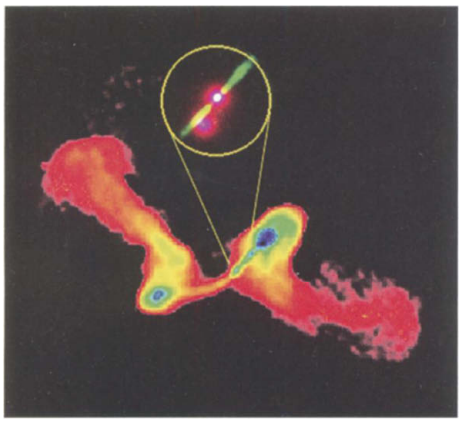


Crossing pattern. A jet (*inset*) at the core of the merging galaxy system NGC 326 might have flipped direction when two giant black holes combined.

the center of our Milky Way, have revealed that most galaxies host supermassive black holes with millions or billions of times the mass of the sun. In active galaxies—those that spew enormous fountains of energy into space—theory holds that these vortexes spin at awesome rates as they devour gas and stars. The incoming matter spirals into a raging disk, which shoots jets into space at nearly the speed of light. Astrophysicists don't yet understand this process, but they assume that the jets mark a black hole's spin axis.

Previous surveys showed that about 7% of active radio galaxies have X-shaped, or "winged," jets ranging in shape from narrow beams to cones. Astronomers thought these features pointed to a precession of the central black hole, much as Earth's spin axis wobbles over time. However, recent high-resolution radio images of some winged galaxies show sharp breaks where a pair of jets angles off into a new direction, rather than sweeping out gradual curves (see figure, above). "That's clearly not precession," says astrophysicist David Merritt of Rutgers University, Piscataway, New Jersey. "It has to flip over."

The likeliest mechanism is the arrival of a second massive black hole during a galaxy collision, say Merritt and his colleague, radio astronomer Ron Ekers of the Australia Telescope National Facility in Sydney. According to their model, an incoming black hole with at least 20% of the mass of its partner will knock the main black hole off kilter, no matter how rapidly it spins.

The calculation agrees with an independent analysis of black hole mergers using Einstein's theory of general relativity, says astrophysicist Scott Hughes of the University of California, Santa Barbara. "It's really hard to torque a black hole around by a large amount without having something as massive as another black hole slam into it," Hughes says. He and astrophysicist Roger Blandford of the California Institute of Technology in Pasadena are preparing their work for publication.

From estimates of how long the X-shaped radio lobes persist, Merritt and Ekers deduce that a typical large galaxy will undergo a black hole–tilting crash once every billion years. That's enough for one such event to pop off somewhere in the universe each year. The result bodes well for astrophysicists who hope to observe the intense ripples in spacetime, called gravitational waves, that should cascade from such mergers.

The research should spur theorists to figure out how gigantic black holes manage to merge—instead of forming binaries that waltz for billions of years, as most models hold. "This suggests that nature does find a way to bring some black holes together," Merritt says. "We're just not sure how."

–ROBERT IRION

EUROPEAN PATENTS

Tough Stance on Stem Cell, DNA Claims

BERLIN—Biotech players hoping to stake claims on human stem cells or DNA sequences in Europe saw a couple of warning shots whiz across their bows last week. On 24 July, the European Patent Office (EPO) strongly limited a controversial patent covering stem cell technology, striking out all references to human or animal embryonic stem (ES) cells. And the influential Nuffield Council on Bioethics, a British think tank, called on patent offices around the world to refrain from awarding patents on DNA sequences.

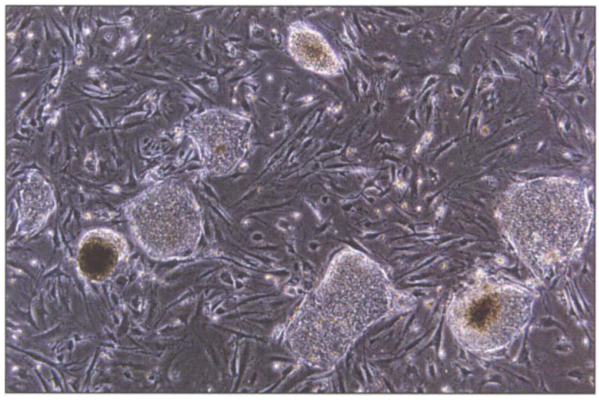
EPO cautioned against reading too much into a single decision in the rapidly developing field of stem cell research. "One could not possibly deduce a patent policy from a single case," says EPO spokesperson Rainer Osterwalder. Nevertheless, EPO's stance contrasts sharply with policies at the U.S. Patent and Trademark Office (USPTO), which has granted half a dozen patents involving human ES cells, including a broad patent on the technique used to derive cell lines. That patent's owner, the Wisconsin Alumni Research Foundation, claims that its patent covers all import and use of human ES cells in the United States. Its application for a similar patent in Europe is under review at EPO.

Last week's EPO ruling concerned the so-called Edinburgh patent, which covers techniques for using molecular markers to identify stem cells. Granted in 1999 to developmental geneticist Austin Smith of the University of Edinburgh and Peter Mountford of Stem Cell Sciences in Melbourne, Australia, the patent generated controversy 2 years ago when Greenpeace charged that its transgenic animals claims could be construed as covering the creation of transgenic humans (*Science*, 3 March 2000, p. 1567).

EPO admitted that it had erred in allowing that claim, explaining that the examiner had simply overlooked the possibility that the patent might cover the creation of human beings. And the patent holders said they never intended to conduct such experiments. Indeed, when the storm broke they proposed modifying their claim accordingly. But before they could do so, 14 parties, including Greenpeace and the governments of Italy, Germany, and the Netherlands, filed opposition petitions.

After 3 days of hearings, an EPO review panel concluded that the patent conflicted with the European Patent Convention, which governs EPO, on two grounds: The convention prohibits patents involving the use of human embryos for industrial or commercial purposes, and it requires that work described in a patent be specific enough to be repeated by an expert in the field. The claims involving ES cells were too vague, the panel said, in part because the patent application was filed in 1994, several years before scientists first reported isolating human ES cells. Faced with that ruling, the patent holders agreed to strike all references to ES cells, leaving only claims dealing with stem cells derived from adults or fetal tissue. The panel allowed the narrower patent to stand and will issue a written decision within several months, after which either side can appeal.

Some experts argue that the ruling does not preclude future patents on the use of human ES cells. According to George Schlich, a patent attorney for the University of Edinburgh and Stem Cell Sciences, researchers might still be able to win European patents on processes involving differentiation of human ES cells into tissues that could be used to treat diseases such as diabetes or heart disease. The key, he says, would be to focus



Ruled out. The European Patent Office has struck down patent claims covering human embryonic stem cells.

CREDITS: (TOP) M. MURGIA *ET AL*./NRAO/VLA; (INSET) STSCI; (BOTTOM) UNIVERSITY OF WISCONSIN, MADISON

a patent on the resulting tissue rather than the starting material, whether that is ES cells or stem cells derived from adults.

In the meantime, if an international panel gets its way, patents on DNA sequences could become harder to win. A day before EPO's ruling, the Nuffield Council on Bioethics issued a report recommending that patents on DNA sequences be "the exception rather than the norm." The report calls for patent offices to distinguish among different uses of a genetic sequence—for example, a specific genetic test, a method of gene therapy, or production of a therapeutic protein—and in general to grant patents on a specified use rather than on the DNA sequence itself. Making such distinctions could help clear up some of the ethical and legal debates over DNA patents, says biotechnology patent expert Mildred Cho of Stanford University. But implementing the Nuffield Council's recommendations, she says, "would require a major shift in thinking at the USPTO" and other patent offices. **–GRETCHEN VOGEL**

2003 U.S. BUDGET

NSF Gets Big Lift; Pluto Mission Backed

Senators Barbara Mikulski (D–MD) and Kit Bond (R–MO) have delivered on their promise to put the National Science Foundation (NSF) budget on a 5-year doubling track. But they also served notice that they are putting the agency on a tight leash.

Mikulski and Bond are chair and ranking member, respectively, of a Senate Appropriations Committee panel that has written a $91 billion bill covering the 2003 budgets of NSF, NASA, the Environmental Protection Agency (EPA) and dozens of other agencies. Last week, the full committee approved a 12% increase for NSF, to $5.35 billion, the largest percentage boost for any major agency in its jurisdiction. The legislators also overrode a White House plan to halt work on a Pluto mission and gave EPA science programs a slight increase.

The committee's vote is only the first step in a budget journey that might not conclude until after the November elections, but it's a big push for NSF's supporters, who have been urging Congress to match the explosive growth enjoyed by the National Institutes of Health in the past 4 years. "This is definitely a positive signal," says Samuel Rankin of the American Mathematical Society and the Coalition for National Science Funding, which is aiming for a 15% increase.

NSF's increase, for the fiscal year starting 1 October, is more than twice the 5% boost requested by the president. Research programs would jump by 15%, to $4.13 billion. Big winners within that account would include the physical sciences, graduate student stipends, a program to help have-not research states, cybersecurity, and research instrumentation.

At the same time, Mikulski and Bond would throttle back on a new program to improve math and science education (*Science*, 11 January, p. 265), expressing concern about NSF's ability to spend its $160 million allotment for this year. And they want to keep a closer eye on NSF's management of big projects. In addition to delaying the start of a proposed $12 million network of environmental monitoring stations, the bill would cut $15 million from a new $35 million earthquake detection and research network, called EarthScope, and freeze the money until NSF hires a permanent director to oversee big new research facilities (*Science*, 12 July, p. 183). The legislators also gave a whopping 28% boost to the agency's in-house watchdog, the inspector general, to carry out more audits of NSF programs.

Promise kept. Senators Barbara Mikulski (*above*) and Kit Bond delivered for NSF.

EPA's science and technology account would receive a 1.7% boost (not counting $90 million in supplemental funding in 2002) to $710 million, more than reversing a 4% cut that the White House requested. The increase includes $10 million for the STAR graduate fellowship program, which the president had proposed transferring to NSF without providing funding—effectively killing it. The Senate bill restores the money and keeps the program at EPA. In a related move, the NSF portion of the bill deletes the proposed transfer of $76 million in programs from EPA and two other agencies (*Science*, 8 February, p. 954).

NASA's $15 billion request—just slightly more than the current budget—would increase by $200 million in the Senate bill. Legislators also set aside $105 million for a Pluto mission that the White House has put on hold, an amount that falls $50 million short of what mission planners say is needed to keep it on track for a 2006 launch.

Legislators also restored a $7 million cut proposed by the White House in the $17 million National Space Biomedical Research Institute in Houston, a move that had angered Texas lawmakers. But the NASA portion of the bill is chockablock with projects, such as $2 million for an aquarium in Maine, that benefit the districts of specific lawmakers but are not related to NASA's mission. The list of so-called earmarks is expected to grow this fall when the House marks up its version of the bill. **–JEFFREY MERVIS**

With additional reporting by Jocelyn Kaiser and Andrew Lawler.

WOMEN'S HEALTH

U.K. Hormone Trial to Pause for Review

For at least 3 months, no new patients will be enrolled in a large trial of hormone replacement therapy (HRT) taking place in the U.K., Australia, and New Zealand. The U.K. Medical Research Council (MRC), the trial's main sponsor, ordered the pause last week and decided to ask an international panel to recommend whether to continue the trial in the face of evidence that prompted termination of a similar U.S. study 3 weeks ago. However, women already enrolled will be asked to keep taking their pills.

Safety reviewers halted the U.S. study, designed to test the long-term benefits and risks of HRT, after an interim analysis found that taking a combination of estrogen and progestin was too risky. The reviewers concluded that an increased risk of breast cancer, stroke, and heart disease outweighed benefits related to colorectal cancer and bone fractures (*Science*, 19 July, p. 325).

Despite the findings of excess risk, U.K. leaders of the Women's International Study of long Duration Oestrogen after Menopause (WISDOM) saw no compelling reason to halt their own trial. Both WISDOM's steering committee and an independent safety panel unanimously concluded that the U.S. study, part of the Women's Health Initiative (WHI), had not conclusively demonstrated the increased risk of heart disease. That meant the balance of risk and harm from HRT was still uncertain, they said, and it was ethical to keep enrolling women, provided they were fully informed about the risks (*Science*, 26 July, p. 492).

CREDIT: (TOP) RICK KOZAK