# Stem Cells, Therapeutic Cloning, and the Soul

**The George C. Marshall Foundation Roundtable**
**Washington DC**

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**October 17, 2001**

"Poets and physicians are closely allied in thought. Diagnostics and cure (truth and love, in essence) belong to both professions."

Robert Graves, in a letter to me, December 30, 1961

President Bush has been this country's most effective teacher of biology since Clarence Darrow. No longer can any citizen blame a bad experience in a high school or college class for ignorance of these facts:

• Two sorts of cells -- sperm and egg -- can live longer than the persons whose bodies produces them. For this to happen, these cells must first join their genetic material together to form a fertilized egg cell with a totally new and unique version of the human genome.

• When a fertilized egg finds itself in a special environment -- a woman's uterus -- it may multiply and differentiate into a new person, whose individuality will be based in large measure on its new genetic makeup. In the laboratory, sperm and egg can be mixed together to form a fertilized egg that will then divide in a dish to produce an early embryo in vitro, which may then be implanted into a woman's uterus to develop into a person, or frozen into a state of suspended animation, or dissociated into separate embryonic stem cells for further study, or discarded.

• Scientists working without federal support have dissociated early embryos into separate cells, and from these they produced some sixty lines of cultured cells that now are claimed to grow indefinitely in a dish. Each of these one day may be stimulated by hormones to differentiate into any of the cell types that make up the body and brain of a person. Such differentiated cells derived from early embryos may have broad medical utility. They may -- in principle, if not yet in practice -- be used to replace tissues worn out by aging or destroyed by accident or infectious disease, or they may be able to rescue the tissues damaged by genetic disease, the inherited inability to produce or maintain one or another aspect of normal tissue development.

All of this current and future biology can be found in the President's short speech of August 10. From these facts and hopes, the President reached the following two conclusions:

• First, the Federal government will fund further research with the sixty currently reported embryonic stem cell lines.

• Second, the federal government will not fund research that would establish any further undifferentiated embryonic stem cell lines, nor research into any other uses of human egg cells.

Both of these conclusions were unexpected and, given the science that accompanied them, both have been hard to understand. The immediate question raised by the first of these two decisions is, why so many lines? If stem cell lines can grow as little balls simply by being given nutrients but not differentiating signals, why not just one cell line, grown and partitioned by the government into as many vials as needed? The complementary question raised by the second decision is, why only these sixty? Having revealed his distaste for the idea of dissociating the cells of an embryo for research purposes, why did the President not authorize research on other technologies that might yield the same or better clinical outcomes without this initial step?

While neither decision makes sense on the basis of the science used by the President to support it, each becomes understandable when seen through the lens of his publicly acknowledged, deeply held religious convictions. It is odd that no one -- not the President, nor the press, nor the many corporate and university ethicists, scientists and doctors who have spoken out in the past few weeks -- has seemed comfortable admitting the matter of personal religious belief to the discussion of these two decisions. Rather than trying to articulate the President's reasoning -- which would require acknowledging that religious belief has had a place in the national discourse, a fact that they surely already know but apparently cannot say aloud -- most commentators have concluded that these decisions represent no more than the ordinary political compromising.

And so, he has been criticized by some for allowing federal funds to be spent on even one such cell line, and by others for denying federal funds that would go to basic research that might generate the medically most useful cells for therapeutic purposes. To consider the religious content of these or any other political decisions may seem parochial, but everyone -- especially those of us who claim as scientists to be willing to look at all the data -- ought to pay attention the beliefs of others and our own religious convictions, because after all they are data in their own right.

To look at the religious content of the President's two decisions, we have to begin with a four-letter word: soul. I trust I will be forgiven if I slip up on details of doctrine, but to me the President's notion of a soul is straightforward enough. Many people -- and I am among them -- feel that the essence of anyone's individual unique value as a person cannot be reduced to 3 billion base pairs, nor even two unique versions of that long string of letters. For us, the essence of being human has to encompass our purpose in being

alive as well as the mechanics of biological survival. For those -- and I am one of them as well -- who believe that our purpose in being alive is to receive both life and its meaning from an unknowable God whose intentions include our well-being, it follows with great force and simplicity that our bodies are in some way sacred. A common way -- not the only way -- to express this strong feeling of being more than a mass of cells with a unique DNA sequence in each, is by the old Greco-Roman notion that located somewhere in each of us is an ineffable, non-physical presence, which we may call the soul.

By its sacred non-physical nature, the soul cannot and will not be studied through science; its presence is a matter of pure belief. For those who also believe in a Creator-God the soul is a gift from the Creator. But the notion of a soul does not depend on a belief in a Creator-God, nor must it be restricted to people. Many people accept a physical world that lacks a Creator God, and believe in an essential quality in any living thing that lives through many generations of bodies. While dissociating the notion of the soul from the physical reality of any one living being, they discover deep and important meaning in their own lives by taking on the obligation to act in such a way that their souls may be so elevated as to attain a higher body in their next reincarnations. The thread that ties together these and other different conceptions of the soul, is the notion that no measurable, controllable aspect of the natural world gives meaning to our lives so well as does something unnatural, immeasurable, and ineffable.

Of course there is no consensus on the matter, and many other people, accepting the evidence of the data we have at face value, conclude that each person is precisely devoid of any essence beyond his or her physical being. But we have only one President, and I think we may assume from his public statements that he is one of the many Americans who believe that each person is the bearer of a sacred soul, and further, that he believes this soul resides not only in every living person, but in every human cell or collection of cells with the potential to become a person. If one believes this -- and again, let me remind us that beliefs are not subject to verification by data; no one needs to display evidence of souls to believe in them -- then the facts of biology so clearly delineated by the President must be deeply unsettling.

The entire technology for the production of embryonic stem cell lines depends upon a willingness to foreclose the potential of a fertilized egg or early embryo for the sake of the utility of its constituent cells. In these religious terms, that is the same as acting to destroy the physical home of a soul, thereby -- depending on the particularities of one's beliefs -- either sending it back to its Creator or destroying it as well. The belief that a technology founded in such an act is wrong and should be forbidden may be insupportable by data, but it is neither silly nor dangerous. Indeed, it is grounded in the same good intentions that proponents use in arguing for the eventual use of these embryonic stem cell lines: the intention to save a life, and -- in religious terms -- thereby to save a soul.

From this perspective one might have expected the President simply to forbid federal funding for work on any cell lines derived from intentionally disrupted human embryos. His first decision -- to allow federal funding for research on cells derived from

any one of sixty such destroyed human embryos -- suggests he may have acted against his own beliefs. Why are these sixty lost souls -- but no others -- to be commemorated by the utility of their constituent cells? Does the President wish our government to have the authority after all to separate among embryos, and declare some the bearers of sacred souls, and others merely balls of cells? Sixty years ago the Nazi regime -- driven not by any wish to cure disease but rather by the simpler wish to remove from this earth some souls within their grasp -- had a word for other such disposable people: "Ballastexistenzen," lives not worth living.

Now that cells from the sixty lines have been declared by the President to be simply a commodity, their value has already begun to be measured as much in economic as in medical terms: there is a lot of money to be made here, and though these sixty cell lines may now be studied with government money, they are not the property of our government. They belong to many different private companies and universities, none of which are likely to be particularly interested in matters of the soul. For non-believers, their possible utility in medicine may justify the use of cells from these sixty lost embryos, but given his own beliefs, why did the President not demand instead they be given a decent burial? The pressure of scientists' promises on the President must have been great, to push him to this act of willful denial of the sacredness of sixty unborn children's souls.

We know some of that pressure from his speech: only with both federal support and private investment will these sixty lines, it was argued, provide medicine with a powerful new source of treatments, specifically the replacement of damaged tissues by the differentiated progeny of embryonic stem cells. But that argument cannot be the whole story, for two reasons: first, it still leaves us without an explanation for the second decision to make these sixty lines the only sources of such future government-supported medical breakthroughs. And second, it disingenuously ignores the likelihood that such uses of cells from these sixty lines are likely to be clouded by the inevitable problem of immune reaction, a problem that has already cast a pall over the injection of novel genes or embryonic cells in medical practice.

No medical use of the progeny of these sixty lines is likely to escape this problem, which derives from the basic biology of human genetic individuality. Each stem cell line will have the genetic specificity of the lost embryo from which it came, not that of the recipient who might need its differentiated progeny. As a result, immune rejection will always set a limit on the utility of these cells in medical practice. Consider a person with type-I diabetes, whose pancreas was depleted by viral infection of all cells that produce insulin on demand. Or, consider a person born with a single mutation that will result in the eventual loss of cells in a region of the brain and bring on the lethal symptoms of Huntington's disease. In a technology based on the sixty cell lines, cells from a lost embryo would be differentiated in a dish into insulin-producing cells or the appropriate sort of nerve cells, and then injected into the patients who, it is hoped, will recover as the cells land in a proper place and carry out their normal differentiation, either by making insulin as called for by the other tissues of the patient, or by linking up to other nerve cells in the brain.

But based on current information we can expect cells from any of these lines to express their own unique, lost genetic individuality as a set of proteins on their surfaces, thereby making the injected cells targets for the recipient's immune system in each case. In other words, we can expect immune rejection to be a concomitant of successful differentiation, and an intrinsic limitation to treatments based on these sixty lines. How sad, then, that the President felt compelled to yield on a matter of religious belief for so risky a promise; and how unfortunate that he compounded the risk by his second decision to set so severe a restriction on further research, when a different line of research might make those sixty lines unnecessary.

There is a second technology for obtaining stem cells, one that has neither the problem of immune rejection in its future, nor -- in my opinion at any rate -- the taint of a lost soul in its design. The technology of therapeutic cloning has no focus other than the clinical needs of one person at a time. In this technology, an egg cell donated by a woman -- not a new embryo, but a cell with no full human genome and no chance of becoming a person -- would have its nucleus removed and a nucleus from a patient put in its place. The egg cell's remaining material -- its cytoplasm -- would reorganize the genes of the patient's genome, so that the donor's genes would recapitulate each embryonic stem-cell stage their ancestral cells went through soon after the earlier formation of the fertilized egg that would become the recipient. The egg cell cytoplasm would be using the donor's nucleus to spin off a population of stem cells, each with the capacity to differentiate in as many ways as a doctor might want, and each also specifically marked on their surfaces with the molecules found only on the cells of the donor.

Nor is that all: if the donor of the nucleus were the victim of a mutational disease like Huntington's Disease, the genomic lesion first could be repaired by genetic engineering of donated cells from any tissue -- blood or skin, say -- and then the genetically-repaired nucleus could be transferred into the egg cytoplasm. In this way a person might be given a set of appropriately differentiating cells that were otherwise genetically his or her own, only freed from the mutation and therefore able to reconstitute the normal function that the inherited disease had foreclosed.

One more advantage: the genetic engineering of the donor's nuclear genome need not be solely to repair an inherited mutation. We know, for instance, that the immune cells of persons who inherit the otherwise unremarkable absence of the cell-surface protein CKR5 cannot be infected by HIV. Such people are rare; they can be identified as remarkably resistant to AIDS even when they engage in repeated high-risk behavior. One might therefore expect that nuclei donated by any HIV-infected person, if genetically engineered to remove the gene for the CKR5 receptor and then passaged through egg cytoplasm, would produce new cells for the AIDS patient's immune system that might re-establish a healthy immune system despite the virus's presence, and even perhaps allow for his or her survival and long-term recovery.

Engineered this way or simply taken from a tissue, differentiated cells from therapeutic clones should not be rejected by the immune system when they are used to treat the donor's own illness; instead, they have the better chance to become a new form of medicine, a tissue replacement treatment designed solely for the one person who donates the nucleus.

Why did the pressure that drove the President to accept research on those sixty cell lines, not also push him to approve further research in this alternative source of stem cells, a source less useful perhaps for basic research, but more precisely tuned to the clinical uses he called upon to justify his authorization for continued research with those sixty lines? Perhaps it was a matter of the soul. One might argue that there is no new soul in the egg cell donated by a woman. But what of the egg cell with the donor's nucleus in it? The former cannot become a person. The latter is genetically the same as a person whose soul is at risk from the very disease this technology might ameliorate, delay or reverse.

Perhaps the President considered that the transfer of the nucleus of a donor into the cytoplasm of an egg was sufficient to create a new soul, insofar as that new cell might have the capacity to be a person. after all, identical twins also share an identical, unique genome, yet certainly each twin has a soul. In any event, the reason given by the President for turning away from this technology did not call upon the notion of a soul, but was based instead on the anxiety that if placed in a woman's body for the requisite nine months, a reoriented human genome in a donor egg cytoplasm might be born as either a clonal copy of the donor, or a genetically-engineered one.

Here the President seemed to be on very strong ground: a cloned human would be a terrible experiment, performed on a person for his or her entire life, with no chance of that person withdrawing from the experiment if it does not go well. A cloned person might have a soul, but the process is abhorrent and of absolutely no clinical utility. It would create a situation little different from slavery. If a child is in any sense the property of its parents, that is only because we presume them to be bound together by that most irrational of feelings, love. The person emerging from an experiment in which a therapeutic clone were placed in a woman's body and carried to term, would be the object of fascinated attention -- if not the property -- of the scientists and doctors who initiated his or her novel genome, and their funders. Their interest in that child would be in its experiences an experiment, an interest hardly based on love; parental consent would merely legitimize a degree of disinterested ownership over another person from birth through death.

In medical terms, cloning a person for any reason sacrifices the current generation for the next, and as such it does not serve the purpose of medicine, that is, to alleviate or cure the suffering of a person already here among us. The creation of any cloned child with a changed genome would be in addition a Promethean grasp at the human germ line, but even cloning a person without genetic manipulation would convert kinship and childhood into just the sort of commodities those sixty cell lines have become. As a

friend once said to make me think again about performing a particularly seductive experiment, if it isn't worth doing, it isn't worth doing well.

The well-founded anxiety that therapeutic cloning might be misused to create a cloned child -- and I share this anxiety with a clear majority of polled citizens -- is no reason to turn away from the new technology of therapeutic cloning. Between the therapeutic clonal cell line and the cloned person stands a formidable barrier, one that I am sure makes this second technology both feasible and safe. That barrier, completely invisible in the President's talk but no less solid for that, is a woman's body. Human eggs -- the sole source of that brilliant cytoplasm that can send a human genome down the paths of differentiation into all the different cells of the body -- are the product of women's bodies. Human embryos and fetuses and newborns are also the products of women's bodies. No potential person can become a person outside of a woman's body. And, in our country at this time, a Supreme Court precedent exists for the notion that a woman, but not her fetus, is a person under the law and therefore subject to both the freedoms and the responsibilities of the law.

Again, the President did not mention a woman's body at all. I cannot be sure of the reason for his having left out this aspect of the biology he has so clearly mastered, but I suspect it was because he was confounded by his religious convictions on another matter entirely: the right of a woman to the use and control of her own body, up to and including her right to end the life of a fetus within her so long as that fetus could not survive outside her body. In the President's publicly stated view, a woman who elects to abort her fetus is ending the life of a new soul, and for that reason she is making a profound religious error. He is of course entitled to this opinion, as are the many Americans who agree with him. It is an opinion that may help in an unexpected way to determine the relative merits of embryo disruption or therapeutic cloning, in medical and religious terms.

The precedent set by the current law opens a rather unexpected door for the President. Consider what would follow if legislation now being discussed were passed into law, and carrying a human clone to term were made illegal. It is clear the President supports such a law and, given what I have just said, so do I. But how could such a law be enforced except under the aegis and with the full endorsement of the current law that holds a woman responsible for the decisions she makes concerning the initiation and termination of her pregnancies? "Pro-choice" and "Pro-life" positions would each face the odd necessity of accepting a portion of the other side's argument in order to retain the merit of their own. From a pro-life position, it would be necessary to acknowledge that a law forbidding the carrying of clones to term could be enforceable on a woman only in the context of every woman having the complete right to choose her actions in this matter; from a pro-choice position it would be necessary to acknowledge that such a new law set a limit on the legality of a woman's choices, albeit in the direction that this position already holds to be the measure of a woman's freedom.

Were such legislation to become the law, then women would be held properly responsible and accountable to assure that a therapeutic clone would not become a person. Under those circumstances, each therapeutic clone would have only one function -- the amelioration of suffering -- and one could argue that as no new soul could have been intended by the technique, none was possible. If the President had only accepted the full responsibility of women in this country in that part of their lives that men cannot replicate but only control, he might have been able to avoid his first decision, which was so clearly in violation of his deeply held religious beliefs. If he had instead issued a strong call for therapeutic cloning from donor eggs, coupled with an equally strong sanction against the intentional creation of new fertilized eggs for research purposes and the implantation of any experimentally modified human embryos into a woman's body, he would have opened up a most promising second line of basic research for all, instead of restricting federal support to a set of cell lines tainted by the crushed intentions of their donors that they become people, the certainty of immune rejection down the road, and the commercial implications of a premature monopoly.

In religious terms, that position -- while being wholly consistent with all the data of biology to date -- would have freed him from the burden of having authorized research on cells that were indeed once intended to be persons in their own right. But because such a ruling would be binding only on women -- there is no other place to find a uterus -- it would have required him to accept that a woman is fully responsible for her body at all times, and that a pregnant woman but not the fetus within her has the legal standing of a person in law. Unable to do this, he issued instead only a strong condemnation of even therapeutic cloning, as if the availability of a woman's body once the cloned line had been made could be taken entirely for granted. It is insulting if not illegal to give women so little credit and so little power that it becomes necessary indirectly to protect them from this potential misuse of their bodies by forbidding therapeutic cloning, a technology that begins with a woman's egg but not her uterus, and might conceivably end with a new, safe, secular technology of healing.

There will be many consequences to the President's two decisions, whether or not congress approves them and they become law. Most are not easily predicted at this time, but one is already clear enough. If either a technology based on the sixty cell lines or one based on therapeutic cloning does lead to safe medical treatments in the near future, then we will find ourselves in a situation of deep and troubling unfairness -- and therefore of religious error -- in this country. The Federal government has agreed to license the use of sixty stem cell lines for basic research, but any medical use of them is likely to be available only for a price high enough to recoup the costs of its development. Health insurance will pay for that, one assumes, but currently about fifty million Americans are without medical insurance, and hence without access to any of the positive developments from this technology. In religious terms, then, the cells of sixty lost souls may be transmuted into good medicine, but then the souls of fifty million Americans will not be preserved nor protected by that eventuality. Here, the religious question will remain what it has been for decades: why not?

There is always time to begin to do better. As a woman provides the egg for a therapeutic clone, one may imagine a situation where the technology may serve to ameliorate the current grotesque imbalance between the our government's current moral fastidiousness about potential lives, and its policies that seem designed to shadow current, actual lives.

Consider a woman suffering from AIDS, who is neither eligible for federal medical insurance nor able to work at a job that would provide her with private insurance. How elegant it would be -- and how clearly different from current policies concerning such women -- if the first therapeutic cloning were done for her, using her own eggs and their own nuclei, creating for her a CKR5-deleted, HIV-resistant immune system at no cost to her, simply because she is a fellow-citizens facing death, and because this might offer her a chance to live.