

[The scientist behind stem cell success story](#)

[South Korean's lab announced major breakthrough this month](#)

- Jeremy Kirk, Chronicle Foreign Service
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Seoul -- When Professor Hwang Woo Suk enters his stem cell laboratory in Building No. 85 at Seoul National University, the blue-suited junior scientists don't even look up from their microscopes.

Hwang and his team, whose groundbreaking stem cell study was released 10 days ago, are working at full speed on research that has left researchers in other countries wondering how the South Koreans did it.

"We have no holiday in this laboratory," said Hwang, who has never taken a vacation with his family.

Their study, published in the May 19 issue of the journal *Science*, marks a crucial step along the path toward potential stem cell-based therapies. Hwang's 43-member team -- collaborating with scientists in the United States and the United Kingdom and within Korea -- created 11 different stem cell lines that exactly match the DNA of human patients with a variety of diseases.

In February 2004, the Korean researchers successfully transferred a single woman's DNA to an embryo, using a batch of 242 eggs donated by 16 women. What's remarkable about their latest accomplishment is that it involved only 185 eggs from 18 donors; 11 new stem cell lines were created from males and females ages 2 to 56.

The technique is called somatic cell nuclear transfer, a procedure that uses days-old donated embryos. It's not illegal in the United States, but in 2001 President Bush halted federal funding for all but a few existing stem cell lines, a move U.S. scientists say has limited what could be promising advances in disease treatments.

When stem cells are taken out of an embryo, it is destroyed, which abortion foes argue amounts to destroying a potential life.

In Washington, the House of Representatives voted Tuesday to lift the ban on federal funding for new stem cell research, and the Senate is likely to follow suit. But the House vote -- 238-194 -- fell short of the 290 votes needed to override Bush's threatened veto.

The method Hwang's team developed involves squeezing out the genetic material from an unfertilized human egg and injecting new genetic material. In Hwang's study, skin cells from humans were injected into the egg hulls. After fusing them with a slight electric charge, cells divided into new stem cell lines.

The goal of the emerging technology is to draft stem cells, which have the ability to transform themselves into cells compatible with various types of body tissues, in an effort to help repair spinal cord injuries and damage caused by diseases such as Parkinson's.

"He always says, 'Do not hurry. We need some time,' " said Kang Sung Keun, an assistant professor who worked on the study with Hwang. "He doesn't want to give some false impression to the patients."

Hwang, 52, grew up in South Chungcheong province; his mother raised cows, which prompted his interest in becoming a veterinarian. "I came from a very isolated, very small area," he said. "At the time, most Koreans faced poverty and starvation. Our family was also very poor."

Over the last five decades, South Korea has become the world's 12th- largest economy, a goal that seemed impossible at the end of the devastating Korean War in 1953. The government prioritized education and poured resources into high-tech fields. Seoul National University is publicly funded, and Hwang says his team gets \$2 million a year solely for research. The stem cell study reported in Science cost only \$250,000 of those funds.

"I think based on my experience, research projects don't depend on the amount of research funds," Hwang said. "I think the result of scientific research depends on (scientists') diligence."

News stories about the research breakthrough widely quoted Hwang as saying his team could manipulate eggs delicately by hand because Koreans use metal chopsticks. "I can say this Korean traditional dining habit would be one very small factor affecting the research outcome," Hwang said, smiling.

The techniques the South Korean team developed are considered therapeutic cloning and not reproductive cloning -- that is, the cloning of human beings. Despite U.S. limitations on federal support for stem cell research, California is undertaking a huge state-financed

therapeutic cloning research program, endorsed by voters in November's elections.

Hwang's research, by contrast, has the full backing of the South Korean government, although there are still ethical concerns in a country in which nearly half the population of 45 million is Christian. Hwang said he believes the general support of the Korean public has tempered some Christians' opposition, although he acknowledges some controversy remains. "When they realize the real goal of our research, they change their opinion," he said. "Some of the top Christian leaders in Korea, even they agree with our research. "

Most representatives in South Korea's National Assembly back stem cell research. On Wednesday, the government announced it would form a special stem cell research task force and pledged an additional \$1 million a year for Hwang's work.

"Hwang's results have showed us Korea's potential and confidence that 'we can do it' in science and technology," Park Ki Young, South Korean President Roh Moo Hyun's top science adviser, said in a statement.

The intellectual property rights to Hwang's work belong to the Korean government, and an opposition lawmaker called Friday for the government to create a special fund to secure expensive international patents.

The government has also quickly responded to emerging legal issues. When Hwang announced in February 2004 that his team had cloned a human embryo and taken out stem cells, there was no law dealing with cloning. On Jan. 1, a law went into effect banning the cloning of humans -- which Hwang has said repeatedly he has no intention of attempting -- but giving the go-ahead for therapeutic cloning.

In February, Seoul voted against a draft of a U.N. declaration that urged governments to ban all forms of human cloning. A Foreign Ministry statement read that the interpretation of human life should lie at a country's own discretion.

"The Korean government is fully supportive of our study," said Kang, the researcher in Hwang's lab.

Like everyone else entering the laboratory, Hwang puts on a one-piece baby-blue suit before he enters a sterilization chamber for a powerful shower of air. From there, Hwang enters a workplace that smells like a high-school dissection classroom.

He describes his lab as a factory, and it has all of the elements of an assembly line: Technicians work to withdraw eggs from clumps of cow and pig ovaries. After the eggs are prepared, they end up in an adjacent room where scientists carefully work to squeeze out the genetic material.

Last Thursday, Hwang explained the procedure involved in the preparation of pig eggs for cloning.

A technician carefully corralled an egg using a stabilization pipette. The egg then received an injection of fresh genetic material. With a tiny electrical charge, the egg was ready to start dividing.

Every day, seven days a week, such eggs are transported to farms where they are implanted into cows and pigs as part of cloning experiments, Hwang said.

By the end of this year, he said, he hopes to be injecting rhesus monkeys and baboons with human stem cells, the first such trials to test cross-species compatibility. Scientists haven't figured out what causes the stem cells to turn into other kinds of cells; discovering what the trigger is and how to control it are major goals.

Hwang is reluctant to speculate when stem cell research will yield safe treatments for people, but, he said, "when this technology can be applied to the human patient, I want it to help all of mankind."

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South Korean geneticist Hwang Woo Suk watches a cloning researcher manipulate pig and cow eggs. Photo by Jeremy Kirk, special to the Chronicle



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