Embryonic Stem Cells and a Reformed Christian World View

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Stem cells promise to treat diseases in ways not before possible. However, the use of human embryonic stem (hES) cells raises important issues that must be dealt with before development of clinical therapies proceeds too far. Key themes from a Reformed Christian perspective are used to frame the issues surrounding hES cells in order to address the central question: Can we obediently develop hES cell technology in order to heal the broken world? These themes include creation-fall-redemption, stewardship, human worth, the kingdom of God and social justice. It may be possible to view hES cell technology as something that promotes redemptive/stewardship roles as long as steps are taken to promote justice for the embryo and society.

It is important that Christians confront the question of hES cell use so that the response to this technology can be proactive instead of reactive.

Since human embryonic stem (hES) cells were first isolated in 1998,[1] controversy has surrounded their use. Scientists desire to study these cells in order to develop their potential use in clinical and research settings while many others have argued that use of hES cells should be discontinued immediately. A variety of positions have developed.[2] At one end of the spectrum, it is argued that embryos have no moral status and so research with hES cells should proceed without restriction. At the other end, it has been suggested that all use of hES cells should stop since it requires the destruction of human embryos which is essentially the killing of humans. Intermediate positions have argued for the regulated use of hES cells under certain conditions.[3] A consensus has not been reached within the Christian community or the public at large. It is important that Christians confront the question of hES cell use so that the response to this technology can be proactive instead of reactive.

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A person's world view will determine how they will respond to the issue of hES cells. World view is "the comprehensive framework of one's basic beliefs about things,"[4] a "set of presuppositions … which we hold … about the basic makeup of our world."[5] A person's world view is the way in which one looks at the world and understands one's place in it.[6] This perspective on the animate and inanimate world guides a person's thoughts as he or she makes decisions. In order to make good decisions and act in a morally consistent way on controversial issues, one must understand one's world view. Christians base their world views on biblical revelation and a common faith commitment, a basic Christian theism that separates them from non-Christian world views.[7] As John Calvin asserts, the Bible provides us with the "spectacles" through which we can understand God and his creation.[8] However, many types of Christian world views have developed due to the roles that life experience and the historical development of faith communities play in world view formation.[9]

This paper will utilize a Christian world view from the Reformed tradition in assessing stem cell use. Its focus is to develop a Reformed Christian perspective on hES cell use that will address this central question: Can we obediently develop hES cell technol-

ogy in order to heal the broken world? To answer this question, the science behind hES cells will be summarized and then important aspects of a Reformed Christian world view will be used to frame the issues surrounding hES cells. Since there are many facets from which to view the question of hES cells, the result of this discussion will be complex instead of a single, simple resolution to the question raised.

Stem Cells

Stem cells are "cells with the capacity for unlimited or prolonged self-renewal that can produce at least one type of highly differentiated descendant."[10] These are relatively undifferentiated (unspecialized) cells that have the capability to become various types of more differentiated cells. The two properties of differentiation and self-renewal allow stem cells to be cultured in a relatively undifferentiated state until they are directed to develop into more specialized cells. Depending on their origin, stem cells could theoretically develop into any of the approximately two hundred types of specialized cells in the body if the appropriate signals were known and applied.

There is great excitement over the potential uses of stem cells.[11] From a basic science perspective, stem cells could be used to understand important processes that control the differentiation of cells during development. They could also be used to identify chemicals that cause developmental abnormalities and to test the safety of potential new drugs. However, the most excitement arises over their potential to cure various types of diseases either by replacing damaged cells or enhancing the survival and function of existing cells. Stem cells have the potential to provide therapeutic benefits for coronary heart disease (approximately 12.9 million cases in the US), type I diabetes (0.8–1.7 million cases), spinal cord injuries (200,000 cases), Parkinson's disease (1.5 million cases), Alzheimer's disease (4 million cases) and others.[12] Considering the number of individuals affected by these diseases in the United States alone, there is tremendous potential for relieving considerable suffering.

Stem cells can be derived from either embryonic or adult tissue. Embryonic stem (ES) cells typically originate from blastocyst stage embryos that are formed approximately six days after fertilization in the human. These blastocysts may be formed from "left over" frozen embryos after in vitro fertilization from infertility procedures but sometimes from embryos specifically created for research purposes.[13] Blastocyst embryos have two basic cell types: the inner cell mass which develops into various cells of the body and the trophoblast which develops into placental tissue. The inner cell mass is isolated and the cells cultured as ES cells.[14] Although ES cells have the potential to develop into any of the types found in the body, they are considered pluripotent instead of totipotent (able to form any embryonic cell or able to form a complete individual) since they are unable to form the supporting tissues of the placenta and would therefore not implant if placed into the uterus.[15] Pluripotent stem cells also have been isolated from testis/ovary precursor tissue from 5–9 week terminated pregnancies and are sometimes referred to as human embryonic gonadal (hEG) cells to distinguish their source.[16] There is also the potential to create embryos using somatic cell nuclear transfer (cloning) techniques. Although this has reportedly occurred, significant obstacles remain before primate nuclear transfer for stem cell production can be attained.[17] The benefit of using cloning techniques would be that a given individual could be the source of his or her own stem cells, circumventing tissue rejection problems that may or may not occur when cells from another individual are used.[18] Other potential methods under study to avoid rejection that do not involve cloning include the use of parthenogenetically activated eggs[19] and ES cells genetically engineered to express the Class I major histocompatability antigens of the transplant recipient.[20] The creation of numerous stem cell lines would also enhance the possibility of using a cell that would not be immunologically rejected.

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Much of the work with ES cells since the 1980s has been with mouse embryos. Researchers have been able to induce cultured mouse ES cells to differentiate into at least nineteen different cell types including nerve, muscle and bone cells.[21] Some success has been attained in using ES cells to treat animal models of human disease such as diabetes, liver disease and Parkinson's disease.[22] Also, mouse ES cell-derived cardiac muscle cells were functional when implanted into mice, and ES cells were used to treat rat models of a human myelin disease and Parkinson's disease.[23] Work with human ES cells has not progressed as far as in animals since they have only recently been derived and limits have been placed on federal funding. Currently, researchers are attempting to control the differentiation of these cells. For example, liver-like cells and insulin producing cells have been derived from hES cells.[24] Clearly,

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many more studies are required with animal and human stem cells before successful treatment of human disease can occur. However, the promise of ES cells seems to be bearing fruit, particularly in the arena of animal experimentation.

The other basic type of stem cell is the adult stem cell. It appears that most, if not all, organs in the body contain some type of stem cell that can be used to renew lost cell types. Sites of stem cell populations include the bone marrow, epidermis, brain, liver, and adipose tissue.[25] It is hypothesized that adult stem cells have a more limited potential to develop into various cell types, and so they are characterized as being multipotent instead of pluripotent.[26] However, recent reports suggest that some adult stem cells have a broader multilineage potential than previously thought,[27] although others have called this conclusion into question.[28] For example, hematopoietic stem cells may be able to form three types of brain cells, skeletal and cardiac muscle cells, and liver cells in addition to blood cells.[29] Animal studies suggest that bone marrow stem cells may be useful in the treatment of myocardial infarction, diabetes, and liver disease.[30]

Less controversy surrounds the use of adult stem cells since the origin of these cells is from an adult who can give consent. It is the use of hES and hEG cells that has generated significant controversy due to the source of the cells. A blastocyst embryo must be destroyed in order to isolate the inner cell mass for hES cells. Testis/ovary precursors use tissue from terminated pregnancies. Many equate these two sources with the killing of human persons. Using cloning techniques to produce blastocyst embryos raises a host of additional ethical issues. Because of the significant moral issues raised, there are those who would advocate only the development of adult stem cells[31] while others argue that both adult and embryonic stem cells be pursued in order to maximize the potential of stem cell use.[32] Although using adult stem cells may be a simple way to relieve an ethical quandary, it does not directly address the issues surrounding hES cell use. If hES cells are more useful than adult cells and if their use can be justified, it would seem prudent to pursue this technology. Thus, the focus of this paper is on the use of hES cells.

Embryonic Stem Cells and A Reformed Christian World View

The Reformed Christian world view is a holistic one that has as a fundamental principle God's sovereignty over all of his creation in the natural and moral realms.[33] All life is subject to the rule of God. A Reformed Christian world view is not dualistic, separating the secular from the sacred, but is an integral perspective that says nothing falls outside of God's purview.[34] It has been characterized by Niebuhr in "conversionist" terms as "Christ the transformer of culture,"[35] and emphasizes personal piety and evangelism along with social and cultural issues.[36] What follows is an analysis of hES cell technology using the following important themes from a Reformed Christian world view: creation-fall-redemption, stewardship, human worth, God's kingdom and social justice. These themes are not mutually exclusive but serve to highlight important aspects of the world view relevant to hES cell technology.

Creation-Fall-Redemption and Stewardship

The principles of creation, fall, and redemption form an overarching framework for a Reformed Christian world view.[37] God created the universe and by his providence he continues to preserve, govern, and care for it.[38] Although characterized as very good, it was not completely finished in the sense that nothing was meant to change after the beginning. Creation continues to unfold according to God's plan; development is expected and desired with humans given a role to play in that process.[39] Therefore, human activities are important for the furtherance of God's plan for this world. The idea of playing God is often used in a very negative sense, that humans are somehow overstepping their bounds and moving into realms that only God should go. However, in a sense humans are called to play God, to be his agents in developing the creation[40] as long as this is done according to his will and plan, playing God "as God plays God."[41] Technological development is an important part of human cultural activity and developing hES technology could be seen as part of God's creative plan.

The fall into sin caused our entire nature to be corrupted[42] and has affected the direction that all of reality is taking,[43] not just humans. Redemption is for all of creation[44] "to reconcile to himself *all* things."[45] Salvation is a restoration of the creation—not a retreat to the original created state, but a removal of the effects of sin at its present level of development. Redemption through Christ places humans in covenant with God and all of creation, accompanied by certain rights and responsibilities.[46] Christians have a role to play in this restorative process, to work as Christ's agents in this world by using their Spirit-driven actions to help redeem the brokenness. Certainly disease was not part of God's original plan, and so alleviating disease is a high calling as Christians work with Christ to redeem the world. Using hES cells to cure previously intractable diseases would provide a significant step toward redeeming the brokenness of creation.

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The creation-fall-redemption theme is intimately tied to the pre-fall call of stewardship, often understood as the cultural mandate.[47] Although stewardship was mandated prior to the fall, this is also a covenantal responsibility in response to Christ's redemptive act.[48] Reichenbach and Anderson describe this stewardship principle as a threefold mandate: to fill, to subdue or rule over, and to care.[49] Since filling the earth is a qualitative change for the better in addition to a quantitative increase in numbers, this mandate calls us to work with God in the development of his creation including cultural possibilities.[50] Subduing or ruling over the earth must be done according to God's plan in a caring manner as caretakers of the creation for God. Technology in general,[51] and hES cells in particular, can be seen as one way to fulfill the stewardship responsibility of developing, caring for, and helping redeem the creation.

A word of caution regarding technology should be noted here. Many would regard technologies as neutral and that the use of the technology will determine whether the activity is good or bad. However, as cogently argued by Monsma and colleagues,[52] technologies are not neutral. Value decisions are made in terms of what technologies will be developed and use of a technology in turn affects what activities will and will not occur. The development of hES cell technology is occurring as part of a commitment to high-tech, expensive, rescue medicine and siphons resources from other approaches to health care.[53] Christians should not fall prey to technicism, an approach that sees technology as the solution to all human problems.[54] It may be that hES cells is an appropriate technology. But one must be wary and not blinded by its apparent promise to the point of neglecting other approaches and becoming over-reliant on technological solutions.

Finally, it could be argued that hES cell technology is part of the brokenness of creation and thus would itself need redemption. To some, redemption would mean avoiding hES cells altogether and focusing only on adult stem cells. However, as will be discussed below, redemption also could mean using human embryos for furthering stewardship in such a way that promotes justice.

Human Worth

Much of the discussion about hES cells centers on this question: What is the worth of the human embryo? This is an important question since embryos must necessarily be destroyed in the derivation of hES cells. This question must be answered adequately in order to decide whether to pursue this technology. The fundamental worth of all humans, the sanctity of life, is an important theme in all theistic world views.[55] This dignity is grounded in the creation of humans in the image of God and their redemption by Christ's work on the cross. As participants in God's covenant, humans are placed in moral community with others and so must treat people with reverence and respect—as ends in themselves and not as means to an end.[56] However, there is significant disagreement on how human embryos fit in. Are embryos human persons from the point of fertilization or is there some other way to look at embryos that would allow their being treated differently from fully developed humans? Intimately tied to this are questions regarding the meaning of being a human person and the image of God.

One approach to determine the status of a human embryo is to identify a developmental stage before which the developing human is not a person and after which full status as a human person is present. Stages that have been used include fertilization (conception), implantation into the uterus (beginning about day 7), early formation of the spinal cord/brain (about day 14), presence of basic body organs including heartbeat (about 4 weeks), brain activity (about 6 weeks), quickening (17–20 weeks), viability (about

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24 weeks) and birth.[57] It is hard to justify choosing any one of these stages as the decisive moment at which personhood is attained. Arguments have been presented elsewhere,[58] and it is beyond the scope of this paper to repeat them. However, special mention will be made regarding conception.

Conception is a common stage chosen by many evangelical Christians for personhood to begin.[59] However, fertilization itself is a process that begins when a spermatozoon meets the egg and is complete when cell division begins, a process that takes approximately 30 hours. At which point during that process is essential humanness present? Peterson believes that the genetic uniqueness which occurs due to fertilization is the strongest argument in favor of conception as the critical stage.[60] This would argue for amphimixis, or the union of the egg and sperm nuclei during fertilization, as the point at which full status is attained. Hui suggests that the presence of a unique genetic constitution, the ontological continuity between the zygote and adult, and the self development of the embryo due to its genetic constitution supports this view.[61]

Using the biological event of amphimixis to define personhood places too much emphasis on an individual's genetic composition. A human person is more than his or her genetic code. Early zygotic divisions are under the influence of maternal information, a concept acknowledged by Hui but minimized by the unsubstantiated assertion that the embryo controls their use.[62] The environment, both before and after birth, plays a major role in the development of a person. In addition, up until approximately 14 days the early embryo is able to divide into two, resulting in identical twins. This leads to confusion regarding the genetic uniqueness of the individual if the conception view of personhood is held since it is not clear which of the two new embryos (and thus persons) is ontologically continuous with the first. Others have made the following analogy: *If* a clone were created from an adult cell, it would be clear that a person existed before this "twinning" event; therefore, a person exists before the twinning of embryos.[63] However, it is very clear in the cloning case which of the two individuals is continuously present before and after while it is not clear at all in the embryo's case. The fact that twins are genetically identical, yet clearly different persons argues against the genetic view. The emphasis on the embryo's ability to self-develop due to its genetic composition[64] diminishes the importance of the variety of factors involved as *God* "knit [us] together in [our] mother's womb."[65]

Part of the argument in favor of fertilization as the critical point is that once fertilized, the zygote has the potential to fully develop into a human person.[66] Certainly after the sperm enters the egg there is potential to develop, but so is there potential in each individual sperm and egg, particularly after they approach each other. Although there are no guarantees, the zygote is more likely to develop fully and can thus be considered to have more potential. Since the embryo's potential is dependent on its successful interaction with the mother, even more potential is present after implantation. Importantly, having potential is not the same as being.[67]

Potential has significance when discussing isolated stem cells as well. Human ES cells are considered pluripotent and adult stem cells multipotent, not totipotent. However, these distinctions are not clear-cut.[68] Some would suggest that if hES cells were totipotent, then each cell would be considered a human person since it has the potential to develop into a complete human,[69] an argument that also holds if adult stem cells were able to become totipotent.[70] As Peters argues, it is not out of the range of possibility that adult stem cells could become totipotent. Although speculative, eventually any cell in the body might be coaxed into being a totipotent stem cell leading to the conclusion that every cell in the body is a potential human.[71] Will every cell in the body then have status as a potential human? Clearly, the very understanding about what it means to be a person is being challenged.

Biblical texts have been used to support the contention that personhood occurs at fertilization.[72] However, careful analysis of these passages suggests that none of them clearly denotes a stage at which personhood is attained.[73] Psalm 139:13–16 and Job 31:15 point to God's knowledge and creative activity prior to birth. Jeremiah 1:5 emphasizes God's relationship with Jeremiah prior to conception. None of the other passages

frequently cited (Job 3:3, Isaiah 49:1, Psalm 51:5, Luke 1:41–44) say anything concrete about when personhood is attained while Exodus 21:22–25 and Numbers 5:11–31 could be interpreted to suggest that personhood is not immediately present at fertilization. The Bible does emphasize, however, God's knowledge about each person prior to birth, his care for people, and the intimate role he played in forming humans.

One important way to address the issue of human worth and when personhood occurs is to analyze what makes humans unique and when during the life cycle this uniqueness is found. Many have identified various important characteristics that seem to separate humans from other animals. These characteristics include imagination, rationality, communication, ability to feel pain, self-conception, self-control, playfulness, curiosity and others.[74] Focusing on these characteristics is problematic since it is difficult to exclude these characteristics from animals. Current research is showing that animals may have some or all of these to a limited degree.[75] Also, using characteristics to define humanity results in a devaluing of those with various types of disabilities.

Christians emphasize the idea that humans are created in the image of God. The problem then comes in defining what is meant by the image of God and when it is present. Old Testament scholars view the "image of God as the royal function or office of human beings as God's representatives and agents in the world, given authorized power to share in God's rule over the earth's resources and creatures."[76] The image of God is not those characteristics that humans have that animals don't but is a transformation of physical characteristics for stewardship responsibilities.[77] It is difficult to pinpoint exactly what the characteristics of the image of God are. Bouma and colleagues emphasize the importance of reflective choice-making that allows humans to perform their stewardly responsibilities in relationship with God, the creation, other people, and the individual.[78] Peterson suggests that the image requires capacity, task, and relationship: the capacity (such as reason) to carry out the stewardship task in relationship to God.[79] We image God by using the stewardship authority given to us and by living in loving communion with others.[80] Although the image is imperfect due to a fallen relationship with God, it is still maintained in a distorted manner.[81] This discussion still begs the question of when the image is seen in humans, leaving the discussion where it was before with no direct biblical guidance. However, it is difficult to claim that the 6-day embryo has the same type of capacity, task, and relationship inherent in the image of God as a newborn does.

The gradualist theory, sometimes called the potentiality principle, is an approach to the problem of when personhood is attained that takes into account the continuum of change that occurs during human development.[82] Using the term "gradualist" distinguishes between the ideas of "potential persons" espoused here versus "persons with potential" inherent in views that emphasize critical stages like conception.[83] The gradualist view states that human life at all stages is created by God and deserves respect, and that embryos are potential humans that realize their full potential as they gradually develop into a fetus and then a child. A general rule of protection for embryos and fetuses is emphasized due to their potential to become imagers of God.[84] No clear point during development where a fertilized egg's potential is changed to a person with the full image of God can be delineated. Extreme care and respect is due embryos because of their potential to fully develop into imagers of God, but they can be treated differently since they have not completely become persons. As development proceeds, increasing care and respect is due because of the increasing development of personhood. The gradualist theory allows the embryo to be held in high regard but takes into account the observation that an embryo is different from a fetus and a newborn, with different capacity, task and relationship inherent in the image of God.

The gradualist view states that human life at all stages is created by God and deserves respect, and that embryos are potential humans that realize their full potential as they gradually develop into a fetus and then a child.

This developmental approach is used in various situations. Parents are seen as caretakers of children, and rights and responsibilities are given in increasing proportion as they develop. Many would argue that aborting a fetus to save a mother's life is justifiable. This is a decision of relative worth, the fetus with potential and the mother actualized. Others would argue that abortion is wrong except in the case of rape or incest. It would be difficult to justify this decision if the developing embryo were fully human. The gradualist theory allows issues to be sorted that are not clear-cut. It provides a way to emphasize the importance of developing humans while allowing valid judgments to be made in difficult situations. In terms of hES cells, it may allow the technology to be seen as something that promotes stewardship and redemption, so long as the embryo is treated with appropriate respect.

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God's Kingdom and Social Justice

Christ established his kingdom at the time of his first coming, but it will be fully instituted at His second coming.[85] Reformed Christians place an important emphasis on the present reign of Christ in the world[86] which leads to "a very practical concern for an involvement in the world."[87] The kingdom of God claims all of creation, not just parts of it.[88] As forcefully stated by Kuyper, "there is not a square inch in the whole domain of our human existence over which Christ, who is Sovereign over *all*, does not cry: 'Mine!'"[89] The implications of this kingdom perspective are that all areas of life demand the activities of Christians in furthering the work of the kingdom[90] and that Christians should be concerned about the conditions of society and justice.

Social justice can be defined as the application of God's desires in the world in our relationships with each other. Justice for the poor and oppressed is a central theme of the Old and New Testaments, and believers are called to care for them.[92] God's kingdom is concerned about justice/righteousness, and since justice is relational it is social by definition.[93] Christians are to seek both the common and individual good.[94] Reformed Christians have been a major driving force for liberty and freedom, and this drive has at its origin the concept of the sovereignty of God.[95]

Alleviating human pain and suffering is part of the redemptive and stewardship roles God has given to humans. Since hES cells have the potential to cure a variety of intractable diseases for a large number of people, the development of this technology would appear to be worth pursuing. Viewing embryos from a developmental perspective, as having worth due to their potential to fully develop as image bearers but yet different from full persons, allows us to consider destroying embryos to create stem cells. However, the issue of justice must be considered as hES cell technology is assessed.

One needs to determine whether justice is done for embryos by using them for hES cells. There is both a desire to fulfill the redemptive/stewardship role and a desire to hold the embryo as a potential image bearer in high regard. Since the present is a "not yet" state[96]—a fallen world where Christ's redemptive work is in the process of permeating all of creation—there is a tension between what one would do in a perfect world and what needs to be done in a fallen one. Moral decisions are often made by weighing options without precise formulas[97] and the Reformed Christian world view allows for grappling with situations on the edge.[98] Multiple examples of this type of tension can be found. Although divorce is considered contrary to God's plan, it is accepted at times. Killing humans is wrong, yet many believe the death penalty is justified and just war theory allows it. Abortion might be considered acceptable by some under certain situations.[99] Human ES cells places two principles at odds: the worth afforded embryos throughout their development versus the desire to alleviate human disease and suffering. In ethical terms, this may be a conflict of prima facie duties.[100] There is the desire to protect human embryos, but the redemptive/stewardship goal of healing coupled with the gradualist theory for embryos may tip the balance in favor of using embryos for hES cells.

Even if we sanction using embryos for hES cell development, the concept of justice still demands that we treat them with respect because of their status as potential image bearers. Respect should be given practical meaning or we should discard the term altogether.[101] Lebacqz argues that respect includes not treating embryos cavalierly, minimizing harm wherever possible, determining the necessity of using each individual embryo and the way the embryo is spoken about and handled.[102]

Respect can be taken further, however, if the concept of purpose is included. Purpose has been used to consider abortions in certain, but not all, situations.[103] As argued earlier, hES cell use may be justified if the purpose is to promote redemption/stewardship responsibilities. This would suggest that using embryos to cure disease or for research to that end would promote respect while using embryos for egotistical or capitalistic purposes or for research that has no intention to promote health would not. The purpose for which the embryos were initially created may also be important. It is common practice to create extra, unused embryos during clinical in vitro fertilization procedures that will be frozen and eventu-

ally discarded. Since the original purpose for creating these embryos was good and since they will be discarded anyway, their use to "save" someone from illness would promote respect for the embryo.[104] Some would argue that creating extra embryos in these situations is wrong and that only as many embryos as are going to be used or donated to "adoptive" parents should be created.[105] While it would be preferable to utilize all embryos created, the gradualist perspective promoted here does not require it. In addition, creating extra embryos minimizes medical harm and cost for the parents. Loss of embryos prior to implantation is a normal occurrence and the purpose for their creation is appropriate. Creating embryos for the sole purpose of research or hES cell development promotes the view that embryos are simply commodities[106] and may lead to reducing the value placed on humans at all stages. Creating embryos using somatic cell nuclear transfer (cloning) techniques raises unique issues that are beyond the scope of this paper. Thus, it is possible to respect an embryo in practical ways and still allow for its use. Respect as defined here is not a set of clearly defined procedures but a system of attitudes, born of a world view, which guide individual actions.

Although purpose can be an important component of maintaining respect for the embryo, it must be remembered that intentions are not always simple or pure. Research often has multiple goals, and the original goal of a research project may change as data are gathered. The creation of excess embryos during infertility treatment may itself be a coercive process born of the pressures of society on women to conceive and of clinics to increase their success rates.[107] A separation of the decision to create extra embryos and using them for research is not always clearly demarcated. An infertile couple may have knowledge of the possibility to use the extra embryos for research and therefore will not be bothered if "extras" are made. In addition, the same people doing the infertility treatment may also be involved in the research. Finally, no matter how diligent one is, motives are under the influence of sin. Even the best of intentions are colored by egotistical desires. This is not an argument against promoting respect for embryos by using the idea of purpose. It is a warning to be led by the Spirit through constant prayer while making decisions regarding embryos, making sure that one's motives fit with God's purposes of redemption and stewardship.

Health care technology in general, and hES cell technology in particular, raises broader societal issues in addition to those that relate to individual embryos. Already mentioned is our society's dependence on high-tech rescue medicine with the concurrent shifting of funds away from other types of health care initiatives such as prevention or minimum health care for all citizens.[108] Also, since stem cell therapy will be expensive, issues regarding access are raised since those in poverty tend to have poor health but will not be able to afford the cures.[109] Stem cell research can be seen as a luxury to those who do not have access to basic heath care.[110] Scarce research funds are being directed toward a therapy that will benefit the few who can afford it.[111] Christians should be concerned about the unequal distribution of wealth, the real everyday needs of everyone and how these resources are allocated.[112]

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Justice must be pursued individually and collectively. Each individual should seek justice for all with whom they come into contact. However, society as a whole depends on the government to ensure that justice is done for the marginalized. This is an important role mandated by God where the State is to balance the need for individual personal liberties with appropriate regulations to ensure that all are treated with justice.[113] Currently in the United States, federally funded research on hES cells is regulated and limited to a few existing stem cell lines while the private sector is completely unregulated.[114] Individual companies, such as Geron, may set up their own advisory boards but it is not a requirement.[115] This situation does not allow for adequate governmental oversight of hES cell research. Government regulation limiting the creation and use of hES cells for medical purposes only is necessary in all sectors in order to maintain the respect due the human embryo as discussed above. In addition, a national approach to health care is needed to promote the concept of distributive justice and provide fairness of access.[116] In order to use hES cells appropriately, it is imperative that the government adequately promote justice for individual embryos and all members of society.

Conclusion

Can we obediently develop hES cell technology in order to heal the broken world? A world view perspective allows all facets of this central question to be addressed. The key Reformed Christian world view themes of creation-fall-redemption, stewardship, human worth, the kingdom of God and social justice provide a way to frame the issues in order to understand them more clearly and to address the

central question. As one looks at this question from a world view perspective, it becomes apparent that the answers are not black and white, and that there is much room for disagreement. Discussing the issue in this way allows Christians to understand each other, identify areas of common ground, and work together toward fulfilling their God-given tasks.

Technologies are developed in response to God's desire that humans work with him as he develops and redeems his creation and in response to his call to stewardship. Since disease is not part of God's original plan, hES technology can be seen as something that promotes redemption and stewardship of the creation. The gradualist theory holds that human embryos have worth due to their potential to develop fully into humans, but since potential is not the same as being they can be treated differently than fully developed humans. This allows for the use of embryos under circumstances that promote justice toward those embryos. Justice demands respect and respect demands appropriate purpose. Therefore, the best argument can be made for using preimplantation "spare" embryos from infertility procedures for hES cells in the area of clinical therapy development. The government must play a key regulatory role in making certain that justice is being done by regulating the creation and use of embryos and providing its citizens fair access to the technology.

Should hES cell technology be pursued? Moral decisions such as these require us to weigh the options and proceed with care. The discussion presented here suggests that embryo use for clinical therapy development is appropriate. This should be done prayerfully to be sure that our motives are pure and *each* embryo used serves an important purpose in order to justly promote the redemptive/stewardship task of alleviating human disease. ✧

Embryo use for clinical therapy development is appropriate. This should be done prayerfully to be sure that our motives are pure and each embryo used serves an important purpose in order to justly promote the redemptive/ stewardship task of alleviating human disease.

Notes

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[1]J. A. Thomson, J. Itskovitz-Eldor, S. S. Shapiro, M. A. Waknitz, J. J. Swiergiel, V. S. Marchall, and J. M. Jones, "Embryonic Stem Cell Lines Derived from Human Blastocysts," *Science* 282 (1998): 1145–7; J. J. Shamblott, J. Axelman, S. Wang, E. M. Bugg, J. W. Littlefield, P. J. Donovan, P. D. Blumenthal, G. R. Huggins, and J. D. Gearhart, "Derivation of Pluripotent Stem Cells from Cultured Human Primordial Germ Cells," *Proceedings of the National Academy of Sciences USA* 95, no. 23 (1998): 13726–31.

[2]G. Outka, "The ethics of stem cell research," Paper presented to the President's Council on Bioethics, April, 2002. www.bioethics.gov/background/outkapaper.html (last accessed December 2003). Revised version in *Kennedy Institute Ethics Journal* 12, no. 2 (2002): 175–213.

[3]A. R. Chapman, M. S. Frankel, and M. S. Garfinkel, "Stem Cell Research and Applications Monitoring the Frontiers of Biomedical Research," *American Association for the Advancement of Science and the Institute for Civil Society*. www.aaas.org/spp/dspp/sfrl/projects/stem/report.pdf (1999): 10–1 (last accessed December 2003).

[4]A. M. Wolters, *Creation Regained: Biblical Basics for a Reformational Worldview* (Grand Rapids, MI: Wm. B. Eerdmans, 1985), 2.

[5]J. W. Sire, *The Universe Next Door: A Basic Worldview Catalog*, 3rd ed. (Downers Grove, IN: InterVarsity Press, 1997), 16.

[6]J. H. Olthuis, "On Worldviews," *Christian Scholars Review* 14, no. 2 (1985): 153–64.

[7]Sire, *The Universe Next Door*, 23–38.

[8]J. T. McNeill, ed., *Calvin's Institutes of the Christian Religion, Book 1* (Philadelphia: Westminster Press, 1960), 70.

[9]Olthuis, "On Worldviews," 153–64.

[10]F. M. Watt and B. L. M. Hogan, "Out of Eden: Stem Cells and Their Niches," *Science* 287 (2000): 1427–30.

[11]National Institutes of Health, "Stem Cells Basics," http://stemcells.nih.gov/infoCenter/stemCellBasics.asp (last accessed December 2003); T. B. Okarma, "Human Embryonic Stem Cells: A Primer on the Technology and Its Medical Applications," in *The Human Embryonic Stem Cell Debate: Science, Ethics and Public Policy,* ed. S. Holland, K. Lebacqz, and L. Zoloth (Cambridge: MIT Press, 2001), 3–13; D. A. Kerr, J. Llado, M. J. Shamblott, N. J. Maragakis, D. N. Irani, T. O. Crawford, C. Krishnan, S. Dike, J. D. Gearhart, and J. D. Rothstein, "Human Embryonic Germ Cell Derivatives Facilitate Motor Recovery of Rats with Diffuse Motor Neuron Injury," *Journal of Neuroscience* 23 (2003): 5131–40.

[12]American Heart Association, *Heart Disease and Stroke Statistics – 2003 Update* (Dallas: American Heart Association, 2002), 5; Center for Disease Control, Diabetes Public Health Resource, *National Diabetes Fact Sheet,* www.cdc.gov/diabetes/pubs/estimates.htm (last accessed December 2003); American Diabetic Association, www.diabetes.org/main/info/facts/facts_natl.jsp (last accessed December 2003); National Spinal Cord Injury Statistical Center, *Spinal Cord Injury: Facts and Figures at a Glance, May 2001,* www.spinalcord.uab.edu (last accessed December 2003); National Parkinson Foundation, Inc., *What the Patient Should Know,* www.parkinson.org/pdedu.htm (last accessed December 2003); Alzheimer's Association, *Statistics About Alzheimer's Disease,* www.alz.org/aboutad/statistics.htm (last accessed December 2003).

[13]D. Josefson, "Embryos Created for Stem Cell Research," *British Medical Journal* 323, no. 7305 (2001): 127.

[14]J. S. Odorico, D. S. Kaufman, and J. A. Thomson, "Multilineage Differentiation from Human Embryonic Stem Cell Lines," *Stem Cells* 19 (2001): 193–204.
[15]National Institutes of Health, "Stem Cells Basics."
[16]J. J. Shamblott, et al., "Derivation of Pluripotent Stem Cells," 13726–31; J. A. Thomson, "Human Embryonic Stem Cells," in *The Human Embryonic Stem Cell Debate*, p. 18.
[17]J. B. Cibelli, A. A. Kiessling, K. Cunniff, C. Richards, R. P. Lanza, and M. D. West, "Somatic Cell Nuclear Transfer in Humans: Pronuclear and Early Embryonic Development," *e-biomed: The Journal of Regenerative Medicine* 2 (2001): 25–31; C. Simerly, T. Dominko, C. Navara, C. Payne, S. Capuano, G. Gosman, K.-Y. Chong, D. Takahashi, C. Chace, D. Compton, L. Hewitson, and G. Schatten, "Molecular Correlates of Primate Nuclear Transfer Failures," *Science* 300 (2003): 297.
[18]J. S. Odorico, D. S. Kaufman, and J. A. Thomson, "Multilineage Differentiation from Human Embryonic Stem Cell Lines," *Stem Cells* 19 (2001): 193–204.
[19]J. B. Cibelli, K. A. Grant, K. B. Chapman, K. Cunniff, T. Worst, H. Green, S. J. Walker, P. Gutin, L. Vilner, V. Tabar, T. Dominko, J. Kane, P. J. Wettstein, R. P. Lanza, L. Studer, K. E. Vrana, and M. D. West, "Parthenogenetic Stem Cells in Nonhuman Primates," *Science* 295 (2002): 819.
[20]Department of Health and Human Services, *Stem Cells: Scientific Progress and Future Directions* (June 2001): 17. Available at http://stemcells.nih.gov/stemcell/pdfs/fullrptstem.pdf (last accessed December 2003).
[21]Ibid., p. 8.
[22]N. Lumelsky, O. Blondel, P. Laeng, I. Velasco, R. Ravin, and R. McKay, "Differentiation of Embryonic Stem Cells to Insulin-Secreting Structures Similar to Pancreatic Islets," *Science* 292 (2001): 1389–94; H. Yamamoto, G. Quinn, A. Asari, H. Yamanokuchi, T. Teratani, M. Terada, and T. Ochiya, "Differentiation of Embryonic Stem Cells into Hepatocyes: Biological Functions and Therapeutic Application," *Hepatology* 37, no. 5 (2003): 983–93; J.-H. Kim, J. M. Auerbach, J. A. Rodriguez-Gomez, I. Velasco, D. Gavin, N. Lumelsky, S.-H. Lee, J. Nguten, R. Sanchez-Pernaute, K. Bankiewicz, and R. McKay, "Dopamine Neurons Derived from Embryonic Stem Cells Function in an Animal Model of Parkinson's Disease," *Nature* 418 (2002): 50–6.
[23]K. Johkura, L. Cui, A. Suzuki, R. Teng, A. Kamiyoshi, S. Okamura, S. Kubota, X. Zhao, K. Asanuma, Y. Okouchi, N. Ogiwara, Y. Tagawa, and K. Sasaki, "Survival and Function of Mouse Embryonic Stem Cell-Derived Cariomyocytes in Ectopic Transplants," *Cardiovascular Research* 58, no. 2 (2003): 435–43; O. Brustle, K. N. Jones, R. D. Learish, K. Karram, K. Choudhary, O. D. Wiestler, I. D. Duncan, and R. D. G. McKay, "Embryonic Stem Cell-Derived Glial Precursors: A Source of Myelinating Transplants," *Science* 285 (1999): 754–6; L. M. Bjorklund, R. Sanchez-Pernaute, S. Chung, T. Andersson, I. Y. C. Chen, K. S. P. McNaught, A.-L. Brownell, B. G. Jenkins, C. Wahlestedt, K.-S. Kim, and O. Isacson, "Embryonic Stem Cells Develop into Functional Dopaminergic Neurons After Transplantation in a Parkinson Rat Model," *PNAS* 99, no. 4 (2002): 2344–9.
[24]L. Rambhatla, C. P. Chiu, P. Kundu, Y. Peng, and M. K. Carpenter, "Generation of Hepatocyte-like Cells from Human Embryonic Stem Cells," *Cell Transplantation* 12, no. 1 (2003): 1–11; S. Assady, G. Maor, M. Amit, J. Itskovitz-Eldor, K. L. Skorecki, and M. Tzukerman, "Insulin Production by Human Embryonic Stem Cells," *Diabetes* 50, no. 9 (2001): 1691–7.
[25]Watt, " Out of Eden," 1427–30.
[26]National Institutes of Health, "Stem Cells Basics."
[27]M. F. Pittenger, A. M. Mackay, S. C. Beck, R. K. Jaiswal, R. Douglas, J. D. Mosca, M. A. Moorman, D. W. Simonetti, S. Craig, and D. R. Marchak, "Multilineage Potential of Adult Human Mesenchymal Stem Cells," *Science* 284 (1999): 143–7; Y. Jiang, B. N. Jahagirdar, R. L. Reinhardt, R. E. Schwartz, C. D. Kenne, X. R. Ortiz-Gonzalez, M. Reyes, T. Lenvik, T. Lund, M. Blackstad, J. Du, S., Aldrich, A. Lisberg, W. C. Low, D. A. Largaespada, and C. M. Verfaillie, "Pluripotency of Mesenchymal Stem Cells Derived from Adult Marrow," *Nature* 418 (2002): 41–9.
[28]Q.-L. Ying, J. Nichols, E. P. Evans, and A. G. Smith, "Changing potency by spontaneous fusion," *Nature* 416 (2002): 545–8; N. Terada, T. Hamazaki, M. Oka, M. Hokl, D. M. Mastalerz, Y. Nakano, E. M. Meyer, L. Morel, B. E. Petersen, and E. W. Scott, "Bone Marrow Cells Adopt the Phenotype of Other Cells by Spontaneous Cell Fusion," *Nature* 416 (2002): 542–5.
[29]National Institutes of Health, "Stem Cells Basics."
[30]D. Orlic, J. Kajstura, S. Chimenti, I. Jakonluk, S. M. Anderson, B. Li, J. Pickel, R. McKay, B. Nadal-Ginard, D. M. Bodine, A. Lerl, and P. Anversa, "Bone Marrow Cells Regenerate Infracted Myocardium," *Nature* 410 (2001): 701–5; BD. Orlic, J. Kajstura, S. Chimenti, D. M. Bodine, A. Leri, and P. Anversa, "Bone Marrow Stem Cells Regenerate Infracted Myocardium," *Pediatric Transplantation* 7, no. 3, Suppl (2003): 86–8; A. Ianus, G. G. Holz, N. D. Theise, and M. A. Hussain, "In Vivo Derivation of Glucose-Competent Pancreatic Endocrine Cells from Bone Marrow Without Evidence of Cell Fusion," *Journal of Clinical Investigation* 111, no. 6 (2003): 843–50; G. Vassilopoulos, P.-R. Wang, and D. W. Russel, "Transplanted Bone Marrow Regenerates Liver by Cell Fusion," *Nature* 422 (2003): 901–4; X. Wang, H. Willenbring, Y. Akkari, Y. Torimaru, M. Foster, M. Al-Dhalimy, E. Lagasse, M. Finegold, S. Olson, and M. Grompe, "Cell Fusion is the Principal Source of Bone-Marrow-Derived Hepatocytes," *Nature* 422 (2003): 897–901.
[31]Christian Medical Association, "Stem Cell Research: Executive Summary," www.cmdahome. org (go to issues and then stem cells) 2001 (last accessed December 2003); Center for Bioethics and Human Dignity, "On Human Embryos and Stem Cell Research: An Appeal for Legally and Ethically Responsible Science and Public Policy," www.cbhd.org/resources/stemcells/position_statement.htm, 1999 (last accessed December 2003).
[32]Chapman, et al., "Stem Cell Research and Applications," p. 3.
[33]H. H. Meeter, *The Basic Ideas of Calvinism,* 6th ed. (Grand Rapids, MI: Baker Book House, 1990), 15–23.
[34]Wolters, *Creation Regained*, pp. 10–1.
[35]H. R. Niebuhr, *Christ and Culture* (New York: Harper and Row, 1951), 45, 190.
[36]J. Hesslink, *On Being Reformed: Distinctive Characteristics and Common Misunderstandings,* 2d ed. (Grand Rapids, MI: Reformed Church Press [Eerdmans], 1988), 64.
[37]Wolters, *Creation Regained*, p. 11; C. Plantinga, Jr., *Engaging God's World: A Christian Vision of Faith, Learning, and Living* (Grand Rapids, MI: Wm. B. Eerdmans, 2002), chaps. 2–4.
[38]H. Bouma, III, D. Diekema, E. Langerak, T. Rottman, and A. Verhey, *Christian Faith, Health, and Medical Practice* (Grand Rapids, MI: Wm. B. Eerdmans, 1989), 8–9.
[39]Wolters, *Creation Regained*, pp. 35–41.
[40]J. C. Peterson, *Genetic Turning Points: The Ethics of Human Genetic Intervention* (Grand Rapids, MI: Wm. B. Eerdmans, 2001), 80–9.
[41]A. D. Verhey, "Playing God," in *Genetic Ethics: Do the Ends Justify the Genes?* ed, J. F. Kilner, R. D. Pentz, and F. E. Young (Grand Rapids, MI: Wm. B. Eerdmans, 1997), 72.
[42]Plantinga, *Engaging God's World*, p. 54.
[43]Wolters, *Creation Regained*, p. 44.
[44]Ibid., p. 57; Plantinga, *Engaging God's World*, pp. 95–6.
[45]Col. 1:20, NIV; italics added.
[46]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, p. 84.
[47]Monsma, et al., *Responsible Technology: A Christian Perspective*, p. 38.
[48]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, pp. 83–94.
[49]B. R. Reichenbach and V. E. Anderson, *On Behalf of God: A Christian Ethic for Biology,* (Grand Rapids, MI: Wm. B. Eerdmans, 1995), 49–56.
[50]Plantinga, Jr., *Engaging God's World*, p. 33; Reichenbach and Anderson, *On Behalf of God: A Christian Ethic for Biology.* pp. 49–51.
[51]Monsma, et al., *Responsible Technology: A Christian Perspective*, pp. 55–7.
[52]Ibid., pp. 24–36.

[53]T. A. Shannon, "Human embryonic stem cell therapy," *Theological Studies* 62, no. 4 (2001): 811–24.
[54]Monsma, et al., *Responsible Technology: A Christian Perspective*, pp. 49–51.
[55]Sire, *The Universe Next Door*, p. 27–30.
[56]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, pp. 84–7, 90–1; K. L. Vaux, *Health and Medicine in the Reformed Tradition* (New York: Crossroad, 1984), 43–6.
[57]Peterson, *Genetic Turning Points*, pp. 116–27; S. B. Rae, *Brave New Families: Biblical Ethics and Reproductive Technologies* (Grand Rapids, MI: Baker Books, 1996), 95–9.
[58]Peterson, *Genetic Turning Points*, pp. 116–27; Rae, *Brave New Families*, pp. 95–104; Reichenbach and Anderson, *On Behalf of God*, pp. 165–6; D. G. Jones, *Brave New People: Ethical Issues at the Commencement of Life* (Grand Rapids, MI: Wm. B. Eerdmans, 1985), 155–64.
[59]Rae, *Brave New Families*, p. 108; P. Lachine, "The Biotech Temptation," *Christianity Today* 43, no. 8 (1999): 26–7; Christian Medical Association, "Stem Cell Research: Executive Summary"; and Center for Bioethics and Human Dignity, "On Human Embryos."
[60]Peterson, *Genetic Turning Points*, p. 127.
[61]E. C. Hui, *At the Beginning of Life: Dilemmas in Theological Bioethics* (Downers Grove, IN: InterVarsity Press, 2002), 58–61.
[62]Ibid., pp. 63–5.
[63]D. M. Sullivan, "The Conception View of Personhood: A Review," *Ethics and Medicine* 19, no. 1 (2003): 11–34.
[64]Hui, *At the Beginning of Life*, p. 60.
[65]Psalm 139:13, NIV.
[66]Peterson, *Genetic Turning Points*, pp. 130–4.
[67]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, pp. 45–8.
[68]T. Peters, "Embryonic Stem Cells and the Theology of Dignity," in *The Human Embryonic Stem Cell Debate*, pp. 127–39.
[69]Christian Medical Association, "Stem Cell Research: Executive Summary."
[70]Hui, *At the Beginning of Life*, p. 254.
[71]Peters, "Embryonic Stem Cells and the Theology of Dignity," pp. 127–39.
[72]Rae, *Brave New Families*, pp. 104–8.
[73]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, pp. 36–7; Peterson, *Genetic Turning Points*, pp. 113–6; Sullivan, "The Conception View of Personhood," pp. 11–34.
[74]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, pp. 28, 35–6; Rae, *Brave New Families*, pp. 100–4.
[75]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, p. 29.
[76]J. R. Middleton, "The Liberating Image? Interpreting the *Imago Dei* in Context," *Christian Scholars Review* 24, no. 1 (1994): 8–25, p. 12.
[77]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, pp. 29–34.
[78]Ibid., p. 32.
[79]Peterson, *Genetic Turning Points*, pp. 69–70.
[80]Plantinga, Jr. *Engaging God's World*, pp. 30–4.
[81]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, pp. 33–4; Peterson, *Genetic Turning Points*, p. 69.
[82]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, pp. 45–8; Reichenback and Anderson, *On Behalf of God*, pp. 112–7; Jones, *Brave New People*, pp. 156–7; R. N. Wennberg, *Life in the Balance: Exploring the Abortion Controversy* (Grand Rapids, MI: Wm. B. Eerdmans, 1985), 112–23.
[83]Hui, *At the Beginning of Life*, pp. 322–8.
[84]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, p. 208; Jones, *Brave New People*, pp. 161–4.
[85]H. Ridderbos, *The Coming of the Kindgdom* (Philadelphia: Presbyterian and Reformed Publishing Company, 1962), 61; J. Hesslink, *On Being Reformed: Distinctive Characteristics and Common Misunderstandings,* 2d ed. (Grand Rapids, MI: Reformed Church Press [Eerdmans], 1988), 65.
[86]I. C. Rottenberg, *The Promise and the Presence: Toward a Theology of the Kingdom of God* (Grand Rapids, MI: Wm. B. Eerdmans, 1980), 48–9.
[87]Hesslink, *On Being Reformed*, p. 65.
[88]Wolters, *Creation Regained*, p. 64.
[89]J. D. Bratt, *Abraham Kuyper: A Centennial Reader* (Grand Rapids, MI: Wm. B. Eerdmans, 1988), 488.
[90]Wolters, *Creation Regained*, p. 67.
[91]Rottenberg, *The Promise and the Presence*, pp. 83, 93.
[92]H. A. Snyder, *A Kingdom Manifesto* (Downers Grove, IL: Inter Varsity Press, 1985), 51–4; P. Toon, *God's Kingdom for Today* (Westchester: Cornerstone Books, 1980), 106,108; Meeter, *The Basic Ideas of Calvinism*, pp. 189–90.
[93]Snyder, *A Kingdom Manifesto*, pp. 54–6.
[94]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, 91–3.
[95]A. Kuyper, *Lectures on Calvinism.* (Grand Rapids, MI: Wm. B. Eerdmans, 1953), 78–9.
[96]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, pp. 16–26.
[97]Wennberg, *Life in the Balance*, pp. 122–3.
[98]Vaux, *Health and Medicine in the Reformed Tradition*, pp. 96–100.
[99]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, pp. 226–33; K. L. Vaux, *Health and Medicine in the Reformed Tradition*, pp. 99–100; Wennberg, *Life in the Balance: Exploring the Abortion Controversy,* pp. 169–73; Hui, *At the Beginning of Life*, pp. 349–52.
[100]K. Lebacqz, "On the Elusive Nature of Respect," in *The Human Embryonic Stem Cell Debate*, p. 159.
[101]G. Meilaender, "Some Protestant Reflections," in *The Human Embryonic Stem Cell Debate: Science, Ethics and Public Policy,* p. 146.
[102]Lebacqz, "On the Elusive Nature of Respect," pp. 158–60.
[103]Bouma III, et al., *Christian Faith, Health, and Medical Practice* pp. 226–33; Vaux, *Health and Medicine in the Reformed Tradition*, pp. 99–100.
[104]Outka, "The Ethics of Stem Cell Research," pp. 175–213.
[105]Rae, *Brave New Families*, pp. 130–40.
[106]Christian Century, "Embryos and Us," *Christian Century* 118, no. 22 (2001): 5–6; Shannon, "Human Embryonic Stem Cell Therapy," pp. 811–24.
[107]C. B. Cohen, "Leaps and Boundaries: Expanding Oversight of Human Stem Cell Research," in *The Human Embryonic Stem Cell Debate*, pp. 212–4.
[108]T. A. Shannon, "From the Micro to the Macro," in *The Human Embryonic Stem Cell Debate*, pp. 180–3.
[109]L. Zoloth, "Jordan's Banks: A View from the First Years of Human Embryonic Stem Cell Research," in *The Human Embryonic Stem Cell Debate*, pp. 237–8.
[110]S. Holland, "Beyond the Embryo: A Feminist Appraisal of the Embryonic Stem Cell Debate," in *The Human Embryonic Stem Cell Debate*, pp. 83–5.
[111]Shannon, "Human Embryonic Stem Cell Therapy," pp. 811–24.
[112]Rottenberg, *The Promise and the Presence*, pp. 98–9; Verhey, "Playing God," p. 70.
[113]Meeter, *The Basic Ideas of Calvinism*, p. 102; R. S. Wallace *Calvin, Geneva, and the Reformation* (Grand Rapids, MI: Baker Book House, 1988), 116.
[114]N. Gibbs and M. Duffy, "The Stem Cell Decision," *Time* (August 20, 2001): 14–6; J. Kluger and M. D. Lemonick, "And What About the Science?" *Time* (August 20, 2001): 20–1.
[115]Zoloth, "Jordan's Banks: A View From the First Years of Human Embryonic Stem Cell Research," pp. 225–8.
[116]Bouma III, et al., *Christian Faith, Health, and Medical Practice*, pp.162–4; M. R. McClean, "Stem Cells: Shaping the Future in Public Policy" in *The Human Embryonic Stem Cell Debate*, 197–207.