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### STEM CELL RESEARCH

## Korean Cloner Admits Lying About Oocyte Donations

South Korea's ambitious plans to create a World Stem Cell Hub, announced in October, were thrown into uncertainty on Thanksgiving Day when Korean researcher Woo-Suk Hwang resigned as president of the venture and from other official posts. He remains a researcher at Seoul National University. Hwang acknowledged in an emotional press conference that two researchers in his lab had donated eggs for his research, and that donors had been paid for their contributions—something he had denied for months.

The admission seems to have done little to diminish Hwang's support in Korea, where he has enjoyed rock-star status, including an "I Love Hwang Woo-Suk" fan club ([cafe.daum.net/ilovehws](http://cafe.daum.net/ilovehws)). Colleagues have reportedly urged Hwang to stay on as leader of the country's bold bid at world leadership in stem cell research. Korean newspapers and Web sites report that sponsors are pulling ads from a TV program that uncovered alleged irregularities in Hwang's egg-collection methods, and Korean women are lining up to donate eggs for stem cell research: A group set up on 21 November to encourage egg donations ([www.ovadonation.or.kr](http://www.ovadonation.or.kr)) had been contacted by 800 would-be donors by the end of the week, according to a spokesperson.

Buoyed by the outpouring of public support, Hwang told *Science* in an e-mail that he's "considering reconsidering" his resignation. But such a turnaround seems unlikely as repercussions ripple through the global community of stem cell researchers. Most scientists would probably agree with bioethicist Insoo Hyun of Case Western Reserve University in Cleveland, Ohio, that "he did the right thing by stepping down."

The events that led to Hwang's downfall appear to be limited to the landmark paper he published in *Science* early last year announcing the world's first success in cultivating a line of stem cells from a cloned human embryo (*Science*, 12 March 2004, p. 1669).

The consent form, summarized in supporting online materials, said the 16 donors had received "no financial payment" for the 242 eggs they contributed to the experiments, although such payments would have been legal under Korean law at the time. (*Science* Editor-in-Chief Donald Kennedy says a correction will be published.)

Some activists and bioethicists wondered how Hwang's team could have located so



**A very public apology.** Woo-Suk Hwang's press conference prompted an outpouring of support in Korea but a more negative reaction elsewhere.

many willing egg donors. Then in May 2004, *Nature* reported that one of Hwang's Ph.D. students, a co-author of the paper, had said in an interview that she and another lab member had donated eggs. Such donations would be ethically questionable because students may feel pressure to donate. The student later denied it, however, pleading poor English skills, and Hwang denied that anyone from his lab had donated eggs.

Rumors about possible improprieties in egg donations heated up again this fall after the 19 October unveiling of the World Stem Cell Hub based at Seoul National University. Hwang's denials began to unravel on 11 November, when his most prominent U.S. collaborator, Gerald Schatten of the University of Pittsburgh in Pennsylvania, announced that he was severing ties with Hwang, claiming that Hwang had misled him

(*Science*, 18 November, p. 1100). Ten days later, Sung-Il Roh, who runs a fertility clinic at MizMedi Hospital in Seoul that supplied eggs for Hwang's research, announced that he had paid at least 20 women about \$1430 each for eggs he had furnished for the 2004 study. Roh said the collections occurred in 2002, before Korea passed a law making such payments illegal. As Hwang's work became well-known, Roh said women were willing to donate eggs without compensation. Roh insisted that Hwang did not know of the early payments.

Hwang finally came clean last week. He admitted that after receiving a call from *Nature* last year, he asked the two women if they had donated eggs. They confessed but "begged me not to publicize the fact" to preserve their privacy. "Now that I reflect on it," he said, "I regret that I didn't come out with the truth." As for payments to donors, he said, "I only found out that some of those eggs had been paid for when Dr. Roh called me a few days ago."

The revelations prompted the ruling party in South Korea's National Assembly to announce plans to set up a new group to ponder bioethics, and the Korean Bioethics Association convened a meeting to discuss what occurred in Hwang's lab. The institutional review board of Seoul National University's veterinary college also investigated the controversy and recommended that a third party with global credibility examine the matter.

Elsewhere in Asia, researchers are feeling the ripples. Norio Nakatsuji, a stem cell researcher at Kyoto University, worries that the fallout could affect discussions on government guidelines for human embryonic stem (ES) cell research, which he fears "may become more strict because of this event."

Arnold Kriegstein, head of the Institute of Tissue and Stem Cell Biology at the University of California, San Francisco (UCSF), says creation of the World Stem Cell Hub may have been "premature." He says hub officials approached UCSF as a possible location for one of the two planned subhubs for generating new lines of human ES cells. But Kriegstein says that after meeting with Hwang's delegation, "we decided not to participate," mainly because guidelines were ▶



unclear on ethical issues such as consent forms for egg donors and the tracking of research materials. Kriegstein and others are not writing off collaboration with the Koreans, however, and they acknowledge that Hwang's published findings are not in doubt. "It's not a blow to the field but to him personally," says Kriegstein.

In the United Kingdom, scientists have generally voiced sorrow about Hwang's mistake and pride in their own system of safeguards. "This highlights why the tough regulatory climate in the U.K. is protection rather than a problem," said biologist Steven Minger of King's College in London.

The future of the hub is now uncertain. On 15 November, the Korean government laid out plans to invest 11.5 billion won (\$11 million) in the venture and make it independent from Seoul National University. There will be no subhub in San Francisco, at least for now. It has been rebuffed by both UCSF and the new California Institute for Regenerative Medicine. And the San Francisco-based Pacific Fertility Clinic, which had agreed to help with egg collection, said last week that it had severed ties with Hwang. Ian Wilmut of the University of Edinburgh, which the hub was eyeing as its European outpost, said "we are saddened" by the events, but "I hope that we can develop col-

laborative links" with the Koreans.

Ironically, some maintain that Hwang now has an operation second to none in its ethical safeguards. This week, *The American Journal of Ethics* published an article by Hyun describing in detail the guidelines now used by Hwang's group for egg procurement, along with a commentary by Mildred Cho and David Magnus of Stanford University in Palo Alto, California, who say that if the outlined procedure is followed, it is "a major step toward meeting the highest standards of ethical oversight for oocyte donation." —CONSTANCE HOLDEN  
With reporting by Gretchen Vogel and Dennis Normile.

GLOBAL CLIMATE CHANGE

# The Atlantic Conveyor May Have Slowed, But Don't Panic Yet

The ponderous churning of the North Atlantic Ocean that carries warm water northward and returns deep, cold water to the south appears to have slowed in the past decade or two. That would mean that this oceanic radiator is bringing less heat to warm Europe and, if global warming is behind the slowdown, will carry less and less heat to high latitudes in the future. But the slowing is hardly larger than the uncertainty of the observations. And "we don't know enough about the ocean to know whether this represents a trend" that will persist, says physical oceanographer Harry Bryden of the National Oceanography Centre (NOC) in Southampton, U.K. Bryden and NOC colleagues report detection of the slowdown this week in *Nature*.

Oceanographers only last year put down a string of instrumented moorings spanning the Atlantic from West Africa to the Bahamas, so for a long conveyor record, the NOC group had to draw on five oceanographic surveys across that stretch of the Atlantic between 1957 and 2004. During ship crossings of a month or two, researchers measured seawater temperature and salinity from the surface to near the bottom. The NOC group used seawater densities calculated from those observations, plus current measurements of the Gulf Stream passing by Florida and a few

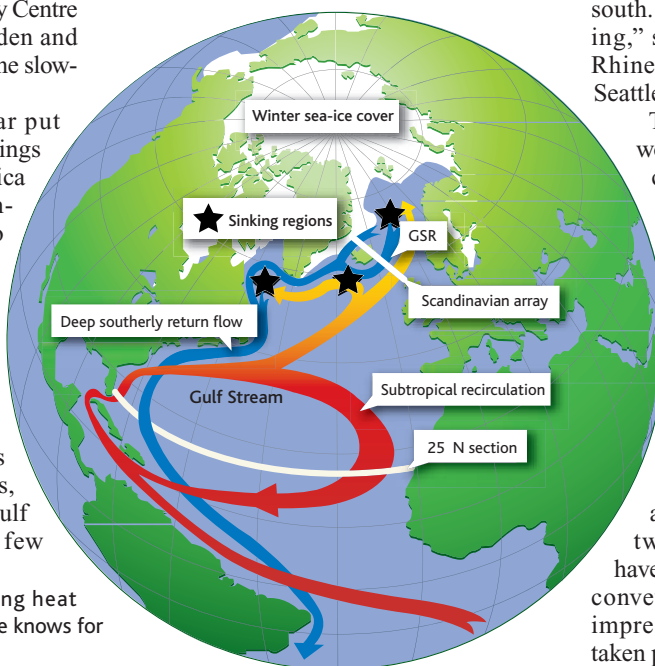
standard assumptions, to estimate the currents heading north and south through the depth of the Atlantic.

The Gulf Stream remained steady through the 47-year period, and Atlantic flows remained much the same through the 1992 survey. But according to the NOC group's analysis, the conveyor appears to have slowed dramatically in 1998 and 2004. Fifty percent more Gulf Stream near-surface waters were turning back southward before reaching very far to the north, whereas part of the deep southward flow of

cold water had decreased by 50%. All in all, the conveyor had slowed by 30%.

The slowing, although sizable, is comparable to the estimated uncertainty of the observations, Bryden notes. Still, "it's real variability," he says. Observed temperature changes driving the conveyor slowdown in shallower waters in the west and in deeper waters are just what he would expect from salinity and circulation changes previously reported in the far north (*Science*, 16 April 2004, p. 371). That's where the conveyor turns down from the surface and heads back south. "The pattern is reasonably convincing," says physical oceanographer Peter Rhines of the University of Washington, Seattle. "It's a pretty nice picture."

The picture is still fuzzy, however. "It would be dangerous to jump to the conclusion that there's a persistent weakening" of the conveyor circulation, says ocean and climate modeler Richard Wood of the Hadley Centre for Climate Prediction and Research in Exeter, U.K. Wood, Rhines, and Bryden all worry that the near-instantaneous snapshots taken by the ocean surveys might have been misleading. Like any part of the complex climate system, the conveyor is bound to slow down at times and speed up at others. The two latest surveys, Wood says, may have happened to catch the Atlantic as the conveyor slowed temporarily, giving the impression that a permanent change had taken place.



**A slowdown?** Currents (red) carrying heat northward may have slowed, but no one knows for how long.

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