

Less encumbered by societal restrictions on embryonic stem cells, scientists in the developing countries of Asia are giving Western researchers a run for their money

Asia Jockeys for Stem Cell Lead

Veterinarian Woo Suk Hwang and gynecologist Shin Yong Moon leapt from obscurity to scientific stardom last February when they isolated embryonic stem (ES) cells from cloned human cells, a world first and a key step toward therapeutic, or research, cloning.

Coming from a region that rarely produces scientific headlines, the announcement by the Seoul National University (SNU) pair stunned researchers around the world. But it was no fluke. Hwang has a long track record of successful animal cloning. Moon is South Korea's leading expert in assisted reproductive technology. The duo were able to draw on the expertise of a dozen co-authors at six institutions. And when Western scientists got their first peek into the SNU lab, they were astounded to see state-of-the-art facilities—and an enviable supply of egg donors.

Largely below the radar screen, the emerging economies of South Korea, Singapore, Taiwan, and China are fast becoming major centers for human ES cell research. Like their colleagues in the advanced scientific powers—including Japan, the United States, and many European countries—researchers in the developing countries of Asia are racing to learn how to transform ES cells into human tissues and organs, which could lead to treatments for conditions that are now intractable, such as diabetes, Parkinson's disease, and spinal cord injuries.

But there is one big difference: Unlike their colleagues in the United States and much of Europe, Asian scientists have the full support of their governments. Because obtaining ES cells involves the destruction of very early stage embryos, many Western governments have placed heavy restrictions on the work. But across Asia, there is little of the conflict with prevailing religious and ethical beliefs that has Western countries hesitating (see sidebar, p. 664). Governments are ramping up funding for both basic and applied stem cell work, setting up new institutes, programs, and grant

schemes, and providing incentives for private companies to join the effort. Giving these efforts a further boost, the region also has legions of lab workers willing to log long hours, and increasing numbers of expatriate scientists are returning home to work in the flourishing environment.

With all these advantages, Asia's scientists believe that they can be fully competitive in, and perhaps even lead, the race to harness stem cells. "Asia has never dominated

and a culture of secrecy among scientists hamper progress. Perhaps most pressing, says South Korea's Hwang, the entire region suffers from a dearth of experienced senior scientists to run the new programs.

A series of firsts

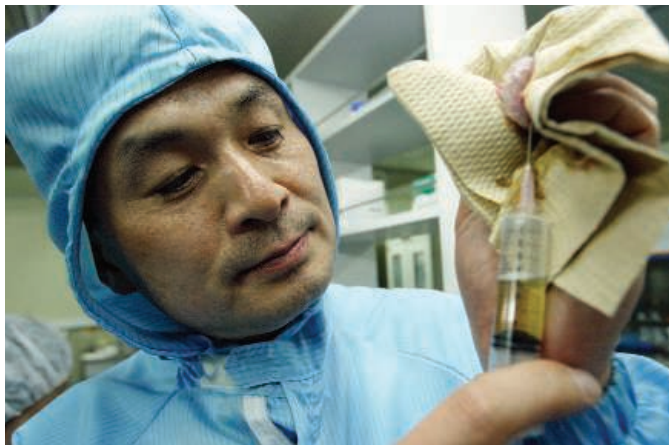
Asian scientists have been at the forefront of research on cloning and stem cells since its inception. At China's Shandong University, embryologist Tong Dizhou produced the world's first cloned vertebrate, an Asian carp, in 1963. He went on to create the first interspecies clone in 1973, by inserting European carp DNA into an Asian carp egg. But Tong's work remained almost unknown outside China.

Two decades later, in 1994, Ariff Bongso, an in vitro fertilization (IVF) expert at the National University of Singapore, reported the first isolation of human ES cells in the journal *Human Reproduction*. But Bongso was unable to keep the cells growing, so the work attracted little publicity. That changed when two U.S. groups—one led by James Thomson of the University of Wisconsin, Madison, and another by John Gearhart

of the Johns Hopkins University School of Medicine in Baltimore, Maryland—almost simultaneously solved the problem of maintaining stable lines of ES cells in 1998 by growing them on "feeder" layers of mouse fibroblast cells. Bongso and colleagues from Monash University in Melbourne, Australia, and Hebrew University in Jerusalem caught up, creating their own stable human ES cell lines in 2000.

Singapore

Singapore was quick to realize the scientific and commercial payoffs of stem cell research. "Given its huge potential, stem cell research has been identified as one of Singapore's niche areas," explains Hwai Loong Kong, executive director of the Biomedical Research Council, a part of Singapore's Agency for Science, Technology, and Research (A*STAR). ES cells became a cornerstone of Singapore's



Spotlight. Woo Suk Hwang (above) and Shin Young Moon grabbed acclaim for South Korea with their breakthrough work with ES cells.

[any field in] cutting-edge biology," says Chunhua "Robert" Zhao, director of the National Center for Stem Cell Research in Beijing. "This could be our chance."

Stem cell researcher George Q. Daley of Harvard Medical School in Boston agrees: "I firmly believe they have an advantage." Although recent state funding initiatives in California and Wisconsin (see sidebar, p. 662) should ease some of the constraints hobbling ES cell research in the United States, says Daley, such efforts are no substitute for federal support, which is still restricted.

Asia does face challenges, however. These countries are still building their scientific infrastructures, and many institutions must make do with older equipment. For some groups, geographical isolation and lingering language barriers hinder participation in conferences and complicate scientific publishing. In China, a lack of coordination