

Life, Liberty and the Defense of Dignity

The Challenge for Bioethics

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❖ CHAPTER THREE

The Meaning of Life— in the Laboratory

People will not look forward to posterity who never look backward to their ancestors. —Edmund Burke

What's a nice embryo like you doing in a place like this? —Traditional

The readers of Aldous Huxley's novel, like the inhabitants of the society it depicts, enter into the Brave New World through "a squat gray building . . . the Central London Hatchery and Conditioning Centre," beginning, in fact, in the Fertilizing Room. There, three hundred fertilizers sit bent over their instruments, inspecting eggs, immersing them "in warm bouillon containing free-swimming spermatozoa," and incubating the successfully fertilized eggs until they are ripe for bottling (or Bokanovskification). Here, most emphatically, life begins with fertilization—in the laboratory. Life in the laboratory is the gateway to the Brave New World.

We stand today fully on the threshold of that gateway. How far and how fast we should continue to travel through this entrance is not a matter of chance or necessity but rather a matter of human decision—*our* human decision. Indeed, it seems to be reserved to the people of this country and this century, by our conduct and example, to decide also this important question.

Should we allow or encourage the initiation and growth of human life in the laboratory? This question, in one form or another, has been an issue for public policy since the mid-1970s, even before the birth of the first test-tube baby in the summer of 1978. Back in 1975, after prolonged deliberations, the National Commission for the Protection of Human Subjects of Biomedical and Behavioral

Research issued its report and recommendations for research on the human fetus. The Secretary of Health, Education and Welfare (HEW) then published regulations regarding research, development and related activities involving fetuses, pregnant women and *in vitro* fertilization. These provided that no federal monies should be used for *in vitro* fertilization of human eggs until a special Ethics Advisory Board reviewed the ethical issues and offered advice about whether government should support any such proposed research. Perhaps for the first time in the modern era of biomedical research, public deliberation and debate about ethical matters led to an effective moratorium on federal support for experimentation.

A few years later, the whole matter once again became the subject of intense policy debate when an Ethics Advisory Board was established to consider whether the United States government should finance research on human life in the laboratory. The question had been placed on the policy table by a research proposal submitted to the National Institute of Child Health and Human Development by Dr. Pierre Soupart of Vanderbilt University. Dr. Soupart requested \$465,000 for a study to define in part the genetic risk involved in obtaining early human embryos by tissue culture methods. He proposed to fertilize about 450 human ova, obtained from donors undergoing gynecological surgery (that is, not from women whom the research could be expected to help), with donor sperm, to observe their development for five to six days, and to examine them microscopically for chromosomal and other abnormalities before discarding them. In addition, he planned to study whether such laboratory-grown embryos could be frozen and stored without introducing abnormalities, for it was thought that temporary cold storage of human embryos might improve the success rate in the subsequent embryo transfer procedure used to produce a child. Though Dr. Soupart did not then propose to perform embryo transfers for women seeking to become pregnant, his research was intended to serve that goal: he hoped to reassure us that baby-making with the help of *in vitro* fertilization was safe, and he sought to perfect the techniques of laboratory growth of human embryos introduced by Drs. Robert Edwards and Patrick Steptoe in England.

Dr. Soupart's application was approved for funding by the National Institutes of Health (NIH) in October 1977, but because of the admin-

istrative regulations, it could not be funded without review by an Ethics Advisory Board. The HEW secretary at the time, Joseph Califano, convened such a board and charged it not only with a decision on the Soupart proposal, but with an inquiry into all the scientific, ethical and legal issues involved, urging it "to provide recommendations on broad principles to guide the Department in future decision-making." After six months of public hearings all over the United States and another six months of private deliberation, the board issued its report in 1979, recommending that research funding be permitted for some *in vitro* experimentation—including the sort proposed by Dr. Soupart. But until very recently, no secretary of health and human services has been willing to act on that recommendation. In fact, Dr. Soupart died in 1981 without having received a clear answer from the government.

There the matter stood until 1994. In the previous year, Congress and President Clinton had for the first time given NIH the authority to support research on human embryos. In response, NIH established the Human Embryo Research Panel to assess the moral and ethical issues raised by this research and to develop recommendations and guidelines for the agency's review. In September 1994 the panel released its report, recommending that some areas of human embryo research be acceptable for federal funding, including research on embryos *created expressly for the purposes of research*, under certain limited conditions. Two months later, the Advisory Committee to the Director of NIH unanimously accepted the panel's report. However, President Clinton directed NIH *not* to allocate resources to "support the creation of human embryos for research purposes," though his directive said nothing about research involving so-called "spare" embryos remaining from clinical *in vitro* fertilization procedures performed to help infertile couples become parents. While NIH was in the process of developing guidelines to support research using those "spare" embryos, Congress stopped the enterprise dead in its tracks by enacting an amendment to the omnibus appropriations bills that prohibited NIH from using federal funds for *any* and *all* research on human embryos. Similar congressional prohibitions have been enacted in every year since then. Meanwhile, private-sector research using human embryos was heating up, yielding some remarkable discoveries that would soon reignite the controversy about federal funding for human embryo research.

In November 1998, Dr. James Thomson of the University of Wisconsin and Dr. John Gearhart of Johns Hopkins University announced the isolation of human embryonic stem cells, so-called pluripotent cells extracted from human embryos that are capable of being turned into any of the tissues of the body. As a result of this capacity, these cells are widely believed to hold great promise for regenerative medicine—the replacement of damaged tissues responsible for many horrible genetic or chronic diseases or disabilities. With this discovery, privately funded research on human embryos went into high gear, and federally funded researchers looked for ways to circumvent the legislative prohibition. By a clever interpretation of the law that went against its spirit but not its letter, NIH attorneys ruled that the prohibiting law actually permitted federal funding of research on the embryonic stem cell *lines*, provided that the researchers were not themselves responsible for the acts of embryo destruction needed to produce them. After a study by the National Bioethics Advisory Commission supported such research, and after the NIH developed guidelines for it, President Clinton authorized such funding in 2000.

Then, a newly elected President Bush announced early in 2001 that he would review the matter before permitting implementation of the NIH plan. During the following six months of deliberation, President Bush consulted widely with persons holding every imaginable viewpoint on the subject, as he sought to find a solution to his moral dilemma: how to allow federally funded scientists an opportunity to find out whether embryonic stem cells could indeed deliver on their therapeutic promise, while at the same time upholding his strong belief that nascent life should not be destroyed in the process. In August 2001, he announced his solution. The federal government would agree to fund embryonic stem cell research only on already existing stem cell lines, but there would be no cooperation in, and no abetting of, any further destruction of human embryos. That is where things stand as this book goes to press, though it is almost certain that we have not heard the end of the matter. The existing stem cell lines might age and wither; newly derived cell lines may show more promise than the existing ones; and other important uses for human embryos in research and treatment will no doubt be discovered. It is almost as certain as death

and taxes that we shall experience enormous pressures to grow more and more life in the laboratory. It is thus extremely important that we think about the meaning of doing so and assess the moral arguments for and against.

The Meaning of the Question

How should one think about such ethical matters, here and in general? There are many possible ways, and it is not altogether clear which way is best. For some people, ethical issues are immediately matters of right and wrong, of purity and sin, of good and evil. For others, the critical terms are benefits and harms, promises and risks, gains and costs. Some will focus on so-called rights of individuals or groups (for example, a right to life or childbirth); still others will emphasize supposed goods for society and its members, such as the advancement of knowledge and the prevention and cure of disease. My own orientation here is somewhat different. I wish to suggest that before deciding what to do, one should try to understand the implications of doing or not doing. The first task, it seems to me, is not to ask "moral or immoral?" or "right or wrong?" but to try to understand fully the meaning and significance of the proposed actions.

This concern with significance leads me to take a broad view of the matter. For we are concerned here not only with some limited research project of the sort proposed by Dr. Soupart, and the narrow issues of safety and informed consent it immediately raises; we are concerned also with a whole range of implications, including many that are tied to foreseeable consequences of this research and its predictable extensions—and touching even our common conception of our own humanity. As most of us are at least tacitly aware, more is at stake than in ordinary biomedical research or in experimenting with human subjects at risk of bodily harm. At stake is the *idea* of the *humanness* of our human life and the meaning of our embodiment, our sexual being, and our relation to ancestors and descendants. In thinking about necessarily particular and immediate decisions, we must be mindful of the larger picture and must avoid the great danger of trivializing the matter for the sake of rendering it manageable.

The Status of Extracorporeal Life

The meaning of "life in the laboratory" turns in part on the nature and meaning of the human embryo, isolated in the laboratory and separate from the confines of a woman's body. What is the status of a fertilized human egg (that is, a human zygote) and the embryo that develops from it? How are we to regard its being? How are we to regard it morally (that is, how are we to behave toward it)? These are, alas, all too familiar questions. At least analogous, if not identical, questions are central to the abortion controversy and are also crucial in considering whether and what sort of experimentation is properly conducted on living but aborted fetuses. Would that it were possible to say that the matter is simple and obvious, and that it has been resolved to everyone's satisfaction!

But the controversy about the morality of abortion continues to rage and divide our nation. Moreover, many who favor or at least do not oppose abortion do so despite the fact that they regard the pre-viable fetus as a living human organism, even if less worthy of protection than a woman's desire not to give it birth. Almost everyone senses the importance of this matter for the decision about laboratory culture of and experimentation with human embryos. Thus, we are obliged to take up the question of the status of the embryo in our search for the outlines of some common ground on which many of us can stand. To the best of my knowledge, the discussion that follows is not informed by any particular sectarian or religious teaching, though it may perhaps reveal that I am a person not devoid of reverence and the capacity for awe and wonder, said by some to be the core of the religious sentiment.

I begin by noting that the circumstances of laboratory-grown blastocysts (that is, three-to-six-day-old embryos, containing from 100 to 200 cells) and embryos are not identical with those of the analogous cases of living fetuses facing abortion or living aborted fetuses used in research. First, the fetuses whose fates are at issue in abortion are unwanted, usually the result of "accidental" conception. The lab-grown embryos are wanted and deliberately created, despite certain knowledge that many of them will be destroyed or discarded. Moreover, the fate of these embryos is not in conflict

with the wishes, interests or alleged rights of the pregnant women. Second, though the federal guidelines governing fetal research permit studies conducted on the not-at-all viable aborted fetus, such research merely takes advantage of available “products” of abortions not themselves undertaken for the sake of the research. No one has proposed and no one would sanction the deliberate production of live fetuses to be aborted for the sake of research—even very beneficial research.* In contrast, we are here considering the deliberate production of embryos for the express purpose of experimentation.

The cases may also differ in other ways. Given the present state of the art, the largest embryo under discussion is the blastocyst, a spherical, relatively undifferentiated mass of cells, barely visible to the naked eye. In appearance, it does not look human; indeed, only the most careful scrutiny by the most experienced scientist might distinguish it from similar blastocysts of other mammals. If the human zygote and blastocyst are more like the animal zygote and blastocyst than like the twelve-week-old human fetus (which already has a humanoid appearance, differentiated organs and electrical activity of the brain), then there will be a much-diminished ethical dilemma regarding their deliberate creation and experimental use. Needless to say, there are articulate and passionate defenders of all points of view. Let us try, however, to consider the matter afresh.

First of all, the zygote and early embryonic stages are clearly alive. They metabolize, respire and respond to changes in the environment; they grow and divide. Second, though not yet organized into distinctive parts or organs, the blastocyst is an organic whole, self-developing, genetically unique and distinct from the egg and sperm whose union marked the beginning of its career as a discrete, unfolding being. While the egg and sperm are alive as cells, something new and alive *in a different sense* comes into being with fertilization. The truth of this is unaffected by the fact that fertilization takes time and is not an instantaneous event. For after fertilization is *complete*, there exists a new individual, with its unique genetic

*Though perhaps a justifiable exception would be a universal plague that fatally attacked all fetuses *in utero*. To find a cure for the end of the species may entail deliberately “producing” (and aborting) live fetuses for research.

identity, fully potent for the self-initiated development into a mature human being, if circumstances are cooperative. Though there is some sense in which the lives of egg and sperm are continuous with the life of the new organism (or, in human terms, that the parents live on in the child-to-be), in the decisive sense there is a discontinuity, a new beginning, with fertilization. *After* fertilization, there is continuity of subsequent development, even if the locus of the new living being alters with implantation (or birth). Any honest biologist must be impressed by these facts, and must be inclined, at least on first glance, to the view that a human life begins at fertilization.* Even Dr. Robert Edwards had apparently stumbled over this truth, perhaps inadvertently, in his remark about Louise Brown, his first successful test-tube baby: "The last time I saw *her*, *she* was just eight cells in a test-tube. *She* was beautiful *then*, and she's still beautiful *now!*"

Granting that a human life begins at fertilization and develops via a continuous process thereafter, surely—one might say—the blastocyst itself can hardly be considered a human being. I myself would agree that a blastocyst is not, in a *full* sense, a human being—or what the current fashion calls, rather arbitrarily and without clear definition, a person. It does not look like a human being nor can it do very much of what human beings do. Yet, at the same time, I must acknowledge that the human blastocyst is (1) human in origin and (2) *potentially* a mature human being, if all goes well. This, too, is beyond dispute; indeed, it is precisely because of its peculiarly human potentialities that people propose to study *it* rather than the embryos of other mammals. The human blastocyst, even the human blastocyst *in vitro*, is not humanly nothing; it possesses a power to become what everyone will agree is a human being. One could even go further: the *in vitro* blastocyst is exactly what a human being is at that stage of human development. Only its extracorporeal location is different.

*The truth of this is not decisively affected by the fact that the early embryo may soon divide and give rise to identical twins or by the fact that scientists may disaggregate and reassemble the cells of the early embryos, even mixing in cells from different embryos in the reaggregation. These unusual and artificial cases do not affect the natural norm, or the truth that a human life begins with fertilization—and does so always, if nothing abnormal occurs.

Because of the embryo's special location, it may be objected that the blastocyst *in vitro* has today no such power, because there is presently no *in vitro* way to bring the blastocyst to that much later fetal stage in which it might survive on its own. There are no published reports of the culture of human embryos past the blastocyst stage (though this has been reported for mice). The *in vitro* blastocyst, like the twelve-week-old aborted fetus, is *in this sense* not viable (in other words, it is at a stage of maturation before the stage of possible independent existence). But if, among the not-viable embryos, we distinguish between the *pre-viable* and the *not-at-all* viable—on the basis that the former, though not yet viable, is capable of becoming or being made viable—we note a crucial difference between the blastocyst and the twelve-week-old abortus. Unlike an aborted fetus, the blastocyst is possibly salvageable, and hence potentially viable, *if it is transferred to a woman for implantation*. It is not strictly true that the *in vitro* blastocyst is *necessarily* not viable. Until proven otherwise, by embryo transfer and attempted implantation, we are right to consider the human blastocyst *in vitro* as potentially a human being and, in this respect, not fundamentally different from a blastocyst *in utero*. To put the matter more forcefully, the blastocyst *in vitro* is more viable, in the sense of more salvageable, than aborted fetuses at most later stages up to, say, twenty weeks.

This is not to assert that such a blastocyst is therefore endowed with a "right to life," that failure to implant it is negligent homicide, or that experimental touchings of such blastocysts constitute assault and battery. (I myself tend to reject such claims, and indeed think that the ethical questions are not best posed in terms of rights.) But the blastocyst is not nothing; it is *at least* potential humanity, and as such it elicits, or ought to elicit, our feelings of awe and respect. In the blastocyst, even in the zygote, we face a mysterious and awesome power, a power governed by an immanent plan that may produce an indisputably and fully human being. It deserves our respect not because it has rights or claims or sentience (which it does not have at this stage), but because of what it is, now and prospectively.

Let us test this provisional conclusion by considering intuitively our response to two possible fates of such zygotes, blastocysts and early embryos. First, should such an embryo die, will we be inclined

to mourn its passing? When a woman we know miscarries, we are sad—largely for *her* loss and disappointment, but perhaps also at the premature death of a life that might have been. But we do not mourn the departed fetus, nor do we seek ritually to dispose of the remains. In this respect, we do not treat even the fetus as fully one of us.

On the other hand, we would, I suppose, recoil even from the thought, let alone the practice—I apologize for forcing it upon the reader—of eating such embryos, should someone discover that they would constitute a great delicacy, a “human caviar.” The human blastocyst would be protected by our taboo against cannibalism, which insists on the humanness of human flesh and does not permit us to treat even the flesh of the dead as if it were mere meat. *The human embryo is not mere meat; it is not just stuff; it is not a “thing.”** Because of its origin and because of its capacity, it commands a higher respect.

How much more respect? As much as for a fully developed human being? My own inclination is to say probably not, but who can be certain? Indeed, there might be prudential and reasonable grounds for an affirmative answer, partly because the presumption of ignorance ought to err in the direction of never underestimating the basis for respect of human life (not least, for our own self-respect), partly because so many people feel very strongly that even the blastocyst is protectably human. As a first approximation, I would analogize the early embryo *in vitro* to the early embryo *in utero* (because both are potentially viable and human). On this ground alone, the most sensible policy is to *treat the early embryo as a pre-viable fetus, with constraints imposed on early embryo research at least as great as those on fetal research.*

*Some people have suggested that the embryo be regarded in the same manner as a vital organ, salvaged from a newly dead corpse, usable for transplantation or research, and that its donation by egg and sperm donors be governed by the Uniform Anatomical Gift Act, which legitimates premortem consent for organ donation upon death. But though this acknowledges that embryos are not “things,” it is a mistake to treat embryos as mere organs, thereby overlooking that they are early stages of a complete, whole human being. The Uniform Anatomical Gift Act does not apply to, nor should it be stretched to cover, donation of gonads, gametes (male sperm or female eggs) or—especially—zygotes and embryos.

To some this may seem excessively scrupulous. They will point to the absence of a distinctive humanoid appearance or the absence of sentience. To be sure, we would feel more restraint in invasive procedures conducted on a five-month-old or even a twelve-week-old living fetus than on a blastocyst. But this added restraint on inflicting suffering on a look-alike, feeling creature in no way denies the propriety of a prior restraint, grounded in respect for individuated, living, potential humanity. Before I would be persuaded to treat early embryos differently from later ones, I would insist on the establishment of a reasonably clear, naturally grounded boundary that would separate “early” and “late,” and on the provision of a basis for respecting the “early” less than the “late.” This burden must be accepted by proponents of experimentation with human embryos *in vitro* if a decision to permit the creation of embryos for such experimentation is to be treated as ethically responsible.

The Treatment of Extracorporeal Embryos

Where does the above analysis lead in thinking about treatment of human embryos in the laboratory? I indicate, very briefly, the lines toward a possible policy, though that is not my major intent.

The *in vitro* fertilized embryo has four possible fates: (1) implantation, in the hope of producing from it a child; (2) death, by active killing or disaggregation, or by a “natural” demise; (3) use in manipulative experimentation—embryological, genetic, extraction of stem cells, etc.; and (4) use in attempts at perpetuation *in vitro* beyond the blastocyst stage, ultimately, perhaps, to viability. Let us consider each in turn.

On the strength of my analysis of the status of the embryo and the respect due it, no objection would be raised to implantation, *in vitro* fertilization and embryo transfer to treat infertility—as in the case of Mr. and Mrs. Brown, now repeated tens of thousands of times—is perfectly compatible with a respect and reverence for human life, including potential human life. Moreover, no disrespect is intended or practiced by the mere fact that several eggs are removed to increase the chance of success. Were it possible to guarantee successful fertilization and normal growth with a single egg, no more

would need to be obtained. Assuming nothing further is done with the unimplanted embryos, there is nothing disrespectful going on. The demise of the unimplanted embryos would be analogous to the loss of numerous embryos wasted in the normal *in vivo* attempts to generate a child. It is estimated that over 50 percent of eggs successfully fertilized during unprotected sexual intercourse fail to implant, or do not remain implanted, in the uterine wall, and are shed soon thereafter, before a diagnosis of pregnancy could be made. Any couple attempting to conceive a child tacitly accepts the sad fact of such embryonic wastage as the perfectly tolerable price to be paid for the birth of a (usually) healthy child. Current procedures to initiate pregnancy with laboratory fertilization thus differ from the natural process in that what would normally be spread over four or five months *in vivo* is compressed into a single effort, using all at once a four or five-months' supply of eggs.*

Parenthetically, we should note that the natural occurrence of embryo and fetal loss and wastage does not necessarily or automatically justify all deliberate, humanly caused destruction of fetal life. For example, the natural loss of embryos in early pregnancy cannot in itself be a warrant for deliberately aborting them or for invasively experimenting on them *in vitro*, any more than stillbirths could be a justification for newborn infanticide. There are many things that happen naturally that we ought not do deliberately. It is curious how the same people who deny the relevance of nature as a guide for evaluating human interventions into human generation, and who deny that the term "unnatural" carries any ethical weight, will themselves appeal to "nature's way" when it suits their

*The problem of surplus embryos may someday be avoidable, for purely technical reasons. Some researchers believe that uterine receptivity to the transferred embryo might be reduced during the menstrual cycle in which the ova are obtained because of the effects of the hormones given to induce superovulation. They propose that the harvested eggs be frozen and then defrosted one at a time each month for fertilization, culture and transfer, until pregnancy is achieved. By refusing to fertilize all the eggs at once—not placing all one's eggs in one uterine cycle—there would not be surplus embryos, but only surplus eggs. This change in procedure would make the demise of unimplanted embryos exactly analogous to the "natural" embryonic loss in ordinary reproduction. Unfortunately, a method of freezing and thawing eggs without destroying them has yet to be found.

purposes.* Still, in this present matter, the closeness to natural procreation—the goal is the same, the embryonic loss is unavoidable and not desired, and the amount of loss is similar—leads me to believe that we do no more intentional or unjustified harm in one case than in the other and we practice no disrespect.

But must we allow the unimplanted *in vitro* embryos to die? Why should they not be either transferred for adoption into another infertile woman, or else used for investigative purposes, to seek new knowledge, say, about gene action in health or disease, or to extract stem cells to be developed for possible use in regenerative medicine? The first option raises questions about lineage and the nature of parenthood to which I will return. But even on first glance, it would seem likely to raise a large objection from the original couple who were seeking a child of their own and not the dissemination of their biological children for prenatal adoption.

But what about experimentation on such blastocysts and early embryos? Is that compatible with the respect they deserve? This is the hard question. On balance, I would think not. Invasive and manipulative experiments involving such embryos very likely presume that they are things or mere stuff and deny the fact of their possible viability. Certain observational and noninvasive experiments might be different. But on the whole, I would think that the respect for human embryos for which I have argued—not, I repeat, their “right to life”—would lead one to oppose most potentially interesting and useful experimentation. This is a dilemma, and one which cannot be ducked or defined away. Either we accept certain great restrictions on the permissible uses of human embryos or we deliberately decide to override—though I hope not deny—the respect due to the embryos.

I am aware that I have pointed toward a seemingly paradoxical conclusion about the treatment of the unimplanted embryos:

*The literature on intervention in reproduction is both confused and confusing on the crucial matter of the meanings of “nature” or “the natural,” and their significance for the ethical issues. It may be as much a mistake to claim that the natural has no moral force as to suggest that the natural way is best, because natural. Though shallow and slippery thought about nature, and its relation to “good,” is a likely source of these confusions, the nature of nature may itself be elusive, making it difficult for even careful thought to capture what is natural.

Leave them alone, and do not create embryos for experimentation only. To let them die naturally would be the most respectful course, grounded on a reverence, generically, for their potential humanity, and a respect, individually, for their being the seed and offspring of a particular couple, who were themselves seeking only to have a child of their own. An analysis that stressed a right to life, rather than respect, would, of course, lead to different conclusions. Only an analysis of the embryo's status that denies both its so-called rights and its worthiness of all respect would have no trouble sanctioning its use in investigative research, donation to other couples, stem cell extraction, commercial transactions and other such activities.

I have to this point ignored the fourth potential fate of life in the laboratory: perpetuation in the bottle beyond the blastocyst state, perhaps ultimately to viability. As a practical matter, this repugnant Huxleyan prospect probably need not concern us much for the time being. But as a thought experiment, it permits us to test further our intuitions about the meaning of life in the laboratory and to discover thereby the limitations of the previous analysis. For these unimplanted, cultivated embryos raise even more profound difficulties. Bad as it may now be to discard or experiment upon them in these primordial stages, it would be far worse to perpetuate them to later stages in their laboratory existence—especially when the technology arrives that can bring them to viability *in vitro*. For how long and up to what stage of development will they be considered fit material for experimentation? When ought they to be released from the machinery and admitted into the human fraternity, or, at least, into the premature nursery? The need for a respectable boundary defining protectable human life cannot be overstated. The current boundaries, gerrymandered for the sake of abortion—namely, birth or viability—may now satisfy both women's liberation and the United States Supreme Court and may someday satisfy even a future pope, but they will not survive the coming of more sophisticated technologies for growing life in the laboratory.*

*In *Roe v. Wade*, the Supreme Court ruled that state action regarding abortion was unconstitutional in the first trimester of pregnancy, permissible after the first trimester in order to promote the health of the "mother," and permissible in order to protect "potential life" only at viability (about 24 weeks), prior to which time the state's interest in fetal life was deemed not "compelling." This rather careless and arbitrary placement of boundaries is already something of an embarrassment, thanks to

But what if perpetuation in the laboratory were to be sought not for the sake of experimentation but in order to produce a healthy living child—say, one with all the benefits of a scientifically based gestational nourishment and care? Would such treatment of a laboratory-grown embryo be compatible with the respect it is owed? If we consider only what is owed to its vitality and potential humanity *as an individuated human being*, then the laboratory growth of an embryo into a viable full-term baby (that is, ectogenesis) would be perfectly compatible with the requisite respect. (Indeed, for these reasons one would guess that the right-to-life people, who object even to the destruction of blastocysts, would find infinitely preferable any form of their preservation and perpetuation to term, in the bottle if necessary.) Yet the practice of ectogenesis would be incompatible with the *further* respect owed to our humanity on account of *the bonds of lineage, kinship and descent*. To be human means not only to have human form and powers; it means also to have a human context and to be humanly connected. The navel, no less than speech and the upright posture, is a mark of our being. It is for these sorts of reasons that we find the Brave New World's hatcheries dehumanizing.

Lineage and Parenthood, Embodiment and Gender

In the summer of 1978, Louise Brown, the first human being to be conceived via *in vitro* fertilization, was born in England. Many people rejoiced at her birth. Some were pleased by the technical accomplishment, many were pleased that she was born apparently in good health. But most of us shared the joy of her parents, who after a long, frustrating and fruitless period, at last had the pleasure and

growing knowledge about fetal development and, especially, sophisticated procedures for performing surgery on the intrauterine fetus, even in the second trimester. Also, because viability is, in part, a matter of available outside support, technical advances—such as an artificial placenta or even less spectacular improvements in sustaining premature infants—will reveal that viability is a movable boundary and that development is a continuum without clear natural discontinuities.

blessing of a child of their own. (Curiously, the perspective of the child was largely ignored. It will thus be easier to come at the matter of lineage by looking at it first from the side of the progenitors rather than the descendants.) In the succeeding twenty-four years, thousands of people have rejoiced as did the Browns, blessed at last with a child of their own thanks only to the hand of science and technology. The desire to have a child of one's own is acknowledged to be a powerful and deep-seated human desire—some have called it instinctive—and the satisfaction of this desire, by the relief of infertility, is said to be one major goal of continuing work with *in vitro* fertilization and embryo transfer. That this is a worthy goal few, if any, would deny.

Yet let us explore what is meant by "to have a child of one's own." First, what is meant by "to have"? Is the crucial meaning that of gestating and bearing? Or is it to have as a possession? Or is it to nourish and to rear, the child being the embodiment of one's activity as teacher and guide? Or is it rather to provide someone who descends and comes after, someone who will replace oneself in the family line or preserve the family tree by new sproutings and branchings, someone who will renew and perpetuate the vitality and aspiration of human life?

More significantly, what is meant by "one's own"? What sense of the phrase is important? A scientist might define "one's own" in terms of carrying one's own genes. Though in some sense correct, this cannot be humanly decisive. For Mr. Brown or for most of us, it would not be a matter of indifference if the sperm used to fertilize the egg were provided by an identical twin brother—whose genes would be, of course, the same as his. Rather, the humanly crucial sense of one's own, the sense that leads most people to choose their own, rather than to adopt, is captured in such phrases as "my seed," "flesh of my flesh," "sprung from my loins." More accurately, since one's own is not the own of one but of two, the desire to have a child of one's own is a *couple's* desire to embody, out of the conjugal union of their separate bodies, a child who is flesh of their separate flesh made one. This archaic language may sound quaint, but I would argue that this is precisely what is being celebrated by most people who rejoice at the birth of Louise Brown, whether they would

articulate it this way or not. Mr. and Mrs. Brown, by the birth of their daughter, embody themselves in another, and thus fulfill this aspect of their separate sexual natures and of their married life together. They also acquire descendants and a new branch of their joined family tree. Correlatively, the child, Louise, is given solid and unambiguous roots from which she has sprung and by which she will be nourished.

If this were to be the only use made of embryo transfer, and if providing *in this sense* "a child of one's own" were indeed the sole reason for the clinical use of the techniques, there could be no objection. Here indeed is the natural and proper home for the human embryo. Here indeed is the affirmation of transmission and the importance of lineage and connectedness. Yet there are also other uses, involving third parties, to satisfy the desire to have a child of one's own in different senses of "to have" and "one's own." I am not merely speculating about future possibilities. With the technology to effect human *in vitro* fertilization and embryo transfer has come the immediate possibility of egg donation (egg from donor, sperm from husband), embryo donation (egg and sperm from outside of the marriage), and foster pregnancy (host surrogate for gestation). Clearly, the need for extramarital embryo transfers is real and large, probably eventually even greater than that for intramarital ones.

Nearly everyone agrees that these circumstances are morally and perhaps psychologically more complicated than the intramarital ones. The reasons touch the central core of gestation and generation. Here the meaning of "one's own" is no longer so unambiguous; neither is the meaning of motherhood and the status of pregnancy. Indeed, one of the clearest meanings of having life in the laboratory is the rupture of the normally necessary umbilical connection between mother and child. This technical capacity to disrupt the connection has in fact been welcomed, curiously, for contradictory reasons. On the one hand, it is argued that embryo donation, or prenatal adoption, is superior to present adoption, precisely because the woman can have the experience of pregnancy and the child gets to be born of the adopting mother, rendering the maternal tie that much closer. On the other hand, the mother-child bond rooted in pregnancy and delivery is held to be of little consequence by those who would

endorse the use of surrogate gestational mothers, say for a woman whose infertility is due to uterine disease rather than ovarian disease or oviduct obstruction. But in both cases, the new techniques serve not to ensure and preserve lineage, but rather to confound and complicate it. The principle truly at work in bringing life into the laboratory is not to provide married couples with a child of their own—or to provide a home of their own for children—but to provide a child to anyone who wants one, by whatever possible or convenient means.

So what? it will be asked. First of all, we already practice and encourage adoption. Second, we have permitted artificial insemination—though we have, after roughly fifty years of this practice, yet to resolve questions of legitimacy. Third, what with the high rate of divorce and remarriage, identification of mother, father and child are already complicated. Fourth, there is a growing rate of illegitimacy and husbandless parentages. Fifth, the use of surrogate mothers for foster pregnancy is becoming widespread with the aid of artificial insemination. Finally, our age in its enlightenment is no longer so certain about the virtues of family, lineage and heterosexuality, or even about the taboos against adultery and incest. Against this background it will be asked, Why all the fuss about some little embryos that stray from their nest?

It is not an easy question to answer. Yet consider: We practice adoption because there are abandoned children who need good homes. We do not, and would not, encourage people deliberately to generate children for others to adopt, partly because we wish to avoid baby markets, partly because we think it unfair to deliberately deprive the child of his natural ties. Recent years have seen a rise in our concern with roots, against the rootless and increasingly homogeneous background of contemporary American life. Adopted children, in particular, are pressing for information regarding their biological parents, and some states now require this information to be made available (on that typically modern rationale of freedom of information, rather than because of the far more profound importance of lineage for self-identity). Even the importance of children's ties to grandparents is being reasserted, as courts are granting visitation privileges to grandparents, over the objections of divorced-and-remarried former daughters- or sons-in-law. The practice of

artificial insemination has yet to be evaluated, the secrecy in which it is practiced being an apparent concession to the dangers of publicity.* Indeed, most physicians who practice artificial insemination (donor) routinely mix in some semen from the husband, to preserve some doubt about paternity—again, a concession to the importance of lineage and legitimacy. Finally, what about the changing mores of marriage, divorce, single-parent families and sexual behavior? Do we applaud these changes? Do we want to contribute further to this confusion of thought, identity and practice?**

Our society is dangerously close to losing its grip on the meaning of some fundamental aspects of human existence. In reviewing the problem of the disrespect shown to embryonic and fetal life in our efforts to master them, we noted a tendency—we shall meet it again shortly—to reduce certain aspects of humanness to mere body, a tendency opposed most decisively in the nearly universal prohibition of cannibalism. Here, in noticing our growing casualness about marriage, legitimacy, kinship and lineage, we discover how our individualistic and willful projects lead us to ignore the truths defended by the equally widespread prohibition of incest (especially parent-child incest). Properly understood, the largely universal taboo against incest, and also the prohibitions against adultery, defend the integrity of marriage, kinship and especially the lines of origin and descent. These time-honored restraints implicitly teach that clarity about who your parents are, clarity in the lines of generation, clarity about

*There are today numerous suits pending, throughout the United States, because of artificial insemination with donor semen (AID). Following divorce, the ex-husbands are refusing child support for AID children, claiming, minimally, no paternity, or maximally, that the child was the fruit of an adulterous "union." In fact, a few states still treat AID as adultery. The importance of anonymity is revealed in the following bizarre case: A woman wanted to have a child, but abhorred the thought of marriage or of sexual relations with men. She learned a do-it-yourself technique of artificial insemination and persuaded a male acquaintance to donate his semen. Ten years after this virgin birth, the semen donor went to court, suing for visitation privileges to see his son.

**To those who point out that the bond between sexuality and procreation has already been effectively and permanently cleaved by the Pill, and that this is therefore an idle worry in the case of in vitro fertilization, it must be said that the Pill—like earlier forms of contraception—provides only sex without babies. Babies without sex is the truly unprecedented and radical departure.

who is whose, are the indispensable foundations of a sound family life, itself the sound foundation of civilized community. Clarity about your origins is crucial for self-identity, itself important for self-respect. It would be, in my view, deplorable public policy to erode further such fundamental beliefs, values, institutions and practices. This means, concretely, no encouragement of embryo adoption or especially of surrogate pregnancy. While it would perhaps be foolish to try to proscribe or outlaw such practices, it would not be wise to support or foster them.

The existence of human life in the laboratory, outside the confines of the generating bodies from which it sprang, also challenges the meaning of our embodiment. People like Mr. and Mrs. Brown, who seek a child derived from their flesh, celebrate in so doing their self-identification with their own bodies and acknowledge the meaning of the living human body by following its pointings to its own perpetuation. For them, their bodies contain the seeds of their own self-transcendence and enable them to strike a blow for the enduring goodness of the life in which they participate. Affirming the gift of their embodied life, they show their gratitude by passing on that gift to their children. Only the body's failure to serve the transmission of embodiment has led them—and only temporarily—to generate beyond its confines. But life in the laboratory also allows other people—including those who would donate or sell sperm, eggs or embryos; or those who would bear another's child in surrogate pregnancy; or even those who will prefer to have their children rationally manufactured entirely in the laboratory—to declare themselves independent of their bodies, in this ultimate liberation. For them the body is a mere tool, ideally an instrument of the conscious will, the sole repository of human dignity. Yet this blind assertion of will against our bodily nature—in contradiction of the meaning of the human generation it seeks to control—can only lead to self-degradation and dehumanization.

In this connection, the case of surrogate wombs bears a further comment. While expressing no objection to the practice of foster pregnancy itself, some people object that it will be done for pay, largely because of their fear that poor women will be exploited by such a practice. But if there were nothing wrong with foster pregnancy, what would be wrong with making a living at it? Clearly,

this objection harbors a tacit understanding that to bear another's child for pay is in some sense a degradation of oneself—in the same sense that prostitution is a degradation primarily because it entails the loveless surrender of one's body to serve another's lust, and only derivatively because the prostitute is paid. It is to deny the meaning and worth of one's body to treat it as a mere incubator, divested of its human meaning. It is also to deny the meaning of the bonds among sexuality, love and procreation. The buying and selling of human flesh and the dehumanized uses of the human body ought not to be encouraged. To be sure, the practice of womb donation could be engaged in for love rather than for money, as it apparently has been in some cases, including the original case in Michigan. A woman could bear her sister's child out of sisterly love. But to the degree that she escapes in this way from the degradation and difficulties of the sale of human flesh and bodily services and the treating of the body as undignified stuff, once again she approaches instead the difficulties of incest and near incest.

To this point we have been examining the meaning of the presence of human life in the laboratory, but we have neglected the meaning of putting it there in the first place, that is, the meaning of extracorporeal fertilization *as such*. What is the significance of divorcing human generation from human sexuality, precisely for the meaning of our bodily natures as male and female, as both gendered and engendering? To be male or to be female derives its deepest meaning only in relation to the other, and therewith in the gender-mated prospects for generation through union. Our separated embodiment prevents us as lovers from attaining that complete fusion of souls that we as lovers seek; but the complementarity of gender provides a bodily means for transcending separateness through the children born of sexual union. As the navel is our bodily mark of lineage, pointing back to our ancestors, so our genitalia are the bodily mark of linkage, pointing ultimately forward to our descendants. Can these aspects of our being be fulfilled through the rationalized techniques of laboratory sexuality and fertilization? Does not the scientist-partner produce a triangle that somehow subverts the meaning of "two"? Even in the best of cases, when technique comes merely to the aid of our sexual natures and our marital hopes, could we be paying in coin of our humanity—whether we recognize it or not—for electing to generate sexlessly?

Future Prospects

Before proceeding to look at some questions of public policy, we need first to consider the likely future developments regarding human life in the laboratory. In my view, we must consider these prospects in reaching our decision about present policy. For clearly, part of the meaning of what we are now doing consists in the things it will enable us, sooner or later, to do hereafter.

What can we expect for life in the laboratory, as an outgrowth of present studies? To be sure, prediction is difficult. One can never know with certainty what will happen, much less how soon. Yet uncertainty is not the same as simple ignorance. Some things, indeed, seem likely. They seem likely because (1) they are thought necessary or desirable, at least by some researchers and their sponsors; (2) they are probably biologically possible and technically feasible; and (3) they will be difficult to prevent or control (especially if no one anticipates their development or sees a need to worry about them). Wise policymakers will want to face up to reasonable projections of future accomplishments, consider whether they are cause for social concern, and see whether or not the principles now enunciated and the practices now established are adequate to deal with any such concerns. I project at least the following:

First, the growth of human embryos in the laboratory will be extended beyond the blastocyst stage. Such growth must be deemed desirable under all the arguments advanced for developmental research up to the blastocyst stage; research on gene action and regulation, epigenetic modification, chromosome segregation, cellular and organic differentiation, fetus-environment interaction, implantation and so on cannot answer all its questions with the blastocyst. Similarly, therapeutic goals that make the undifferentiated stem cells so attractive will make differentiated embryonic tissues and embryonic organs even more attractive, and we can expect enormous efforts to find ways to support embryonic growth in the laboratory to stages when these materials could be obtained. Such *in vitro* post-blastocyst differentiation has apparently been achieved in the mouse, in culture; and efforts are being made to engineer artificial placentas and wombs someday usable to support human embryological growth

and development. Besides, one need not wait for such artifices: the use of other mammals as temporary hosts for human embryos is already an available possibility. How far such embryos will eventually be perpetuated is anybody's guess, but full-term ectogenesis cannot be excluded. Neither can the existence of laboratories filled with many living human embryos, growing at various stages of development.

Second, experiments will be undertaken to alter the cellular and genetic composition of these embryos, at first without subsequent transfer to a woman for gestation, perhaps later as a prelude to reproductive efforts. Again, scientific reasons now justifying current research already justify further embryonic manipulations, including formations of hybrids or chimeras (within species and between species); gene, chromosome and plasmid insertion, excision or alteration; nuclear transplantation or cloning; and so forth. In assisted-reproduction clinics, embryos are already being tested for the presence of abnormal genes and chromosomes prior to implantation ("pre-implantation genetic diagnosis"), and we may expect sooner rather than later the possibility of genetic intervention to add, subtract or alter the embryonic DNA. Techniques of DNA recombination, knowledge of the human genome and perfected skills of handling human embryos make prospects for precise genetic manipulation much nearer than anyone would have guessed ten years ago. And embryological and cellular research in mammals is making astounding progress, much of it presumably transferable to humans.*

Third, the growth of commercial and industrial-scale "human embryonics" is extremely likely. Storage and banking of living human ova and embryos have already been undertaken, complementing the commercial sperm banks established a generation ago. Dozens of biotech companies are already working on human embryos, and the products they are making—including embryos created or modified using genetic engineering—are being submitted for patents.

*The shape of the future was heralded back in the 1970s when the cover of *Science* featured a picture of a hexaparental mouse, born after reaggregation of an early embryo with cells disaggregated from three separate embryos. That sober journal called this a "handmade mouse"—literally a *manu-factured* mouse—and went on to say that it was "manufactured by genetic engineering techniques."

I can here do no more than identify a few kinds of questions that must be considered in relation to such possible coming control over human heredity and reproduction: questions about the wisdom required to engage in such practices; questions about the goals and standards that will guide our interventions; questions about changes in the concepts of being human, including embodiment, gender, love, lineage, identity, parenthood and sexuality; questions about the responsibility of power over future generations; questions about awe, respect, humility; questions about the kind of society we will have if we follow along our present course.

Though I cannot discuss these questions now, I can and must face a serious objection to considering them at all. Most people would agree that the projected possibilities raise far more serious questions than do simple fertilization of a few embryos, their growth *in vitro* to the blastocyst stage, and their subsequent use in experimentation or possible transfer to women for gestation. Why burden present policy with these possibilities? Future abuses, it is often said, do not disqualify present uses (though these same people also often say that "future benefits justify present practices, even questionable ones"). Moreover, there can be no certainty that A will lead to B. This thin-edge-of-the-wedge (or "slippery slope") argument has been open to criticism.

But such criticism misses the point for two reasons. First, critics often misunderstand the wedge argument, which is not primarily an argument of prediction, that A will lead to B, say, on the strength of the empirical analysis of precedent and an appraisal of the likely direction of present research. It is primarily an argument about the logic of justification. Do not the principles now used to justify the current research proposal already justify *in advance* the further developments? Consider some of these principles:

1. It is desirable to learn as much as possible about the processes of fertilization, growth, implantation and differentiation of human embryos and about human gene expression and its control.
2. It would be desirable to acquire improved techniques for enhancing conception, for preventing conception and implan-

tation, for the treatment of genetic and chromosomal abnormalities, and so on.

3. It would be desirable to extract stem cells or to harvest embryonic tissues for use in regenerative medicine.
4. In the end, only research using *human* embryos can answer these questions and provide these techniques.
5. There should be no censorship or limitation of scientific inquiry or research.

This logic knows no boundary at the blastocyst stage, or, for that matter, at any later stage. For these principles *not* to justify future extensions of current work, some independent additional principles (for example, a principle limiting such justification to particular stages of development) would have to be found. (Here, the task is to find such a biologically defensible distinction that could be respected as reasonable and not arbitrary, which is difficult—perhaps impossible—given the continuity of development after fertilization.) Perhaps even more important than any present decision to encourage bringing human life into the laboratory will be the reasons given to support that decision. We will want to know *precisely* what grounds our policymakers will give for endorsing such research, and whether their principles have not already sanctioned future developments. If they do give such wedge-opening justifications, let them do so deliberately, candidly and intentionally.

A better case to illustrate the wedge logic is the principle offered for the embryo transfer procedure as treatment for infertility. Will we support the use of *in vitro* fertilization and embryo transfer because it provides a child of one's own, in a strict sense of "one's own," to a married couple? Or will we support the transfer because it is treatment of involuntary infertility, which deserves treatment in or out of marriage, hence endorsing the use of any available technical means that would produce a healthy and normal child, including surrogate wombs, cloning or even ectogenesis?

Second, logic aside, the opponents of the wedge argument do not counsel well. It would be simply foolish to ignore what might come next and fail to make the best possible assessment of the implications of present action (or inaction). Let me put the matter bluntly:

The decisions we must now make may very well help to determine whether human beings will eventually be produced in laboratories. I say this not to shock—and I do not mean to beg the question of whether that would be desirable or not. I say this to make sure that we and our policymakers face squarely the full import and magnitude of this decision. Once the genies let the babies into the bottle, it may be impossible to get them out again.

The Question of Federal Funding

So much, then, for the meanings of initiating, housing and manipulating human embryos in the laboratory. We are now better prepared to consider the original practical question: Should we allow or encourage these activities? The foregoing reflections still make me doubt the wisdom of proceeding with these practices, both in research and in their clinical application, notwithstanding that valuable knowledge might be had by continuing the research and identifiable suffering might be alleviated by using it to circumvent infertility. To doubt the wisdom of going ahead makes one at least a fellow traveler of the opponents of such research, but it does not, either logically or practically, require that one join them in trying to prevent it, say, by legal prohibition. Not every folly can or should be legislated against. Attempts at prohibition here would seem to be both ineffective and dangerous—ineffective because impossible to enforce; dangerous because the costs of such precedent-setting interference with scientific research might be greater than the harm it prevents. To be sure, we already have legal restrictions on experimentation with human subjects, restrictions that are manifestly not incompatible with the progress of medical science. Neither is it true that science cannot survive if it must take some direction from the law. Nor is it the case that all research, because it is research, is or should be absolutely protected. But it does not seem to me that *in vitro* fertilization and growth of human embryos or embryo transfer deserve, at least at present, to be treated as sufficiently dangerous for legislative interference.*

*I regard human cloning as a different matter, and favor legislative proscription. See Chapter Five.

But if doubting the wisdom does not oblige one to seek to outlaw the folly, neither does a decision to permit require a decision to encourage or support. A researcher's freedom to do *in vitro* fertilization, or a woman's right to have a child with laboratory assistance, in no way implies a public (or even a private) obligation to pay for such research or treatment. A right *against* interference is not an entitlement *for* assistance. The question repeatedly debated from 1975 through 2001 was not whether such research should be permitted or outlawed, but only whether the federal government should fund it.

I propose to discuss this policy question here, and at some length, not because it is itself timely or relatively important—it is neither—but because it is exemplary. Policy questions regarding controversial new biomedical technologies and practices—as well as other morally and politically charged matters on the border between private and public life (for example, abortion, racial discrimination, developing the artificial heart, or affirmative action)—frequently take the form of arguments over federal support. Social control and direction of new developments is often given not in terms of yes or no, but rather, how much, how fast, or how soon? Thus, much of the present analysis can be generalized and made applicable to other specific developments in the field and to the field as a whole.

The arguments in favor of federal support are well known. First, the research is seen as continuous with, if not quite an ordinary instance of, the biomedical research that the federal government supports handsomely; roughly one-half of the money spent on biomedical research in the United States comes from Uncle Sam. Why is this research different from all other research? Its scientific merit has been attested to by the normal peer review process of NIH. For some, that is a sufficient reason to support it.

Second, there are specific and highly desired practical fruits expected from the anticipated successes of this new line of research. Besides relief for many cases of infertility, the research promises new birth control measures based upon improved understanding of the mechanisms of fertilization and implantation, which in turn could lead to techniques for blocking these processes. Also, studies on early embryonic development hold forth the promise of learning

how to prevent some congenital malformations and certain highly malignant tumors (for example, hydatidiform mole) that derive from aberrant fetal tissue. Most important, research with embryonic stem cells and other more developed embryonic tissues offers great hope for treatment of many serious chronic diseases and disabilities, ushering in a new era of "regenerative medicine."

Third, as he who pays the piper calls the tune, federal support would make easy federal regulation and supervision of this research. For the government to abstain, so the argument runs, is to leave the control of research and clinical application in the hands of greedy, adventurous, insensitive, reckless or power-hungry private physicians, scientists or drug companies, or, on the other hand, at the mercy of the vindictive, mindless and superstitious civic groups that will interfere with this research through state and local legislation. Only through federal regulation—which, it is said, can follow only with federal funding—will we have reasonable, enforceable and uniform guidelines.

Fourth is the chauvinistic argument that the United States should lead the way in this brave new research, especially as it will apparently be going forward in other nations. Years ago, one witness testifying before the Ethics Advisory Board that was charged to advise HEW regarding federal funding of *in vitro* fertilization research deplored the fact that the first test-tube baby was British and not American. He complained, in effect, that the existing moratorium on federal support had already created what one might call an "*in vitro* fertilization gap." Similar arguments were heard during the stem cell funding debate in 2001. The preeminence of American science and technology (and commerce!), so the argument implies, is the center of our preeminence among the nations, a position that will be jeopardized if we hang back out of fear.

Let me respond to these arguments, in reverse order. Conceding—even embracing—the premise of the importance of science for American strength and prestige, it is far from clear that failure to support *this* research would jeopardize American science. Certainly the use of embryo transfer to overcome infertility, though a vital matter for the couples involved, is hardly a matter of vital national interest—at least not unless and until the majority of American women are similarly infertile. The demands of international

competition, admittedly often a necessary evil, should be invoked only for things that really matter; a missile gap and an embryo transfer gap are chasms apart. In areas not crucial to our own survival, there will be many things we should allow other nations to develop, if that is their wish, without feeling obliged to join them. Moreover, one should not rush into potential folly in order to avoid being the last to commit it.

The argument about governmental regulation has much to recommend it. But it fails to consider that there are other safeguards against recklessness, at least in the clinical applications, known to the high-minded as the canons of medical ethics and to the cynical as liability for malpractice. Also, federal regulations attached to federal funding will not in any case regulate research done with private monies, for example, by the drug companies. Moreover, there are enough concerned practitioners of these new arts who would have a compelling interest in regulating their own practice, if only to escape the wrath and interference of hostile citizens' groups in response to unsavory goings-on. Organized professional societies have and will issue guidelines for their members, and the prestige of membership keeps even the more adventurous from violating the norms. The available evidence does not convince me that a sensible practice of *in vitro* experimentation requires regulation by the federal government.

In turning to the argument about anticipated technological powers, we face difficult calculations of unpredictable and more-or-less likely costs and benefits, and the all-important questions of priorities in the allocation of scarce resources. Here it seems useful to consider separately the techniques for generating children, the anticipated techniques for birth control or for preventing developmental anomalies and malignancies, and studies that could usher in the great age of regenerative medicine.

First, accepting that providing a child of their own to infertile couples is a worthy goal—and it is both insensitive and illogical to cite the population problem as an argument for ignoring the problem of infertility—one can nevertheless question its rank relative to other goals of medical research. One can even wonder whether it is indeed a *medical* goal, or a worthy goal for medicine, that is, whether alleviating infertility, especially in this way, is part of the art of

healing. Just as abortion for genetic defect is a peculiar innovation in medicine (or in preventive medicine) in which a disease is treated by eliminating the patient (or, if you prefer, a disease is prevented by "preventing" the patient), so laboratory fertilization is a peculiar treatment for oviduct obstruction in that it requires the creation of a new life to "heal" an existing one. All this simply emphasizes the uniqueness of the reproductive organs in that their proper function involves other people, and calls attention to the fact that infertility is not a disease, like heart disease or stroke, even though obstruction of a normally patent tube or vessel is the proximate cause of each.

However this may be, there is a more important objection to this approach to the problem. It represents yet another instance of our thoughtless preference for expensive, high-technology, therapy-oriented approaches to disease and dysfunctions. What about spending this money on discovering the causes of infertility? What about the prevention of tubal obstruction? We complain about rising medical costs, but we insist on the most spectacular and the most technological—and thereby often the most costly—remedies.

The truth is that we do know a little about the causes of tubal obstruction, though much less than we should or could. For instance, it is estimated that at least one-third of such cases are the aftermath of pelvic inflammatory disease, caused by that uninvited venereal guest, gonococcus. Leaving aside any question about whether it makes sense for a federally funded baby to be the wage of aphrodisiac indiscretion, one can only look with wonder at a society that will have "petri-dish babies"* before it has found a vaccine against gonorrhea.

True, there are other causes of blocked oviducts, and blocked oviducts are not the only cause of female infertility. True, it is not logically necessary to choose between prevention and cure. But *practically*

*There has been much objection, largely from the scientific community, to the phrase "test-tube baby." More than one commentator has deplored the exploitation of its "flesh-creeping" connotations. They point out that a flat petri dish is used, not a test tube—as if that mattered—and that the embryo spends only a few days in the dish. But they don't ask why the term "test-tube baby" remains the popular designation, and whether it does not embody more of the deeper truth than a more accurate, laboratory appellation. If the decisive difference is between "in the womb" or "in the lab,"

speaking, with money for research as limited as it is, federal research funds targeted for the relief of infertility should certainly go first to epidemiological and preventive measures—especially where the costs of success in the high-technology cure are likely to be great.

What about these costs? I have already explored some of the nonfinancial costs, in discussing the meaning of the research for our images of humanness. Let us, for now, consider only the financial costs. How expensive is a baby produced with the aid of *in vitro* fertilization? Hard to say exactly. To the costs of hormone preparation of ovaries and uterus, laparoscopy, fertilization and growth *in vitro*, and transfer, one must add the costs of closely monitoring the baby's development to check on her "normality" and, should it come, the costs of governmental regulation. And then there are the costs of failure and having to try again. A conservative estimate places the costs of a successful pregnancy of this kind between \$10,000 and \$15,000. If we use the conservative figure of 500,000 for estimating the number of infertile women with blocked oviducts in the United States whose *only* hope of having children lies with *in vitro* fertilization,* we reach a conservative estimate cost of \$5 to \$7.5 billion. Is it fiscally wise for the federal government to start down this road?

Clearly not, if it is also understood that the costs of providing the service, rendered possible by a successful technology, will also

the popular designation conveys it (see "An Afterword," below). And it is right on target, and puts us on notice, if the justification for the present laboratory procedures tacitly also justifies future extensions, including full ectogenesis, say, if that were the only way a wombless woman could have a child of her own, without renting a human womb from a surrogate bearer.

*This figure is calculated from estimates that between 10 and 15 percent of all couples are involuntarily infertile, and that in more than half of these cases the cause is in the female. Blocked oviducts account for perhaps 20 percent of the causes of female infertility. Perhaps 50 percent of these women might be helped to have a child by means of reconstructive surgery on the oviducts; the remainder could conceive *only* with the aid of laboratory fertilization and embryo transfer. These estimates do not include additional candidates with uterine disease (who could "conceive" only by embryo transfer to surrogate-gestators), nor those with ovarian dysfunction who would need egg donation as well, nor that growing population of women who have had tubal ligations and who could later turn to *in vitro* fertilization. It is also worth noting that not all the infertile couples are childless; indeed, a surprising number are seeking to enlarge an existing family.

be borne by the taxpayers. Nearly everyone now agrees that the kidney machine legislation, obliging the federal government to pay for kidney dialysis for anyone in need, is an impossible precedent— notwithstanding that individual lives have been prolonged as a result. But once the technique of *in vitro* fertilization and embryo transfer is developed and available, how should the baby-making be paid for? Should it be covered under medical insurance? If a national health insurance program is enacted, will and should these services be included? (Those who argue that they are part of medicine will have a hard time saying no.) Failure to do so will make this procedure available only to the well-to-do, on a fee-for-service basis. Would that be a fair alternative? Perhaps, but it is unlikely to be tolerated. Indeed, the principle of equality—equal access to equal levels of medical care—is the leading principle in the press for medical reform. One can be certain that efforts will be forthcoming to make this procedure available equally to all, independent of ability to pay, under Medicaid or national health insurance or in some other way. (A few years ago, an egalitarian Boston-based group concerned with infertility managed to obtain private funding to pay for artificial insemination for women on welfare!)

Much as I sympathize with the plight of infertile couples, I do not believe they are entitled to the provision of a child at public expense, especially now, especially at this cost, especially by a procedure that also involves so many moral difficulties. Given the many vexing dilemmas that will surely be spawned by laboratory-assisted reproduction, the federal government should not be misled by compassion to embark on this imprudent course.

In considering the federal funding of such research for its other anticipated technological benefits, independent of its clinical use in baby-making, we face a more difficult matter. In brief, as is the case with all basic research, one simply cannot predict what kinds of techniques and uses it will yield. But here, also, I think good sense would at present say that before one undertakes human *in vitro* fertilization to seek new methods of birth control (for example, by developing antibodies to the human egg that would physically interfere with its fertilization) one should make adequate attempts to do this in animals. One simply can't get sufficient numbers of human eggs to do this pioneering research well—at least not without subjecting

countless women to additional risks not to their immediate benefit. Why not test this conceit first in the mouse or rabbit? Only if the results were very promising—and judged also to be relatively safe in practice—should one consider trying such things in humans. Likewise, the developmental research can and should be first carried out in animals, especially in primates. Purely on scientific grounds, the federal government ought not *now* to be investing its funds in this research for its promised technological benefits—benefits that, in the absence of pilot studies in animals, must be regarded as mere wishful thoughts in the imaginings of scientists.

The use of human embryos for stem cell research, the current subject of controversy, is a much closer call. Proponents of this research believe that it carries enormous benefits for millions who now suffer from incurable diseases and disabilities—orders of magnitude greater than the numbers of infertile couples—through regenerative medicine. This is today a most fashionable area of research, and although no one knows whether it will pay off, it would be foolish to gainsay it. Debate continues as to whether embryonic stem cells will be more or less effective than adult (or nonembryonic) stem cells in the treatment of disease; but as of this writing there is no evidence that tissues derived from embryonic stem cells have produced a true cure of any human disease, even in animal models of human diseases. Privately funded stem cell research will certainly proceed. Thanks to President Bush's decision, federal funds are available now for work on some sixty-four embryonic stem cell lines established before that decision was made. We are a long way from knowing whether this research will succeed and whether any more cell lines will be needed. But before we face this question, every effort should be made both to exploit the potential of adult stem cells and to prove that embryonic stem cell treatments can actually cure diseases in animals.

There remains the first justification: research for the sake of knowledge itself—knowledge about cell cleavage, cell-cell and cell-environment interactions, and cell differentiation; knowledge of gene action and gene regulation in both normal and diseased tissues; knowledge of normal and abnormal embryonic development; knowledge of the effects and mechanisms of the action of various chemical and physical agents on growth and development; knowledge of

the basic processes of fertilization and implantation. This is all knowledge worth having, and though much can be learned using animal sources—and these sources have barely begun to be sufficiently exploited—the investigation of these matters in *man* would, sooner or later, require the use of human embryonic material. Here, again, there are questions of research priority about which there is room for disagreement, among scientists and laymen alike. But there is also a more fundamental matter.

Is such research consistent with the ethical standards of our community? The question turns in large part on the status of the early human embryo. If, as I have argued, the early embryo is deserving of respect because of what it is, now and potentially, it is difficult to justify submitting it to invasive experiments, and especially difficult to justify *creating* it solely for the purpose of experimentation. The reader should test this conclusion against his or her reaction to imagining the Fertilizing Room of the Central London Hatchery or, more modestly, to encountering an incubator or a refrigerator full of living embryos.

But even if this argument fails to sway our policymakers, another one should. For their decision, I remind you, is not whether *in vitro* fertilization and embryo research should be permitted in the United States, but whether our tax dollars should encourage and foster it. One cannot, therefore, ignore the deeply held convictions of a sizable portion of our population—it may even be a majority—that regards the human embryo as protectable humanity, not to be experimented upon except for its own benefit. Never mind if these beliefs have a religious foundation—as if that should ever be a reason for dismissing them! The presence, sincerity and depth of these beliefs, and the grave importance of their subject, are what must concern us. The holders of these beliefs have been very much alienated by the numerous court decisions and legislative enactments regarding abortion and research on fetuses. Many who by and large share their opinions about the humanity of prenatal life have with heavy heart gone along with the liberalization of abortion, out of deference to the wishes, desires, interests or putative rights of pregnant women. But will they go along with what they can only regard as gratuitous and willful assaults on human life, or at least on potential and salvageable human life, and on human dignity? We can ill

afford to alienate them further, and it would be unstatesmanlike, to say the least, to do so, especially in a matter so full of potential dangers.

Technological progress is but one measure of our national health. Far more important is the affection and esteem in which our citizenry holds its laws and institutions. No amount of relieved infertility is worth the further disaffection and civil contention that the lifting of the moratorium on federal funding is likely to produce. People opposed to abortion and people willing to permit women to obtain elective abortion but at their own expense will not tolerate having their tax money spent on scientific research that requires what they consider to be cruelty at best, and possibly murder. Wise statesmanship will take this matter most seriously and continue to refuse to lift the moratorium on federal funding of embryo research—at least until persuaded that the public will give its overwhelming support. Imprudence in this matter may be the worst sin of all.

An Afterword

This has been for me a long and difficult exposition. Many of the arguments are hard to make. It is hard to get confident people to face unpleasant prospects. It is hard to ask people to take seriously such “soft” matters as lineage, identity, respect and self-respect when they are in tension with such “hard” matters as a cure for infertility or new methods of contraception. It is hard to claim respect for human life in the laboratory in a society that does not respect human life in the womb. It is hard to talk about the meaning of sexuality and embodiment in a culture that treats sex increasingly as sport and has trivialized gender, marriage and procreation. It is hard to oppose federal funding of baby making in a society that increasingly expects the federal government to satisfy all demands, and that—contrary to so much evidence of waste, incompetence and corruption—continues to believe that only Uncle Sam can do it. And, finally, it is hard to speak about restraint in a culture that seems to venerate very little above man’s own attempt to master all. Here, I am afraid, is the biggest question about the reasonableness of the desire to become masters and possessors of nature, human nature included.

Here we approach the deepest meaning of *in vitro* fertilization. Those who have likened it to artificial insemination are only partly correct. With *in vitro* fertilization, the human embryo emerges for the first time from the natural darkness and privacy of its mother's womb, where it is hidden away in mystery, into the bright light and utter publicity of the scientist's laboratory, where it will be treated with unswerving rationality, before the clever and shameless eye of the mind and beneath the obedient and equally clever touch of the hand. What does it mean to hold the beginning of human life before your eyes, in your hands—even for five days (for the meaning does not depend on duration)? Perhaps the meaning is contained in the following story.

Long ago there was a man of great intellect and great courage. He was a remarkable man, a giant, able to answer questions that no other human being could answer, willing boldly to face any challenge or problem. He was a confident man, a masterful man. He saved his city from disaster and ruled it as a father rules his children, revered by all. But something was wrong in his city. A plague had fallen on generation; infertility afflicted plants, animals and humans. The man promised to uncover the cause of the plague and cure the infertility. Resolutely, confidently, he put his sharp mind to work to solve the problem, to bring the dark things to light. No reticence, no secrets, a full public inquiry. He raged against the representatives of caution, moderation, prudence and piety, who urged him to curtail his inquiry; he accused them of trying to usurp his rightfully earned power, to replace human and masterful control with submissive reverence. The story ends in tragedy: He solves the problem, but in making visible and public the dark and intimate details of his origins, he ruins his life and that of his family. In the end, too late, he learns about the price of presumption, of overconfidence, of the overweening desire to master and control one's fate. In symbolic rejection of his desire to look into everything, he punishes his eyes with self-inflicted blindness.

Sophocles seems to suggest that such a man is always in principle—albeit unwittingly—a patricide, a regicide and a practitioner of incest. These are the crimes of the tyrant, that misguided and vain seeker of self-sufficiency and full autonomy, who loathes being reminded of his dependence and neediness, who crushes all opposition

to the assertion of his will, and whose incest is symbolic of his desire to be the godlike source of his own being. His character is his destiny.

We men of modern science may have something to learn from our philosophical forebear Oedipus. It appears that Oedipus, being the kind of man an Oedipus is (the chorus calls him a paradigm of man), had no choice but to learn through suffering. Is it really true that we, too, have no other choice?