
Design and Destiny

Jewish and Christian Perspectives on Human
Germline Modification

edited by Ronald Cole-Turner

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Religion and the Question of Human Germline Modification

Ronald Cole-Turner

Advances in biotechnology are bringing us closer to the day when human beings will engineer specific genetic changes in their offspring. Some see this as the ultimate in human folly. They fear that parents, merely by knowing they have the option to design the child they want, will forget how to love the child they are given. Others see such genetic modification as a logical extension of medicine, consistent with basic human values and parental love.

Should we encourage the development of this technology and embrace it when it arrives? Should we human beings modify our offspring through genetic modification of the human germline? Pondering these possibilities, Hans Jonas asked: “Whether we have the right to do it, whether we are qualified for that creative role, is the most serious question that can be posed. . . . Who will be the image-makers, by what standards, and on the basis of what knowledge?”¹ With his questions, Jonas calls our attention not so much to technology as to our vision of a technologically modified humanity. What does it mean to be human, to be the sort of human that uses these technologies, or to be a human being upon whom they are used? What are the limits of human action, and who or what is guiding the process?

Like Jonas, the contributors to this book call our attention not to technology but to humanity. They draw upon the resources of traditional Judaism and Christianity to reflect on the meaning and destiny of human life, the values and principles that guide human behavior, and the meaning of our use of medicine and technology to maintain our health and to improve our condition.

A public conversation about germline modification has already begun. So far, however, the partners in the conversation are largely limited to

scholars in fields such as bioethics and public policy. Aside from isolated comments and momentary worries about the dangers of “designer babies” or films such as *GATTACA*, the wider public has not been involved. What is needed is a public discussion that is broadly participatory and richly informed, building on but actively expanding the current discussion, which has largely “been confined to elite governmental commissions or scholarly groups.”²

One way to expand the conversation and to engage the public is to approach the question of human germline modification in religious terms. Religion is the language of morality for many if not most human beings, even in late modernity. Beyond its capacity to reach a wider public, however, religion introduces something new precisely by reintroducing something old. By drawing attention to rich traditions of belief and morality, religious voices enrich the debate, adding complexity, multidimensionality, and counterintuitive thinking. For that reason, and not for mere political sensitivity, religious scholars are often invited to participate in public discussions of science, technology, and public policy. This book, too, is based on the hope that religious voices might deepen the public conversation about human germline modification, taking it to new dimensions of reflection on the meaning of our humanity.

Is This Book Really Needed?

Even so, many may think that a book on religious perspectives on human germline modification is not needed. One reason is that the technical feasibility of human germline modification is still far off in the distant future. Overcoming the scientific and technological barriers standing its way will require decades at the very least, it is said, and once the technical possibility is clearly in sight (if ever), there will be plenty of time to debate the wisdom and morality of the use of the technology.

Another reason why some may think this book is not needed is because religion really has no legitimate or constructive role to play in public discussions about science and technology. In a secular and pluralistic age, public conversation about the future of human nature must be grounded in philosophy, not in religious doctrines. Of course, even in

our secular era, religion shows no sign of dying. But the religions disagree with each other on just about everything, and they cannot possibly all be right. No single denomination or religious institution can claim to speak for more than a minority. By contrast, it is said, philosophy is universal in its assumptions and therefore deserves the sort of global respect that religion can never attain. A third objection is that no one needs a book to tell them that religious leaders and scholars are strongly opposed to human germline modification. This is common knowledge, or so it is thought.

All three objections, however, are based on misunderstandings. The truth is that a public discussion of human germline modification is timely because the technology is closer than many think, that each religion and every philosophy are all limited in the power to persuade more than minorities, and that a surprising range of religious scholars and leaders actually endorse some forms of human germline modification. Each of these points deserves a brief comment.

The Discussion Is Timely

Germline modification of nonhuman species has been under way for more than twenty years and is becoming routine in areas such as agriculture and biomedical research using animals. Researchers have created transgenic or germline-modified sheep, mice, rats, and even a primate, the rhesus monkey.³ The techniques that are used on nonhuman animals such as sheep or mice involve the production and destruction of many embryos. These techniques are universally regarded as ethically unacceptable for use on human beings.

Research is currently under way on a wide range of technologies that might change this situation. No one can predict exactly when or how these technical hurdles might be overcome, but researchers in the field generally believe that given enough time, the technology of germline modification will develop to the point where the techniques themselves pose no insurmountable ethical obstacle. In other words, some day human germline modification will be safe and achievable by techniques that are generally regarded as ethical for use on human beings. When that happens, the moral question of the wisdom of using the technology will be squarely before us.

While no one can predict how long it will take for research to bring us to this point, it is clear that recent research has advanced rapidly. According to the consensus report of a major 2005 study, which uses the term “human germline genetic modification” or HGGM, advances in research reported in 2004 and 2005 have “overcome what were long regarded as impenetrable technical barriers, bringing the possibility of HGGM much closer. Therefore, the time is right for a new public discussion about whether, when, and how HGGM research should proceed.”⁴

By one definition, human germline modification has already occurred. In 2001, a reproductive clinic in New Jersey reported success in “the first case of human germline genetic modification resulting in normal healthy children.”⁵ What they achieved, if it deserves to be called germline modification at all, was highly limited in its scope. Nevertheless, many observers agree that “the application of the rapidly emerging techniques of gene therapy to heritable human genetic modification is inevitable.”⁶

Many technical difficulties must yet be overcome before germline modification can be regarded as acceptably safe for human use, and it is not clear when and how they will be overcome. There can be little doubt, however, that in a time frame and through developments we cannot foresee, some form of human germline genetic modification will become available in the not-too-distant future and that one day we will wake up to find ourselves overtaken by “the inevitability of new choices.”⁷

If so, then a new discussion should begin before the technology is entirely in place. Anyone who has ever worried that morality too often lags behind technology might tolerate our being a little premature. The new discussion, broadened in its scope and the diversity of its participants, and drawing upon our collective human resources of moral and spiritual wisdom, should aim at creating the cultural resources necessary to illumine the human future, preferably before and not after the technology arrives on the scene. The advice of experts is clear: “[I]ndividuals and public advisory committees would be wise to begin the discussion of this important topic sooner rather than later.”⁸ The time has come to open up the discussion, to broaden its range of participants, and to bring to bear the moral and religious traditions that shape our values and our culture even today.

Religion and Philosophy Have a Shared Role to Play in Public Debate

Philosophical critics of human germline modification and reproductive cloning often point to religion as their partner in opposing these technologies. For instance, Francis Fukuyama and Leon Kass appeal to religious opposition to biotechnology to win support for their conclusions. They even praise religion, up to a point. Fukuyama says that religious objections to biotechnology are to be admired for their clarity and immediacy, for example, the “sharp distinction between human and nonhuman creation; [for] only human beings have a capacity for moral choice, free will, and faith, a capacity that gives them a higher moral status than the rest of animal creation.”⁹ Most of all, religion motivates or galvanizes resistance. As Fukuyama puts it, “religion provides only the most straightforward motive for opposing certain new technologies.”¹⁰ Furthermore, “religion often intuits moral truths that are shared by nonreligious people”¹¹

Even so, for Fukuyama and Kass, the role of religion is limited. It may be a useful ally with great powers to mobilize public support, but theology is not appropriate for public argument. “While religion provides the most clear-cut grounds for opposing certain types of biotechnology, religious arguments will not be persuasive to many who do not accept religion’s starting premises. We thus need to examine other, more secular, types of arguments.”¹² Not wanting his own objections to germline modification to be dismissed as religion, Fukuyama seeks to separate his argument from religion. “I believe that it is important to be wary of certain innovations in biotechnology for reasons that have nothing to do with religion.”¹³

According to Leon Kass, secular critics of biotechnology must take care to distinguish their own philosophical arguments from similar-sounding religious objections because philosophical or “serious moral objections . . . are often facetiously dismissed as religious or sectarian.”¹⁴ Kass continues: “Religious thought—I would hesitate to call it theorizing—has its own profound understanding of the human condition and teachings about the moral life, an understanding deep enough to help us address the large questions of our humanity at stake in life’s encounters with biotechnology. But the pluralistic premises of American ethical discourse and the fashions of the modern academy lead the mainstream

to view such religious traditions at best with suspicion and often with outright contempt.”¹⁵ Philosophy should strip its arguments of “religious thought.” However, should it fail to do so completely, then “never mind if these beliefs have a religious foundation—as if that should ever be a reason for dismissing them!”¹⁶

It is of course true that specific religious beliefs are not widely shared and may even be regarded with contempt or bewilderment by those outside a tradition. And it is true, as Fukuyama argues, that religious arguments are not likely to persuade the nonreligious. The same may surely be said of metaphysics, particularly the sort of metaphysical assertions about human nature employed by Fukuyama and Kass. If the contemporary secular academy dismisses religion, it is hardly hospitable to metaphysics. Outside the academy, the balance of popular support swings even more in the direction of religion. Of course, the validity of an argument does not depend at all upon the percentage of the population that finds it persuasive. However, the point made by Kass and Fukuyama is not that philosophy is true while religion is not, or even that philosophy’s presuppositions are more universally plausible than those of any particular religion, but merely that philosophy is more popular in its persuasiveness than religion. This is an empirical claim that lacks support.

More damaging to the philosopher’s case for the superiority of philosophy over religion in public debate is the fact that philosophers disagree among themselves. If disagreements among the religions count against religion having a public role, the same should be true of philosophy. This is especially obvious when we limit our scope to contemporary philosophers who have written on human germline modification. Along with Kass and Fukuyama, Jürgen Habermas has argued on philosophical grounds against such technologies as human germline modification. While agreeing in their conclusion that these technologies must be opposed, Habermas disagrees with Fukuyama and Kass on the basis for the opposition. Habermas in fact invokes the very argument that Fukuyama and Kass employ against religion and turns it into an argument against philosophical metaphysics, which is the foundation upon which Fukuyama, in particular, bases his argument.

Fukuyama argues that germline modification would violate human nature, which “is the sum of the behavior and characteristics that are typical of the human species, arising from genetic rather than environmental factors.”¹⁷ Then he asks: “What is it that we want to protect from any future advances in biotechnology? The answer is, we want to protect the full range of our complex, evolved natures against attempts at self-modification. We do not want to disrupt either the unity or the continuity of human nature, and thereby the human rights that are based on it.”¹⁸

Habermas agrees with Fukuyama that human germline modification is wrong, but he rejects Fukuyama’s line of argument as indistinguishable from religion. Philosophy must turn away equally from religion and metaphysics. Habermas warns against relying on “the classical image of humanity derived from religion and metaphysics.”¹⁹ Modern science has undermined confidence in metaphysics and religion equally. Human “nature” is conceptually adrift and technologically plastic. As much as he might want to restrain “technical self-optimization” by appealing to the classical views of a normative human nature, religious or metaphysical, Habermas warns against such a move. “Unless we fall back on treacherous metaphysical certainties, it is reasonable to expect persisting disagreements in the discourse universe of competing approaches to a species ethics.”²⁰

Our point is not to disparage philosophy or metaphysics as a public voice, or even to ask philosophers not to disparage religion while excluding themselves, but to suggest that in both cases, our powers to communicate and to persuade are limited. If so, then perhaps the right question to ask is this: What do we hope philosophy and religion will contribute to the public debate on questions like germline modification? If we hope for arguments that persuade majorities or unify cultures or justify legislation, we are likely to be disappointed. Such is not the role of religion or philosophy in today’s context. But if we expect to deepen the debate, to enrich our understanding, and to pause long enough in our head-long rush to the future to draw upon traditional sources of human wisdom and well-tested accounts of human virtue, and if we hope to argue with fresh vigor while respecting deeply held differences, then metaphysics and religion may both have something to say.

Even today, many still find that religion has unique capacities to nurture in us that which is compassionate and devoted to the healing of others for the sake of nothing more than the healing of others, to lead us beyond a focus on ourselves while at the same time heightening our awareness of our susceptibility to the old temptations to which technology can add unexpected allure. Religion invites us to reflect on our weaknesses and anxieties so that we might know ourselves well enough to avoid some of the exploitations and high-tech seductions that might otherwise prey upon our fears, making sophisticated fools of us. Taken seriously, religion reminds us daily to do justice, to guard against new forms of discrimination and unfairness that might come from expansive powers, and to seek broad access to the benefits of technologically advanced medicine. All these things religion does in individual lives and in communities of faith, and in so doing affects the broader culture, adding to its collective wisdom, maturity, and depth.

Correcting the Record: Religious Support for Human Germline Modification

It is widely believed that religious scholars and leaders oppose human germline modification, if not unanimously, then at least by a wide margin. Kass and Fukuyama assume this when they point to religion as support for their own objections. This view, however, is mistaken, and one of the more important contributions of this book is to set the public record straight. Religious support for germline modification is qualified and conditional, of course, but the majority of religious voices and nearly all the official statements of religious bodies leave the door open on the question of the morality of genetic modification of human offspring.

Why is it so often thought that religion is opposed to germline modification? One reason might lie in the public's tendency to exaggerate greatly the amount of conflict between science and religion. While historians of science have long since rejected the idea of warfare between science and religion, the news media and the general public still believe that these two arenas of human life are locked into some perpetual state of conflict. More often than not, religious scholars and institutions are supportive of science and technology, especially medicine, complaining

only of the scientism that sometimes passes for science or specific methods of research, such as experiments involving human embryos.

More than any other, one phrase summarizes the warfare view, especially in the context of biomedical research and in such areas as human germline modification. That phrase is “playing God,” which is most often used as a kind of verbal protest when it is felt that someone is going too far in making life-and-death decisions for other human beings. In that respect, the phrase resonates well in a secular society that defends autonomy, for the person who plays God intrudes not on God’s sovereignty, but on the sovereign autonomy of another person. One of the classic uses of the phrase is found in the writings of a Protestant theologian, Paul Ramsey, who in the early 1970s wrote in opposition to the development of *in vitro* fertilization (IVF) techniques for human beings. According to Ramsey, “Men ought not to play God before they learn to be men, and after they have learned to be men they will not play God.”²¹

This phrase has taken on a life of its own and is echoed today by many who share the idea that there must be limits to the use of biomedical technology, even by those whose objections are not based in religion. For example, Leon Kass uses the phrase this way: “By it is meant one or more of the following: man, or *some* men, are becoming creators of life, and indeed, of individual living human beings (*in vitro* fertilization, cloning); they stand in judgment of each being’s worthiness to live or die (genetic screening and abortion)—not on moral grounds, as is said of God’s judgment, but on somatic and genetic ones; they also hold out the promise of salvation from our genetic sins and defects (gene therapy and genetic engineering).”²² Jürgen Habermas uses the phrase this way: “‘Partner in evolution’ or even ‘playing God’ are the metaphors for an auto-transformation of the species which it seems will soon be within reach.”²³ In both cases, these philosophers use this phrase as a kind of rhetorical shorthand to warn that certain technologies go too far and that God (or those at least who believe in God) are opposed.

The myth of the warfare and the rhetoric of playing God all came together in the public theater in 1983 when a large and diverse group of religious leaders, such as Catholic bishops and Protestant denominational leaders, signed a highly publicized statement in opposition to

germline modification. As much as anything, this event has created the impression that religious scholars and leaders are united in opposition to this technology. The statement was developed and promoted, not by a theologian or church leader, but by Jeremy Rifkin, an economist whose book *Algeny* came out the same month. Rifkin was able to secure the signatures of leaders from across the spectrum of religious bodies, including the most conservative and liberal Protestants, who sometimes signed without seeking scientific or theological advice. The document, which is worded as a resolution, comes to this conclusion: “[E]fforts to engineer specific genetic traits into the human germline should not be attempted.”²⁴

The fact that this statement was signed by many church leaders, such as bishops and heads of denominations, certainly lends support to the claim that Christian leaders are all opposed to germline modification. A closer examination of the official texts of the religious communities, however, leads to quite a different conclusion. The next section of this chapter reviews some of these texts. First, however, it is instructive to return for a moment to Paul Ramsey, who warned about the dangers of playing God. In the same book from which that quotation is taken, Ramsey endorses the idea of human germline modification. Already in the early 1970s he was able to foresee the possibility of what might lie ahead and far from condemning it, he strongly endorsed it: “The notation to be made concerning genetic surgery, or the introduction of some anti-mutagenic chemical intermediary, which will eliminate a genetic defect before it can be passed on through reproduction, is simple. Should the practice of such medical genetics become feasible at some time in the future, it will raise no moral questions at all—or at least not that are not already present in the practice of medicine generally. Morally, genetic medicine enabling a man and a woman to engender a child without some defective gene they carry would seem to be as permissible as treatment to cure infertility when one of the partners bears this defect.”²⁵ While Ramsey is wary of the possibility of playing God, he does not include human germline modification or genetic surgery under the heading of the prohibited.

Contrary to popular opinion, religious scholars and leaders are not unanimously opposed, but are in fact generally open to the possibility

of a morally acceptable approach to human germline modification. Ever since the idea of genetic surgery was first discussed in the 1960s, some theologians and religious ethicists have recognized that germline modification may be technologically farfetched, but it is not obviously immoral or irreligious. In fact, precisely because of their religious convictions, many religious leaders and scholars over the past few decades have seen the idea of germline modification as morally preferable to any other response to the problem posed by the genetic transmission of disease. Germline modification, for all the challenges it poses, does offer some hope that an embryo may be treated rather than discarded, or that a healthy embryo might be created in the first place, and for such reasons it invites religious consideration by many. According to many religious scholars and leaders, including most of the contributors to this volume, germline modification is not obviously wrong but quite possibly is acceptable under certain conditions. This perspective is clearly present in the official statements of religious leaders and institutions, the subject of the next section of this chapter.

Religion and Germline Modification: Cautious, Conditional Approval

Despite its public visibility, the 1983 letter is unique among religious statements, not just in the widespread but unreflective process that produced it or in its simplistic and categorical judgments, but mainly in its content. The letter refuses to leave the door open at all to the moral permissibility of human germline modification. If the letter is unusual, a more typical statement is found in the publications of the World Council of Churches (WCC), whose participant churches have a combined membership of over half a billion and include most Protestant denominations and Orthodox churches. After much study and review by the member denominations, the WCC issued a report in 1989 saying that “The World Council of Churches proposes a ban on experiments involving genetic engineering of the human germline at the present time, and encourages the ethical reflection necessary for developing future guidelines in this area.”²⁶ For anyone reading too quickly, the word “ban” jumps out, confirming any prior notion that religion opposes germline modification. Read more carefully, however, the report clearly bases its opposition on

safety grounds “at the present time” rather than on permanent moral grounds.

A similar position was endorsed in 2006 by the National Council of the Churches of Christ, USA, whose members include most U.S. Protestant denominations. In its report, the council states: “Effective germ line therapy could offer tremendous potential for eliminating genetic disease, but it would raise difficult distinctions about ‘normal’ human conditions that could support discrimination against people with disabilities. But the human community has some time to reflect on this conundrum. Inaccuracies in somatic gene therapy have resulted in activating dangerous nearby genes and led U.S. regulators to temporarily suspend all human gene therapy using viral vectors. As a result, the case for germ line therapy, which would affect not only those presently treated but all their descendants as well, has become even more difficult to make.”²⁷ The statement carefully notes the advantages but also the social and moral challenges posed by the prospect of germ-line modification. It refers to current difficulties in gene therapy for human somatic cells, suggesting that these hurdles raise even more difficult challenges to safety that must be met before germline modification could ever be seriously entertained. The report does not, however, oppose the idea of germline modification, provided these concerns can be addressed.

The United Methodist Church, one of the largest Protestant denominations in the United States, has developed a comprehensive position on genetics. Generally speaking, the position is cautious, even restrictive. In 1992, the Methodist Church endorsed this statement of opposition: “Because its long-term effects are uncertain, we oppose genetic therapy that results in changes that can be passed to offspring (germ-line therapy).”²⁸ This wording is modified slightly in 2000:

We oppose human germ-line therapies (those that result in changes that can be passed to offspring) because of the possibility of unintended consequences and of abuse. With current technology it is not possible to know if artificially introduced genes will have unexpected or delayed long-term effects not identifiable until the genes have been dispersed in the population.

We oppose both somatic and germ-line therapies when they are used for eugenic purposes or enhancements, that is, to provide only cosmetic change or to provide social advantage.²⁹

In the 2000 statement, opposition to germline modification is qualified by the reference to “current technology,” which might change the moral assessment. In that reading of the statement, the core idea of germline modification for therapy is not opposed if safety can be assured in the long term and enhancement is avoided.

Perhaps more surprising is that the largest and most conservative major U.S. Protestant denomination, the Southern Baptist Convention, has left the door open to human germline modification, provided of course that safety concerns are resolved. In June 2006, the national gathering of the convention adopted a resolution aimed largely at restating objections to embryo research and to research that involves human–animal chimeras or mosaics. The resolution says this about germline modification: “RESOLVED, That we cannot endorse any use of human germline modification at this time, no matter how well-intentioned, due to the unpredictability of the process and the possible introduction of irreversible destructive errors into the human gene pool.”³⁰ Here again, those who wrote and supported this wording were careful to base their objections on grounds of safety “at this time,” thereby leaving open the door to reconsideration on moral grounds. While these statements cannot be read as endorsements of germline modification, they must be seen for their care not to endorse what cannot be done, but to leave the door open for now in tacit recognition that there are serious moral reasons in favor of germline modification.

Some might think that even though the Protestants have failed to condemn human germline modification, Catholics are surely reliable in making the religious case against any alteration of the human germline. Precisely the opposite is the case, for if anything, the Catholic statements more clearly define the good that might be gained by a germline approach. In the chapters that follow, James Walters and Thomas Shannon carefully show how Catholic theology does not lead to a categorical rejection of germline modification. On the contrary, as long as certain constraints are in place, the core idea of human germline modification is acceptable. One of these constraints—shared with some of the Protestant statements, such as the United Methodist position—is that germline modification must be for therapy only and avoid what might be called human enhancement. In addition, however, Catholic moral theology objects to human

in vitro fertilization and the use of a human embryo for nontherapeutic purposes. In other words, it is not acceptable to create or to treat the embryo outside the human body, nor can one embryo be used to create or treat another embryo.

These constraints place strong but not insurmountable limits on germline modification. According to a high-level Vatican theological committee, human germline modification remains a possibility: "Germ line genetic engineering with a therapeutic goal in man would in itself be acceptable were it not for the fact that it is hard to imagine how this could be achieved without disproportionate risks especially in the first experimental stage, such as the huge loss of embryos and the incidence of mishaps, and without the use of reproductive techniques. A possible alternative would be the use of gene therapy in the stem cells that produce a man's sperm, whereby he can beget healthy offspring with his own seed by means of the conjugal act."³¹ Next to this statement, the comment of Pope John Paul II might be noted: "A strictly therapeutic intervention whose explicit objective is the healing of various maladies such as those stemming from chromosomal defects will, in principle, be considered desirable, provided it is directed to the true promotion of the personal well-being of the individual."³²

The Vatican encyclical *Donum vitae* quotes these words of Pope John Paul II, offering its own statement in greater detail: "As with all medical interventions on patients, one must uphold as licit procedures carried out on the human embryo which respect the life and integrity of the embryo and do not involve disproportionate risks for it but are directed towards its healing, the improvement of its condition of health, or its individual survival."³³ While such procedures might not involve any germline modification, it is also clear from the context that they may do so, at least inadvertently. Together, these statements can be taken as reflecting the official teaching of the Catholic Church.

These statements should not be interpreted as endorsement for attempts at germline modification that ignore the constraints. The use of human germline modification for therapeutic purposes is a good and noble end, but it must not be pursued by means or techniques that violate the constraints. It must be noted, further, that honoring the constraints might mean that germline modification is never possible in a way that is morally accept-

able. In the future, it might even turn out that human germline modification becomes possible in ways that satisfy the prevailing secular standard of safety, but nevertheless in a way that does not meet these Catholic standards and therefore is condemned by the church, but not because it is intrinsically wrong. Intrinsically, human germline modification for therapeutic reasons is morally acceptable to the Catholic Church.

From these statements, Protestant and Catholic, it may be concluded that the Christian churches generally do not oppose the core idea of human germline modification for therapeutic purposes. Two conditions have been noted in these statements. The first condition, shared implicitly if not explicitly by all the statements, is that any use of germline modification must be for therapeutic rather than enhancement purposes. In asserting this condition, no one is claiming to know precisely how to distinguish therapy from enhancement. However, in the most general terms, there is believed to be a difference between using this technology to allow the conception and birth of a child while diminishing the likelihood of a serious genetic disease, and using the technology to produce a child with socially desirable traits. The second condition, which is limited to the Catholic statements (although individual Protestants and Orthodox might agree), is that the means employed in human germline modification must avoid reproductive technologies such as in vitro fertilization or any nontherapeutic use of human embryos. An embryo may not be made to exist outside the body nor treated in a way that is not intended for its own benefit in respect to its developmental potential.

Of these two conditions, the first is generally endorsed by the contributors to this volume and by other scholars whose views are briefly noted in chapter 9. In chapter 5, Cameron and DeBaets make the important argument that the first condition needs to have the same sort of teeth as the second. If Catholic approval is to be withheld if the objections to IVF cannot be met, should not all (or nearly all) religious approval be withheld if the condition regarding therapy versus enhancement cannot be met? Cameron and DeBaets predict that even if the line between therapy and enhancement can be drawn, it cannot be held, for it is not in our nature to observe such a constraint. If approval is conditional upon observing a line between therapy and enhancement, and we expect that the line cannot be held, must religious scholars and leaders withhold

approval? Chapter 9 will return to this question. In addition, it will explore another moral condition that must be met if germline modification is to be morally acceptable: Its use must be consistent with religious principles of social and economic justice. The justice condition is often noted but rarely developed in a thorough way, except by a few individual religious scholars.

In the chapters that follow, scholars in Judaism and Christianity reflect on the internal dynamics of their faith, which like Ramsey's thought is always more complex and subtle than the public recognizes. The authors focus on the question of germline modification by engaging it, not simply with a view to a yes or no answer, but as a context for a rigorous exercise in theological self-examination. Stated negatively, the goal is to counter the public view that religion is simplistic and monolithic, capable of little more than neo-Luddite complaints against modernity and technology. Positively, the goal is to open up some of the complexity of religious and theological reflection for the public in order to provoke a deeper discussion. In the next section of this chapter, however, attention is directed to the question of how to define human germline modification and what techniques might make it possible.

Human Germline Modification—Definitions and Techniques

Definitions

Human germline modification goes by several names, such as “germline gene therapy” or “designer babies.” The term used here is human germline genetic modification, sometimes shortened to germline modification. The word “therapy” is avoided because of its strongly positive connotations. Until a medical technique is proven to bring about healing, it must be regarded as experimental and should not be called therapy. Furthermore, calling it therapy disguises the fact that in the end germline modification might be used primarily not for therapy but for what might be called enhancement.

If the term “therapy” is prejudicial in favor of the technology, the term “designer babies” is rhetorically negative, prompting thoughts of fashion design or trendy engineering, perhaps implying that any use of germline modification is the equivalent of designing a child with just the right

features and options. Of course, germline modification might be criticized for harboring a secret tendency in that direction, but the criticism must be argued, not presupposed in the choice of terms. In contrast to both “therapy” and “design,” the term “modification” is more precise and rhetorically neutral.

Germline genetic modification is called “germline” because the modification could pass to future generations. It affects the so-called germline cells, modifying their DNA in ways that may be inherited by offspring. A major study completed in 2005 defined germline modification this way: “Human Germline Genetic Modification refers to techniques that would attempt to create a permanent inheritable (i.e. passed from one generation to the next) genetic change in offspring and future descendants by altering the genetic makeup of the human germline, meaning eggs, sperm, the cells that give rise to eggs and sperm, or early human embryos.”³⁴

Embryos are included in the list of germline cells because modifying the genes of the embryo, if done at the time of fertilization, will affect all the cells that come from the early embryo, which include the germline cells, specifically sperm, eggs (or oocytes), and their precursors. Conversely, if oocytes or sperm or their precursors are modified, any embryos they produce will also be modified. In any case, the key point is that any modification of the DNA of germ cells could be inherited by future generations.

Germline modification is typically distinguished from somatic cell gene modification, which is most commonly known as somatic cell gene therapy or simply as gene therapy. In 1990, the first somatic cell gene modification was attempted, and since then hundreds of experiments have been conducted involving thousands of patients. The goal typically is to treat a genetic disease by modifying the DNA that causes it. Results so far have been disappointing, with little success and a few well-publicized individual tragedies that were setbacks for the whole field. Human germline modification, by contrast, targets the germline cells.

Techniques

If germline cells are the target, what are the techniques that might be used to modify their DNA? What are the procedures and technologies

that might actually change the genes in germline cells? A range of strategies has been proposed. At present, all of the suggested strategies have limitations or problems that stand in the way of their being attempted in acceptably safe experiments. Nevertheless, nearly all of them are being used, one way or another, in experiments with nonhuman animals or with human cell cultures.

The techniques fall into two basic categories. Strategies in the first group focus on adding new DNA, whereas these in the second group attempt to correct or replace the existing DNA with a another segment. In the first group at least four types of techniques are being developed.

Viral Vectors Viruses are naturally able to transport DNA into living cells and insert it into the chromosomes. Viral vectors are viruses that have been modified to keep them from causing disease. The DNA to be inserted into the cells is first inserted into the modified virus. Millions of copies are produced and allowed to enter the target cells. The hope is that the transported DNA will begin to function inside the targeted cells, ideally overriding a genetic disease. There are two major problems with viral vectors. First, the inserted DNA may not end up in the right location, in which case it might not work, or worse, it might interrupt a normal gene. Second, the old, disease-related DNA remains, and so does the viral DNA itself, which could cause problems in a developing embryo or later in life.

Nonviral Vectors To avoid at least the problem of the viral DNA, some researchers have developed nonviral techniques for inserting DNA into cells. One approach is to insert just the DNA strand itself into the cell by microinjection. Another is to package the DNA in a tiny capsule of fatty substance that can pass into the cell. These and other techniques avoid the insertion of viral DNA but have the other problems associated with viral vectors.

Artificial Chromosomes A completely different approach to adding DNA involves constructing what amounts to a small version of a chromosome. The DNA in the nucleus of cells is packed into chromosomes that duplicate themselves when the cell divides. Researchers have been able to create human artificial chromosomes, imitating the basic struc-

ture found in nature but containing just the DNA that researchers build into it. The thought is that an artificial chromosome might be inserted into an embryo at fertilization. The main advantage of artificial chromosomes is that they can carry twenty to thirty times as much DNA as the largest capacity viral vectors.³⁵ Large genes and indeed many genes can be built into an artificial chromosome and transferred as a unit into a living cell. If used in germline modification, however, the presence of these chromosomes might cause chromosomal abnormalities, a serious health concern. Quite likely an artificial chromosome would have to be removed in the distant future when a person with germline modification seeks to reproduce.

Ooplasm Transfer This approach, which is of narrow interest but important because it has already been used, was developed as a way to help avoid a rare set of diseases known as mitochondrial disorders. Most DNA is located in chromosomes but a tiny portion is found in small structures outside the cell nucleus. These structures, called mitochondria, are inherited only from one's mother. If a woman with a mitochondrial disorder wants to have children, she knows that they will all inherit her disorder. In order to avoid this while helping her have children with her own nuclear DNA, researchers have developed a way to transfer ooplasm, which contains the mitochondria, from a donor egg to the prospective mother's egg and then fertilize the modified egg.³⁶ The DNA of the resulting children (mitochondrial, not nuclear) is modified by technology, and so in a minimal way this procedure falls within the scope of the definition for germline modification.³⁷ It is not likely that this technique will be used widely, but it is historically significant as the first use of human germline modification.

In addition to adding DNA, it may be possible to replace or repair the DNA that is present in the germ cell. The advantage of replacement or repair is that the old DNA sequence is not left behind, possibly causing health problems in the future. Two approaches have been proposed.

Gene Repair DNA mutates or changes spontaneously in the human body. These mutations could lead to disease, including cancer, but

fortunately the cells themselves correct these errors. It is possible to mimic this function by constructing short sequences of DNA and its companion, RNA, and packaging the sequence so that it can enter specific target cells. There the DNA–RNA sequence finds the mutation, binds to it, and forces it to change.³⁸ If this technique can be successfully developed, it still faces an important limit. It is capable of correcting only the tiniest amount of DNA. A few genetic diseases are caused by a one-base mutation, and these might be treated through this approach. Or it might be possible to use this technique to disable or “knock out” a gene that could be causing a disease. The major advantage of gene repair as a strategy for germline modification is that it leaves no unwanted DNA behind.³⁹

Gene Targeting This strategy is also known by a more technical term, “homologous recombination,” which uses a series of steps precisely to replace a mutated gene or an unwanted DNA sequence with a corrected gene. The process is too complicated to use directly on embryos or on eggs or sperm, but it might be possible to use it to modify cells that can be made to produce eggs or more likely, sperm. This approach will likely require an intermediary step involving human embryonic stem cells. It has been shown that gene targeting can be used to produce precise genetic modifications of human embryonic stem cells. These modified stem cells, multiplying in a dish, can then be selected by separating out those cells that have the correct modification from those that do not.⁴⁰ The next step is to use these genetically modified stem cells to produce the precursors of sperm or oocytes. Researchers have done this with mice.⁴¹ If this technique can be applied to human beings, it may be possible to modify stem cells and from them produce eggs or sperm that carry the modification. From that point it would be relatively easy to create embryos with the genetic change.

One important question has to do with what is sometimes called inadvertent germline modification. When researchers are attempting gene modification of somatic cells, how do they know that they are not modifying the germline cells in the patient’s body? They may be trying to avoid germ cells, but if they affect them, does this count as germline modification? The answer is yes, according to the definition used in 2000

by the American Association for the Advancement of Science (AAAS). According to this study, “inheritable genetic modifications [IGM] refer to the technologies, techniques, and interventions that are capable of modifying the set of genes that a subject has available to transmit to his or her offspring. IGM includes all interventions made early enough in embryonic or fetal development to have global effects on the gametes’ precursor tissues, as well as the sperm and ova themselves. IGM encompasses inheritable modifications regardless of whether the intervention alters nuclear or extranuclear genomes, whether the intervention relies on molecular genetic or other technical strategies, and even whether the modification is a side effect or the central purpose of the intervention.”⁴² For the AAAS study, inadvertent modification of a germline was specifically included in the scope of the definition, primarily because of its link to research occurring today in somatic cell modification.⁴³

The question of inadvertent modification of a germline is not directly addressed by the authors of the chapters that follow. Indirectly, however, the issue is always before us. Whether such modification is permissible may be the most important relevant public policy question on the immediate horizon. If inadvertent modification of a germline must be avoided without exception, then gene modification of somatic cells comes under a huge burden of proof that it is avoiding all germline changes. Such a policy might preclude certain techniques from ever being accepted.

What is under consideration here is not inadvertent bad effects. What is at stake is whether inadvertent beneficial effects might be permitted or whether, simply because they affect the germline, they must be banned regardless of their benefit. For example, if researchers treating a patient for a genetic disease eliminate the disease-linked DNA from germ cells, and if the patient then produces children who are free of the disease, have the researchers acted immorally and should public policy prevent them from doing so? Some might say yes if they believe that germline modification is inherently evil and that researchers have an obligation to avoid even a low degree of risk. Others, however, will say that under some circumstances, germline modification is not evil and that in such a case good has been done twice, first to the patient and then to the offspring.

To a large extent, our acceptance of inadvertent modification of a germline hinges on our moral stance toward intended germline modification. If so, then the debate over the morality of germline modification has immediate public policy implications, affecting how we regulate today's proposals for modification of somatic cells.

Deepening the Discussion, Enriching the Debate

The contributors to this volume draw upon living religious traditions to widen and enrich the public debate over the human future. Elliot N. Dorff provides a helpful general introduction to the various ways religions draw upon ancient texts and traditions to make sense of contemporary challenges. He notes that from the tradition and perspectives of Judaism, there is a strong presumption in favor of medicine and the moral legitimacy of altering the natural world for a good purpose, and thus in favor of germline modification. At the same time he raises profound worries about human weakness and the ensuing potential for misuse of powerful technologies, and so he cautions us to proceed with care and with open deliberation.

Thomas A. Shannon clearly sets out the official teachings of the Catholic Church related to biomedical research in general and embryo research in particular. The core moral principle is that the dignity or value of human life must be protected without qualification from conception. A human embryo may be treated medically if the objective is therapeutic for the embryo. Germline modification, therefore, is morally acceptable. However, it is also true that in official teaching, the human embryo may never be used as a means to an end, whether to expand knowledge or to treat another person. This has implications for embryonic stem cell research and the use of nuclear transfer (cloning) for research purposes or as a way of treating another person. These constraints also limit the methods by which germline modification might be achieved, with the effect that what is permissible in principle might be impossible in practice. Shannon concludes with a review of his own criticisms of these constraints.

H. Tristram Engelhardt, Jr., notes the multiplicity of religions and even of Christianities, insisting upon the one he calls traditional. On the basis

of traditional Christianity, he identifies specific limitations or conditions that must be met by germline modification. With these in place, he concludes on the basis of the core theological doctrines of traditional Christianity that a curative or therapeutic use of germline modification is permissible, possibly even obligatory. Perhaps most interesting is that Engelhardt's approval of germline modification is not limited to therapy in the usual sense but takes in a much wider scope, based on the distinctive features of traditional Christian doctrine. According to the traditional doctrine of creation, God creates human beings to be immortal, and while immortality is lost owing to the Fall, human longevity in Biblical times is ten times greater than it is today. There is no objection here to efforts to extend the human life span, a point that complicates any notion of a universally obvious breakpoint between therapy and enhancement. At the same time, any hope of a transhuman or posthuman future is seen as a poor substitute for the expected transformation that comes in the future of humanity divinized or made to participate in the life of the divine.

Nigel M. de S. Cameron and Amy Michelle DeBaets, reflecting the core anthropological insight of classical protestantism, insist that human nature is defined theologically in relation to God as its source (creator) and destiny (assumed in Christ). Technology must never aim to go beyond human nature as created or given by God and as assumed or taken up by God, as if we were permitted to transcend our natures by biomedical enhancement. This amounts to a categorical objection to enhancement. Yet this is exactly what germline modification will do, they argue, and any thought that its use can be limited to therapy is delusional. Therefore, the only religiously responsible position is to stop the whole field.

James J. Walter draws upon core Catholic doctrines to explore the question of germline modification, concluding that it is theologically legitimate. It is not, as some charge, an illicit act of playing God, as if it were an intrusion on God's sole prerogatives in respect to the creation of human life. In particular, he rejects the view that nature is fixed or static and that any technological modification violates natural order. On the other hand, we should be wary of our tendency to let technology become the raw assertion of human will over nature, as if no inherent

goodness and purpose were present in nature to constrain our acts. Better to think of our actions as a kind of co-creation that honors God's purposes and contributes to them. The development of germline modification presents great challenges. Based on a theological analysis of major themes of the Catholic faith, however, Walter concludes that germline modification is defensible as consistent with a theological view of God's creative and redemptive purposes.

Lisa Sowle Cahill agrees that germline modification is acceptable for therapy but not for enhancement. Her essay raises questions about the difficult concept of human nature, which she identifies, not with a list of fixed properties grounded in the biology of each individual, but as arising from our sociality, which enables our flourishing when it is characterized by justice. The problem of enhancement is that it threatens to undermine justice and therefore poses a threat to our nature as social.

Continuing some of these themes, Celia Deane-Drummond focuses on the question of human moral agency and how traditional notions of conscience and virtue might apply to case-by-case uses of germline modification. On this basis she concludes that we should not rule out germline modification. In addition to attention to ourselves as moral agents, we also need to consider the methods that might be used to achieve germline modification. Instrumental or nontherapeutic use of embryos, for example, is not permissible, and so any strategy of germline modification that requires the creation and destruction of embryos is ruled out.

The final chapter explores more fully the religious case in favor of human germline modification, examining at length the moral conditions that are often tied to that approval. The chapter concludes with a return to the challenge posed by Hans Jonas, which focuses our attention not so much on the technologies of human transformation, but on those human beings who will use them and those who will be made different by them.

Notes

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