EDITORIAL

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Stem Cell Research and Ethics: An Update

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Stem cell therapies are not new. Bone marrow stem cell transplants have been performed for decades with much of the general public unaware that this is, in fact, a stem cell therapy.

While the use of adult-derived stem cells and storage of cord blood has caused little debate, it is only since 1998[1] when researchers first learnt how to remove stem cells from human embryos that controversy has ensued.

Embryonic stem (ES) cells, being pluripotent, have the potential to form all types of cells, and, therefore, have a huge potential in curing human disease. Research using human ES cells could help to better understand early human development, be used to research possible toxic effects of drugs (drug-screening) and, most importantly, be used in the field of regenerative medicine in the development of cell replacement therapies. However, both political and religious leaders have discussed the moral implications of destroying human embryos.

In 2001 in the US there was a restriction on funding for ES cell research by President George Bush. President Bush stated that federal funds could only be used for research on human embryonic stem cell lines that had already been established, preventing researchers from creating more. However, this did not inhibit researchers receiving private funding. President Barack Obama went on to lift the ban in 2009.

At the core of the ES cell issue is the question: when does life begin?[2] This question closely links to debates over abortion and with the "pro-life" movement. However, even this debate is not uniform as while some oppose abortion and the use of human ES cells, others oppose abortion but support stem cell research using frozen embryos that remain after a woman or couple has completed infertility treatment, citing the "lesser of two evils" argument.

The debate about stem cells is also a religious one. As Rana Dajani[3] explained in her editorial, discussions in Jordan concluded that stem-cell research is permissible in Islam providing it is carried out to improve human health, since Muslim scholars consider life to start 40–120 days after conception. Denominations of the Christian faith, including Roman Catholics and Orthodox Christians, believe that the embryo has a status of a human individual from conception and therefore any decisions/interventions not in favor of the embryo violates the right of the embryo to life.[4] Understandably, such conclusions are not easy to reach, and such theological debate is beyond the scope of this article.

As a result of the discussions in Jordan, in January 2014 the country passed a law to control research and therapy using human ES cells. The regulation was the first in the Arab and Islamic region. It highlights the recognition that Jordan has for the potential of stem cell therapy and provides a framework for other countries in the region to follow. The law specifically bans private companies from using human ES cells, limiting research or therapies to government, and publically funded organizations/institutions, which have higher levels of transparency and are supervised by the health ministry and a specialized committee.

Although there is no published record of ES cell research in Oman, stem cell transplantation (bone marrow, peripheral blood, and cord blood) has been carried out at Sultan Qaboos University Hospital (SQUH) since 1995.[5] More recently, researchers at SQUH established the first national voluntary cord blood bank in the country. This caters for parents who have a child with a disorder that would normally be cured by bone marrow transplantation and who wanted their newborn baby's cord blood to be collected and processed for a possible matched related transplant for their offspring.[5]

Adult-derived stem cell sources are also available. Adult stem cells are multipotent, meaning that they are capable of producing multiple (but not all)

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cell types. These are found in a variety of tissues, including the fetus. Initially researchers believed that adult stem cells could only form the cell types of the organ from which they were derived, but the cells have shown more versatility than this.[6,7]

The first transplanted human organ grown from adult stem cells was performed in 2008 by researchers from the University of Padua, the University of Bristol, and Politecnico di Milano.[8] They harvested a section of trachea from a donor and stripped it of all cells, leaving a cartilage scaffold which was seeded with stem cells taken from the recipient patient's bone marrow. The new section of trachea was then grown in the laboratory over four days and transplanted into the patient. Four months later their research, which was published in *The Lancet*, reported that the patient's immune system showed no signs of rejection.

Other breakthroughs, such as the ability to induce pluripotency in adult cells (iPS cells) may bring the debate over ES cells to an end. However, it will not remove the ethical concerns over the use of human ES cells. iPS cells are not exactly the same as human ES cells, which will be needed to act as the control for measuring the "stemness" of other cells.[9] As yet, the cells that will be the most useful for cell replacement therapies has not been determined, which warrants the study of all stem cell types.

An additional ethical consideration is that iPS cells have the potential to develop into a human embryo, in effect producing a clone of the donor. However, many nations are already prepared for this, having legislation in place that bans human cloning for various purposes, although there is no consensus around the world on these policies.[10]

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