will simply stop talking to it. **–RICHARD A. KERR**

PSYCHOPHARMACOLOGY

Drug Critic Sues After School Pulls Job Offer

A British psychiatrist and critic of antidepressant drugs is suing the University of Toronto (UT) and an affiliated mental health center for breach of contract after the center rescinded a job offer to him.

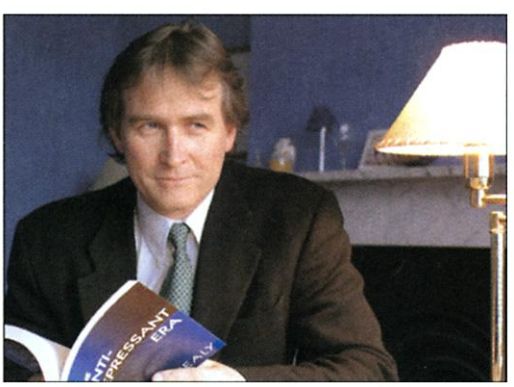
David Healy, a reader in psychological medicine at the University of Wales College of Medicine in Cardiff, claims that his academic freedom was violated after he gave a speech last fall criticizing drug companies and arguing that the popular antidepressant Prozac "can lead to suicide." His suit, filed in Toronto on 24 September, seeks reinstatement of the job offer at the Centre for Addiction and Mental Health (CAMH) or $9.4 million in lost salary and damages for libel. CAMH officials have told Healy—and explained in letters to their staff—that they felt his views are "extreme" and incompatible with the responsibilities he would assume.

Healy is a prominent historian of psychopharmacology who in recent years has testified as an expert witness for plaintiffs claiming injury from drugs like Prozac, known as SSRIs (selective serotonin reuptake inhibitors). In August 2000, CAMH formally offered him the post as clinical director of its mood and anxiety disorders program and professor of psychiatry at the University of Toronto, at an annual income of about $250,000. Healy accepted the written offer the following month.

On 30 November, Healy delivered a lecture in Toronto on "psychopharmacology and the government of self." In the talk, which he has given at numerous other locations and posted on his Web site (www.pharmapolitics.com), he discussed negative effects of antipsychotic and antidepressant drugs, including brain injury and suicides. The lecture caused quite a stir.

Less than a week later, CAMH chief physician David Goldbloom informed Healy that "While you are held in high regard as a scholar of the history of modern psychiatry ... we believe that it is not a good fit between you and the role as leader of an academic program. ... This view was solidified by your recent appearance." In a 17 May letter to his board of directors, CAMH head Paul Garfinkel wrote that Healy "has expressed extreme views that are inconsistent with published scientific evidence. These views go well beyond his peer-reviewed published work." Garfinkel said Healy's future colleagues were "shocked" by his presentation "to the point where the Centre felt that Dr. Healy would not have the necessary respect and support of staff."

Healy has sought support for his position, and last month 30 scientists—including Nobelists Arvid Carlsson and Julius Axelrod—signed a letter to the university saying that the case was an "affront" to academic freedom. Healy says that his views on psychotropic drugs should not have surprised



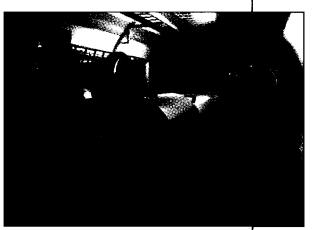
Costly words. David Healy's lecture led a Canadian mental health center to withdraw its job offer.

CREDITS: (TOP TO BOTTOM) CERN; COURTESY OF D. HEALY

ScienceScope

Budget Acceleration Europe's flagship particle accelerator, the Large Hadron Collider (LHC), is having budget troubles. The $1.6 billion project is facing a 20% budget overrun, officials revealed last month, with no easy solution in sight.

The increases are due to unexpectedly high excavation costs and rising prices for the LHC's 1236 superconducting magnets—which nudge charged particles along their 27-kilometer circular path—according to Luciano Maiani, director-general of CERN, the LHC's home lab near Geneva.



Next month, Maiani will have to present CERN's finance committee with a plan for paying the increased cost. It may involve obtaining extra loans and asking LHC partners, including the United States, to cough up more cash.

Physicist Gerardus 't Hooft of Utrecht University in the Netherlands worries that the money troubles could delay LHC operations, now set to start in 2006. But CERN officials aren't worried, saying there are "no technical reasons yet for a delay."

Retying the Knot Scientific collaborations between the United States and India and Pakistan have received a green light in the wake of the 11 September terrorist attacks.

The U.S. government cracked down after both nations tested nuclear weapons in May 1998, requiring U.S. organizations to obtain a license before shipping civilian materials deemed to have a dual military use to more than 300 institutions. The so-called "entities list" was trimmed somewhat in December 1999 and again in March 2000.

The latest easing, according to Indian officials, lifts the rules for most civilian R&D organizations, including many under the Defense Research and Development Organization. It follows a 22 September decision by President George W. Bush to waive prohibitions on trade in dual-use materials. Sri Krishna Joshi, a solid state physicist and president of the Indian National Academy of Sciences, welcomed the news, calling the restrictions "totally unnecessary." A small number of agencies involved in nuclear, missile, and space programs in the two countries remain under the restrictions.

university officials, who he suggests are trying to assuage Eli Lilly and Co., the maker of Prozac, which in recent years has given $1.5 million to CAMH.

CAMH officials have denied that their actions have any financial motive. In an April letter to Healy (available on his Web site), Goldbloom wrote that Healy's comments about "thousands of people killing themselves ... because of fluoxetine [Prozac] ... were incompatible with published scientific evidence and hence incompatible with ... responsibility of leadership of a clinical and academic program." Jack Barchas, chair of the psychiatry department of Cornell University Medical School in New York City, says that Healy has done "superb" work on the history of psychopharmacology but that his claims about SSRIs are "not convincing."

Healy says that results from a small study of SSRIs on healthy volunteers support his arguments but that "confidentiality orders" prevent him from revealing additional data. But Barchas says publication is the only way for Healy to make a convincing case. "There's not a major journal in the field that wouldn't be delighted to receive a careful evaluation of this data," Barchas says.

–CONSTANCE HOLDEN

GENETICS

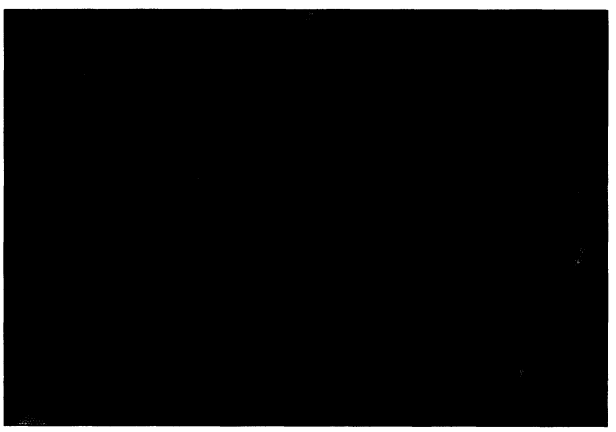
Closing In on the Centromere

The centromere is one of the genome's greatest enigmas. First noticed 120 years ago under a microscope as the cinched waists of the chromosomes, these sections of DNA have until now defied the best efforts of cell biologists and geneticists to understand them. Yet the centromere is critical for the proper sorting of chromosomes during cell division; if it doesn't work correctly, the result can be cancer, defects in development, or similar misfortunes.

Now, on page 109, geneticists from Case Western Reserve University and University Hospitals of Cleveland Research Institute in Ohio provide the clearest look yet at a human centromere. Huntington Willard and his colleagues have demonstrated that a 3-million-base stretch of DNA embedded in what many have called the centromere is really all it takes to make a functional centromere. To their surprise, the nature of this core DNA indicates that, rather than being highly conserved, the centromere has changed significantly during primate evolution. "It's a fundamental study using an elegant genomics and genetics approach," comments Peter Warburton, a molecular biologist at Mount Sinai School of Medicine in New York City.

For decades, researchers have known that centromeres and their associated proteins are anchor points for the spindle of fibers that separates paired chromosomes, causing the two to move to opposite sides of the cell as it divides. They have observed under the microscope that when each chromosome replicates in mitosis, the two resulting chromatids are linked at the centromere until the spindle pulls them apart.

Twenty years ago, Willard suggested that repetitive DNA—short patterns of bases repeated over and over that are characteristic of the centromere in most higher organisms—could be important to the centromere's function. "I caught a fair bit of flak for suggesting that repetitive DNA had a role," he recalls.



Centromere revealed. The "waist" of paired chromosomes, the centromeres can be located by the yellow stain revealing centromeric proteins in both native chromosomes (blue) and artificial ones (red). The X chromosomes' centromeres are red dots.

CREDIT: M. K. RUDD/CASE WESTERN RESERVE UNIVERSITY

About that same time, biologists sequencing budding yeast determined that its centromere was a small stretch of nonrepetitive DNA, just 125 bases long. This new finding suggested that the repetitive DNA, called heterochromatin, was not the actual centromere but rather flanked it.

But when researchers later tried to determine the structure of the centromere in a range of organisms, from humans to flies, they hit a brick wall. Their high-powered sequencing machines stopped dead when they reached the heterochromatin. And in those rare instances when parts of that DNA could be sequenced, researchers were stymied in attempts to reassemble those parts into a whole centromere.

Willard persisted, however, urging grad student Mary Schueler to take a close look at the centromeric regions in human X chromosomes. She and her colleagues also focused on centromeres from patients with Turner syndrome, who often have truncated sex chromosomes. In some of these patients, the X chromosome was chopped off right where one of the chromosome's two "arms," the P arm, meets the heterochromatin flanking the centromere. Using these as a starting point, Schueler began working toward the center of the centromere, mapping the repetitive sequences along the way in anticipation of someday sequencing them.

Called alpha satellite repeats, each "repeat" in this 450,000-base region was about 171 bases long and was almost—but not exactly—identical to the other repeats. As Schueler approached the center of the centromeric region, she found that the DNA sequence changed to what is known as a higher order array. Not only did this stretch contain recurring sets of 171-base repeats—the hallmark of alpha satellite DNA—but each set had a dozen repeats and then the entire set was repeated again.

When Willard and his colleagues deleted the flanking DNA, they found that the higher order array, some 3 million bases long, could still function in cell division, suggesting that it made up the true functional centromere. The researchers put that suggestion to the test by inserting the higher order array into artificial chromosomes; it acted like a normal centromere during cell division, vindicating Willard's earlier hunch. "They showed that the sequence they were looking at was competent to be a centromere," says Steve Henikoff, a geneticist at the Fred Hutchinson Cancer Research Center in Seattle.

Because the centromeres have been so difficult to tackle, they remain as gaps in most completed sequences, including that of the human genome. But this work "is a major boost for convincing people to attack difficult [chromosome] regions," says Daphne Preuss, another persistent geneticist at the University of Chicago who has been unraveling the centromere of the plant *Arabidopsis* (*Science*, 15 December 2000, p. 2057). To date, Schueler and her colleagues have sequenced just a bit of the centromeric region closest to the P arm of the X chromosome, but they plan to forge ahead. "It's been assumed that these regions are too difficult," Schueler explains. "But that is not the case. You can map and sequence them."

Already the data hint at the history of the centromere on the human X chromosome. Based on the sequencing of the centromere completed to date, Willard's team concludes that the higher order array contains far fewer sequence variations—with the sets of repeats being more than 98% identical—than the flanking sequences. This suggests that the core is much younger than the flanking re-