Society for the Protection of Unborn Children

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The past, present and possible future of stem cell research

by Anthony Ozimic

One of the best-known fields within cutting-edge science today is stem cell (hereafter "SC") research. Every week not just the scientific press but increasingly the mainstream media report new breakthroughs. The advances are being made at all stages of the scientific process: speculation, theory, laboratory research, clinical trials and patient treatments. At the same time as these technical achievements, a debate about the ethics of different types of SC technology continues to rage, nationally and internationally.

The basics of SC research began in the 1960s. Scientists realised that both animals and humans contained flexible cells which are able to re-grow and regenerate tissue and blood. These cells were found in both born and unborn individuals, including in embryos about a week after conception. The first big moment regarding human SCs did not arrive until 1998 when the first line of SCs was derived from human embryos at the University of Wisconsin-Madison. Both the scientific and ethical debate about SCs began to heat up after this point.

The most controversial proposed technology involves creating new human embryos by a process called somatic cell nuclear transfer (SCNT). In this process, a human egg (ovum) is emptied of its nucleus, and the nucleus of an ordinary ('somatic') cell from the human body is combined with that egg. The resulting embryo is 99% genetically identical to the person from whom the somatic cell was taken. It is therefore understandable that SCNT was quickly dubbed "human cloning". SCs are extracted from the embryo five to seven days after conception. This extraction usually destroys the embryo, though one team of US scientists has been working on a non-destructive technique.

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A widespread fear arose amongst both supporters and opponents of embryo research that these 'cloned' embryos could be implanted into women and brought to birth, thus creating a whole new category of people with uncertain biological ancestry. Would such children be the child, the (time-delayed) twin or even the slave of the donor of the somatic cell? Would the donor of the enucleated egg or the woman who gave birth to the 'clone' be deemed to be the child's mother? Governments and scientists moved quickly to ban or heavily restrict avenues for this possibility, which became known as "reproductive cloning".

The stated objective of SCNT is to extract SCs from the resulting embryos, with the goal of creating therapies matched to the patient's body. The ideal scenario, according to this theory, is that patients with say, Parkinson's disease, would have embryos created by SCNT using their somatic cells. SCs would be extracted from these embryos, cultured into the laboratory and inserted into the patients in order to regenerate diseased tissue. (A parallel goal is the creation of whole organs for transplantation.) This technique, labelled "therapeutic cloning", has not yet been shown to work. And as Dr Harry Griffin, of the Roslin Institute which created "Dolly" the sheep, the world's first cloned mammal, pointed out:

"Therapeutic cloning is clearly not therapeutic for the embryo."[1]

A big feature of the SC debate is the opposition to all ESC research by those groups and individuals who hold that human life begins at conception, and therefore that human embryos are human beings with the same right to life as adults. This opposition is largely synonymous with the pro-life lobby, a movement that also opposes legal abortion. As with the debate over abortion, many but not all opponents of ESC have strong religious beliefs, though they argue that primarily their opposition is ethically, not religiously motivated.

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[1] Conference, 14 Nov. 2000, quoted SPUC, 20 Dec. 2000 http://bit.ly/j9qX11

'Therapeutic cloning', and the extraction of ESCs from embryos left over from in-vitro fertilisation (IVF) cycles, were authorised by the British parliament in 2001, followed by a general ban on 'reproductive cloning' in 2002. More recently, in 2008 the British parliament passed a law which entrenched and expanded a wide range of embryological techniques, including ESC research. Under prime ministers Tony Blair and Gordon Brown, a UK Stem Cell Fund was established, with the express aim of making Britain the stem cell capital of the world.

At the same time as developments in ESC research, an alternative was already progressing. Adult stem cell (ASC) research deploys those SCs which can already be found in the tissue and blood of born human beings. Such cells have the same basic propensity as ESCs: a power to multiply into certain types of tissue. No embryos or eggs are involved, thus avoiding ethical objections to the use of embryos and eggs.

Advocates of ESC research argue that, unlike ESCs, ASCs are not 'pluripotent': they can't turn into many different tissue-types. Defenders of ASC research respond that this aspect is what has made ASCs successful but ESCs dangerously unmanageable. They point out that ASC research has delivered benefits to patients in over 80 different medical conditions, whereas ESC research has only just reached (in 2009) the clinical trial stage[2]. As Dr David Prentice, a US life-scientist says:

> *"After over 30 years of embryonic stem cell research, first with mouse and then human embryonic stem cells, not a single patient has been helped."*[3]

The pro-ESC side argues that citing that disparity is defeatist and unfair, though they accept that ASC research is a major element in the overall effort successfully to deploy SCs in therapies.

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[2] Dr Robert Lanza, US stem cell pioneer, personal website, http://bit.ly/kUX7Ss
[3] National Right To Life News Today, 17 May, 2011 http://bit.ly/iHqOui

Another recent alternative to ESC research was discovered in 2007. Research teams in Japan and America, independent of each other, successfully reprogrammed somatic cells to give them the same much-prized pluripotency as ESCs. Like ASCs, these induced pluripotent stem cells (IPSCs) gave the possibility of using SCs without having to use embryos or eggs.

The advent of IPSCs has been welcomed warmly by opponents of the widescale destruction of human embryos usually inherent in the extraction of ESCs. Even some ESC supporters have switched their attention to IPSCs. Even Dr Ian Wilmut, another co-creator of Dolly the sheep, has decided to move his research focus from ESCs to IPSCs. Some hoped that the raging ethical debate (dubbed "The Clone Wars" after the 2000 *Star Wars* film), might have at least some measure of resolution.

Also like ASCs, it was hoped that IPSCs will avoid the tendency - experienced by ESCs - of forming tumours or of being rejected by the patient as foreign bodies. The latest IPSC findings, however, have revealed these same problems. Strong proponents of ESC research are arguing that the limitations of both ASCs and IPSCs prove the case for continuing to allow and promote ESC research. As Dr Robert Lanza, the world's leading pioneer of ESC research, argues:

> *"This reopens the whole need for S.C.N.T, which will be controversial. We had thought we had put that aside with this technology."*[4]

Opponents of ESC research respond that the unnatural process of SCNT will always be more likely to result in technical and safety failures. As Dr James Sherley, a Boston-based scientist has argued:

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[4] New York Times, 13 May 2011 http://nyti.ms/in2Q6g

"The promises of cures from cloned human embryonic stem cell research are indeed misguided. Whether extracted from IVF embryos or cloned embryos, embryonic stem cells are unable to mend tissues and organs … Many more years from now, this picture will not change. Embryonic stem cells lack the natural biological properties required for repair of non-embryonic tissues." [5]

So where does the debate go from here? Over the past decade, a clearer picture has emerged of the likely future settlement. Legal permission for SCNT, and ESC research generally, is unlikely to be reversed or seriously hindered. 'Reproductive cloning' is likely to retain the disapproval of governments, most experts and public opinion. Advances will continue to be made, mostly in ASCs, with continuing problems for both ESCs and IPSCs, at least in the short-term.

The future is likely to be marked by ongoing political battles regarding regulation and funding. In Britain, the Coalition government has moved to abolish the Human Fertilisation and Embryology Authority (HFEA), the body which regulates embryo research, as part of the new government's "bonfire of the quangos". Last month the European Court of Human Rights ruled that patents on human SCs were unlawful. In America, there is an ongoing law suit between scientists opposed to ESC research and the Obama administration over the legality of federal funding.[6]

Everyone conscious of the debate about SCs realises that it is not merely a pedantic in-house discussion between academics. Momentous issues are at stake: the creation and destruction of human entities, the future of medical science and the limits of official power. Individuals, too, may be powerfully affected: from the family of the Parkinson's patient hoping for a cure, to the women suffering life-threatening side-effects after donating their eggs for research.[7] It's a debate no one interested in science and humanity can afford to miss.

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[5] John Smeaton, SPUC director, blog, 26 May 2008 http://bit.ly/jotdqm
[6] John Smeaton, SPUC director, blog, 7 Sept. 2010 http://bit.ly/aa1ID3
[7] Center for Bioethics and Culture, 4 May 2011 http://bit.ly/jSCuTN