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A giant step forward for science, but quest for new medical treatments goes on

The Newcastle technique

Ian Sample, science correspondent
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Progress in stem cell research is proving to be swift, but significant hurdles must be cleared before the advances can be turned into useful medical treatments, experts say.

Extensive research is needed to understand how to keep stem cells alive without becoming contaminated, how to transform them into a range of useful tissues and the potential risks posed by stem cell therapies, they add.

Researchers face other barriers - a severe shortage of donated human eggs to use in their experiments and significant opposition from groups objecting to the creation of embryos destined to be destroyed in the name of research.

The rate at which scientists are unravelling the potential of stem cells was demonstrated today with scientists in Newcastle reporting the creation of Europe's first cloned human embryo, and a study from a South Korean team that used cloned embryos to generate stem cells. For the first time, the stem cells were genetically matched to patients with specific medical conditions or spinal cord injuries.

Both teams are using the cloning procedure to create embryonic stem cells, which are believed to be more versatile than other types of stem cells, including adult, foetal and umbilical cord stem cells. Embryonic stem cells are generally considered as unique in being able to grow into any other tissue in the body.

Advocates of embryonic stem cells believe they will have a big impact on medicine in two ways. Stem cells created from people with genetic diseases will allow scientists to study the biological mechanisms of disease in far more detail than ever before. More ambitiously, embryonic stem cells that are genetically matched to patients might one day be used to regenerate failing tissues and organs without fear of them being rejected by the body's immune system.

Embryonic stem cells were first created by James Thompson at the University of Wisconsin and John Gearhart at Johns Hopkins University in Baltimore. Since then, the race to use embryonic stem cells to treat medical conditions has become fierce.

In January, scientists at the University of Wisconsin-Madison announced that they had successfully converted stem cells into spinal nerve cells, a stepping stone, they say, on the way to a cure for motor neurone disease. In February, researchers at the University of Illinois in Chicago reported that embryonic stem cells could change the face of cosmetic surgery and be used to grow breast implants. In May, Hans Keirstead at the University of California, Irvine, published a study showing how paralysed rats regained their ability to walk after having their spinal cord injuries treated with human embryonic stem cells.

Only two groups in Britain have licences to clone human embryos to create stem cells. Last year, the Newcastle group led by Miodrag Stojkovic at Newcastle University and Alison Murdoch at the Newcastle NHS Fertility Centre, was awarded Britain's first cloning licence. Last month, the team was granted permission by the Human Fertilisation and Embryology Authority to produce stem cells from people suffering from type I diabetes in the hope that they will lead to new therapies for the condition.

Ian Wilmut, the creator of Dolly the sheep, based at the Roslin Institute in Edinburgh, was granted a licence earlier this year to clone embryos as part of his research into motor neurone disease.

But despite the intense activity and money being poured into stem cell research, there are still a lot of unknowns that will prevent new treatments becoming available in the near term. "Even with all the advances being made, it's hard to see a real therapy completing clinical trials within 10 years," said Stephen Minger, director of the stem cell lab at King's College, London.

One of the biggest problems stem cell researchers face is that the process is still highly inefficient, meaning large numbers of donated human eggs are needed to achieve even a single cloned embryo.

The egg shortage not only determines the rate at which stem cell research progresses. According to some in the field, the shortage of eggs means stem cell therapies will never become mainstream treatments. With today's success rate, Patrick Cusworth, of the lobby group Life, says that if 350,000 people in Britain have type I diabetes, it would take 35m eggs to treat them. Fewer than 1m have been created in fertility clinics since 1990, he adds.

Stem cell research hit a setback in January when scientists reported that all of the embryonic stem cells grown to date were contaminated with animal products. The contamination was caused by the stem cells being kept alive on a bed of mouse cells and treated with a serum from foetal calves. Work is under way to find a sterile means of keeping cells alive.

A further hurdle lies in developing therapies from embryonic stem cells. While there are hopes that some conditions could be treated by simply injecting stem cells into diseased organs, many therapies would require the stem cells to be grown into specific tissues, a feat that is proving tough to achieve.

Ethical considerations are also hampering stem cell research. In the US, federal law introduced by the Bush administration places severe restrictions on the use of embryonic stem cells. In March, the UN sought a blanket ban on human cloning, and although Britain rejected it, several European countries gave it their backing.

"The ethical considerations cannot be brushed aside. You can argue about whether a cloned embryo is a person, but you cannot get away from the fact that it is alive and it is human," said Neil Scolding, a professor of neuroscience at Bristol University.

Gerald Schatten, a stem cell expert at the University of Pittsburgh who collaborated with the South Korean team on today's study, argues that it would be unethical not to pursue stem cell therapies. "With the promise of curing devastating disease and reversing injuries that cause so much human suffering, isn't it a moral obligation for scientists to continue this avenue of research responsibly?" he said.