Stem Cell Debate

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Abstract: The definition of stem cell is "an unspecialized cell that gives rise to a specific specialized cell, such as a blood cell". Stem Cell is the original of life. All cells come from stem cells. Serving as a repair system for the living body, the stem cells can divide without limit to replenish other cells as long as the living body is still alive. When a stem cell divides, each new cell has the potential to either remain a stem cell situation or become another type of cell with a more specialized function, such as a muscle cell, a red blood cell, a bone cell, a nerve cell, or a brain cell. Stem cell research is a typical and important topic of life science. This material collects some literatures on stem cell debate.
[Smith MH. **Stem Cell Debate**. *Stem Cell Debate*. *Stem Cell* 2013;4(3):132-141] (ISSN 1545-4570). http://www.sciencepub.net/stem. 7

Key words: stem cell; life; gene; DNA; protein; debate

Debates on Stem Cell Research

There are a lot of debates on the stem cell research. Stem cell research is a high-tech question and the people involved in this rebates should have certain scientific knowledge on the stem cell. It is OK for the politicians or religionists to show their opinions on any topic they are interested in, but not suitable for them to make decisions (or make laws) that will significantly influence the scientific research as this field the politicians or religionists are not specialized. Such as, it is not suitable for the American President George W. Bush to show the power in the stem cell research. It is scientists' job. When politics and science collide, science should do scientific way, rather political way. Major ethical and scientific debates surround the potential of stem cells to radically alter therapies in health care (Williams, 2005).

The most important thing is to produce more stem cells. Stem cells come from stem cells. What we need is to find the method to produce plenty stem cells by stem cells. We need to culture stem cells and let stem cells divide in the cultured condition, but not differentiate.

How to create more stem cells? One way is to culture stem cells in vitro and divide the cultured stem cells. This is good and efficient, but the technique is difficult. The second possibility is to clone a baby and use the stem cells of the baby before the birth. For the second choice, the technique is OK, but some legal and moral (ethic) problems created. This is related to how to definite an alive human body. Is an embryo an alive human? Or only the after the birth she/she can be considered as an alive human body? If only after the birth, it could be no problem to use the cells (including stem cells) and tissues and organs of the embryos for the alive human.

The best way to keep life longer is to keep the cell live longer. However, it is not easy to get this.

If under the strict control, we can use the clone cell to create an embryo and produce tissues and organs by this embryo, then used for the donator to treat his/her disease. This will be benefit for the people. But, the legal and ethic are still problem.

Dr. Karim Nayernia, an Iranian biomedical scientist, made the mouse embryonic stem cells become sperm producing cells and then used the sperm to create healthy baby mice in 2006.

Stem cells exist in all multicellular organisms, which can divide through mitosis to produce more stem cells (offring stem cells) for self-renew, and differentiate into diverse specialized cell types for the replacement of the died cells in the living body. Two broad types of stem cells exist in mammals: embryonic stem cells and adult stem cells. The embryonic stem cells are isolated from the inner cell mass of blastocysts and the adult stem cells exist in various tissues. Stem cells and progenitor cells play the funcltion to repair the damaged body and to replenish adult tissues. In the embryo part of the stem cells differentiate into all the specialized cells and the other part of the stem cells maintain the normal turnover of regenerative organs, such as blood, skin, or intestinal tissues.

Important events on stem cell research

- 1908: The term "stem cell" was proposed for scientific use by the Russian histologist Alexander Maksimov (1874–1928) at congress of hematologic society in Berlin. It postulated existence of haematopoietic stem cells.
- 1960s: Joseph Altman and Gopal Das present scientific evidence of adult neurogenesis, ongoing stem cell activity in the brain; their

reports contradict Cajal's "no new neurons" dogma and are largely ignored.
- 1963: McCulloch and Till illustrate the presence of self-renewing cells in mouse bone marrow.
- 1968: Bone marrow transplant between two siblings successfully treats SCID.
- 1978: Haematopoietic stem cells are discovered in human cord blood.
- 1981: Mouse embryonic stem cells are derived from the inner cell mass by scientists Martin Evans, Matthew Kaufman, and Gail R. Martin. Gail Martin is attributed for coining the term "Embryonic Stem Cell".
- 1992: Neural stem cells are cultured *in vitro* as neurospheres.
- 1995: Dr. B.G. Matapurkar pioneers in adult stem-cell research with clinical utilization of research in the body and neo-regeneration of tissues and organs in the body. Received International Patent from US Patent Office (USA) in 2001 (effective from 1995). Clinical utilization in human body also demonstrated and patented in 60 patients (World Journal of Surgery-1999 and 1991]).
- 1997: Dr. B.G. Matapurkar's surgical technique on regeneration of tissues and organs gets published in textbook of Rodney Maingot's Abdominal Operations (USA). Regeneration of faellopian tube and uterus published in Textbook of Gynaecology, JP Publishers, edited by Dr. S. Salhan in 2010.
- 1997: Leukemia is shown to originate from a haematopoietic stem cell, the first direct evidence for cancer stem cells.
- 1998: James Thomson and coworkers derive the first human embryonic stem cell line at the University of Wisconsin–Madison.
- 1998: John Gearhart (Johns Hopkins University) extracted germ cells from fetal gonadal tissue (primordial germ cells) before developing pluripotent stem cell lines from the original extract.
- 2000s: Several reports of adult stem cell plasticity are published.
- 2001: Scientists at Advanced Cell Technology clone first early (four- to six-cell stage) human embryos for the purpose of generating embryonic stem cells.
- 2003: Dr. Songtao Shi of NIH discovers new source of adult stem cells in children's primary teeth.
- 2004–2005: Korean researcher Hwang Woo-Suk claims to have created several human embryonic stem cell lines from unfertilised human oocytes. The lines were later shown to be fabricated.
- 2005: Researchers at Kingston University in England claim to have discovered a third category of stem cell, dubbed cord-blood-derived embryonic-like stem cells (CBEs), derived from umbilical cord blood. The group claims these cells are able to differentiate into more types of tissue than adult stem cells.
- 2005: Researchers at UC Irvine's Reeve-Irvine Research Center are able to partially restore the ability of rats with paralyzed spines to walk through the injection of human neural stem cells.
- April 2006 Scientists at the University of Illinois at Chicago identified novel stem cells from the umbilical cord blood with embryonic and hematopoietic characteristics.
- August 2006: Mouse Induced pluripotent stem cells: the journal *Cell* publishes Kazutoshi Takahashi and Shinya Yamanaka.
- November 2006: Yong Zhao et al. revealed the immune regulation of T lymphocytes by Cord Blood-Derived Multipotent Stem Cells (CB-SCs).
- October 2006: Scientists at Newcastle University in England create the first ever artificial liver cells using umbilical cord blood stem cells.[81][82]
- January 2007: Scientists at Wake Forest University led by Dr. Anthony Atala and Harvard University report discovery of a new type of stem cell in amniotic fluid. This may potentially provide an alternative to embryonic stem cells for use in research and therapy.
- June 2007: Research reported by three different groups shows that normal skin cells can be reprogrammed to an embryonic state in mice. In the same month, scientist Shoukhrat Mitalipov reports the first successful creation of a primate stem cell line through somatic cell nuclear transfer
- October 2007: Mario Capecchi, Martin Evans, and Oliver Smithies win the 2007 Nobel Prize for Physiology or Medicine for their work on embryonic stem cells from mice using gene targeting strategies producing genetically engineered mice (known as knockout mice) for gene research.
- November 2007: Human induced pluripotent stem cells: Two similar papers released by their respective journals prior to formal publication: in *Cell* by Kazutoshi Takahashi and Shinya Yamanaka, "Induction of pluripotent stem cells from adult human fibroblasts by defined factors", and in *Science* by Junying Yu, et al., from the research group of James Thomson, "Induced pluripotent stem cell lines derived from human somatic cells": pluripotent stem cells generated

from mature human fibroblasts. It is possible now to produce a stem cell from almost any other human cell instead of using embryos as needed previously, albeit the risk of tumorigenesis due to c-myc and retroviral gene transfer remains to be determined.

- January 2008: Robert Lanza and colleagues at Advanced Cell Technology and UCSF create the first human embryonic stem cells without destruction of the embryo
- January 2008: Development of human cloned blastocysts following somatic cell nuclear transfer with adult fibroblasts
- February 2008: Generation of pluripotent stem cells from adult mouse liver and stomach: these iPS cells seem to be more similar to embryonic stem cells than the previously developed iPS cells and not tumorigenic, moreover genes that are required for iPS cells do not need to be inserted into specific sites, which encourages the development of non-viral reprogramming techniques.[92]
- March 2008-The first published study of successful cartilage regeneration in the human knee using autologous adult mesenchymal stem cells is published by clinicians from Regenerative Sciences
- October 2008: Sabine Conrad and colleagues at Tübingen, Germany generate pluripotent stem cells from spermatogonial cells of adult human testis by culturing the cells in vitro under leukemia inhibitory factor (LIF) supplementation.
- October 30 2008: Embryonic-like stem cells from a single human hair.
- January 2009: Yong Zhao and colleagues confirmed the reversal of autoimmune-caused type 1 diabetes by Cord Blood-Derived Multipotent Stem Cells (CB-SCs) in an animal experiment.
- March 1 2009: Andras Nagy, Keisuke Kaji, *et al.* discover a way to produce embryonic-like stem cells from normal adult cells by using a novel "wrapping" procedure to deliver specific genes to adult cells to reprogram them into stem cells without the risks of using a virus to make the change. The use of electroporation is said to allow for the temporary insertion of genes into the cell.
- May 28 2009 Kim *et al.* announced that they had devised a way to manipulate skin cells to create patient specific "induced pluripotent stem cells" (iPS), claiming it to be the 'ultimate stem cell solution'.
- October 11 2010 First trial of embryonic stem cells in humans.
- October 25 2010: Ishikawa *et al.* write in the Journal of Experimental Medicine that research shows that transplanted cells that contain their new host's nuclear DNA could still be rejected by the invidual's immune system due to foreign mitochondrial DNA. Tissues made from a person's stem cells could therefore be rejected, because mitochondrial genomes tend to accumulate mutations.
- 2011: Israeli scientist Inbar Friedrich Ben-Nun led a team which produced the first stem cells from endangered species, a breakthrough that could save animals in danger of extinction.
- January 2012: The human clinical trial of treating type 1 diabetes with lymphocyte modification using Cord Blood-Derived Multipotent Stem Cells (CB-SCs) achieved an improvement of C-peptide levels, reduced the median glycated hemoglobin A1C (HbA1c) values, and decreased the median daily dose of insulin in both human patient groups with and without residual beta cell function. Yong Zhao's Stem Cell Educator Therapy appears "so simple and so safe"
- October 2012: Positions of nucleosomes in mouse embryonic stem cells and the changes in their positions during differentiation to neural progenitor cells and embryonic fibroblasts are determined with single-nucleotide resolution.
- 2012: Katsuhiko Hayashi et al. reported in the Journal Science that they used mouse skin cells to create stem cells and then used these stem cells to create mouse eggs. These eggs were then fertilized and produced healthy baby offspring. These latter mice were able to have their own babies.

Literatures

Alikani, M. (2007). "The debate surrounding human embryonic stem cell research in the USA." Reprod Biomed Online **15 Suppl 2**: 7-11.

Despite its potential for reducing human suffering, the advancement of human embryonic stem cell research has not been given top priority by the US government, and the scientific community has been engaged in a debate on this issue in the USA and beyond. The central question in this debate is whether the promise of stem cells justifies the destruction of human embryos - mainly embryos that are surplus to the needs of patients undergoing infertility treatment. It is argued here that this debate belongs in the same category as the debates on global warming and evolution, because it has much in common with both.

It is conducted with a heavy load of scientifically uninformed views and beliefs and framed largely by an implacable opposition with the aim of creating public confusion and doubt. It is primarily politically motivated and, as is true about the debate on evolution, it is rooted in religion. A human embryo is not a human being or person even if it is deserving of - and receives - respect and extraordinary care in the context of assisted human reproduction. Rather than engaging in a futile debate that clouds the way forward in a vital branch of biology, scientists ought to continue to emphasize the importance of human embryo research.

Baylis, F. and C. McLeod (2007). "The stem cell debate continues: the buying and selling of eggs for research." J Med Ethics **33**(12): 726-31.

Now that stem cell scientists are clamouring for human eggs for cloning-based stem cell research, there is vigorous debate about the ethics of paying women for their eggs. Generally speaking, some claim that women should be paid a fair wage for their reproductive labour or tissues, while others argue against the further commodification of reproductive labour or tissues and worry about voluntariness among potential egg providers. Siding mainly with those who believe that women should be financially compensated for providing eggs for research, the new stem cell guidelines of the International Society for Stem Cell Research (ISSCR) legitimise both reimbursement of direct expenses and financial compensation for many women who supply eggs for research. In this paper, the authors do not attempt to resolve the thorny issue of whether payment for eggs used in human embryonic stem cell research is ethically legitimate. Rather, they want to show specifically that the ISSCR recommended payment practices are deeply flawed and, more generally, that all payment schemes that aim to avoid undue inducement of women risk the global exploitation of economically disadvantaged women.

Beckmann, J. (2004). "On the German debate on human embryonic stem cell research." J Med Philos **29**(5): 603-21.

Germany since 1990 has one of the strictest human embryo protection laws, yet according to the Stem Cell Act of 2002 allows, under strict conditions, the import and use of human embryonic stem cells (hESC) for high priority research goals. The author tries to show how this is taken to be coherent by the parliamentary majority (though not necessarily by the general public) in Germany. In doing so, he firstly looks into the chronicle of the debate in Germany showing its different stages since 1999, then dwells upon the relation between the law and the role of ethics in this issue, and thirdly presents the two fundamentally different positions of the German debate, that is, that the human embryo created for IVF purposes is a human being and stands from its very beginnings under the constitutional principles of respect for, and protection of, human life versus the position that before being implanted the human embryo may become a human being and therefore belongs to the human species only potentially, so that its right to life protection may be assessable over against other high priority goals, such as research aiming at possible help for patients with life-endangering diseases. In spite of the Stem Cell Act of 2002, the debate of the German general public goes on, especially due to the recent EU 6th Research Framework Program which plans to also fund hESC research.

Capps, B. (2008). "Authoritative regulation and the stem cell debate." Bioethics **22**(1): 43-55.

In this paper I argue that liberal democratic communities are justified in regulating the activities of their members because of the inevitable existence of conflicting conceptions of what is considered as morally right. This will often lead to tension and disputes, and in such circumstances, reliance on peaceful or orderly co-existence will not normally suffice. In such pluralistic societies, the boundary between permissible and impermissible activities will be unclear; and this becomes a particular concern in controversial issues which raise specific anxieties and uncertainty. One context that has repeatedly raised issues in this regard is that of biotechnology and, in particular, the recent stem cell debate, on which this paper concentrates. While such developments have the potential to make significant improvements to therapeutic progress, we should also be sceptical because predicting the impact of these developments remains uncertain and complex. For the sake of socio-political stability, it will therefore be necessary to enact and enforce rules which limit these competing claims in public policy but which may not be compatible with what individual moral commitments ideally permit. One way to achieve this is to establish procedural frameworks to resolve potential disputes in the public sphere about what is right, wrong, or permissible conduct. I argue that for one to commit to authoritative regulation, an idea of harm prevention through state intervention is necessary; and that this requires optimum mechanisms of procedure which allow the individual the opportunity to compromise and yet to continue to oppose or fight for changes as demanded by his or her moral position.

Curley, D. and A. Sharples (2006). "Ethical questions to ponder in the European stem cell patent debate." J Biolaw Bus **9**(3): 12-6.

Patents may be refused in Europe on ethical grounds. Whereas in the past this issue has arisen only infrequently, recent developments in human embryonic stem cell research have given rise to conflicting opinions in Europe as to the approach that should be adopted in relation to patents. The United Kingdom Patent Office has adopted a positive policy towards inventions involving human embryonic stem cells, but the European Patent Office has to date refused to grant patent applications involving similar subject-matter. A series of legal questions on the role of ethics in granting European patents is now to be considered for clarification by the European Patent Office. The answers to these questions should eventually resolve the debate on the patenting of human embryonic stem cells throughout Europe.

de, S. C. N. M. (2006). "Research ethics, science policy, and four contexts for the stem cell debate." J Investig Med **54**(1): 38-42.

There are plainly conscientious differences of opinion among scientists, politicians, and the public in respect of both the ethics of embryonic stem cell research and the more general question of the role of public policy in setting parameters for what is legal and what is funded in the biosciences. Although professional discussion of embryonic stem cell research is not hampered by the often misleading oversimplifications of the press, it remains true that the wide range of ethical options is rarely explored. These varied positions arise from a series of at least six logically distinct policy options, which we may summarize in these terms: (a) All use of human embryos for research is wrong. (b) Excess in vitro embryos may be used, but others should not be created for the purpose. (c) In vitro embryos, but not clonal embryos, may be created with the intent of using them for research. (d) Clonal embryos, but not in vitro embryos, may be created with the intent of using them for research. (e) Only certain excess embryos destroyed before a certain date should be used. (f) Only certain excess embryos created before a certain date should be used. Moreover, in any policy permitting research use of the embryo, two further sets of issues are raised. First is the question of consent. Second is the question of time limits. As advancements in biotechnology shape the possibilities of the twenty-first century and hold out both promise and threat to the human future, it is crucial that we develop a national and global conversation that both encourages science and its potential and takes wider social responsibility for the purposes for which science is engaged.

Devolder, K. (2006). "What's in a name? Embryos, entities, and ANTities in the stem cell debate." J Med Ethics **32**(1): 43-8.

This paper discusses two proposals to the US President's Council on Bioethics that try to overcome the issue of killing embryos in embryonic stem (ES) cell research and argues that neither of them can hold good as a compromise solution. The author argues that (1) the groups of people for which the compromises are intended neither need nor want the two compromises, (2) the US government and other governments of countries with restrictive regulation on ES cell research have not provided a clear and sound justification to take into account minority views on the protection of human life to such a considerable extent as to constrain the freedom of research in the area of stem cell research, and (3) the best way to deal with these issues is to accept that many people and most governments adopt a gradualist and variable viewpoint on the human embryo which implies that embryos can be sacrificed for good reasons and to try to find other, less constraining, ways to take into account minority views on the embryo. Finally, another more efficient and time and money sparing compromise will be proposed for those who accept IVF, a majority in most societies.

Green, R. M. (2008). "Embryo as epiphenomenon: some cultural, social and economic forces driving the stem cell debate." J Med Ethics **34**(12): 840-4.

Our human embryonic stem cell debates are not simply about good or bad ethical arguments. The fetus and the embryo have instead become symbols for a larger set of value conflicts occasioned by social and cultural changes. Beneath our stem cell debates lie conflicts between those who would privilege scientific progress and individual choice and others who favour the sanctity of family life and traditional family roles. Also at work, on both the national and international levels, is the use of the embryo by newly emergent social groups to express resentment against cultural elites. The organisational needs of religious groups have also played a role, with the issue of protection of the embryo and fetus serving as a useful means of rallying organisational allegiance in the Roman Catholic and evangelical communities. Because the epiphenomenal moral positions on the status and use of the embryo are driven by the powerful social, cultural or economic forces beneath them, they will most likely change only with shifts in the underlying forces that sustain them.

Harris, L. H. (2000). "Ethics and politics of embryo and stem cell research: reinscribing the abortion debate." Womens Health Issues **10**(3): 146-51.

Research on human embryos is controversial. Whether federal dollars can or should fund this work has been debated for 25 years, without satisfactory resolution. Many commentators point out that current conflict over embryo research grows out of this country's seemingly intractable conflict over abortion and the moral status of the fetus. This commentary reviews the most recent iteration of the embryo research debate--federal funding of human embryonic stem cell investigation--and explores the ways in which the terms of this debate not only reflect abortion disputes, but may in turn be shifted to strengthen feminist claims vis-a-vis abortion.

Kitzinger, J. and C. Williams (2005). "Forecasting science futures: legitimising hope and calming fears in the embryo stem cell debate." Soc Sci Med **61**(3): 731-40.

Controversies about biotechnologies often centre not so much on present scientific facts as on speculations about risks and benefits in the future. It is this key futuristic element in these arguments that is the focus of this article. We examine how competing visions of utopia or dystopia are defended through the use of diverse vocabularies, metaphors, associations and appeals to authority. Our case study explores how these rhetorical processes play out in the debate about embryo stem cell research in UK national press and TV news media. The findings show how predictions from those in favour of embryo stem cell research are supported by both hype and by anti-hype, by inconsistent appeals to the technologies' innovative status and by the selective deconstruction of concepts such as 'potential' and 'hope'. The debate also mobilises binary oppositions around reason versus emotion, science versus religion and fact versus fiction. This article highlights how traditional assertions of expertise are now combined with ideas about compassion and respect for democracy and diversity. It also highlights the fact that although news reporters are often responding to topical events the real focus is often on years, even decades ahead. Close attention to how images of the future are constructed, and the evolution of new strategies for legitimation are, we suggest, important areas of on-going research, particularly in discussions of scientific and medical developments and policy.

Maio, G. (2004). "The embryo in relationships: a French debate on stem cell research." J Med Philos **29**(5): 583-602.

While many European countries are entering unknown legal terrain where the embryo in vitro is concerned, France can already look back on a long tradition of public discussion and legal codification of ways of dealing with in vitro embryos. In its comprehensive law of 1994, France had still rejected embryo research; however, due to the promising perspectives of stem cell research, the new law now pending implies a clear liberalization of the 1994 provisions. Both the French lawmakers and the National Ethics Commission have repeatedly argued that possible utilization of embryos for research purposes may seem legitimate from the moment that there is no more "parental project." De facto, this concept implies that an embryo can be transformed into an object from the moment that the parents cease to desire it and that the value of protection is solely dependent on the will of third persons. At the same time, France is still speaking of guaranteeing respect for the "dignity of the embryo," which would mean that an embryo must not be reduced to a thing and treated for purposes which are not his own. Therefore, the French solution is not a consistent and honest solution, and in its new legal provisions, France has involved herself in manifold contradictions. France has rejected the conception of pre-embryo, but is de facto following Britain's model without making it explicit.

Mauron, A. and B. Baertschi (2004). "The European embryonic stem-cell debate and the difficulties of embryological Kantianism." J Med Philos **29**(5): 563-81.

As elsewhere, the ethical debate on embryonic stem cell research in Central Europe, especially Germany and Switzerland, involves controversy over the status of the human embryo. There is a distinctive Kantian flavor to the standard arguments however, and we show how they often embody a set of misunderstandings and argumentative shortcuts we term"embryological Kantianism."We also undertake a broader analysis of three arguments typically presented in this debate, especially in official position papers, namely the identity, continuity, and potentiality arguments. It turns out that these arguments do not support the strong, quasi-personal status accorded to the embryos in these official opinions.

Moore, K. E., J. F. Mills, et al. (2006). "Alternative sources of adult stem cells: a possible solution to the embryonic stem cell debate." Gend Med **3**(3): 161-8.

The complex moral and ethical debate surrounding the definition of the origins of human life, together with conflicting current and proposed legislation on state and federal levels, is hindering the course of research into the therapeutic uses of human embryonic stem cells. However, newly identified sources of adult stem cells, free from many of the ethical and legal concerns attached to embryonic stem cell research, may offer great promise for the

advancement of medicine. These alternative sources may alleviate the need to resolve the stem cell debate before further therapeutic benefits of stem cell research can be realized. While legislation and ethics evolve to address the legal and moral issues of embryonic stem cell research, innovative researchers will continue to search for and find real and present solutions for cell-based therapies using adult stem cells.

Myskja, B. K. (2009). "Rationality and religion in the public debate on embryo stem cell research and prenatal diagnostics." Med Health Care Philos **12**(2): 213-24.

Jurgen Habermas has argued that religious views form a legitimate background for contributions to an open public debate, and that religion plays a particular role in formulating moral intuitions. Translating religious arguments into "generally accessible language" (Habermas, Eur J Philos 14(1):1-25, 2006) to enable them to play a role in political decisions is a common task for religious and non-religious citizens. The article discusses Habermas' view, questioning the particular role of religion, but accepting the significance of including such counter-voices to the predominant views. Furthermore it is pointed out that not only religious but also numerous secular views stand in need of translation to be able to bear on policy matters. Accepting Habermas' general framework, I raise the question whether experts (such as clinicians working in relevant specialised areas of care) participating in political debates on biomedical issues have a duty to state their religious worldview, and to what extent the American government decision to restrict embryo stem cell research is an illegitimate transgression of the State-Church divide.

Noble, M. (2005). "Ethics in the trenches: a multifaceted analysis of the stem cell debate." Stem Cell Rev **1**(4): 345-76.

The increasing understanding of stem cell biology has opened up the possibility of using cell transplantation to treat a large variety of diseases. The medical need to identify optimal therapies is being challenged, however, by some members of society who seek to impose on this scientific quest their views--generally associated with particular religious beliefs--of what constitutes allowable research. This conflict mirrors earlier battles, extending over 150 years, between those implementing inoculation and vaccination to protect against smallpox and those who felt this to be unethical for religious reasons. For the many individuals who might benefit from the potential of stem cell medicine, such prolonged debate is unacceptable. In this review, conflicts in this debate are examined by holding opponents of embryonic stem cell (ESC) research to the standards applied to the science. The challenge of identifying optimal cells for tissue repair is juxtaposed with misrepresentations of stem cell science by those opposed to ESC research. Absolutist views on ethics are juxtaposed with examples of the bad science and unethical acts that occur when dogmatic religious filters and definitions of human-ness are forced upon scientific discussions. Finally, after considering how opponents of ESC research may, ironically, enhance commercial demand for cells derived from fetuses aborted for personal reasons of the mother, 10 proposals are offered that would--if followed by all participants in this debate--produce more ethically balanced discussions and a more comprehensive body of data from which evidence-based conclusions can be drawn.

Perry, D. (2000). "Patients' voices: the powerful sound in the stem cell debate." Science **287**(5457): 1423.

Millions of patients may benefit from the applications of stem cell research, although there is disagreement about whether public funds should be used to develop the science. Patients have been key to winning political support. Acting as advocates, they have contended that public investment will speed the research and bring accountability to biomedical technology. A political dispute about the new research, which holds the potential for cures to devastating diseases and to foster healthy aging, shows the need to respect public sensibilities and to court public approval, as well as the importance of involving patients in debates where the methods of biomedical discoveries and ethical beliefs collide.

Scott, C. T. and R. A. Reijo Pera (2008). "The road to pluripotence: the research response to the embryonic stem cell debate." Hum Mol Genet **17**(R1): R3-9.

The controversies surrounding embryonic stem cell research have prompted scientists to invent beyond restrictive national policy and moral concerns. The impetus behind these reports comes from different sources, including individually held moral beliefs, societal pressures and resource constraints, both biological and financial. Along with other contributions to public policy such as advocacy or public testimony, experimentation and scientific curiosity are perhaps more natural responses scientists use to surmount impediments to research. In a research context, we review the history of the first stem cell discoveries, and describe scientific efforts leading up to recent reports of pluripotent lines made without the use of human embryos and eggs. We argue that despite the promise of these new lines, we must not lose sight of fundamental questions remaining at the frontiers of embryology and early human development. The answers to these questions

will impact studies of genetics, cell biology and diseases such as cancer, autoimmunity and disorders of development. Human embryonic stem cell research is barely a decade old. The recent pace of discovery--in spite of federal restrictions--is testament to the potential of these cells to uncover some of biology's most intractable mysteries.

Sherley, J. L. (2008). "The importance of valid disclosures in the human embryonic stem cell research debate." Cell Prolif **41 Suppl 1**: 57-64.

Misinformation erodes the legitimacy of any public debate. Since the start of human embryonic stem cell research deliberations in the USA, misinformation concerning the nature of human embryos, their availability for research, and the potential for using them to develop new medical therapies have been widespread and persistent. Basic facts, well understood by physicians and biologists, have been so misstated and misrepresented in the news media and political speeches that the general public has been put in a state of constant uncertainty. The solution to the present troubling condition is better education in the form of diligent, honest, and complete scientific disclosure by responsible scientists and physicians; and more care given to accurate reporting by news media. Several key aspects of newly emerging embryonic and non-embryonic stem cell technologies are defined and discussed as they relate to the debate over the use of human embryos for medical research. An important topic for consideration is how to disclose with clarity the scientific basis for human embryonic life. Thereafter, failings in proposed technologies for developing new therapies with human embryonic stem cells, that have been grossly under-reported, are examined. Finally, properties of adult stem cells are presented in contradistinction to embryonic stem cells, both in terms of adult stem cells as a scientifically better alternative to embryonic stem cells and in terms of the technological challenges that must be overcome to realize the potential of adult stem cells for new medical therapies.

Simonstein, F. (2008). "Embryonic stem cells: the disagreement debate and embryonic stem cell research in Israel." J Med Ethics **34**(10): 732-4.

While some people claim that the present disagreement over embryonic stem (ES) cell research cannot be resolved, others argue that developing transparency and trust are key elements that could resolve the existing disagreements over such research. This paper reveals that transparency is not necessarily a requirement for advancing ES cell research, since in Israel, for instance, there is (almost) no transparency, and research nevertheless flourishes. Moreover, trust is not independent of cultural values and religious beliefs. Because of these beliefs, the environment in Israel for ES cell research has been pragmatic and liberal. The Israeli case illustrates the key role that culture and religion can play in biomedical research; it also suggests that as far as cultural values or religious beliefs of people in Western countries strongly oppose research on embryonic tissue, it would be very difficult, if not impossible, to overcome the disagreements.

Sitko, B. J. (2002). "Reconstructing the stem cell debate." Princet J Bioeth **5**: 92-104.

Human embryonic stem cells have been a major topic in science, medicine, and religion since their discovery in 1998. However, due to the complex discourse and rhetoric of scientific language, debate has remained within the professional realm via "expert bioethics." Using the tenets of pragmatism, the author examines the need to move the debate to society as a whole and disentangle the stem cell debate from the ideologies of the human cloning and abortion debates. Opening this issue to a societal debate will advance societal growth, resulting in informed decisions on moral issues, funding, or regulation associated with hES cell research.

Spyridonidis, A., R. Zeiser, et al. (2005). "Stem cell plasticity: the debate begins to clarify." Stem Cell Rev **1**(1): 37-43.

The stem cell story begins with the recognition of the regenerative powers of the head of the Lernean Hydra and the human liver (Prometheus) by the ancient Greeks. In modern times, the adult human stem cell has been epitomized by the hematopoietic stem cell in the bone marrow. More recently, bone marrow derived cells were reported to contribute to nonhematopoietic organs, suggesting a level of plasticity not previously expected. However, other reports failed to repeat some of these results, resulting in a heated debate on the plasticity of adult stem cells that has crossed over into the public domain and become a matter of political impact on the use of embryonic vs adult stem cells for organ regeneration or gene therapy. This review discusses the current status of the "plasticity" debate and presents existing data on detection methodology, underlying mechanisms, physiological implications, and clinical significance.

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