Embryonic Stem Cell Research; Medical Genius or Playing God?

By
Luke Holland

Word count: Approx 2000

Grade awarded June 2006: PASS

Research Paper
Based On Pathology Lectures
Medlink 2005
Abstract

Organ transplants are frequently the only solution to terminal diseases but the shortage of donors and the problems of rejection have led to developments in Embryonic Stem Cell (ESC) research. Thousands of lives could be saved by the growth of new organs for transplant that would be a perfect match and with zero chance of being rejected. Unfortunately the key to one of the greatest medical achievements of all time also brings both ethical and moral implications. Articles in the New Scientist gave me a basic understanding of the science of Embryonic Stem Cell research but also showed that articles on the subject can be both biased and misleading and that for intelligent decisions to be made published information must be neutral and scientifically accurate.

Introduction

The importance of Embryonic Stem Cells (ESCs) derives from the fact that they are ‘pluripotent’; they have the ability to differentiate into almost any type of specialised cell, e.g. nerve cells or heart muscle cells. Whole tissues could be cultured and implanted into a patient. A patient suffering from diabetes could be treated by the implantation of ESCs that had been differentiated into pancreatic ‘insulin producing’ cells.

To obtain these cells an embryo has to be created. Embryos occur naturally through a sperm cell joining with an ovum during intercourse, but this method is impracticable. Embryos required for medical research in this country are nearly always obtained from spare IVF embryos which would otherwise be discarded. Many countries do not allow Embryonic Stem Cell research to be executed but others are more relaxed. The embryos required for the treatment of diseases can also be created by cloning. Cloning a human embryo can be achieved by extracting an egg cell from a donor, and removing an adult cell from the patient who requires treatment. The egg is denucleated and the nucleus from the patient cell is transferred to the egg. Using a chemical process the new cell begins to divide and an embryo is now in the making. Whether they are obtained through cloning or from spare IVF, after approximately five days a ball of cells called a blastocyst is formed. Stem cells can be extracted from this blastocyst but the process will unavoidably destroy the embryo. In the UK an embryo develops rights as time goes on, and when they are only five days old they have no rights at all, making it a legal process. Embryonic stem cell research started in 1998 when James Thomson, of the University of Wisconsin, successfully removed cells from spare IVF embryos and established the first human embryonic stem cell line (a group of ESCs cultured in a laboratory).
Stem cells extracted from embryos are not the only type of stem cell that exists, nor are they the only area of research involving cell recreation. ‘Adult Stem Cells’ are also part of modern research. Some scientists believe that they have potential similar to ESCs; many disagree. Adult stem cells occur in many tissues of the human body, but are not pluripotent. They are described as ‘multipotent’. This means that they can differentiate into just one specific group. For example, multipotent blood stem cells give rise to the red cells, white cells and platelets in the blood.

Discussion

Embryonic Stem Cell transplantation involves the creation and demolition of human embryos to save the lives of patients, but how morally acceptable is it?

Dr Evan Harris, a British Liberal Democrat MP and science spokesman, who is pro-ESC research, says:

“This research is very pro-life. The life of a clump of cells smaller than a pin-head – the pre-14-day-old embryo – does deserve some respect. But the lives of people with cancer, diseases such as Parkinson's and organ failure, who could be saved by the development of stem cells, deserve to be given a higher value.” ii

Professor Julia Polak, Director of the Tissue Engineering Centre - Hammersmith, says:

“I may feel sorry about two or three cells but also I care about the millions of cells that are a human person.” iii

A blastocyst is actually made from between 60 and 100 cells, and a human person billions, but the principle is the same: that the life of a fully conscious and sentient adult is more important than the life of an embryo that has no recognisable features or personality and absolutely no nervous system.

One article (New Scientist, 6 October 2001) was written by an anti-ESC research advisor, Daniel Callahan. He wrote that he did not see ESC research as an urgent or imperative area of science and that the lives of embryos, no matter how old, must be respected. But at the end of the piece there is a picture (left) of a human foetus of approximately 10 weeks of age with identifiable limbs, eyes, head and clearly human. The caption implies
that it is of an embryo about to be destroyed in the research process. The article is inaccurate and a direct appeal to emotion: the argument is flawed.

As part of my research I carried out a brief survey on the Daniel Callahan article by asking twenty-eight people of mixed ages and backgrounds to read the article and if, as a result, they were for or against cloning human embryos for medical research.

Of the twenty-eight people, seventeen had no objections and of the eleven who objected, only two of them still disagreed after I had explained to them the exact size and nature of the embryo. This indicated that the public is easily mislead by inaccurate and biased reporting and it also shows that many people are not worried about the ethical issues with using embryonic stem cells anyway.

Religion can be a key factor in dictating a person's response to embryonic stem cell research but of the two people who entirely disagreed with the proposals in my questionnaire, neither claimed to be religious. Their views were more sentimental; they believed that destroying a human embryo is morally wrong. One actually described it as ‘murder’.

Given the significant opposition it is inevitable that there are going to be strenuous developments in stem cell research to avoid the ethical concerns and allow progress with minimal opposition.

Companies in the US and Britain are working on a method called parthenogenesis whereby human embryonic stem cells can be produced that do not have the potential to develop into a child.

Normally when an embryo is created it gets one set of chromosomes from the mother and one set from the father. Parthenogenesis duplicates one set of maternal chromosomes and develops as if it had been fertilised. It cannot develop into a human being but sometimes will develop sufficiently for researchers to extract the equivalent of undifferentiated embryonic stem cells. It is claimed that this new method has already been carried out successfully on monkeys. Cells created through parthenogenesis stayed undifferentiated for four months when kept with special ‘feeder cells’. It is very likely that parthenogenesis could also work for humans; if this is the case then it seems reasonable to claim that a way may have been found to create ESCs without destroying what some people see as a potential person.

Another process is called ooplasmic transfer and is currently being worked on by many companies. The procedure takes cytoplasm from an egg cell and injects it into an adult cell e.g. a skin cell. The egg cytoplasm seems to turn the specialised adult cell back into an undifferentiated state. However there are concerns at the moment that these implants could become cancerous; far more research is needed.
Whether embryonic stem cells made without embryos satisfy the moral issue is the next question to be answered. Bruno Quintavalle, of the Pro-life Alliance seems to think so. He argues that:

“It’s not an egg fertilised by sperm, so as far as the act is concerned it’s not an embryo\[iv\].

There are of course opposing views. Daniel Callahan (q.v.) claims:

“The fact that one line of research is promising is not enough to automatically allow it to trump ethical problems”\[v\]. But later he says:

“The parthenogenesis method looks perhaps the most promising. It also avoids the problems of another proposed method [ooplasmic transfer]. This would offend some, perhaps many, by mixing species material”\[vi\].

Scientists are also working on a type of cell known as a multipotent adult progenitor cell (MAPC) which can be found in bone marrow. They have the same potential as ESCs but are not maintained through cloning. It is thought that they have the ability to differentiate into a multitude of cell types but, even more promisingly, they do not seem to develop into cancerous masses. Freda Miller of McGill University\[vii\] says that the new cells may appear to have the characteristics of functioning cells but it is questionable as to whether they would actually work in the body. In defence of the current research, Ihor Lemischka of Princeton University claims that:

“The data looks very good, it’s very hard to find any flaws”\[viii\].

Another article published in The Daily Telegraph (25 March 2006) described a further avenue of research that attempts to bypass the ethical concerns, announcing that “highly flexible\[ix\] stem cells, which hold very similar properties to embryonic stem cells, have been isolated from the testes of mice. Professor Robin Lovell-Badge of the MRC National Institute for Medical Research, said:

“This is a very exciting piece of work. These findings would also overcome barriers for scientists in countries with regulations that restrict work with human embryonic stem cells, such as Germany”\[x\].

These cells could be extracted from the testicles of men through biopsy, could be cultured in a laboratory and implanted into a patient. Obviously this would be effective in males only but it is possible that similar cells may exist in the ovaries of females. This is a very significant development because it is a relatively simple procedure and because of the cells’ flexibilities they have great potential in helping a whole host of diseases. However they do not avoid all moral dilemmas as, “...they could equally be used to make animal-human chimeras.”\[xi\]. Despite this, Dr Raanan Gillon, Emeritus Professor of
Medical Ethics at Imperial College, London, claimed it to be, “...a welcome development...”.\textsuperscript{xii}

Despite the general consensus of experts that ESCs are the most probable method of growing suitable tissues to implant into human bodies – doubts in the developments of this area have recently arisen with the resignation and disgrace of one of the world’s leading embryo scientists, Professor Hwang Woo-suk of Korea\textsuperscript{xiii}. It has recently come to the attention of the scientific world that his results were forged in order to maintain his iconic title as the world’s most successful cloner\textsuperscript{xiv}. This humiliating setback for his team has a lot more significance across the whole planet than may be apparent. The exposure of the phoney results has meant that previous research by the Korean team is now questionable, and it is also ammunition for anti-ESC activists who now have evidence that supports their conclusion that ESC research should be banned. They could argue that Hwang’s creation of results could be proof that in fact ESCs are not an appropriate medical treatment: that it’s just that scientists are unwilling to admit it.

**Conclusion**

It seems inevitable that Embryonic Stem Cell research will have a great impact on the world of medicine in the years to come but, as yet, there is no complete scientific answer to the outstanding ethical and moral hurdles. Although many attempts are being made to bypass the ethical problems it still seems probable that normal embryonic stem cells will make the first breakthrough.

It is easy to envisage a patient, in a country where the attitudes towards stem cell research (e.g. Korea) are more relaxed, being cured of organ failure or neuro-degenerative disease by stem cell therapy. Popular opinion will move in favour of Embryonic Stem Cell therapy, political tension on the subject will settle down and laws will be relaxed.

Other methods of stem cell therapy will be openly and rapidly advanced; countries competing with one another to see who can provide the world with the newest and most exciting proposals.

On 3\textsuperscript{rd} December 1967, Dr. Christiaan Barnard performed the world’s first human heart transplant operation, and inevitably contemporaries of him condemned the medical triumph. In spite of this, almost thirty-nine years later heart transplantation is a widely accepted practice, and for this reason I conclude that the answer to the question ‘Will embryonic stem cell research lead to a medical breakthrough?’ is ‘Certainly, but it will take time for the ideas to be accepted by the whole world.’
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