

CHRISTIAN FAITH AND HUMAN BEGINNINGS

CHRISTIAN CARE AND PRE-IMPLANTATION HUMAN LIFE



A Report of the Commission on Theology and Church Relations
of The Lutheran Church—Missouri Synod

September 2005

Abbreviations:

AC = Augsburg Confession

FC SD = Formula of Concord, Solid Declaration

FC Ep = Formula of Concord, Epitome

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Christian Faith and Human Beginnings

Christian Care and Pre-implantation Human Life

Introduction

Pastor Solomon was having an interesting week. His calendar showed that Rachel and James were due to meet with him next Monday. Their physician was recommending that they try *in vitro* fertilization (IVF), since other treatments for their infertility had failed. They wanted Pastor Solomon to help them think about the moral and spiritual implications of this recommendation. A local pro-life group had also called with questions about stem cell research and had pointed him to some arguments that claimed that IVF clinics were failing to respect human life in ways very similar to abortion clinics. The main argument was that “life begins at conception.” IVF clinical practice fertilizes human eggs in a laboratory setting and often includes decisions not to transfer every one of the fertilized eggs into the woman’s body. Some are frozen for possible future transfer and others are discarded. And some that are frozen are now being destroyed as they become sources for stem cells to be used in medical and biological research.¹

Pastor Solomon had recently been examining end-of-life issues with the adult Bible class. He had drawn upon the Bible Study in *Christian Care*

¹ The Commission on Theology and Church Relations (CTCR) discussed many aspects of IVF in its 1996 report *Christians and Procreative Choices: How Do God’s Chosen Choose?* (see pages 34–39) and in its 2002 report *What Child Is This? Marriage, Family and Human Cloning* (see pages 9, 17–21). In the 1996 report, the problem of decisions not to transfer embryos is said to be “of the utmost seriousness” (38). “When embryos explicitly created from within a marriage are denied the possibility of nurture in the womb that God created to receive them,” says the report, “then the unique and sacred expression in the embryo of the one-flesh union of marriage is subject to distortion and diminution” (39). In the present report the matter of protecting pre-implantation embryos is addressed in much more detail (cf. footnote 18 in the 2002 report), and our focus is on Christian participation in public debate concerning the use of embryos for medical research and therapy.

at *Life's End*, which made frequent use of the principle "Always to care, never to kill."² He and the class thought that this principle shed useful light on care for humans at the end of life. Pastor Solomon found himself wondering whether this line of thought could help him with the beginning-of-life issues that he was now encountering.

Pastor Solomon first tried using this principle to examine care for human life in the womb. In the womb we find fragile and vulnerable human lives on their way to birth into human families and community. Pastor Solomon was encouraged that "Always to care, never to kill" seemed to sum up familiar Christian teaching concerning protection and care for lives in the womb.

His current questions, however, were not about life in the womb but about fertilized eggs in IVF clinics, and particularly about those that were not being transferred into a woman's womb. "Always to care, never to kill" certainly sums up a Christian's attitude to the human lives that are given to us. And fertilized eggs are human. Pastor Solomon recognized that most thoughtful participants in these debates about the beginnings of life outside the womb in laboratories readily admitted that the coming together of sperm and egg was a crucial step in the beginning of a human life. The debates were not about whether conception began a human life but about whether human life that is never implanted in the womb comes under the principle "Always to care, never to kill" in the same way that life developing in the womb and beyond does.

Pastor Solomon had often studied and used the various Scripture passages that speak of God's regard for His people's lives not only before we were in the womb (for example, Jer. 1:5) but even from before the foundation of the world (Eph. 1:4). Those passages certainly settle the question of whether baptized children of God should thankfully confess God's knowledge and love of them from long before the coming together of sperm and egg that began their physical development. But he had also discovered that Christian theologians are not of one mind concerning whether these same passages also speak about every fertilized egg, including the many that in the natural course of procreation or in the clinic are never successfully implanted in a mother's womb.

² *Christian Care at Life's End*, A Report of the Commission on Theology and Church Relations of The Lutheran Church—Missouri Synod, 1993, 26–30. This principle is used in the CTCR's 1993 report as a way of summing up biblical teaching about Christian care for others at the end of life, and it is used in a similar fashion in the present report with regard to beginning-of-life issues. Other complex and challenging ethical issues such as war and capital punishment require careful examination of scriptural texts that are specifically relevant to these issues and that require the consideration of additional factors (e.g., the divinely-instituted role of civil government to care for its citizens by protecting them from those who seek to do them harm). For further information, see the CTCR reports *Guidelines for Crucial Issues in Christian Citizenship* (1968), *Report on Capital Punishment* (1976), and *Render Unto Caesar...and Unto God: A Lutheran View of Church and State* (1995). The reports of the CTCR can be found online at www.lcms.org/ctr.

Pastor Solomon was confident that human life, implanted in a mother's womb, was to be nurtured and loved, and he knew how to counsel and teach about this topic with his people. But now Rachel and James and a local pro-life group were asking him for advice about human life in a laboratory Petri dish prior to implantation in the womb. And so for the last few days he had applied himself again to Scripture, and he had also begun to become better informed about IVF clinical practice and about stem cell research and cloning. He began to review the broad range of arguments currently employed in the debates that both Christians and non-Christians are having about the moral and spiritual significance of pre-implantation fertilized eggs. His goal was to understand when and how a newly begun human life comes to be regarded by God (and therefore also by us) as a life to be nurtured and loved unconditionally.

Our fictional Pastor Solomon's situation is the one that the Commission on Theology and Church Relations found itself in as it applied itself to the assignment to provide guidance on questions about embryonic stem cell research and cloning for biomedical research.³ In this report we seek to help Christians become better informed about the science and clinical practice of IVF, genetic research, and cloning. We also survey the wide range of ethical arguments that are being brought to bear on these issues. In the final part of this report we return to Pastor Solomon and consider how the principle "Always to care, never to kill" is applicable to questions about human beginnings.

Overview: The Riddle of Human Beginnings

In vitro fertilization (IVF), embryonic stem cell research, and cloning technology require that Christians, along with other concerned and

³ In 1998 Res. 3-15B the Synod requested that the CTCR prepare "a study document to help the church, on the basis of the Word of God, make informed ethical judgments concerning cloning and attendant issues" (1998 *Convention Proceedings*, 120; cf. also 1977 Res. 3-26 and Bylaw 3.9.6.2.1.c in the 2004 *Handbook* of the Synod). The Commission's initial response to this assignment was its 2002 report *What Child Is This? Marriage, Family and Human Cloning*, which focuses on the issue of reproductive cloning: "Reproductive cloning," notes the CTCR, "makes use of genetic science in ways that also provoke significant ethical and moral questions concerning research and technology that manipulate cells that give rise to human life. The Commission is subjecting such questions to biblically disciplined scrutiny and will address these and other issues in subsequent studies" (6). The present report, therefore, is offered in response to 1998 Res. 3-15B's request for scriptural and ethical guidance concerning "cloning and attendant issues." Some of the "attendant issues" specifically noted in the CTCR's 2002 report are: "1) How are we to respond to questions surrounding therapeutic (as opposed to reproductive) cloning, including questions raised by stem cell research? 2) Who will have access to the blessings of genetic knowledge and who will be oppressed by its burdens? 3) Can we expect that society will strive to maximize blessings and minimize banes? 4) How should Christians seek to influence the pursuit and development of genetic science and cloning? 5) What roles can Christian congregations play in helping Christian people seek God's will in these matters?" (6, fn. 5).

thoughtful individuals, return to fundamental questions concerning what it is to be a human whom God loves and whom God would have us love and nurture. The development of genetic science and technology is having the beneficial effect of challenging Christians to redouble their efforts to mine God's Word and to seek to discern God's will in the face of the new questions and possibilities that are being raised each day. There is disagreement not only within contemporary culture but also among Christians on questions about whether and how pre-implantation embryonic cells in laboratories should be accorded protection rather than being discarded in clinics or destroyed or compromised by research.⁴

Consider an example of challenging disagreement among thoughtful Christians and others. In July 2002 the United States President's Council on Bioethics issued a report on *Human Cloning and Human Dignity: An Ethical Inquiry*.⁵ Robert George, a Princeton ethicist, is a member of the Council and a staunch advocate of the position that embryos outside the womb in clinics and laboratories—whether the result of combining sperm and egg or the result of cloning technology—are to be accorded protection on the same basis as live-born humans. He reports that while the 17 members of the Council unanimously voted to oppose reproductive cloning,⁶ they

⁴ The Commission will be defending the position that pre-implantation embryos in laboratories are to be accorded protection on the same basis as live-born humans. Many who defend this position use the language of "human personhood" to make the case. The CTCR's 1984 report *Abortion in Perspective* explained why the case might best be made without relying too heavily on the language of personhood: "We refer to the child in the womb as a *human being* but refrain from referring to that child as a *person* though we have no objection to the use of personal language in that context. We do this simply for the sake of clarity and to avoid unnecessary and futile disputes. In the contemporary meaning used by some, a person is a being aware of itself as a self-conscious self, capable of relating to other selves and envisioning for itself a future. On the basis of such an understanding, some would deny that the life of the unborn child is *personal life*. The more traditional sense given by Christian theologians to the term "person" would predicate it of any member of the human species, any individual sharing our common nature—whether or not that nature is at any moment developed to its fruition in the life of that individual. Human nature has a capacity to know, love, desire, and relate to others. We share in that human nature even though we do not exercise all the functions of which it is capable. Thus, the contemporary understanding adopted by some will designate as a person only one presently exercising certain characteristic human capacities; it understands personal life in functional terms. The more traditional understanding of Christian theologians regards personhood as an endowment which comes with our nature, even if at some stages of life we are unable to exercise characteristic human capacities. Obviously, some important philosophical disputes—chiefly, the debate between nominalists and realists—are involved here. We bypass these arguments and simply refer to the unborn child as a *human being*. Whatever we may say of personal qualities, human beings do not come into existence part by part as do the artifacts we make. Human beings come into existence and then gradually unfold what they already are. It is human beings who are made in God's image and valued by God—and whose inherent dignity ought also to be valued by us" (28, fn. 17).

⁵ For the full text of this report and additional background materials, see <http://www.bioethics.gov/reports/cloningreport/index.html>.

⁶ See *What Child Is This?* for a biblical perspective that opposes reproductive cloning.

divided 10 to 7 on a proposal for a four-year moratorium on cloning to produce human embryos for biomedical research. Of the 10 in favor of a moratorium, 7 argued for an immediate and permanent legal prohibition of cloning embryos for biomedical research. The other 3 in favor of the moratorium argued that while such cloning might be permissible, more time was needed for reflection and debate. Among the 7 who argued for an immediate and permanent prohibition, some (like Robert George) argued that embryos in clinics and laboratories are to be accorded protection on the same basis as live-born humans. Others among the 7, however, were not convinced that the argument for prohibition could or should be based on a claim that embryos should be accorded protection on the same basis as live-born humans.⁷

In March 2004 this same Council issued a report called *Reproduction and Responsibility: The Regulation of New Biotechnologies*.⁸ Leon Kass, chair of the Council, writes in his personal statement that “the report’s major contribution is to show how a heterogeneous group of individuals, whose opinions range almost as widely as those of the American people, has agreed on the need to set limits on some uses of some biotechnologies, in order to protect common values.”⁹ In her personal statement, Council member Rebecca Dresser notes that Council members continue to “disagree on the moral and social value of technologies that enable more people to have biologically related children, expand opportunities to test embryos and fetuses for genetic traits, and offer researchers new avenues for studying preimplantation embryos.”¹⁰

Kass and Dresser are stressing two points about the Council’s work: 1) that disagreement is extensive on the central questions concerning stem cell research and the related science and technologies, and 2) that people whose opinions range widely can nonetheless hope to make progress as they reason together. As Lutherans who share a common faith and life in The Lutheran Church—Missouri Synod (LCMS), we have even more reason than members of that diverse Council to hope that we can make progress toward consensus on the questions before us.

Because the Commission on Theology and Church Relations is committed to making progress toward consensus across the broad range of opinions found in our society and in the LCMS, this report does not assume that biblically disciplined reasoning concerning stem cells and preimplantation human life will produce moral imperatives that are “obvi-

⁷ Robert George, “Embryo Ethics: Justice and Nascent Human Life,” Bradley Lecture, Boston College Institute for the Study of Politics and Religion (February 20, 2004), unpublished typescript, 1.

⁸ This report can be found online at <http://www.bioethics.gov/reports/reproductionandresponsibility/index.html>.

⁹ *Ibid.*, 245.

¹⁰ *Ibid.*, 232.

ous” to everyone. Instead, the Commission has labored to listen long and hard to the ways in which thoughtful people make a variety of cases in addressing these topics. The Commission’s hope is twofold: 1) that by careful articulation of competing viewpoints we can help people make progress toward consensus on the questions before us, and 2) that by patiently working toward consensus, we in the LCMS may also find ways of articulating our pro-life position that can command attention from persons who may have thought that they could easily dismiss our pro-life reasoning. In this way we hope to contribute to strategies for making progress in the context of the political realities of our pluralized society.

In 1984, when IVF science and technology were relatively new, Christian ethicist Oliver O’Donovan put his finger on the challenge that now fully confronts us. IVF science, said O’Donovan, has provided us with detailed knowledge of human beginnings and has puzzled us by “presenting to us members of our own species who are doubtfully proper objects of compassion and love.”¹¹ In those early days of the technology O’Donovan acknowledged that science may contribute to deeper moral knowledge, but he proposed that the wisest course in the face of the ambiguities of human beginnings would be to abandon IVF so we are no longer presented with the profoundly troubling ambiguity.

During the ensuing 20 years the practice of IVF has not been abandoned, and science is contributing ever more complex insight. Ethicist Ronald Green comments on how increasingly complex scientific insight complicates moral reflection:

The invention of the microscope and the ability to isolate sperm and egg for research purposes allowed us to witness fertilization. What better candidate for the beginning of a human life, when elements from the two parents seem to unite in a single new entity? The later understanding that this union signaled the beginning of major genetic transformations, as chromosomally haploid sex cells became an actively dividing embryo with diploid cells, reinforced the conclusion that this was the decisive “moment” when the human individual began. Older religious ideas of ensoulment contributed to this conclusion. God’s intervention to create the spirit was now mapped onto the newly discovered biological information. But this way of understanding events was bound to be transitory. Newer scientific information has thrown doubt on these certainties. Fertilization, which looked like a “moment,” can now be seen as an extended biological process. What seemed like a one-time event—individuation—is now perceived as a process that can continue for up to two weeks.¹²

¹¹ Oliver O’Donovan, *Begotten or Made?* (Oxford: Oxford University Press, 1984), 65.

¹² Ronald M. Green, “Stem Cell Research: A Target Article Collection, Part III—Determining Moral Status,” *American Journal of Bioethics* 2:1 (Winter, 2002), 23.

Today we know that IVF is a widely used technology and that we cannot escape pondering the significance of human life presented to us in Petri dishes in an IVF clinic. Access to human life in these earliest stages in a laboratory setting requires us carefully to examine the sources of some people's uneasy sense that life in this form is "doubtfully" an object of compassion and love.

The Structure of This Report

In part one of this report we provide a basic and strictly objective account of contemporary scientific and technological practice in IVF clinics, in embryonic stem cell research, and in cloning techniques. The goal is to be well informed and to achieve clarity concerning actual practice in contemporary science and technology.

In part two we provide a survey of contrasting lines of reasoning concerning the moral implications of the scientific and technological practices described in the first part. The goal is to understand the various strategies of reasoning and to examine in detail why and how people are puzzled concerning the status of human life in its earliest stages.

In part three we develop lines of reasoning rooted in biblical faith that can help us make progress in discerning and loving human lives in the midst of contemporary scientific and technological practices. We find that we are able to offer some biblically disciplined moral guidance on questions concerning pre-implantation human life in IVF clinics, on questions concerning the derivation of stem cells from pre-implantation human life, and on questions concerning cloning for biomedical research.

This report rigorously examines the arguments of thoughtful Christians and others who do not defend the principle that pre-implantation embryos should be accorded protection in the same way as live-born humans. Upon examination, the Commission on Theology and Church Relations has remained convinced that both biblical and philosophical perspectives support the wisdom of protecting pre-implantation embryos from the time of conception. This has been the point of view summed up in the pro-life claim that "life begins at conception."

Thus, we apply the principle "Always to care, never to kill" also to pre-implantation life. We readily acknowledge the puzzling and complex features of the issues we are addressing, and we offer this moral guidance in a spirit of humility. We trust that our fairness in weighing the competing arguments will be evident, and will elicit equally fair responses from those whose weighing of the arguments leads them to different conclusions.

Part One: Science and Human Beginnings

Physically, the development and growth of the human body is directed by our genes,¹³ some 20,000 to 25,000 sets of physical instructions encoded in the DNA in our cells.¹⁴ Except for cells that are involved in our reproductive systems, every other cell in our body contains the entire set of genes, a complete set of instructions for our physical being. But cells in our bodies differ from each other because only certain of the genes in a cell are actively directing the production, for example, of new skin cells or new muscle cells.

Our cells' genetic instructions come in a double set of paired genes. In the usual case mothers contribute one complete set of genes and fathers the other. Thus, we are physically similar to our parents and yet different because each parent has contributed only half of her or his own total set of instructions to the new set that is our own. This is because sperm and eggs include only one half of the double set of genes found in the other cells of our bodies. Each sperm and egg draws upon the father's or mother's double set of genes in ways that make each sperm and egg genetically different from the others despite their coming from the same parent. When sperm and egg fuse in conception, a new and unique double set of genes is formed from the single contribution of each. As the Psalmist says, we are "fearfully and wonderfully made" (Ps. 139:14).

We turn now to a survey of more recent technologies involved in the conception of new human persons.

Artificial insemination is a relatively simple technique that introduces sperm into the woman's body by some means other than sexual intercourse. Sperm often comes from the woman's husband, but donor sperm from outside a marriage is also used. This technique changes the way that sperm is made available, but it does not change the basic genetic fact that the embryo conceived has a new set of genetic instructions that combines a set of genes from the egg and a set from the sperm.¹⁵

¹³ See the glossary of terms and abbreviations included at the end of this report for this and other technical terms and acronyms used in this document.

¹⁴ See *Nature* 431: 7011 (October 21, 2004), 927, 931 for a discussion of the difficulties involved in determining the precise number of genes in the human genome. A summary report concerning recent estimates can be found at <http://www.newscientist.com/article.ns?id=dn6561> and a popular report at http://www.usatoday.com/tech/science/genetics/2004-10-20-fewer-genes-needed_x.htm.

¹⁵ For an assessment of this method of procreation, see *Christians and Procreative Choices*, 21–22.

Modern day *surrogacy* is the practice of having a woman who is not intended to be the social mother of the child provide the womb in which the child develops until he or she is able to be born. Embryos can be conceived in the surrogate's womb by natural intercourse or more likely by artificial insemination. In this case the surrogate's egg contributes half of the genetic instructions for the child. *In vitro* fertilization and the technology of cloning (see below) make it possible to introduce into the womb an embryo that is in no way genetically related to the surrogate. In the usual practice of *in vitro* fertilization the child will have a new set of genetic instructions combining genes from whatever egg and sperm were brought together to form the embryo. As we will see, cloning changes the way the set of genetic instructions comes into the new life.¹⁶

In vitro fertilization (IVF) refers to a variety of highly sophisticated techniques whereby an embryo is brought about outside a woman's body. Several different methods are used for transferring the embryo into the woman's womb. The usual practice of *in vitro* fertilization changes the place and the way that sperm and egg come together, but this practice does not change the basic genetic fact that the embryo has a new set of genetic instructions resulting from the fusion of sperm and egg. *In vitro* techniques often use sperm and eggs from a married couple, but the technology, of course, can use any source of eggs and sperm.

On July 25, 1978, in Great Britain, Louise Joy Brown was the first child born of IVF techniques. Her sister Natalie was born through IVF in 1981. Today, IVF procreation is widely accepted throughout the world as a medical intervention to address problems of infertility. Many IVF children are born each day. Estimates are that at least 45,000 IVF children have been born in the United States in the past two decades. On Louise Brown's twentieth birthday in 1998, the BBC News reported that IVF had led to about 200,000 babies being born during the first twenty years of the use of this technique.¹⁷

Cloning marks a significantly different approach to a child's origin. In cloning the set of genetic instructions that directs the embryo's physical development derives not from the combination of genes from two parents but from a set of genetic instructions identical to that of the single "parent" from which the clone is generated. The word "clone" comes from the Greek κλών (*klōn*), meaning sprout or twig. *Merriam Webster's Collegiate Dictionary* (Tenth Edition) defines a clone as "an individual grown from a single somatic cell of its parent and genetically identical to it." ("Somatic" means a bodily cell that has a complete set of paired genes, rather than a sex cell

¹⁶ For an assessment of this method of procreation, see *Christians and Procreative Choices*, 7–20.

¹⁷ See news.bbc.co.uk/hi/english/health/newsid_135000/135747.stm.

that has only half of the set of paired genes.) The use of the word “clone” as a noun in the English language dates from the beginning of the twentieth century. The word became a verb in the middle of the twentieth century.

Cloning is not a new feature in the world of biology. In the plant and insect world there are many examples of reproduction occurring by an identical offshoot coming from the parent stock.

Indeed, our own human development from embryo to adult human involves the cloning of the original single cell produced at our conception. All the cells currently in our body are clones of that original cell.

The phenomenon of identical twins is also an example related to cloning. Identical twins occur when, very soon after conception, the embryo splits into two distinct entities. Both entities have identical sets of genetic instructions, but each grows independently. In the earliest stages of embryonic development all the genes in the instruction set are equally at work or dormant in each cell alike, so that when the embryo splits, full development of both new entities is possible. Not long into the development, however, cells in the embryo begin to differentiate. Some begin to form heart muscle, others form other organs, and so forth. Once the cells begin to differentiate, the possibility of natural identical twinning is past.

Genetic science is now pursuing the possibility of taking a differentiated cell from an adult human, returning it to a state where it can direct the entire development of an embryo, introducing it into an egg that has been emptied of its own genetic instructions, and then inducing the cell to use the nutrients in the egg cell to begin to develop into a new individual. Very few people advocate cloning to bring about a new live-born human. In a previous report, the Commission addressed the prospect of cloning to produce a new live-born human.¹⁸ Many people, however, currently advocate using cloning to produce pre-implantation human life from which stem cells might be retrieved for biomedical research and for possible therapeutic interventions. This is sometimes called “therapeutic cloning” in contrast to “reproductive cloning,” but a more descriptive phrase is “cloning for biomedical research.” The retrieval of stem cells ends the development of the embryo; the embryo is prevented from developing into a live-born human.¹⁹

We now review key points concerning *in vitro* fertilization and proposals to retrieve stem cells from pre-implantation human life.

1. This report uses the terms “fertilized egg,” “pre-implantation human life,” and “embryo” to point to the earliest stages of the beginnings of

¹⁸ See the CTCR’s 2002 report *What Child Is This?* (see also footnotes 1 and 3 above).

¹⁹ Some people raise the question of whether the cloned entity is a human embryo. Because the cloned entity could develop into a fully functioning human being, we consider that the ethical questions concerning embryos apply also to entities produced by cloning for biomedical research.

a new human life. In the past forty years science has opened fascinating windows on these stages.

2. Many lines of thought concerning pre-implantation human life use the term “human life” while leaving open questions concerning the moral significance of human life seen in the earliest stages of the beginnings of a new human life.
3. *In vitro* fertilization differs from natural procreation by initiating the cycle of human life in a laboratory Petri dish outside a woman’s reproductive system.
4. Pre-implantation human life is often lost in the natural process of procreation, even though the cycle of human life has been initiated entirely within a woman’s reproductive system. Physician Carolyn B. Coulam reports that “the magnitude of [naturally occurring] fetal wastage in humans is considerable, approaching a loss of up to three quarters of fertilized ova.”²⁰
5. Pre-implantation human life is also often lost in IVF practices. In the best of circumstances only about one third of embryos transferred to the woman’s reproductive system lead to a successful beginning of a pregnancy, let alone to a live birth.²¹ Pre-implantation human life is also lost through decisions not to transfer fertilized eggs.
6. A decision not to transfer a fertilized egg leads to further decisions about whether to discard the unused embryos, to freeze them for future attempts at pregnancy, or to use them for research and as sources for stem cells. The embryos that are not transferred are either left to expire and be discarded, or (if they are thought to be viable) they can be preserved by being frozen for possible future use. Some of those that are frozen are later thawed and transferred, but others are eventually discarded or remain frozen with little or no prospect for future transfer. Estimates for 1999 were that 75,000 IVF children would be born (twice the number of children available for adoption) and 19,000 embryos would be frozen. In the same year, a conservative estimate of the total number of embryos currently frozen was 188,000.²² An estimate in September 2002 was that “over 200,000 embryos are left over from *in vitro* fertilization (IVF) attempts to help couples have children. The unused embryos are frozen in labs all over the United States, wait-

²⁰ *Clinical Obstetrics and Gynecology* 29 (December 1986), 863.

²¹ See, e.g., A.J. Wilcox (et al.), “Incidence of early loss of pregnancy,” *New England Journal of Medicine* 319: 4 (1988), 189–194; E.R. Norwitz (et al.), “Implantation and the survival of early pregnancy,” *New England Journal of Medicine* 345: 19 (2001), 1400–1408. For additional information and references, see on line at http://www.bioethics.gov/reports/stemcell/appendix_a.html#_edn4; also <http://www.begc.crbr.ulaval.ca/themes/themes5.htm>.

²² Lori B. Andrews, “Embryonic Confusion,” *Washington Post* (May 2, 1999), B.01, B.04.

ing for a decision about what will be done with them.”²³ In 2004 the estimate had jumped to 400,000 frozen embryos in the United States alone.²⁴

7. A *stem cell* is a cell from the embryo, fetus, or adult that has, under certain conditions, the ability to reproduce itself for long periods or, in the case of adult stem cells, throughout the life of the organism. Stem cells are able to give rise to specialized cells that make up the tissues and organs of the body. This definition and the following definitions are drawn from information on stem cells provided by the National Institutes of Health of the United States Government.²⁵

Adult stem cells (also called *somatic stem cells*): Research began in the 1960s, and scientists have reported that “adult stem cells occur in many tissues and that they enter normal differentiation pathways to form the specialized cell types of the tissue in which they reside. Adult stem cells may also exhibit the ability to form specialized cell types of other tissues, which is known as transdifferentiation or plasticity.”²⁶

Embryonic stem cells: Research on mouse embryos began more than twenty years ago. In late 1998 the first successful isolation and culture of human embryonic stem cells occurred at the University of Wisconsin-Madison.

The embryos used in these studies were created for infertility purposes through *in vitro* fertilization procedures and when they were no longer needed for that purpose, they were donated for research with the informed consent of the donor. . . . In the 3 to 5 day old embryo, called a blastocyst, a small group of about 30 cells called the inner cell mass gives rise to the hundreds of highly specialized cells needed to make up an adult organism. In the developing fetus, stem cells in developing tissues give rise to the multiple specialized cell types that make up the heart, lung, skin, and other tissues. In some adult tissues, such as bone marrow, muscle, and brain, discrete populations of adult stem cells generate replacements for cells that are lost through normal wear and tear, injury, or disease.²⁷

²³ Jeffrey P. Kahn, “‘Adoption’ of frozen embryos a loaded term,” <http://www-cgi.cnn.com/2002/HEALTH/09/17/ethics.matters/>.

²⁴ John Van Regenmorter, “Frozen Out,” *Christianity Today* 48:7 (July 2004), 32.

²⁵ See “Stem Cells: Scientific Progress and Future Research Directions” (June 2001) at <http://stemcells.nih.gov/info/scireport> and “Stem Cell Basics” (August 2005) at <http://stemcells.nih.gov/info/basics>.

²⁶ “Stem Cell Basics,” IV.C.

²⁷ *Ibid.*, I.A.

8. Stem cells derived from a blastocyst are said to be *pluripotent*:

[T]he fertilized egg is said to be totipotent—from the Latin *totus*, meaning entire—because it has the potential to generate all the cells and tissues that make up an embryo and that support its development in utero. The fertilized egg divides and differentiates until it produces a mature organism. Adult mammals, including humans, consist of more than 200 kinds of cells. These include nerve cells (neurons), muscle cells (myocytes), skin (epithelial) cells, blood cells (erythrocytes, monocytes, lymphocytes, etc.), bone cells (osteocytes), and cartilage cells (chondrocytes). Other cells, which are essential for embryonic development but are not incorporated into the body of the embryo, include the extraembryonic tissues, placenta, and umbilical cord. All of these cells are generated from a single, totipotent cell—the zygote, or fertilized egg.... Most scientists use the term pluripotent to describe stem cells that can give rise to cells derived from all three embryonic germ layers—mesoderm, endoderm, and ectoderm. These three germ layers are the embryonic source of all cells of the body.²⁸

Pluripotent human embryonic stem cells are derived from the inner cell mass of a four- or five-day-old blastocyst. “Adult stem cells are generally limited to differentiating into different cell types of their tissue of origin. However, some evidence suggests that adult stem cell plasticity may exist, increasing the number of cell types a given adult stem cell can become.”²⁹

9. Cloning techniques can be used to produce an embryo³⁰ without the need for bringing sperm and egg together. Cloning for biomedical research, so-called “therapeutic” cloning, is the practice of using cloning not to bring about another live-born human being (reproductive cloning) but to provide an embryo that could be used as a source of stem cells and for other research. The technical term for this cloning technique is “*Somatic Cell Nuclear Transfer*” (SCNT). Many of the proposed therapeutic benefits of SCNT are closely connected to stem cell research. Others suggest that SCNT could be used to separate the nucleus from the egg of a pre-implantation life threatened by diseased mitochondria, thus permitting this life to develop disease-free in a donor egg.
10. When stem cells are derived from an embryo, the embryo is destroyed. People disagree about the significance of discarding or destroying embryos, including the totipotent cells produced by SCNT.

²⁸ “Stems Cells,” Chapter 1: The Stem Cell.

²⁹ “Stem Cell Basics,” V.

³⁰ See footnote 19 concerning use of the term “embryo” applied to a cloned human life.

11. Many scientists argue that embryonic stem cells offer great promise for medical research. Research on embryonic stem cells may help scientists better understand how undifferentiated stem cells become differentiated. Serious medical conditions like cancer and various birth defects are due to abnormal cell division and differentiation. Improved understanding, therefore, may help with future therapies. Scientists also hope to learn how to use stem cells to generate cells and tissues that could be used for cell-based therapies.

Stem cells, directed to differentiate into specific cell types, offer the possibility of a renewable source of replacement cells and tissues to treat diseases including Parkinson's and Alzheimer's diseases, spinal cord injury, stroke, burns, heart disease, diabetes, osteoarthritis, and rheumatoid arthritis.³¹

However, "a significant hurdle to this use and most uses of stem cells is that scientists do not yet fully understand the signals that turn specific genes on and off to influence the differentiation of the stem cell."³² Stem cells may also be used to help in the testing of new drugs to determine risks and benefits to human health.

A survey of contemporary science does not, of course, take us very deeply into the moral questions and problems raised by the possibilities opened to us by scientific research. In the next part of the report we will be discussing the moral significance of pre-implantation human life in the very earliest stages. In connection with this discussion, the following terms and descriptions may prove helpful:

Stages of development: An ovum, after fertilization, is called a zygote. This becomes, in turn, a morula, blastocyst, embryo and fetus. After birth, the fetus is a newborn.

Day 1 — Zygote: A recently fertilized ovum (first cell division).

Day 2 — 2-4 cell stage.

Days 3-4 — Morula: A very early stage of pre-natal mammalian development. This stage starts when the zygote has developed into a mass of 8-16 cells. This is typically 4 days after fertilization, and about 10 days before it becomes implanted in the wall of the womb. Some IVF techniques transfer the embryo into the woman's reproductive system at this stage.

Days 5-7 — Blastocyst: A stage of pre-natal mammalian development that (in humans) extends from the morula stage (a shapeless mass of cells about 4 days after fertilization), to a bilaminar (two layer) embryo stage, 30-150 cells (1 week after fertilization). Some IVF techniques transfer the embryo at this stage, and this is the stage at which stem cells can be obtained.

³¹ "Stem Cell Basics," VI.

³² *Ibid.*

Embryo: A stage of pre-natal mammalian development that (in humans) extends from 2 to 8 weeks after fertilization. It is termed a “bilaminar” or two-layer embryo during its second week and becomes a trilaminar (three-layer) embryo during its third week. At 9 weeks it is called a fetus. The word “embryo” is also used generally to speak of all the early stages of development.

Fetus: A stage of pre-natal mammalian development that (in humans) extends from 9 weeks after fertilization until birth.

Pre-embryo: A term popularized by many writers, almost all of whom are not scientists. It refers to a zygote, morula (8 cells), blastocyst, or embryo before it develops a “primitive streak.”

Primitive streak: A marking which appears on a blastocyst about 14 days after fertilization, at about the time that it is implanted in the wall of the uterus. Division into identical twins is very rare after this point. (See below on “Twinning.”) The streak will eventually develop into the spinal column.

Twinning: A process by which a morula, blastocyst, or embryo divides in half to produce twins with identical genetic makeup. This normally happens at some time up to the 14th day after fertilization, before the “primitive streak” appears. Twinning does rarely happen later than 14 days and produces conjoined twins; these are popularly called “Siamese twins.”³³

Part Two: Pre-implantation Human Life— Contrasting Lines of Reasoning

The Main Question Currently in Controversy

Ethicists and theologians widely agree that the most important question raised by contemporary *in vitro* practice and genetic technology concerns *the moral status of pre-implantation human life*. This report concentrates on this main question, but we should not forget other questions that also deserve attention by Christian people. For example:

- Apart from questions about the moral status of pre-implantation human life, is this sort of research appropriate?

³³ Further information concerning these terms and descriptions can be derived from a variety of sources readily available on the Internet.

- Who will have access to the blessings of genetic knowledge and who will be oppressed by its burdens? Can we expect that society will strive to maximize blessings and minimize banes?
- How should citizens, and particularly Christians, seek to influence the pursuit and development of genetic science and cloning?
- What roles can Christian congregations and other civic organizations play in helping our society make responsible decisions in these matters?³⁴

The main question posed above, however, continues to be regarded as the most important question. In the Summer 2002 issue of *Health Matrix: Journal of Law–Medicine*, for example, Alo Kosen (a JD candidate at Case Western Reserve University School of Law) writes that “we must answer just one question: what is the preborn?”³⁵ Michael Panicola, writing in the *National Catholic Bioethics Quarterly*, observes that “the question of the moral status of the preimplantation embryo is one of the most controversial ethical and policy issues of the modern day.”³⁶ In a report published in 2001 by the Evangelical Lutheran Church in America (ELCA) called *Human Cloning: Papers from a Church Consultation* we read that “the primary moral question of stem cell research is the moral status of the pre-implantation embryo.”³⁷

Comprehensive governmental advisory reports for the European Union and for Canada concur that the most central issue concerns the moral status of the pre-implantation embryo. These reports also stress the tie between generally accepted IVF practices and the proposed new possibilities connected with stem cell research.³⁸

Some suggest that given the disagreements among thoughtful observers concerning this primary question, a moratorium should be put in place on any research that destroys pre-implantation human life. A moratorium on such research, however, would not address the problems relating to *in vitro* fertilization clinical practice that is now widely accepted. We must do our best to examine and understand the competing arguments concerning the moral/spiritual significance of pre-implantation human life.

³⁴ See *What Child Is This?*, 6 (fn. 5).

³⁵ “Are We Killing the Weak to Heal the Sick?: Federally Funded Embryonic Stem Cell Research,” *Health Matrix: Journal of Law–Medicine* 12:2 (Summer 2002), 507.

³⁶ “Three Views of the Preimplantation Embryo,” *National Catholic Bioethics Quarterly* 2:1 (Spring 2002), 91.

³⁷ Roger A. Willer, “Threads from the Conversation,” in *Human Cloning: Papers from a Church Consultation*, ed. Roger A. Willer (Chicago: Evangelical Lutheran Church in America, 2001), 86.

³⁸ See, e.g., the essays contained in *Adoption of an Opinion on Ethical Aspects of Human Stem Cell Research and Use* prepared by The European Group on Ethics in Science and New Technologies to the European Commission (Paris: January, 2001 [Revised Edition]). (Hereafter *Ethical Aspects*.) Also see Laura Shanner, *Embryonic Stem Cell Research: Canadian Policy and Ethical Considerations*, A Report for Health Canada, Policy Division, March 31, 2001 (Copyright Laura Shanner, 2001).

Scientific and Philosophical Perspectives

In the following paragraphs we survey arguments concerning the moral status of pre-implantation human life. Often, those who argue that every embryo should have an opportunity to grow in the womb employ their arguments in the hopes that they can establish the truth of a moral continuity between pre-implantation human life and human life in all the later stages. But those who argue that embryos can be discarded and/or used for research often employ their arguments in a more modest hope that they can cast reasonable doubt upon claims of moral continuity. Persons on this side of the controversy tend to take for granted that the prospect of developing therapies for live-born humans provides a moral imperative for research that should not be turned back if reasonable doubt can be raised about moral continuity between pre-implantation human life and later stages of human life. We will return to this very important observation in our own constructive argumentation in the next section.

When the central question concerning the moral status of pre-implantation human life is addressed from a scientific and/or philosophical perspective, the opposing sides divide over

- *how to approach* questions about the moral/spiritual significance of pre-implantation human life, and
- *what conclusions* are rightly to be drawn from whatever approach is considered appropriate.

The approaches divide roughly into

- approaches that look for some *inherent indicator* of moral/spiritual significance, and
- approaches that look for some *relational/historical indicator* of moral/spiritual significance.

In both approaches the argument often begins with an agreement that we are asking questions about pre-implantation *human life* and that we typically accord full moral/spiritual status to living humans.

Inherent Indicator Approaches

Those who seek inherent indicators argue more or less along the following lines. Some argue that full moral/spiritual status is shown by the very words “human life.” No morally relevant distinction can be made between fertilized eggs as “human life” and live-born humans. Pre-implantation human life differs in no morally relevant way from live-born human life. Consequently, all protections owed to live-born humans are owed also to pre-implantation human life. In the introduction we noted that Robert George follows this line of reasoning. Similarly, Alo Kosen writes that

“human parents can only produce human offspring.”³⁹ This line of reasoning is often put forward by those within the LCMS as they voice support for the Synod’s pro-life position. For example, Dennis Di Mauro, director of Lutherans For Life of the Mid-Atlantic States, writes that “human life is simply too precious to be discarded just because it is no longer wanted.”⁴⁰

Others argue that the moral/spiritual status of pre-implantation human life is mysteriously ambiguous. For example, the ELCA consultation notes that

...the ELCA statement on abortion seems to provide ambiguous guidance, or, according to some, inconsistent claims. It seems to make an absolute claim that human life at every stage has inherent value. However, the statement’s acceptance of abortion, even as a tragic option, suggests that ‘inherent value’ is not intended as an absolute claim, but rather implies gradations of value.⁴¹

In the ELCA collection of papers Mark J. Hanson writes that the moral status of the embryo

...is not an issue that can be settled by science. And even within many religious and philosophical traditions, a range of positions exists. ...Ultimately, however, it is an issue destined to remain rooted in mystery. This entails that any ethical argument that rests on assumptions regarding the status of the embryo will be contested and uncertain.⁴²

Two essays in the report on stem cell research by the European Group on Ethics⁴³ bring home the significance of a controversial point argued by Harvard philosopher Michael Sandel. According to Sandel, “The view that the embryo is a person derives support from the Kantian assumption that everything is either a person worthy of respect or a thing open to use. It’s an all-or-nothing ethic that consigns the rest of existence to utility and turns every moral question to a debate over the bounds of personhood.” But, says Sandel, people’s moral intuitions do not in fact conform to this all-or-nothing view. He argues that while some people insist that even a 7-day-old embryo has the same moral status as an adult human being, society’s laws and customs do not support this belief.⁴⁴

³⁹ Konsen, 507.

⁴⁰ See the “Letters” section of *The Lutheran Witness* (November 2002), 4.

⁴¹ Willer, “Threads,” in *Human Cloning*, 86.

⁴² “Cloning for Therapeutic Purposes: Ethical and Religious Considerations,” in *Human Cloning*, 60.

⁴³ See footnote 38 above.

⁴⁴ “The Ethics of Human Cloning,” a lecture sponsored by the Center for Ethics and the Professions at Harvard University, 18 November 2002; excerpted and summarized by Ken Gewertz, “Sandel defends human cloning for research,” *Harvard Gazette* (November 21, 2002). (Available online at <http://www.hno.harvard.edu/gazette/2002/11.21/13-cloning.html>.)

What is at stake here is whether (as Sandel argues) there is a “third” position between those who ascribe complete human personhood to the embryo and those who deprive the embryo of all dignity. University of Paris legal philosopher Bernard Mathieu takes a position opposite to Sandel: he argues that there is no third position.⁴⁵ University of Bristol ethicist Alastair Campbell argues that however difficult the third position may be, scientific progress is forcing us to refine our moral categories to get beyond the either/or, all-or-nothing presumptions so often found in these debates.⁴⁶

Still others argue, on what they take to be scientific/philosophical grounds, that the moral/spiritual status of pre-implantation human life can be seen to be not simply ambiguous but in fact significantly different from that of living humans in the womb and in the world. Some focus on what they take to be decisive differences between pre-implantation human life and live-born humans. Here are some of the arguments for this position.

Pre-implantation human life differs from implanted human life in several important respects. Because none of the cells in the newly fertilized egg has yet specialized for differentiated tasks, one cannot distinguish between the cells that will become placenta and those that will become the individual. For the same reason, the individuality of the fertilized egg is somewhat ambiguous because natural or artificial division of the cells into two parts can produce two distinct individuals who share a common DNA inheritance. Some argue that these facts about newly fertilized eggs make their moral status different from that of an embryo having differentiated cells and having achieved implantation in the womb. Roman Catholic ethicist Thomas Shannon writes in *Commonweal*:

We can think of the preimplantation embryo as our common human nature for two reasons. First, even though this entity is genetically distinct from its parents and even genetically unique, it is not yet individualized. Individualization does not occur until after the process of restriction is completed, some two weeks after the process of fertilization. To my mind, this process is a biological analogy to Scotus’s concept of the principle of individuation, the constricting of the common nature into an individual. After the process is completed (normally after two weeks), the cells are committed to being specific cells in specific body parts. This is the biological beginning of true (though not full) individuality and, I would argue, marks a critical ethical line.

However, prior to that time, these human cells are indifferent to becoming specific cells in this particular body. They are not, I would argue, morally privileged by virtue of individuality or,

⁴⁵ “Legal Aspects of the Use of Human Stem Cells,” in *Ethical Aspects*, 118–133.

⁴⁶ “Ethical Issues in Therapeutic Cloning,” in *Ethical Aspects*, 111–117.

a fortiori, by personhood. True, they are morally privileged by being human cells, cells that manifest the human genome, and as such are an entity that represents the essence of human nature. This is the second reason why the preimplantation embryo can be understood in terms of Scotus's "common nature." Essentially such research would be utilizing cells that in fact represent what is common to humans in the most basic sense; our common human nature in the blastomere is preindividual and prepersonal. And because these cells are our common human nature and not individualized human nature (the minimal definition of personhood), I argue that cells from this entity may be used in research to obtain and develop stem cells for use in transplantation or to develop specific human tissue or perhaps even organs.

Clearly those from whom such entities come must consent to this research, and the blastomeres must be handled with respect. But ultimately, such research is not research on a human person. It is research on our common human nature, and as such is morally justifiable.⁴⁷

Michael Panicola summarizes a related line of thought this way: it is claimed that "the preimplantation embryo is in a pre-personal stage of development at least until it attains a certain level of biological stability, which coincides with the formation of the primitive streak, and as such is only entitled to limited respect and protection." He goes on to argue, however, that these considerations do not "sufficiently" work to overcome the burden of proof required to depart from "previously held views of the value of human life in its earliest beginnings."⁴⁸

A related consideration of differences typically focuses on matters concerning the physical, mental, and emotional capacities of living humans as opposed to those of pre-implantation human life. This line of reasoning rejects the suggestion that *potential* to develop such capacities makes pre-implantation human life morally identical to living humans. The difference in actual capacities is said to make a significant difference in moral/spiritual status.

Relational/Historical Approaches

Those who approach the main question from a standpoint of relational/historical indicators also often begin from the agreement that we are asking questions about pre-implantation *human life* and that we typically accord full moral/spiritual status to living humans. Those who seek relational/historical indicators argue more or less along the following lines.

⁴⁷ "Remaking ourselves? The ethics of stem-cell research," *Commonweal* 125 (December 4, 1998), 9–10.

⁴⁸ Panicola, "Three Views," 91.

Some argue that full moral/spiritual status is shown by the very words “human life.” No morally relevant distinction can or should be made concerning how we relate to fertilized eggs and how we relate to living humans. Pre-implantation human life differs in no morally relevant way from human life in live-born humans. Consequently, the protective, caring relationships owed to live-born humans are owed also to pre-implantation human life. Oliver O’Donovan offers a detailed and carefully nuanced theological version of this approach in chapter four of his book *Begotten or Made?* (“And Who is a Person?”). His arguments are examined below in connection with our discussion of “Biblically Informed Theological Perspectives” because O’Donovan situates these arguments in a theological as well as scientific/philosophical context.

The opposing side argues that, in the light of our actual relational practices, the moral/spiritual status of pre-implantation human life can be seen to be significantly different from that of living humans in the womb and in the world. This line of argument stresses the very different way in which parents and the rest of society *do* typically relate to pre-implantation human life. Moral/spiritual status is assessed in the light of how we typically relate. Actual practice is taken to be illustrative of the underlying moral significance.

An illustrative thought experiment was proposed by Boston University law professor George Annas. Steve Stice, a stem cell researcher at University of Georgia, reports how Annas’s thought experiment has influenced his thinking. Annas “asked a group of scientists to imagine a tank of frozen embryos in one corner of a room and a five-year-old child in the other corner. When a fire breaks out, who or what do you save first? The answer is obvious—we don’t view embryos in the same light as a five-year-old child.”⁴⁹ Writing in the *Lancet*, Riccardo Baschetti suggests that “what differentiates a pile of bricks from a house is the human investment, in the form of labour, sweat, and care. Likewise, what differentiates a human embryo from a human being is the parental investment.” “By contrast,” he maintains, “in the case of an embryo, in stages at which its existence is generally unnoticed, the parental investment is nought.”⁵⁰

People also point to differences in naming and other relational activities, including Baptism and funeral/memorial practices. The conclusion is that we (rightly) respect pre-implantation human life while not according to such life the moral/spiritual status ascribed to living humans.

In part one we noted that in the best of circumstances the practice of *in vitro* fertilization only about one third of embryos transferred to the

⁴⁹ “Ethics at the boundaries of science,” “Back Page” interview in *Georgia Magazine* 81:1 (December 2001); see <http://www.uga.edu/gm/1201/FeatBac.html>.

⁵⁰ “Science, philosophy, religion, and use of embryonic stem cells,” Correspondence section of *The Lancet* 359:9322 (June 8, 2002), 2037; see <http://www.thelancet.com/journals/lancet/article/PIIS0140673602087998/fulltext>.

woman's reproductive system lead to a successful beginning of a pregnancy, let alone to a live birth. We further noted that this loss of embryos in IVF mimics results in natural conception. Physician Carolyn B. Coulam reports that "the magnitude of [naturally occurring] fetal wastage in humans is considerable, approaching a loss of up to three quarters of fertilized ova."⁵¹ In light of this fact of nature some argue that nature itself seems to relate to pre-implantation human life differently than to implanted life.

In summary, we have examined two different approaches within scientific and philosophical lines of reasoning. One approach looks for inherent indicators of moral/spiritual significance, and the other looks for relational/historical indicators of moral/spiritual significance. Persons who favor one or the other approach tend to doubt that the competing approach can provide the insights we need, but the two approaches typically interact with each other, so the question seems to be which approach is primary.

We have undertaken this brief review of scientific/philosophic arguments so that in part three we can organize our response to the many different lines of reasoning. For similar reasons we must also review competing biblically informed theological arguments.

Biblically Informed Theological Perspectives

When the question concerning the moral status of pre-implantation human life is addressed from a biblically informed theological perspective, the opposing sides again divide over

- *how to approach* questions about the moral/spiritual significance of pre-implantation human life, and
- *what conclusions* are rightly to be drawn from whatever approach is considered appropriate.

These approaches divide roughly into

- approaches that look for *specific biblical texts* that indicate the moral/spiritual significance of pre-implantation human life,
- approaches that look for some biblically informed *inherent indicator* of moral/spiritual significance, and
- approaches that look for some biblically informed *relational/historical indicator* of moral/spiritual significance.

This report acknowledges that use of specific biblical passages should conform to principles of exegesis and hermeneutics that are accepted in the LCMS. We postpone discussion of specific passages to part three in which the constructive argumentation is presented. In part three we will also discuss principles derived from Scripture that are relevant to questions about the beginnings of human life.

⁵¹ Coulam, 863.

Inherent Indicator Approaches

Approaches that look for some biblically informed inherent indicator of moral/spiritual significance often make reference to biblical “image of God” language. It is well to note with respect to the ELCA papers that “the Christian tradition has offered several explanations as to what exactly constitutes the *imago dei*. There is not a clear tradition as to whether or when it applies to pre-birth human beings.”⁵² Approaches that discuss the “image of God” tend to be similar to scientific/philosophical arguments that look for inherent indicators of moral/spiritual status. (Some exegetes suggest, however, that “image of God” language may actually point more toward a relational/historical approach.)

Some, taking the biblically informed “inherent indicator” approach, maintain that full moral/spiritual status is shown by the very words “human life.” Human parents, made in God’s image, can only produce human offspring, made in God’s image.

Others contend that the moral/spiritual status of pre-implantation human life is mysteriously ambiguous. They hold that any ethical argument based on assumptions regarding the image of God in the embryo will be contested and uncertain.

Still others hold that pre-implantation human life has a different status from life planted in the womb and born into the world. In the ELCA papers Cynthia Cohen briefly surveys possible uses of “image of God” language and tends toward the conclusion that “those who bear the ‘image of God’ have certain characteristics that embryos do not and the concept of *imago dei* would not provide grounds for claiming that they are owed protection from destruction during research.”⁵³

Relational/Historical Approaches

A significant line of theological argumentation claims that the relational/historical approach is best suited to arguments informed by Scripture. (If we follow those exegetes who claim that biblical “image of God” language should be interpreted relationally rather than in terms of inherent characteristics, then “image of God” would point to this approach.)

Above, in our survey of scientific and philosophical approaches, we briefly mentioned Oliver O’Donovan’s essay “And Who is a Person?” (chapter four of *Begotten or Made?*). In this essay O’Donovan offers a careful discussion of the development of “person” language in connection with the early church’s discussions of the Trinity and of the person of Christ. He claims that Christian thinkers were drawn by God’s Word away from

⁵² Willer, “Threads,” in *Human Cloning*, 86.

⁵³ “Ethical Questions about the Use of Embryos and Women in Therapeutic Cloning (A Response to Mark Hanson),” in *Human Cloning*, 67.

ancient classical philosophy that uses purely qualitative categories to analyze humanity, categories such as “intellect” and “soul.” They preferred analyses that focus on persons as subjects with *histories* and *names*.⁵⁴ As a result of wrestling with Christ’s unique “hypostatic (personal) union of divine and human natures” the church fathers came to understand that

A person is a substance [*hypostasis*, “subject”; different from *ousia*, “being”], and a nature is the ‘specific property’ of a substance; it is not the case (as supposed by heretics on all sides) that to every nature there corresponds a person. In other words, the distinctive qualities of humanity are attributable to persons, not persons to the qualities of humanity. (54)

This biblically-based approach inevitably leads to questions—in ways that philosophical qualitative approaches do not—concerning when personal identity begins and ends.

O’Donovan goes on to argue for the full moral/spiritual status of pre-implantation human life on the basis of this relational/historical approach. He notes that the “theological observations do not of themselves yield any very precise view of the beginnings of individual identity. ...we must learn from what scientists can tell us about where the story of each individual begins” (56).

He tentatively claims in the light of genetic science in the early 1980s that science indicates (but does not demonstrate) “the beginning of a new personal history at conception” (56). Still, he cautions that “we cannot overlook the possibility either that geneticists may change their minds about how to interpret what they have seen, or that other investigators may yet describe discontinuities between conceptus and child which may, in the event, appear more fundamental” (57). He does not think that statistics concerning the loss of a majority of pre-implantation human lives will, as a mere statistical argument, provide a clear indication to counter the presumption that the new personal history begins at conception (57).

O’Donovan also seems to want to argue that the ultimate decision must be made on grounds other than science. “It remains for another mode of knowledge to discern the hypostasis [personal subject] behind the appearances” (57). Toward the end of his essay he offers a method of discernment: “We discern persons only by love, by discovering through interaction and commitment that this human being is irreplaceable” (59). “To discern my neighbour I have first to ‘prove’ neighbour to him...To perceive a brother or a sister, I have first to accept him as such in personal interaction” (60).

This mode of discernment leads him to argue that the “crime” of research on and destruction of pre-implantation human life “should not be

⁵⁴ O’Donovan, 49–56. Page references to this work in the remainder of this section appear in parentheses in the text.

the old-fashioned crime of killing babies, but the new and subtle crime of making babies to be ambiguously human, of presenting to us members of our own species who are doubtfully proper objects of compassion and love" (65). "[W]hen we start making human beings [in IVF]," suggests O'Donovan, "we necessarily stop loving them; that which is made rather than begotten becomes something that we have at our disposal, not someone with whom we can engage in brotherly fellowship" (65). He concludes that

...there is no road which leads us from observation first to fellowship second, only a road which leads us from fellowship first to discernment second. ...Unless we approach new human beings, including those whose humanity is ambiguous and uncertain to us, with the expectancy and hope that we shall discern how God has called them out of nothing into personal being, then I do not see how we shall ever learn to love another human being at all. (66)

Others, however, take up O'Donovan's argumentation at precisely this point, and turn it against his conclusions. They agree that the question of the moral and spiritual significance of pre-implantation human life should be decided on the basis of relational/historical considerations. And they focus on O'Donovan's statement that pre-implantation life presents "to us members of our own species who are doubtfully proper objects of compassion and love" (65). They then engage in the sorts of arguments we saw in the scientific and philosophical perspectives that point to marked differences between the way humans typically interact with embryos and the way they interact with fetuses and live-born infants. Their conclusion is that this biblically informed approach shows significant differences between the moral and spiritual significance of pre-implantation human life and that of fetuses and infants.

The relational/historical approach is a promising way of thought, well grounded in Scripture and Trinitarian doctrine that is rooted in the Scripture. Reflection on Christian thought concerning Trinitarian persons and, in particular, Christ's divine/human personhood, provides a key to biblically informed discussions of what it is to be a person with full moral/spiritual status. This Trinitarian approach takes the arguments beyond an exclusive focus on the Fifth Commandment understood in a Greek way to concern for an isolated entity's "right to life." The conversation expands to consider the entire Decalog and human fellowship with God and with each other.

In this Christian theological perspective the key question becomes: where does God's fellowship with human persons, and thus our own fellowship with human persons, appropriately begin with a history and a name? We will return to this question in the constructive arguments of part three.

Part Three: Discerning and Loving Human Persons

Pastor Solomon has been meeting with various people including biology faculty at the local university. He has decided to arrange for an adult study series in the congregation on *in vitro* fertilization, stem cell research, and cloning for biomedical research.⁵⁵

An important part of the study involves helping people become well informed about current possibilities and practices in these areas. He has used part one of this report to help in this task. Another important part of the study requires that people become familiar with the main lines of argument on various sides of the issues. Part two helps with this task. But he also believes that God's people need to be well prepared to defend the principle that pre-implantation embryos should be accorded protection on the same basis as live-born humans.

Pastor Solomon offers two main lines of reasoning in favor of this principle:

1. God's Word makes plain that God cares for human lives from beginning to end. Pastor Solomon recognizes that challenging questions have been raised concerning whether God's care extends across all fertilized eggs, but he believes that the burden of proof lies with those who claim that God's care is not so extensive. And he does not think clear and convincing arguments have been made to carry the burden.

2. Pastor Solomon suggests that the first line of biblically informed theological reasoning connects closely with scientific and philosophical considerations. Human embryos, beginning with conception, are set on a course of development that leads continuously to an unfolding of a unique human life. Some people both in and out of the church maintain that this continuous unfolding is punctuated with moments where a line can be drawn between embryonic life that need not be protected and embryonic or fetal or live-born life that should be protected. But Pastor Solomon has found no biblical evidence for drawing such a line. Indeed, people of biblical faith find it compelling that several passages speak of God's love and care for an individual from even before the earliest physical moment. Furthermore, science and philosophy have not been able to agree on which punctuation point is the best to choose for drawing a moral line. Once again, Pastor Solomon contends that biblical faith places the burden of

⁵⁵ He had already arranged a study that examined the issue of reproductive cloning in the light of the Commission's 2002 report *What Child Is This?*

proof on those who would deny protection to certain embryos. And he does not think that clear and convincing arguments have been made to carry the burden.

Pastor Solomon's reasoning about "burdens of proof" is suited to the controversial situation the church finds itself in today. At the beginning of part two we observed that those who take the position that embryos should be protected tend to think of themselves as trying to demonstrate the truth that the continuity between pre-implantation human life and later stages of human life carries a significant moral meaning. They believe that this continuity requires the extension of full protection to embryonic life. In contrast, persons who defend the use of embryos for stem cell research tend to claim that defenders of pre-implantation human life have not produced clear and convincing proof of a continuity between embryonic life and later stages that can undergird significant moral implications. Without always realizing or acknowledging their strategy, people advocating the use of embryos for research tend to be making an implicit "burden of proof" argument. They claim that because the health and well-being of people afflicted by disease and injury might be improved through embryonic stem cell research, a heavy burden of proof lies upon those who would stop the research. Their hope is that by casting some doubt upon the pro-life arguments, they can claim that the burden has not been met and therefore the research can go forward.

What the Commission is now suggesting in the person of Pastor Solomon is that pro-life proponents should recognize the burden of proof reasoning used by their opponents. Once this is recognized, pro-life arguments can take a new strategic direction. If the proponents of research wish to use burden of proof reasoning, they need to defend their claim that the burden of proof rests upon those who seek to protect embryos. Our fictional Pastor Solomon is turning the tables on the opponents. A crucial claim in his argumentation is that in matters so serious as the taking of lives that are in continuity with lives we know we should protect, the burden lies not on those who defend human lives but on those who would kill them.

The defenders of embryonic stem cell research should no longer be allowed to claim that just because they can cast some doubt upon the full moral significance of embryonic life, they are thereby freed from concern with the possibility that fellow humans are being killed. They, rather than those who defend the embryos, are under the burden fully to prove that embryos are not to be afforded the protections they would fully receive at some moment in the future. Once this is understood, then if reasonable doubt can be cast upon the claim that embryos can be killed without moral consequence, the burden of proof has not been met—and the research should not go forward.

We are not suggesting that we should abandon attempts to establish the truth of the moral significance of the continuity between embryonic life

and later stages. We are simply noting that in the midst of serious and pervasive disagreement, burden of proof reasoning is one way humans in argumentative conflict try to make progress. We think that the defenders of embryonic stem cell research are implicitly using this type of reasoning, but that their use of it will not stand up to scrutiny—as can its use by those who seek to defend embryos.

In the following paragraphs we expand on Pastor Solomon’s biblical insights, and then we turn to the use of burden of proof reasoning in the midst of scientific and philosophical disagreement. This latter examination takes the form of commentary on the opposing lines of thought surveyed in part two.

The Relevance of Specific Bible Passages

Turning to biblically informed theological perspectives, we begin with a discussion of specific scriptural texts. Certain Scripture passages are often cited in support of the view that all fertilized eggs have a moral significance identical with that of a live-born human. What is needed is a defense of a principle of interpretation that can extend the range of such passages equally to all fertilized eggs and to cloned human entities, including the roughly sixty percent of the naturally occurring fertilized eggs that are lost early in the natural procreative process.

A review of biblical scholarship in the LCMS has produced the following observations. One approach contends that the use of Scripture for this type of issue forces us to make Scripture speak to a problem that we have little or no reason to think Scripture was intending to address. A somewhat different approach offers considerations that may make it possible to argue that Scripture is indeed addressing relevant features of our contemporary problems about pre-implantation embryos. But this approach too notes that a simple quoting of the texts does not provide the comprehensive and systematic interpretive argument that is needed so that we can be confident that we are not imposing our own meanings upon God’s Word.

We now provide some details of this latter approach to examine whether and how biblical passages might be used in connection with debates about pre-implantation embryos. Several passages have regularly been used to connect Scripture with questions about pre-implantation human life.

Here are the main passages:

Jeremiah 1:5 “Before I formed you in the womb I knew you, and before you were born I consecrated you; I appointed you a prophet to the nations.”

Psalms 139:13–16 “¹³For you formed my inward parts; you knitted me together in my mother’s womb. ¹⁴I praise you, for I am fearfully and

wonderfully made. Wonderful are your works; my soul knows it very well. ¹⁵My frame was not hidden from you, when I was being made in secret, intricately woven in the depths of the earth. ¹⁶Your eyes saw my unformed substance; in your book were written, every one of them, the days that were formed for me, when as yet there were none of them.”

Job 10:8–12 “Your hands fashioned and made me, and now you have destroyed me altogether. ⁹Remember that you have made me like clay; and will you return me to the dust? ¹⁰Did you not pour me out like milk and curdle me like cheese? ¹¹You clothed me with skin and flesh, and knit me together with bones and sinews. ¹²You have granted me life and steadfast love, and your care has preserved my spirit.”

Job 31:15 “Did not he who made me in the womb make him [Job’s servant]? And did not one fashion us in the womb?”

[**Luke 1:41; 2:12, 16; and 18:15–17** are often used to show that Scripture makes no distinction between infants in the womb and live-born infants, but those passages do not seem immediately applicable to this report’s assignment concerning questions about human embryos not yet in the womb.]

Extending the Range of the Passages

Usages of these passages to shed light on the significance of pre-implantation human life sometimes simply assume that the passages speak of every fertilized egg. The passages, however, do not directly speak about every fertilized egg, so the arguments need to show how to extend the range of reference of the passage from the more narrow focus on Jeremiah or the psalmist or Job. Two observations assist in this task.

1. A first observation focuses on Job 31. Here Job explicitly sees God equally fashioning both Job and his slaves in the womb. This suggests that the range of reference can be extended to the origin of all living humans in the womb. The passage provides a firm starting point for work that can then be summed up in a second observation.

2. We notice in many forms of human communication that general truths are often expressed in concrete reference to a more focused situation. Romans 7 is full of what appear to be highly personal observations of Paul concerning himself. In verses 15–25 Paul’s words are highly personal, yet God’s Word clearly intends the apostle’s “I” statements to speak also to the rest of us about law, sin, and God’s rescuing us in Christ. In a similar way God’s Word may intend that highly personal words concerning the earliest beginnings of the physical lives of Jeremiah, the psalmist and Job have a range that extends farther than simply their specific situations.

A related argument focuses on the incarnation. Since Jesus is the new Adam, the true human, then what can be said specifically about his human nature also has application to us. Again, a more focused reference is seen to have a range that extends beyond the specific reference.

Disagreements Concerning Application of the Passages

We are well advised to treat application of these passages fairly and carefully. Interpretation and application to contemporary issues require that we set the passages within a comprehensive and systematic understanding of Scripture and the Christian life. For this reason we have presented arguments that help us extend the range of the biblical passages to all humans who have lived in the womb and in the world.

Disagreement concerning the application of specific passages to pre-implantation human life is likely to continue. When God's Word speaks of His fashioning living humans from the very beginning we can be certain that all living humans—Job, his slaves, Jeremiah, you, I, the infant in the womb, etc.—have been the object of God's creative act from the very beginning of our human lives. Indeed, Eph.1:4 tells us Christians that God "chose us in Christ before the foundation of the world to be holy and blameless before him in love." We can say that God's Word wants us to know about His intense interest in each of us from the beginning.

The challenge we face is this: some Christians remain puzzled and troubled that so many fertilized eggs are lost in natural or laboratory conditions before they ever have a discernible human history. They ask, does the citing of these specific passages suffice to lead us to say that these fertilized eggs have also been the object of God's creative act in the same way as applies to those who have a history of growth in the womb and birth in the world? We discuss this matter in more detail below.

Scripture's Bias Toward Life

In addition to looking at specific passages, we can also let Scripture guide us into more general insights concerning God's care for human life. For example, most people who are willing to have their reasoning disciplined and guided by God's Word are likely to agree on principles such as the following:

- a. The God who created the world continues to be intimately involved in the world and takes an intense and caring interest in human lives from beginning to end. See, for example, Psalm 139.
- b. Passages like Jer. 1:5 and Eph. 1:4 establish the truth that God's interest in the lives of persons born into this world actually extends to the time prior to the earliest physical moment of those lives.
- c. The God revealed in Scripture takes special care for persons who are weak, vulnerable, and/or defenseless. One window into this special care can be seen in the protections urged for widows and orphans. We read in Ex. 22:22, "You shall not mistreat any widow or fatherless child." James writes, "Religion that is pure and undefiled before God, the Father, is this: to visit orphans and widows in their affliction, and to keep oneself unstained from the world" (1:27). God's people know

that His care for them is not conditioned by their own strength or glory but rather by God’s mercy (Deut. 7:7–8; 1 Cor. 1:26–31).

- d. God intends for humans to share in His care for human lives from beginning to end and from “least” to “greatest.”

We still face the challenge that Christians do in fact continue to disagree about the application of these principles to pre-implantation human life. Some hold that these principles apply to all fertilized eggs and that the specific texts discussed in the preceding section show that God has directly revealed in Scripture the significance of all pre-implantation human life. Others, however, counter that God has not spoken directly in Scripture to the issue of the significance of all pre-implantation human life, so application of the agreed-upon principles to pre-implantation human life requires further argumentation showing that all fertilized eggs should be included under these principles.

When conversing with people who are not convinced that these passages and principles extend to pre-implantation human life, we can nonetheless assert that—at the very least—the bias in Scripture testifies to God’s care for all human life. This comprehensive care casts reasonable doubt upon attempts to remove embryonic human life from under the umbrella of God’s love. Furthermore, Scripture offers no guidelines for exempting certain lives from God’s interest and care. Those who seek to remove embryonic human life from God’s care and our own owe us decisive arguments to show that this is morally and spiritually defensible. We do not think that the reasoning they have set forth is decisive.

Constructive Commentary on Biblically Informed Theological Perspectives

At this point we return to the biblically informed theological perspectives surveyed in part two and offer constructive commentary.

Biblically Informed Inherent Indicator Perspectives

In part two we surveyed approaches that look for some biblically informed inherent indicator of moral/spiritual significance. These approaches often make reference to biblical “image of God” language. We noted that the Christian tradition has offered differing explanations as to what exactly constitutes the image of God.⁵⁶ We also noted disagreements about whether pre-implantation human life shows the inherent qualities necessary for concluding that this life should be characterized as bearing an image of God that demands full protection of this life.

⁵⁶ We also noted that a contrasting exegetical approach recommends interpreting “image of God” language more along the lines of the relational/historical indicator approach.

We have weighed the contending approaches and find that none of them succeeds in establishing that pre-implantation human lives need not be afforded full protection in the way that human lives at later stages are protected. We believe that in so weighty a matter as the discarding and destruction of nascent human life, a full burden of proof lies on those who would remove protections from certain human lives. In our view, none of the opposing arguments succeeds in carrying the burden of proof. Meanwhile, biblical faith has ample testimony to God's care for human lives even prior to implantation in the womb. Consequently, we do not consider that biblically informed inherent indicator approaches can serve to justify a failure fully to protect pre-implantation human life.

Biblically Informed Relational/Historical Perspectives

In our survey in part two we also discussed a different and significant line of biblical theological argumentation that claims that a relational/historical approach is best suited to the scriptural data. We examined Oliver O'Donovan's perspective resulting from his reflection on Trinitarian and Christological doctrine. A significant feature of this viewpoint is the claim that we primarily discern the moral and spiritual significance of any human life by loving that life and serving as neighbor to that life. This approach seems to draw upon the way that the Samaritan in Jesus' parable discerned who was his neighbor by the concrete act of loving that neighbor.

O'Donovan's way of putting the case is summed up in these words: "It remains for another mode of knowledge to discern the hypostasis [personal subject] behind the appearances."⁵⁷ Toward the end of his essay he offers a method of discernment: "We discern persons only by love, by discovering through interaction and commitment that this human being is irreplaceable."⁵⁸ "To discern my neighbour I have first to 'prove' neighbour to him... To perceive a brother or a sister, I have first to accept him as such in personal interaction."⁵⁹

With O'Donovan we recognize that IVF and cloning technologies have provided us with detailed knowledge of human beginnings and have puzzled us by "presenting to us members of our own species who are doubtfully proper objects of compassion and love."⁶⁰ But while we recognize how puzzling the specific details can be, we again note that in so weighty a matter as the discarding and destruction of nascent human life a full burden of proof lies on those who would remove protections from certain

⁵⁷ O'Donovan, 57.

⁵⁸ *Ibid.*, 59.

⁵⁹ *Ibid.*, 60

⁶⁰ *Ibid.*, 65.

human lives. None of the puzzles raised by detailed scientific knowledge of human beginnings succeeds in carrying this burden of proof. Indeed, while we are serious in giving modern science its due, we consider that the biblical call to discern neighbors through love and care is much more plain than the opposing views suggesting that we need not protect human life in its earliest beginnings. Consequently, we do not consider that biblically informed “relational/historical” arguments can serve to justify a failure fully to protect pre-implantation human life. In fact, we consider that this line of reasoning calls us back again to love and service of “the least of these,” our sisters and brothers.

We commend further wrestling with the details of a well-grounded scriptural, Christological and Trinitarian approach. Reflection on Christian thought concerning Trinitarian persons and, in particular, Christ’s divine/human personhood, can enable us to examine in greater depth what it is to be a person with full moral/spiritual status. This approach can also carry the discussion beyond an exclusive focus on an isolated individual’s “right to life.” Instead, the conversation can expand beyond those somewhat “set piece” and “sterile” debates into a consideration of the meaning of human fellowship with God and with one another.

Constructive Commentary on Scientific and Philosophical Perspectives

Our fictional Pastor Solomon is also persuaded that this first line of biblically informed theological reasoning connects closely with a second. Human embryos, beginning with conception, are set on a course of development that leads continuously to an unfolding of a unique human life.

We proceed to a careful examination of key scientific and philosophical approaches that were surveyed in part two. In our survey we observed that when the moral status of pre-implantation human life is addressed from a scientific and/or philosophical perspective, the opposing sides divide in a way similar to the divisions in biblically informed arguments. Some approach the issue looking for inherent indicators while others emphasize relational/historical considerations. We find it noteworthy that both approaches typically begin with agreement that we are asking questions about pre-implantation *human life* and that we typically accord full moral/spiritual status to living humans. This agreement reinforces our position that the burden of proof lies with those who would deny protection to pre-implantation human life.

While we agree with those who maintain that pre-implantation human life should be fully protected, we acknowledge that the relative newness of our engagement with pre-implantation human life and our consequent unfamiliarity with embryonic life keep the arguments from achieving a

character of transparent obviousness. The duty to protect pre-implantation human life will not seem completely compelling to all thoughtful participants in the debates. Our own strategy remains one of demonstrating that no contrary argument has achieved a level of obviousness that would lift the burden from us to protect pre-implantation human life.

We are aware that one of the most common reasons given to support destroying embryos for stem cell research focuses on the promise of therapies that could provide significant help to people who are seriously ill or handicapped. Don't these neighbors, whom some would also designate "the least of these," deserve our loving aid and protection? Are they not also our neighbors in need? As we noted above, people who reason this way are implicitly claiming that the burden of proof lies on those of us who oppose embryonic stem cell research and would deny potentially life saving therapies to people in need. They say that unless we can provide convincing arguments in support of protecting pre-implantation embryos, then we have not met the burden of proof and the harvesting of stem cells from embryos should be permitted.

While we grant the moral urgency of caring for people in need, we cannot, in the absence of convincing arguments, grant the removing of protections from pre-implantation lives whose moral status is so closely connected with the moral status of all humans. Furthermore, we are by no means at a point in contemporary research at which use of embryonic stem cells is the last and best hope for ameliorating the suffering of these people. Indeed, scientists are currently exploring whether the use of adult stem cells, obtained in ways that cause no moral uncertainty, might not provide a more promising and effective line of research than use of embryonic stem cells.

Research and scientific debate concerning the relative merits of using adult stem cells rather than embryonic stem cells is constantly changing as new results and information are published. An Internet search on "adult stem cells" and on "alternatives to embryonic stem cells" will produce a long list of articles and websites reporting results and/or contributing to the debate. In the midst of changing information one point stands out: use of embryonic stem cells is not the only promising line of current research. This point prompts us to question why, in the absence of clear and convincing arguments that show destruction of embryos to be a moral practice, so much scientific and political pressure has been generated to rush forward with embryonic stem cell research when other promising work could first be pursued.

We have seen evidence of several factors creating the pressure. These include human scientific curiosity: people have a strong desire to unlock the secrets of the embryo whether or not the research is promising practically or controversial ethically. Another factor is an understandable desire not to leave any stone unturned in the search for cures for people suffering

disease and disability. Yet another factor is the promise of economic gain. In this last case the argument seems to be that somewhere in the world the research will be done, and the research may yield unimaginable economic gain. Why should I, or my university, or my state forego the possibility of these riches simply because the moral status of the embryo is uncertain? *Roe v. Wade* is thought to leave people free to choose life or death for nascent life on the basis of the desires and needs of adult humans. Many now are prepared to choose death for embryos in order to serve the curiosity, desires and needs of adult humans.

We also noted that some have claimed that the moral/spiritual status of pre-implantation human life is mysteriously ambiguous. Such claims point to our lack of certainty concerning the significance of human beginnings. These claims cannot be used as arguments to lift the burden of proof for those who would remove protections.

The more challenging approaches uncovered in part two are those that develop lines of reasoning meant to demonstrate the significant difference morally and spiritually between pre-implantation life and human life in the womb and in the world. These lines of reasoning require careful examination.

Inherent Indicators in Scientific and Philosophical Perspectives

Some maintain that pre-implantation human life differs from implanted human life because none of the cells in the newly fertilized egg has yet specialized for differentiated tasks. They point out that one cannot distinguish between the cells that will become placenta and those that will become the individual. They note that for the same reason the individuality of the fertilized egg is somewhat ambiguous, because natural or artificial division of the cells into two parts can produce two distinct individuals who share a common DNA inheritance. They contend, therefore, that the moral status of pre-implantation human life differs from that of an embryo that has differentiated cells and has achieved implantation in the womb. In part two we provided an extended example of this line of thought from Roman Catholic ethicist Thomas Shannon.

Shannon's argument is biologically informed and sophisticated, but the evidence is not as straightforward as he makes it out to be. For example, Princeton's Robert George points out that these undifferentiated cells in the embryo are nonetheless "a unitary, self-integrating, actively developing human organism." The fact of undifferentiation and monozygotic twinning in the early embryo, he points out, "certainly does not show that the embryo is a mere 'clump of cells.'"⁶¹ He explains how the embryo, already at the two-cell stage, is synthesizing a glycoprotein that is instru-

⁶¹ George, "Embryo Ethics," 8.

mental “in the compaction process at the eight-cell stage.”⁶² In his view this and other evidence makes the point “that from the zygote stage forward, the embryo is not only maintaining homeostasis, but is internally integrating various processes to direct them in an overall growth pattern toward maturity.”⁶³

Our point is that the scientific facts concerning the earliest stages of pre-implantation human life do not obviously support removing protection from such life. Indeed, the impressive unitary and forward-looking development of the embryo actually supports a posture of respect and support toward all embryonic human life. In our survey we noted that Michael Panicola, in a way similar to our approach, sympathizes with arguments like those offered by Thomas Shannon, but concludes that these considerations do not “sufficiently” work to overcome the burden of proof required to depart from “previously held views of the value of human life in its earliest beginnings.”⁶⁴

Some who advocate removing protection from pre-implantation human life focus on matters concerning the physical, mental, and emotional capacities of living humans as opposed to pre-implantation human life. This line of reasoning rejects the suggestion that the *potential* to develop such capacities makes pre-implantation human life morally identical to living humans. The difference in actual capacities is said to make a significant difference in moral/spiritual status.

We need not pause long over this old argument. Human life is characterized by many physical, mental, and emotional capacities in various stages of realization. Well known hazards attend any framework for ethical decision-making that would deprive a human being protection for his or her life simply on the grounds that she or he has failed to realize one or another capacity.

Relational/Historical Indicators in Scientific and Philosophical Perspectives

In our survey in part two and in our constructive discussion of biblically informed approaches here in part three we gave special attention to lines of reasoning that approach our questions from a standpoint of relational/historical indicators. We must now critically examine lines of reasoning in this approach that seek to show why protection can be denied to pre-implantation human life.

The opposing side contends that in the light of our actual relational practices, the moral/spiritual status of pre-implantation human life can be

⁶² *Ibid.*

⁶³ *Ibid.*, 9.

⁶⁴ Panicola, “Three Views,” 91.

seen to be significantly different from that of living humans in the womb and in the world. This line of argument stresses the very different way in which parents and the rest of society do typically relate to pre-implantation human life. Moral/spiritual status is assessed in the light of how we typically relate. Actual practice is taken to be illustrative of the underlying moral significance. For example, in part two we reported an illustrative thought experiment proposed by Boston University law professor George Annas. His thought experiment is meant to show that we relate to embryos in decisively different ways from the way in which we relate to live-born humans. People also point to differences in naming and other relational activities, including Baptism and funeral/memorial practices. The conclusion is that we (rightly) respect pre-implantation human life while not according to such life the moral/spiritual status accorded to living humans.

Perhaps related to this line of reasoning is the observation that in the best of circumstances with *in vitro* fertilization only about one third of embryos transferred to the woman's reproductive system lead to a successful beginning of a pregnancy, let alone to a live birth. In light of this fact of nature some hold that nature itself seems to relate to pre-implantation human life differently than it does to implanted life.

Working backward through these related lines of thought, we make the following observations. First, many hazards attend the drawing of conclusions from "natural facts" such as those concerning loss of fertilized eggs in natural conception. Consider an analogous argument that might have been offered in cultures that practiced infanticide: in the natural course of infant development we experience very high rates of infant mortality. We might conclude that we are free not to protect infant lives until they reach a safer maturity. The conclusion demonstrates that this reasoning is flawed, but the argument is of precisely the same structure as the one offered concerning the loss of fertilized eggs.⁶⁵

When they seek to interpret nature, Lutherans often look to Rom. 8:20 and reflect on a natural world currently subjected to frustration. We are accustomed to acknowledging how God's will and purpose are hidden in the natural world. In Luther's view, "we need the wisdom that distinguishes God from His mask. The world does not have this wisdom."⁶⁶

⁶⁵ A study of one Brazilian shantytown culture reports how mothers often refrain from naming or baptizing infants "until they begin to walk or talk" (311). In an environment in which "loss is anticipated and bets are hedged" the culture conceives of an infant "as human, but significantly less human than the grown child or adult. There is socialized" in the Alto mother an emotion of estrangement toward the infant that is protective to her, but potentially lethal to the child" (312–313). Nancy Scheper-Hughes, "Culture, Scarcity, and Maternal Thinking: Maternal Detachment and Infant Survival in a Brazilian Shantytown," *Ethos* 13: 4 (Winter, 1985), 291–317. See also Nancy Scheper-Hughes, "Death Without Weeping" in *Natural History* (October 1989), 8–16, and Robert F. Spencer, "The North Alaskan Eskimo: A Study in Ecology and Society," *Smithsonian Institution Bureau of American Ethnology Bulletin* 171: 92–93.

⁶⁶ "Lectures on Galatians" (1535), *Luther's Works*, American Edition (St. Louis: Concordia Publishing House, 1963), 26: 95.

Commenting on Luther's insight, Heinrich Bornkamm urges caution: "Whoever supposes that he can grasp God in nature or in history with his hands, as it were, confuses God with His masks and does not differentiate between these. He gropes and reaches out into the dark. Here there is no room for reliance and confidence. I can rely only on him whose heart is known to me."⁶⁷ God makes His heart known to us through the revelation of His Word—centered in the Gospel of His Son Jesus Christ—and not through the facts of nature. The Lutheran Confessions also point us to Christ and not to facts of nature or history as the source of our sure knowledge about God, His love, and His gracious will for our lives. In its discussion of the scriptural doctrine of election, the Formula of Concord comments on the challenging questions raised by nature and history and offers the following counsel concerning reflection on God's knowledge of all things: "[O]ne should as a matter of course refrain from speculation over the naked, secret, hidden, inscrutable foreknowledge of God. On the contrary, one should focus on how God's counsel, intention, and preordination in Jesus Christ (who is the genuine, true 'Book of Life' [Phil. 4:3; Rev. 3:5; 20:15]) is revealed to us through the Word" (FC SD XI, 13).

We agree with Oliver O'Donovan's judgment that statistics concerning the loss of a significant percentage of pre-implantation human lives will not, as a mere statistical argument, provide a clear indication to counter the presumption that the new personal history begins at conception. We find that the puzzling biological facts concerning loss of fertilized eggs in natural conception do not of themselves suffice to refute the claim that a new personal history begins at conception.

George Annas's thought experiment concerning rescuing embryos depends on an assumption that love and care are to be offered to humans in a manner indexed to our assessment of their worthiness. People may indeed more easily see the "worthiness" of a live-born infant than of an embryo suspended in nitrogen, but love and care for humans is not something that flows from us in response to the other's worth. Rather, God's love gives us humans our worth. So, acknowledging God's valuing of humans, our love and care go out to others. Furthermore, even in its own terms, this thought experiment overlooks the following possibility. A person might indeed decide to rescue the child rather than the embryos when only one or the other can be saved. But this decision does not yet show what could and should be done if all could be rescued. A decision to save a five-year-old child rather than a ninety-five year old invalid does not suggest that the life of the invalid is less precious in God's sight.

We have maintained throughout this discussion that those who propose to use embryos for research must convince us that embryos need not be protected. The approaches proposed thus far do not succeed in pro-

⁶⁷ Heinrich Bornkamm, *Luther's World of Thought*, trans. Martin H. Bertram (St. Louis: Concordia Publishing House, 1958), 68.

viding clear and convincing evidence to lift the burden of proof that lies on those who propose to destroy embryos. In the absence of decisive arguments, pre-implantation embryonic life should be afforded the benefit of the doubt and the benefit of life.

One further consideration should weigh heavily upon us as we contemplate excluding embryonic life from fundamental protections. Human beings have a bad history of sliding down slippery slopes. If we become accustomed to excluding some human lives even when we may reasonably doubt the ethics of the exclusion, we may in our sinful pride find pretexts also to exclude other lives from the circle of our care. This fact of human moral carelessness should make us all redouble our efforts to be completely sure about our ethics before we press forward.

Conclusions: Christian Care for Pre-implantation Human Life

In this report we have examined the arguments of thoughtful Christians and others who do not defend the principle that pre-implantation embryos should be accorded protection on the same basis as live-born humans. We have acknowledged that some have raised challenging questions concerning whether God's care extends across all fertilized eggs and cloned human entities.

In response we have argued the following points. First, God's Word makes plain that God cares for human lives from beginning to end. Second, the burden of proof lies with those who claim that God's care does not extend across all fertilized eggs and cloned humans. Third, no arguments in favor of removing protection from pre-implantation embryos attain the strength necessary to carry the burden of proof.⁶⁸

Implications for Congregational Life

In the next section we discuss implications for individual and societal decision making, but we begin in this section with a discussion of congrega-

⁶⁸ The goal of this report has been to inform, to give a sense of the complexity and uncertainty that surrounds current debate on the status of embryos, and to develop a line of reasoning that can be used to defend protection of human life from the beginnings of conception. We have sought to make use of an approach that will not immediately divide the readers into those who already agree with us and those who just knew we would not understand them. In this light we advise against the use of the language of "murder" in regard to the discarding of pre-implantation life.

tional life. The Christian congregation is a community of people who hear the Savior's voice and gather around Word and sacraments. The church "is the assembly of all believers among whom the gospel is purely preached and the holy sacraments are administered according to the gospel" (AC VII, 1). People who are drawn to Christ by the Holy Spirit seek to shape their lives in a God-pleasing way. The New Testament makes plain that the single most important feature of a God-pleasing life is Spirit-given faith in the good news that we have been forgiven and granted new life in Christ.

In this report we are probing what life in Christ might mean for decisions about *in vitro* fertilization and stem cell research. We have maintained that biblically disciplined moral reasoning puts the burden of proof on those who would deny protection to embryos. While we believe that this burden has not been met by any of the arguments that have been offered, we are aware that people in our congregations currently have widely differing views concerning the right understanding of the moral significance of pre-implantation human life. We can and must pray and hope that God will guide our society, both Christian and non-Christian, toward consensus on moral truth concerning pre-implantation human life. Meanwhile, because God has entrusted His church with the clear message of reconciliation centered in Jesus Christ through whom God has reconciled us to Himself (2 Cor. 5:19), we dare not let societal disagreement on a moral and political question cause us to lose our focus on the Gospel-centered mission of the church.

The Lutheran church has rightly distinguished three uses of God's Law.⁶⁹ The first use concerns God's left hand rule or kingdom and is designed to produce civil righteousness. But civil righteousness does not justify us before God; civil righteousness is not the church's primary concern. In so far as matters of social morality and political practice involve civil righteousness, social morality and politics are not to become the chief focus of the church's work.⁷⁰

The second use of the Law involves God's condemnation of humanity's age-old rebellion against Him. St. Paul writes, "For there is no distinction: for all have sinned and fall short of the glory of God, and are justified by his grace as a gift, through the redemption that is in Christ Jesus, whom God put forward as a propitiation by his blood, to be received by faith" (Rom. 3:22b-25). The church focuses on this "theological" use of the Law, because we recognize that God's universal wrath against sin is His "alien" work designed to point us to the Lamb of God who takes away the sin of the world.

⁶⁹ See, e.g., FC SD VI.

⁷⁰ The complex relationship between the church's mission and civil righteousness is explored in detail in the CTCR's September 1995 report *Render Unto Caesar...and Unto God: A Lutheran View of Church and State*.

In the current debates about IVF and stem cell research, the church recognizes how God calls all of our lives into question, regardless of whether our pursuit of civil righteousness leads us to support or to oppose morally troubling IVF practices and medical research. In “O God of Earth and Altar” G. K. Chesterton prays, “Tie in a living tether The prince and priest and thrall; Bind all our lives together; Smite us and save us all.”⁷¹ We understand that God must smite us all with His Law, so that we all may be saved in Christ.

In its treatment of the third use of the Law, Article VI of the Formula of Concord discusses both God’s *critique* of our lives and God’s *guidance* for our lives as those who have been reborn through Holy Baptism. God’s *critique* applies to Christians because

...even if they are reborn and “renewed in the spirit of their minds” [Eph. 4:23], this rebirth and renewal is not perfect in this world. Instead, it has only begun. Believers are engaged with the spirit of their minds in continual battle against the flesh, that is, against the perverted nature and character which clings to us until death and which because of the old creature is still lodged in the human understanding, will, and all human powers. (FC Ep VI, 4).

God’s *guidance* applies because Christians “have been redeemed by the Son of God so that they may practice the law day and night (Ps. 119[1])” and “it is necessary for the law of God constantly to light their way” (FC Ep VI, 2, 4).

In this report we conclude that biblically disciplined reasoning concerning pre-implantation human life compels us to respect and protect these lives as we continue to address the current state of human knowledge and insight. In the next section we examine implications of this conclusion for practical decision-making.

Implications for Practical Decision-Making

Embryonic Stem Cell Research

We urge the research community to renounce the troubling basis upon which researchers push us to go forward with the killing of embryos. The usual argument offered in the political debates has two main premises:

1. We do not have a clear understanding of the moral significance of pre-implantation human life.
2. But we believe that embryonic stem cell research holds great promise for alleviating human suffering.

⁷¹ *Lutheran Book of Worship* (Minneapolis: Augsburg Publishing House, 1978), Hymn 428 (stanza 3).

This argument concludes that until we actually know that destroying embryos is immoral, we should proceed with this promising research.

In contrast we argue that destruction of human life cannot be justified by pointing to promising outcomes for other humans. This is especially the case because embryonic stem cell research is by no means the final hope for helping those who are suffering.

We urge scientists, policy makers, potential embryo donors, and politicians to examine with more care whether the best course in the face of moral uncertainty is to press full steam ahead with morally problematic research. This question should trouble not only Christians but also anyone who tries to think clearly about human life. The practical course at the current time should be to shift resources away from this morally troublesome research to other promising lines of research in the pursuit of healing for suffering humans.⁷²

Decisions Concerning In Vitro Fertilization

We began this report with questions concerning the moral use of *in vitro* fertilization.⁷³ Protection of pre-implantation life is a high priority both for couples seeking to become pregnant through IVF and for clinicians working in IVF clinics. IVF aims at bringing about healthy embryos and at nurturing those embryos in the womb. Practical problems arise with regard to two practices:

1. Decisions are made not to transfer to the woman's reproductive system certain embryos that are thought not to be viable. These decisions usually include a practice of letting "nonviable" embryos expire.
2. Decisions are made not to transfer certain embryos when a couple has produced more embryos than required for their family plans. The result is that we are presented today with hundreds of thousands of embryos frozen in suspended animation, with no foreseeable opportunity for transfer to a woman's reproductive system.

⁷² We recognize that, in the rapidly changing world of embryonic stem cell research, novel proposals and practices may shed new light on the ethical situation. As this report was reaching its final shape, two proposals were being debated that suggested ways to obtain embryonic stem cells that might seem to avoid destroying viable embryos. "Two methods that create embryonic stem (ES) cells without destroying viable embryos can work—at least in mice. But although some scientists and ethicists herald the research as a step toward finding an uncontroversial way to produce ES cells, it seems clear that neither method completely resolves the ethical debate" (Gretchen Vogel, "Deriving 'Controversy-Free' ES Cells Is Controversial," *Science* 310 (October 21, 2005), 416; available online at www.sciencemag.org). If a way can be found to produce embryonic stem cells without destroying embryonic life, then the question of the moral status of the human embryo would no longer be the key question confronting us in embryonic stem cell research.

⁷³ The reader is referred once again to the CTCR's earlier reports on *Christians and Procreative Choices* (1996) and *What Child Is This* (2002) for a broader treatment of this issue in the context of Scripture's teaching about marriage and the family.

Some, including various theologians in the LCMS, suggest that the solution to both of these practical problems is, in principle, to arrange for a couple to transfer all of their embryos with a view toward nurture in the womb. If all embryos are dealt with in this fashion, then respect for human life is thought to have been clearly expressed. Others maintain that the practice of not transferring all the embryos is, in principle, similar to the sifting of embryos in natural procreation. Nature, it is claimed, usually selects against nonviable embryos. Clinical practice is simply following nature's lead. This observation applies most directly to point one above, the practice of not transferring certain embryos thought not to be developing in a viable way.⁷⁴ While we do not presume to advise on all of the intricacies of medical procedures and possibilities, we urge couples and their medical advisers to aim toward the practice of transferring all embryos. If the goal is to initiate and foster human life, then we trust that those involved will let their respect for human life guide them in their practical decisions.

At the same time, the practice of freezing embryos for future attempts at pregnancy can be a life-affirming practice. If couples provide an opportunity for each embryo to be transferred, then respect for human life is being clearly expressed. We consider that respect for human life can also be expressed by making embryos available for adoption by couples willing to provide the opportunity for life.⁷⁵

Moral difficulties arise, however, when hundreds of thousands of frozen embryos end up having no viable prospects for transfer to a woman's reproductive system. Under these circumstances three possibilities present themselves:

1. No decision is made, and the embryos face an indefinite future of suspended animation.
2. After a specified length of time, the embryos are thawed and allowed to expire. This is the legislated practice in Great Britain at the current time.
3. Couples donate their unused embryos to scientific research.

⁷⁴ See again the theological commentary on the hiddenness of God in the perplexing matters of the loss of pre-implantation life (pages 40–41 above). Needless to say, the unfathomable activity of the "hidden God" at work in and through a fallen creation is hardly a reliable guide for our moral decision-making.

⁷⁵ For more information and a variety of helpful resources on embryo adoption, see <http://adopting.adoption.com/child/embryo-adoption.html>. This Web site includes prominent reference to the "Snowflakes" embryo adoption program, a division of Nightlight Christian Adoptions (see http://www.nightlight.org/snowflakes_description.asp). According to the "Snowflakes" Web site: "Embryos preserved in frozen storage offer great hope for life and for families facing fertility challenges. When a family has been successful in having a child through *in vitro* fertilization, embryos are often cryo-preserved, resulting in the question of what to do with them. These frozen embryos can be the hope of a child for an infertile couple. Embryo adoption shares this wonderful hope with others. In 1997, Nightlight began the Snowflakes Frozen Embryo Adoption Program, which is helping some of the more than 400,000 frozen embryos realize their ultimate purpose—life—while sharing the hope of a child with an infertile couple."

Concerning option three, we have already made clear that definite and serious moral uncertainty attends the use of embryos for scientific research. We urge couples not to consign their embryos to this fate. The advice to use these lives so that others may benefit could only be given if we were certain that these lives lack full moral significance. But we do not have this moral certainty.

Concerning options one and two, we strongly urge couples not to put themselves in this position. They should make provision for all their viable embryos to be transferred. They will in this way not be faced with decisions to leave their embryos with indefinite futures nor to let them expire.

But what about the thousands of embryos with no future prospects? Some will argue that they should remain in indefinite suspended animation in the hope that we may find a moral course for their futures. Others may urge that respect for these lives will mean facing up to a tragic necessity of letting them expire. Our advice to fellow Christians is that couples seek through pregnancy or through embryo adoption to find a living future for any embryos they have produced.

Implications for Public Debate

We suggest that Christians familiarize themselves with the current and changing state of debate concerning embryonic stem cell research. We have offered an approach that we think can help Christians engage others in serious reflection upon respect for human life.

Citizens in a democracy also have the opportunity and responsibility to participate in the political processes of their country. Embryonic stem cell research is an issue that will be contested in many different ways in North America. Christians will have occasions in the coming days and years to play their part in helping their countries fashion defensible policies.

Human embryos, beginning with conception, are set on a course of development that leads continuously to an unfolding of a unique human life. Consequently, biblically disciplined moral reasoning puts the burden of proof on those who would deny protection to certain embryos. And that burden has not been carried by any of the arguments that have been offered. We have found no moment in this unfolding where a convincing line can be drawn between embryonic life that need not be protected and embryonic or fetal or live-born life that should be protected. Science and philosophy have not been able to agree on any punctuation point in human development for drawing a moral line. Furthermore, the Bible speaks of God's love and care for an individual from even before the earliest physical moment. We therefore apply the principle "Always to care, never to kill" to pre-implantation human life.

GLOSSARY⁷⁶

Adult stem cell—An undifferentiated cell found in a differentiated tissue that can renew itself and (with certain limitations) differentiate to yield all the specialized cell types of the tissue from which it originated.

Artificial Insemination (AI)—A technique that introduces sperm into a woman's body by some means other than sexual intercourse. Sperm often comes from the woman's husband (AIH), but donor sperm from outside a marriage is also used (AID).**

Astrocyte—One of the large neuroglia cells of neural tissues.

Blastocyst—A preimplantation embryo of about 150 cells. The blastocyst consists of a sphere made up of an outer layer of cells (the trophoctoderm), a fluid-filled cavity (the blastocoel), and a cluster of cells on the interior (the inner cell mass).

Bone marrow stromal cells—A stem cell found in bone marrow that generates bone, cartilage, fat, and fibrous connective tissue.

Cell division—Method by which a single cell divides to create two cells. This continuous process allows a population of cells to increase in number or maintain its numbers.

Cell-based therapies—treatment in which stem cells are induced to differentiate into the specific cell type required to repair damaged or depleted adult cell populations or tissues.

Cell culture—Growth of cells *in vitro* on an artificial medium for experimental research.

Clone—A line of cells that is genetically identical to the originating cell; in this case, a stem cell.

Cryopreservation—Preservation (as of cells) by subjection to extremely low temperatures.*

Culture medium—The broth that covers cells in a culture dish, which contains nutrients to feed the cells as well as other growth factors that may be added to direct desired changes in the cells.

⁷⁶ Unless otherwise indicated, definitions are from the current (November 7, 2005) scientific glossary on the National Institutes of Health stem cell research site at <http://stemcells.nih.gov/info/glossary.asp>. Definitions marked by a single asterisk (*) are taken from *Merriam-Webster's Collegiate Dictionary* (Eleventh Edition, 2003). Definitions marked by a double asterisk (**) are taken from the glossary of the CTCR's 2002 report, *What Child Is This?*

- Differentiation**—The process whereby an unspecialized early embryonic cell acquires the features of a specialized cell such as a heart, liver, or muscle cell.
- Directed differentiation**—Manipulating stem cell culture conditions to induce differentiation into a particular cell type.
- DNA**—Deoxyribonucleic acid, a chemical found primarily in the nucleus of cells. DNA carries the instructions for making all the structures and materials the body needs to function.
- Ectoderm**—Upper, outermost layer of a group of cells derived from the inner cell mass of the blastocyst; it gives rise to skin, nerves, and brain.
- Embryo**—In humans, the developing organism from the time of fertilization until the end of the eighth week of gestation, when it becomes known as a fetus.
- Embryoid bodies**—Clumps of cellular structures that arise when embryonic stem cells are cultured.
- Embryonic germ cells**—Cells found in a specific part of the embryo/fetus called the gonadal ridge that normally develop into mature gametes.
- Embryonic stem cells**—Primitive (undifferentiated) cells from the embryo that have the potential to become a wide variety of specialized cell types.
- Embryonic stem cell line**—Embryonic stem cells, which have been cultured under *in vitro* conditions that allow proliferation without differentiation for months to years.
- Endoderm**—Lower layer of a group of cells derived from the inner cell mass of the blastocyst; it gives rise to lungs and digestive organs.
- Feeder layer**—Cells used in co-culture to maintain pluripotent stem cells. Cells usually consist of mouse embryonic fibroblasts.
- Fertilization**—The process whereby male and female gametes unite.
- Fetus**—A developing human from usually two months after conception to birth.
- Gamete**—A mature male or female germ cell (sperm or egg). These cells contain only one-half of the paired genes found in other bodily cells, and they are capable of forming a new and physically unique individual by fusion with a gamete of the opposite sex.**
- Gene**—A functional unit of heredity that is a segment of DNA located in a specific site on a chromosome. A gene directs the formation of an enzyme or other protein.
- Genetic Science**—The systematic study of how genes govern physical development, sometimes simply called genetics.**
- Hematopoietic stem cell**—A stem cell from which all red and white blood cells develop.

- Homeostasis**—A relatively stable state of equilibrium or a tendency toward such a state between the different but interdependent elements or groups of elements of an organism, population, or group.*
- Human embryonic stem cell**—A type of pluripotent stem cell derived from the inner cell mass of the blastocyst.
- In vitro***—Literally, “in glass”; in a laboratory dish or test tube; an artificial environment.
- In vitro* fertilization**—An assisted reproduction technique in which fertilization is accomplished outside the body.
- Inner cell mass**—The cluster of cells inside the blastocyst. These cells give rise to the embryonic disk of the later embryo and, ultimately, the fetus.
- Long-term self-renewal**—The ability of stem cells to renew themselves by dividing into the same non-specialized cell type over long periods (many months to years) depending on the specific type of stem cell.
- Mesenchymal stem cells**—Cells from the immature embryonic connective tissue. A number of celltypes come from mesenchymal stem cells, including chondrocytes, which produce cartilage.
- Mesoderm**—Middle layer of a group of cells derived from the inner cell mass of the blastocyst; it gives rise to bone, muscle, and connective tissue.
- Microenvironment**—The molecules and compounds such as nutrients and growth factors in the fluid surrounding a cell in an organism or in the laboratory, which are important in determining the characteristics of the cell.
- Mitochondrion**—Any of various round or long cellular organelles...that are found outside the nucleus, produce energy for the cell through cellular respiration, and are rich in fats, proteins, and enzymes.*
- Neural stem cell**—A stem cell found in adult neural tissue that can give rise to neurons, astrocytes, and oligodendrocytes.
- Neurons**—Nerve cells, the structural and functional unit of the nervous system. A neuron consists of a cell body and its processes, an axon, and one or more dendrites. Neurons function by the initiation and conduction of impulses and transmit impulses to other neurons or cells by releasing neurotransmitters at synapses.
- Passage**—A round of cell growth and proliferation in cell culture.
- Plasticity**—The ability of stem cells from one adult tissue to generate the differentiated cell types of another tissue.
- Pluripotent**—Ability of a single stem cell to develop into many different cell types of the body.
- Proliferation**—Expansion of a population of cells by the continuous division of single cells into two identical daughter cells.

- Regenerative or reparative medicine**—A treatment in which stem cells are induced to differentiate into the specific cell type required to repair damaged or depleted adult cell populations or tissues.
- Reproductive Cloning**—The use of technologies of cloning to produce a new individual animal or human. Reproductive cloning replaces the fusing of *gametes* (sperm and egg) with techniques that take a full set of paired genes from a bodily cell and that use this set in an egg that has been emptied of its own genetic instructions. The resulting individual has the same set of paired genes that the donor of the cell has and is sometimes called a “delayed identical twin” of the donor.**
- Reproductive Technologies**—Term referring to a variety of technologies that have been developed to address problems of human infertility.**
- Signals**—Internal and external factors that control changes in cell structure and function.
- Somatic stem cells**—Another name for adult stem cells.
- Stem cells**—Cells with the ability to divide for indefinite periods in culture and to give rise to specialized cells.
- Stromal cells**—Non-blood cells derived from blood organs, such as bone marrow or fetal liver, which are capable of supporting growth of blood cells *in vitro*. Stromal cells that make this matrix within the bone marrow are also derived from mesenchymal stem cells.
- Subculturing**—The process of growing and replating cells in tissue culture for many months.
- Surface markers**—Surface proteins that are unique to certain cell types, which are visualized using antibodies or other detection methods.
- Surrogacy**—The practice of having a woman who is not intended to be the social mother of the child provide the womb in which the child develops until it is able to be born.**
- Teratoma**—A tumor composed of tissues from the three embryonic germ layers. Usually found in ovary and testis. Produced experimentally in animals by injecting pluripotent stem cells, in order to determine the stem cells’ abilities to differentiate into various types of tissues.
- Transdifferentiation**—The observation that stem cells from one tissue may be able to differentiate into cells of another tissue.
- Trophoblast**—The extraembryonic tissue responsible for implantation, developing into the placenta, and controlling the exchange of oxygen and metabolites between mother and embryo.
- Undifferentiated**—Not having changed to become a specialized cell type.



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