



### STEM CELLS

## Korean University Will Investigate Cloning Paper

**SEOUL AND TOKYO**—Embattled Korean stem cell scientist Woo Suk Hwang and his university have bowed to pressure for an investigation into a growing list of questions about a landmark paper he and colleagues published in *Science* in June 2005 (17 June, p. 1777). On 12 December, Seoul National University (SNU), where Hwang works, announced it will conduct an investigation at the scientist's request. This follows a 7 December petition for an investigation from 30 SNU faculty members to university president Un Chan Chung. Prompted initially by anonymous allegations made on a public Web site about irregularities in the paper, scientists in Korea and elsewhere are calling for the paper's key DNA fingerprinting tests to be redone by an independent researcher.

(As *Science* went to press, one of Hwang's co-authors, Gerald Schatten of the University of Pittsburgh in Pennsylvania, asked *Science* to remove his name from the paper.)

Meanwhile, stem cell researchers elsewhere are worried about the possible fallout. The lab's as-yet-unreplicated feat of creating human embryonic stem (ES) cell lines that match the DNA of patients inspired a global ramp-up in stem cell efforts. Such ES cell lines might one day provide replacement cells genetically matched to a patient suffering from Parkinson's disease or diabetes. Hwang's team not only showed that producing such ES cell lines was possible but also that it could be done efficiently, with relatively few donated oocytes per cell line. Alan Colman, head of Singapore-based ES Cell International and a member of the team that produced Dolly the sheep, the first cloned mammal, says, "I'd still like to believe this is a case of sloppy presentation but good science." If the results of the paper do not hold up, he says it could set the field back to a time when many thought the research "was too difficult and inefficient to pursue." It would also provide ammunition to

opponents of the research, he says.

The latest revelations center on the DNA fingerprinting in the paper's supplementary online material first posted on 19 May 2005; the fingerprinting data purportedly show that



**Back to work.** Cloning researcher Woo Suk Hwang returned to his lab on 12 December. He had been hospitalized for several days suffering from symptoms of stress and fatigue.

the ES cells are genetically identical to the patients. There are also new allegations about another set of images in the online material that Hwang last week told editors at *Science* had been erroneously duplicated (*Science*, 9 December, p. 1595). All the scientific questions can apparently be traced to anonymous observations about the paper posted on an Internet message board hosted by the Biological Research Information Center (BRIC) (bric.postech.ac.kr). BRIC officials declined to comment, but a senior Korean scientist who has followed the postings agreed to discuss the issue provided he not be identified. (The Korean scientists contacted for this article requested anonymity because they fear a backlash against what are perceived to be attacks on Hwang, who has become a national icon. "This issue is now completely beyond the realm of science," one laments.)

The senior scientist says the message board writer, who claims to be a life science researcher, first pointed out the possibility of duplicated images early on 5 December Korea time. Hwang's e-mailed notice of problems with duplicate images arrived at

*Science*'s editorial offices on 4 December at 11:29 p.m. Eastern Standard Time, which would have been 1:29 p.m. on 5 December in Korea, or several hours after the images were posted on the message board.

On 7 December, a critique of the DNA fingerprinting results appeared on the BRIC site. DNA fingerprinting shows a genetic match between two samples when peaks in the traces line up. But because the height and shapes of peaks are influenced by random factors, they should not be identical. The anonymous poster pointed out that the traces for several cell lines appear to be identical to the traces from the respective patients. In other cases, the background noise on the two traces looks very similar.

Alec Jeffreys, a genetic fingerprinting expert at the University of Leicester, U.K., said in an e-mail that "some of the traces do look unusually similar in peak shape and background noise." He declined to comment further without seeing the original data.

The anonymous poster also notes that Hwang's admission of duplicated images does not include other images that appear to have been duplicated.

The postings have elicited a flurry of responses. The consensus, says the senior scientist following the BRIC postings, seems to be that if Korean scientists don't take the lead in reviewing the paper, "the integrity of the Korean scientific community might be questioned by the world community."

Two of the 30 SNU professors who signed the petition asking for an investigation told *Science* the group first learned of the questions surrounding the paper from the BRIC discussion. One of the two professors contacted by *Science* says that they are not trying to discredit Hwang. "Dr. Hwang is a pioneer researcher in the field, and his studies should be pursued. We just see a serious need for a review."

The investigation comes amid a flurry of claims and counterclaims in the Korean media. On 10 December, a Korean news Web site called Pressian reported that it had seen a transcript from an unaired documentary by the Korean Munhwa Broadcasting Corp. MBC pulled the documentary, prepared for a weekly TV show called *PD Notebook*, in response to public outcry over allegations ▶

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The spotlight  
dims



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Another  
Hawaiian  
invasion



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A better  
light  
bulb?



that the investigative team had coerced its sources; MBC later apologized for the investigative team's transgressions. Pressian claimed that in an interview for the unaired segment, a member of Hwang's team alleged that Hwang had directed him to manipulate photographs of stem cells. The lab member had previously said that the interview was coerced. On 11 December, Hwang's team issued a statement dismissing the allegations.

In this charged atmosphere, SNU held a press conference on 12 December to announce its investigation. Jung Hye Roe, SNU's dean of research affairs, said SNU would form an

investigative committee of experts from within and outside the university. They will not be publicly identified and will not respond to press inquiries. Roe said SNU may cooperate with the University of Pittsburgh, which started its own investigation at Schatten's request. One of the two SNU professors contacted by *Science* says the announcement of the investigation is welcome. But this professor added that because the details have not yet been set, "we need to keep an eye on how the investigation goes." On 9 December, *Science* Editor-in-Chief Donald Kennedy wrote to Hwang encouraging him to cooperate with

efforts to verify his findings.

Colman thinks the only way to prove whether and how many of the ES cell lines match the donors is a new genetic analysis. "There is an absolute necessity now to have an independent investigator redo the fingerprinting," he says. But this could be problematic. Fresh samples might have to be taken from the donors, and that would entail again gaining informed consent. The university has not yet set any timeline for its investigation.

—DENNIS NORMILE AND GRETCHEN VOGEL

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SPACE SCIENCE

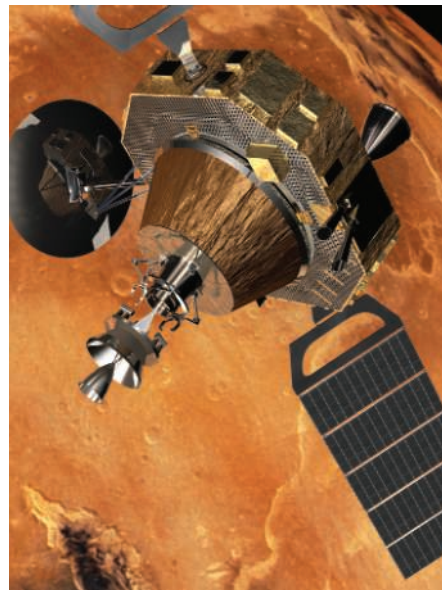
# ESA Hits the Right Note, and Funding Flows

To stay afloat, the European Space Agency (ESA) is forced to go through an often painful routine: It has to convene ministers from its 15 member states every few years and ask them to hammer out a long-term budget, generally requiring some hard sacrifices. But ESA got a pleasant surprise last week. Following the latest such meeting in Berlin, it came away with almost everything it asked for. ESA said it needed a total of \$10.04 billion for current programs and new initiatives covering everything from launcher development to exploration of Mars; it was granted \$9.87 billion, 98% of its request. There was one casualty: Ministers dropped a proposed collaboration with Russia to develop a crewed shuttle called Clipper.

The pain factor at ESA ministerial meetings usually involves haggling over how much member states are willing to pledge to mandatory programs—to which all must contribute in line with their gross domestic products—and how much each will splurge on optional programs. The largest chunk of mandatory funding goes to ESA's highly regarded science program. It has been suffering a decade-long erosion of resources as funding increases were pegged below inflation at earlier meetings. This time, science won \$2.5 billion for 2006–10, which includes annual increases of 2.5%, slightly above inflation. "Psychologically, this is a very positive step," says David Southwood, the program's director.

Cost overruns in several missions over the past few years have put the science program under severe pressure. It forced the cancellation of the Eddington planet-hunting mission in 2003 (*Science*, 14 November 2003, p. 1130)

and put the BepiColombo mission to Mercury under threat. The program "was facing a major crisis," says space scientist Mark Sims of the University of Leicester, U.K. Last week's reversal "makes many difficulties go away but not all of them," he adds. Southwood says the program will host a meeting of researchers in January to plan future priorities; in February, ESA's Science Program Committee will meet to decide which of four missions on the program's roster—Solar Orbiter, BepiColombo, the Gaia star-mapper, and LISA, a gravitational-wave interferometer—will get the go-ahead.



**There and back again.** Aurora's future plans include the Mars Sample Return mission.

The agency also won \$4.3 billion to continue its programs in the earth sciences, telecommunications research, participation in the international space station, development of the new, small Vega rocket, and further refinements to the giant Ariane 5. A new program, dubbed Global Monitoring for Environment and Security (GMES), won \$300 million, 26% more than ESA had asked for. GMES is a collaboration between ESA and the European Union to provide decisionmakers with environmental data from satellites.

Aurora, ESA's new optional program of planetary exploration (*Science*, 25 November, p. 1272), won enthusiastic backing. Aurora's first mission, the \$700 million ExoMars, will search for signs of life on the Red Planet. It was oversubscribed by about 8% at Berlin. "This should enable the mission to be bigger" than currently planned, says Sims, who chairs the U.K.'s Aurora Advisory Committee. The extra money could pay for a small orbiter in addition to the rover and base station already planned.

The one sour note was the failure of any of Europe's large spacefaring nations—France, Germany, Italy, and the U.K.—to support Clipper. ESA asked for \$60 million for 2 years of joint studies with Russian researchers to see if the minishuttle could give European astronauts independent access to space. Manuel Valls of ESA's exploration program says officials will spend the next 6 months or so refining the proposal and then present it again to member states. "It's a long-term program," Valls says. "Making it right will be worthwhile."

—DANIEL CLERY

CREDIT: ESA