Making babies —the new biology and the "old" morality

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Good afternoon ladies and gentlemen. This is your pilot speaking. We are flying at an altitude of 35,000 feet and a speed of 700 miles an hour. I have two pieces of news to report, one good and one bad. The bad news is that we are lost. The good news is that we are making excellent time. —*Author unknown*

THOUGHTFUL men have long known that the campaign for the technological conquest of nature, conducted under the banner of modern science, would someday train its guns against the commanding officer, man himself. That day is fast approaching, if not already here. New biomedical technologies are challenging many of the formulations which have served since ancient times to define the specifically human—to demarcate human beings from the beasts on the one hand, and from the gods on the other. Birth and death, the boundaries of an individual human life, are already subject to considerable manipulation. The perfection of organ transplantation and especially of mechanical organs will make possible wholesale reconstructions of the human body. Genetic engineering, a prospect already visible on the horizon, holds forth the promise of a refined control over human capacities

and powers. Finally, technologies springing from the neurological and psychological sciences (e.g., electrical and chemical stimulation of the brain) will permit the manipulation and alteration of the higher human functions and activities—thought, speech, memory, choice, feeling, appetite, imagination, love.

The advent of these new powers for human engineering means that some men may be destined to play God, to re-create other men in their own image. This Promethean prospect has captured the imagination of scientist and layman alike, and is being hailed in some quarters as the final solution to the miseries of the human condition. But this optimism (not to say *hybris*) has been tempered by the dim but growing recognition that the use of these new powers will raise profound and difficult moral and political questions—and precisely because the objects on which they are to operate are human beings. In this essay, I consider some of these moral and political questions in connection with one group of new technologies: the technologies for making babies.

Why make babies?

Why would anyone want to provide new methods for making babies? A major reason given is that, in many instances, the "old"[1] method is not possible. Despite greatly increased abilities to diagnose and to treat the causes of infertility in recent years, some couples still remain involuntarily childless. Thus, paradoxically, while the need to limit fertility becomes ever more apparent, some scientists and physicians have taken it as their duty to satisfy the natural desire of every couple to have a child, by natural or artificial means.

Some rather large questions arise here. Physicians have a duty to treat infertility by whatever means only if patients have a right to have children by whatever means. But the "right to procreate" is an ambiguous right, and certainly not an unqualified one. Whose right is it, a woman's or a couple's? Is it a right to carry and deliver (i.e., only a woman's right) or is it a right to nurture and rear? Is it a right to have your own biological child? Even if involuntary sterilization imposed by a government would violate such a right, however de-

[1] This awkward use of "old" calls attention to the subtle traps laid for us by the abuse of language. In a time and place where novelty and originality are considered cardinal virtues, and when faddishness has replaced tuberculosis as the scourge of the intellectual classes, one should vigorously resist the tendency to make things attractive simply by emphasizing their newness. Is the "old" way of beginning life *merely* old, simply traditional and conventional?

fined, is it "violated" or denied by sterility not imposed from without but due to disease? Is the inability to conceive a disease? Whose disease is it? Can a couple have a disease? Does infertility demand treatment wherever found? In women over seventy? In virgin girls? In men? Can these persons claim either a natural desire or natural right to have a child, which the new technologies might or must provide them? Does infertility demand treatment by any and all available means? By artificial insemination? By *in vitro* fertilization? By extracorporeal gestation? By parthenogenesis? By cloning—i.e., "xeroxing" of existing individuals by asexual reproduction?[2]

Simply posing these questions suggests that both the language of rights and the language of disease could lead to great difficulties in thinking about infertility. Both point to possessions or properties of single individuals, for it is an individual who bears rights and diseases. Yet infertility is a relationship as much as a condition—a relationship between husband and wife, and between generations too. More is involved than the interests of any single individual. Ultimately, to consider infertility (or even procreation) solely from the perspective of individual rights can only undermine—in thought and in practice—the bond between childbearing and the covenant of marriage. And in a technological age, to view infertility as a "disease," one demanding treatment by physicians, automatically fosters the development and encourages the use of all the new technologies mentioned above.

A second reason given for seeking new methods for making babies is that sometimes the old method is thought to be undesirable or inadequate, primarily on eugenic grounds. A diverse—and ultimately incompatible—collection of champions are presently in bed together under this rationale: patient-centered physicians and genetic counsellors seeking to prevent the transmission of inherited diseases to prospective children of carrier parents, species-centered pessimists concerned to combat the alleged deterioration of the human gene pool, and zealous optimists eager to engineer "improvements" in the human species. The new methods called for include the growth of early embryos in the laboratory with selective destruction of those who do not pass genetic muster; directed mating with eugenically selected eggs, sperm, or both; and asexual replication of existing "superior"

[2] Those who seek to submerge the distinction between *natural* and *unnatural* means would do well to ponder these questions, and reflect on what they themselves mean when they speak of "a natural desire to have children" or "a [natural human] right to have children." One cannot speak of natural desires or natural human rights or, indeed, about disease, without having some notion of "normal," "natural," and "healthy" for human beings.

individuals. But serious questions can be raised with respect to these ends as well. For example, we may know which diseases we would wish not to have inflicted upon ourselves and our offspring, but are we wise enough to act upon these desires? In view of our ignorance concerning why certain genes survive in our populations, can we be sure that the eradication of genetic disease (or of any single genetic disease) is biologically a sensible goal? Might it not have unanticipated genetic consequences?

The species-centered goals are even more problematic. Do we know what constitutes a deterioration or an improvement in the human gene pool? One might well argue that, at least under present conditions, the crusaders against the deterioration of the species are worried about the wrong genes. After all, how many architects of the Vietnam war have suffered from Mongolism? Who uses up more of our irreplaceable natural resources and who produces more pollution—the inmates of an institution for the retarded or the graduates of Harvard College? It is probably as indisputable as it is ignored that the world suffers more from the morally and spiritually defective than from the genetically defective. Thus, it is sad that our best minds are busy fighting our genetic shortcomings while our more serious vices are allowed to multiply unmolested.

Perhaps this is too harsh a judgment. Certainly, our genetic inheritance is entrusted to us for safekeeping and not for abuse or neglect. Perhaps a case could be made for the desirability and wisdom of certain negative or even positive eugenic goals. Still, as in the treatment of infertility, we shall also have to consider which means, if any, can be justified in the service of *any* reasonable goals.

Thirdly, there are scientific goals which themselves generate new beginnings in life. In other words, there is a limit to what can be learned about the nature and regulation of fertilization, embryonic development, or gene action from lives begun in the old, undisturbed, natural manner. This is no doubt true. But if the goal is scientific knowledge of these processes for its own sake, there is little need to develop new beginnings in *human life*. Embryological experimentation in a wide range of mammals, employing all the new technological possibilities, would yield the basic understanding. There is at present no reason to believe that the fundamental mechanisms of differentiation differ in monkeys and in man. Until extensive animal studies show otherwise, the human experiments can only be given a technological and not a purely scientific justification. (Indeed, it is the philanthropic foundations interested in finding new drugs for abortion or contraception who are supporting much of the work on the laboratory

growth of human embryos. For example, the work of R. G. Edwards and his colleagues in Cambridge, England, is supported by the Ford Foundation.) These technological purposes and activities (and others, such as the use of early embryos in culture to test for mutation- or cancer-producing chemicals and drugs, or to work out techniques for genetic manipulation) may well be desirable, but they need to be so identified and distinguished from the quest for knowledge simply. Adequately to assess the desirability of any specific means, and properly to weigh alternative means, requires a clear understanding of which ends are being served.

Finally, new methods for making babies are being sought precisely because they are new and because they can be sought. While not praiseworthy reasons, these certainly are important reasons, and all-too-human ones. Drawn by the promise of fame and glory, driven by the hot breath of competitors, men do what can be done. Biomedical scientists are no less human than anyone else. Some of them will be unable to resist the lure of immortality promised the father of the first test tube baby. Moreover, regardless of their private motives, they are encouraged to pursue the novel because of the widespread and not unjustified belief that their new findings will probably help to alleviate one form or another of human suffering. They are also encouraged by that curious new breed of techno-theologian who, after having pronounced God dead, discloses that God's dying command was that mankind should undertake its limitless, no-holds-barred self-modification, by all feasible means.

So much then for reasons why some have called for and helped to promote new beginnings for human life. But what precisely is new about these new beginnings? Such life will still come from pre-existing life; no new formation from the dust on the ground is being contemplated, nothing as new—or as old—as that first genesis of life from non-living matter is in the immediate future. What is new is nothing more radical than the divorce of the generation of new human life from human sexuality, and ultimately from the confines of the human body, a separation which began with artificial insemination and which will finish with ectogenesis, the full laboratory growth of a baby from sperm to term. What is new is that sexual intercourse will no longer be needed for generating new life. (The new technologies provide the corollary to the pill: babies without sex.) This piece of novelty leads to two others: There is a new co-progenitor, the embryologist-geneticist-physician, and there is a new home for generation, the laboratory. The mysterious and intimate processes of generation are to be moved from the darkness of the womb to

the bright (fluorescent) light of the laboratory, and beyond the shadow of a single doubt.

But this movement from natural darkness to artificial light has the most profound implications. What we are considering, really, are not merely new ways of beginning individual human lives but also—and this is far more important—new ways of life and new ways of viewing life and the nature of man. Man is partly defined by his origins; to be bound up with parents, siblings, ancestors, is part of what we mean by "human." By tampering with and confounding these origins, we are involved in nothing less than creating a new conception of what it means to be human.

Consider the views of life and the world reflected in the following different expressions to describe the process of generating new life. The Hebrews, impressed with the phenomenon of transmission of life from father to son, used a word we translate "begetting" or "siring." The Greeks, impressed with the springing forth of new life in the cyclical processes of generation and decay, called it *genesis*, from a root meaning "to come into being." (It was the Greek translators who gave this name to the first book of the Hebrew Bible.) The pre-modern, Christian, English-speaking world, impressed with the world as given by a Creator, used the term pro-creation. We, impressed with the machine and the gross national product (our own work of creation), employ a metaphor of the factory, re-production. And Aldous Huxley has provided "decantation" for that technology-worshipping Brave New World of tomorrow.

"In vitro" fertilization—state of the art

The first technological development I shall discuss is an accomplishment recently reported from several laboratories around the world, most publicly from that of Dr. R. G. Edwards in Cambridge, England: the fertilization, in the test tube, of human egg by human sperm, and the subsequent laboratory culture of the young embryo. The major technical difficulty overcome was to obtain mature, functional eggs. To surmount this difficulty, Edwards and his obstetrician colleague, Dr. P. C. Steptoe, have devised a surgical method, known as laparoscopy, to obtain matured eggs directly from the ovaries prior to ovulation. From a single woman as many as three or four eggs can be recovered at one operation. Upon addition of sperm, fertilization occurs with a small but significant fraction of these eggs. Kept in culture medium, a majority of the fertilized eggs begin to divide, and a small fraction reach the blastocyst stage

(i.e., age of about 7-8 days), the stage at which the early embryo normally implants itself in the wall of the uterus. Successful implantation of laboratory-grown embryos has been reported in rabbits and in mice, but not in humans. The physical transfer of the embryo into the uterine cavity poses no problem, but implantation may be difficult to achieve with regularity, since this process is poorly understood. It *is* known that the uterine lining is receptive to implantation only for a short portion of the menstrual cycle, and that only embryos at a certain stage are capable of implantation. Thus, the timing of transfer is likely to be critical. The results in mice can be considered to be somewhat encouraging. A recent article reports that nearly half of the transferred blastocysts developed into full-term, apparently normal progeny; however, the success rate over all stages was low, with only four per cent of the initial number of eggs giving rise at the end to viable mice. No gross abnormalities have been noted in any of the animals born alive following blastocyst transfer. And although some researchers would prefer to learn more about the control of implantation in animals before proceeding further in the human work, others are inclined to go ahead in humans on a trial and error basis. In fact, Edwards and Steptoe hope to accomplish transfer and subsequent growth into a baby sometime in the next year or two.

This summarizes the current state of the art on new beginnings in *human* life. But there is much work being done with other mammals which will provide knowledge and techniques someday applicable to humans. Some of these developments deserve mention (although a detailed treatment is beyond the scope of this essay). Considerable progress has been made in growing older mammalian embryos in the laboratory. Dr. D.A.T. New and his colleagues in Cambridge, England, have been successful in growing rat and mice embryos bathed in blood serum medium for about one third (the middle third) of the whole gestation period. As the embryo approaches term-size, it can no longer be maintained bathed in media, but requires more efficient circulation and exchange of nutriments, gases, and wastes. Various artificial pump and perfusion techniques, analogous to the artificial kidney machine, are being studied in an effort to design an artificial placenta. Finally, a long-standing early barrier to extensive laboratory culture, located just after the blastocyst stage, has recently fallen. Dr. Yu-Chih Hsu of Johns Hopkins University has reported the successful culture of mouse embryos from the blastocyst stage to a stage having a differentiated and beating heart. Thus, from both ends and from the middle, research-

ers are gradually closing in on the possibility of complete extracorporeal gestation. It should be stressed that these techniques are being pursued primarily to make possible a better understanding of the full scope of embryonic development. However, even though no scientists at present appear to be interested in going from fertilization to birth entirely in the laboratory,[3] the technology to do so is gradually being worked out piece by piece.

Techniques to predetermine the sex of unborn children may also be just around the corner. Since the sex is determined solely by the X- or Y-chromosome content of the sperm, techniques for physical separation of X-carrying from Y-carrying sperm would make sex control possible through artificial insemination. Attempts to effect such a separation have all met with failure, but new efforts can be expected, partly because of recently discovered methods for detecting the Y-chromosome in cells, methods which may serve as an assay for successful separation. A second method of sex control, already successfully demonstrated in rabbits, involves the sexing of embryos (prior to implantation) by cell-staining techniques or chromosome analysis. Embryos of the desired sex could then be transferred to the recipient females. Though accurate, this sexing technique is not without its problems, since embryonic tissue needs to be removed for testing. In the rabbit work, only about one in five embryos sexed by these methods developed to full term, and there was at least one monstrous birth. Even if these technical difficulties were ironed out, it is doubtful that many will accept the costs and inconvenience of *in vitro* fertilization or even artificial insemination merely to control the sex of their offspring—unless perhaps they are known carriers of a sex-linked genetic disease such as hemophilia. Less cumbersome methods, e.g., a chemical method that would selectively destroy either the X- or the Y-carrying sperm in the man's body or soon after intercourse, are conceivable but as yet unreported, even in animals.

Finally, the generation of man-animal hybrids or "chimeras" has been predicted by some reputable scientists. These might be produced by the introduction of selected non-human genetic material into the developing human embryos. Fusion of human and non-human cells in tissue culture has already been achieved.

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[3] Although no scientist *appears* to be, at least one *is* interested, according to a quotation in Albert Rosenfeld's book, *The Second Genesis* (Englewood Cliffs, N.J.: Prentice-Hall, 1969): " 'If I can carry a baby all the way through to birth *in vitro*,' says an American scientist who wants his anonymity protected, 'I certainly plan to do it—though obviously, I am not going to succeed on the first attempt, or even the twentieth' " (p. 117).

"In vitro" fertilization—ethical questions

At the end of a recent popular review article in *Scientific American* summarizing the work on human embryos, Drs. Edwards and Fowler offer the following conclusion: "We are well aware that this work presents challenges to a number of established social and ethical concepts. In our opinion the emphasis should be on the rewards that the work promises in fundamental knowledge and in medicine." Here, we are told that we *should* "emphasize" promised rewards in knowledge and power at some future time at the expense of established (don't they really mean "establishment" or "conventional"?) ideas of right. But this is itself a judgment of value—untenable as a *general* proposition for experimentation on human subjects—whose soundness in this particular case cannot be determined until the full range of ethical, social, legal, and political implications is carefully studied and understood.

Let us consider first what is probably the least controversial and likely to be the most popular use, at least initially, for *in vitro* fertilization, the provision of their own child to a childless couple, where oviduct disease in the woman obstructs the free passage of egg and sperm, and hence also fertilization.[4]

At first glance, the intramarital use of *artificial fertilization* resembles, ethically, *artificial insemination (husband).* The procedure simply provides for the union of the wife's egg and the husband's sperm, circumventing the pathological obstruction to that union. But there is at least this difference. There is an alternative treatment for infertility due to tubal obstruction, namely surgical reconstruction of the oviduct, which, if successful, permanently removes the cause of infertility (i.e., it treats the underlying disease, not merely the desire to have a child). Moreover, it does so without need for manipulation of embryos. At present, the success rate for oviduct reconstruction is only fair, but with effort and practice this is bound to improve. This therapeutic surgery for the woman is without possible moral objection or adverse social consequences. Therefore, it is to be preferred over artificial fertilization, both in principle (namely,

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[4] There are many infertile women so affected, crude estimates suggesting as many as one per cent of all women. Approximately 10 per cent of couples are infertile, and in more than half of these cases the cause is in the female. Blocked or abnormal oviducts account for perhaps 20 per cent of the female causes of infertility. However, not all such women—perhaps only a minority—are suitable candidates for the intramarital use of *in vitro* fertilization. Many women who have blocked tubes also have associated disordered ovaries, making it difficult or impossible for a doctor to obtain eggs from them. For this reason, only some of these women are likely to be able to provide their own eggs for fertilization.

one should use the least objectionable means to achieve the same unobjectionable end) and in practice, should both options be feasible and available.

A sufficient reason for this preference is related to the most important intrinsic difference between artificial insemination and artificial fertilization. In the latter, fertilization occurs in the laboratory, as do the earliest stages of embryonic development. Considerably more manipulation is involved, and, unlike the procedures of artificial insemination, there is necessarily deliberate manipulation of the embryo itself. Serious questions can be raised about the effects of the manipulations on the child who is eventually produced by this procedure. These medical questions about safety and "normality" lead to a perplexing moral question: Does the parents' desire for a child entitle them to have it by methods which carry for that child an unknown and untested risk of deformity or malformation?

How unknown are the risks? The leading researchers appear to disagree. Drs. Edwards and Steptoe are reported ready to proceed with implantation if tests on the embryos can rule out the presence of genetic or other defects. Apparently, they are both concerned about the risks and ignorant of their likelihood. In their judgment, "the normality of embryonic development and efficiency of embryo transfer cannot yet be assessed."[5]

In contrast to Edwards and Steptoe, Dr. Landrum Shettles at Columbia University does not talk about the need for further tests, and appears ready to proceed, having thrown the gauntlet and the burden of proof to those who might be more cautious or who might raise other objections. In a recent article he states that "the grossly normal blastocyst" was not transferred to the patient for the single reason that she had recently undergone uterine surgery. He adds: "Otherwise, there was no discernible contraindication for a successful transfer *in vitro* [*sic;* he means *in utero*] and continued development. This is scheduled for patients with ligated or excised fallopian

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[5] Perhaps it was a concern for possible risks to the offspring that accounts for the unexplained judgment, quite surprising in the light of his later words and deeds, rendered by Edwards in his *Scientific American* article written only five years ago: "If rabbit and pig eggs can be fertilized after maturation in culture, presumably human eggs grown in culture could also be fertilized, *although obviously it would not be permissible to implant them in a human recipient.* We have therefore attempted to fertilize cultured human eggs *in vitro*" (emphasis added). The last sentence indicates that Edwards had no qualms about the "permissibility" of doing the fertilizations themselves. If taken seriously, the entire quotation displays that curious form of technocratic logic in which a course of action is deduced simply from the possibility of action: "Presumably human eggs can also be fertilized, *therefore* we have tried to fertilize them." Is a similar logic now at work in regard to implantation?

tubes who may want a child, with the ova obtained by culdoscopy or laparoscopy."[6]

The truth is that the risks are very much unknown. Although there have been no reports of gross deformities at birth following successful transfer in mice and in rabbits, the number of animals so far produced in this way is much too small to exclude even a moderate risk of such deformities. In none of the research to date has the question of abnormalities been systematically investigated. No attempts have been made to detect defects which might appear at later times or lesser abnormalities apparent even at birth. In species more closely related to humans, e.g., in primates, successful *in vitro* fertilization has yet to be accomplished. The ability regularly to produce normal monkeys by this method would seem to be a minimum prerequisite for using the procedure in humans.[7]

Laboratory testing of the human embryos themselves, prior to transfer, cannot provide enough information about "normality," and might itself do damage. Ordinary microscopic observation of the early embryo can disclose gross abnormalities, but it provides too crude a measure of normality. Most genetic tests cannot be done on a given embryo without damaging it; morever, there are few genetic tests presently available for the doing. Furthermore, damages could be introduced during the transfer procedure, after the last inspection is completed. Conceivably, the manipulations may even make possible the implantation of some abnormal embryos which would have been spontaneously aborted had they been generated under natural conditions.

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[6] The tone of the recent scientific articles and the reports of this research in the scientific and popular press suggest to the ordinary reader that a race may be on to do the first embryo transfer. If such a race is on, it is likely that the swift will abandon caution to the more sober, and will trust to luck that his victory in the race does not issue in a deformed or retarded child.

[7] This view is shared by some of the more cautious—and hence, less publicly known—researchers, including Dr. Luigi Mastroianni, chairman of obstetrics and gynecology at the University of Pennsylvania: "It is my feeling that we must be very sure we are able to produce normal young by this method in monkeys before we have the temerity to move ahead in the human." Dr. Mastroianni adds: "In our laboratory, our position is, 'Let's explore the thing thoroughly in monkeys and establish the risk.' Then we can describe that risk to a patient and obtain truly informed consent before going ahead. We must be very careful to use patients well and not be presumptuous with human lives. We must not be just biologic technicians." I would dissent from this fine statement only to suggest that both doctor and prospective parents would be "presumptuous with human lives" in proceeding unless there were known to be no risks. Such confidence cannot be provided by the monkey experiments alone. Monkey experiments would neither rule out nor establish the risk of mental retardation for children resulting from the experiments in humans. Unfortunately, as is often the case, only humans can provide the test system for assessing the risks of using the procedure in humans.

In sum, there is at present no way of finding out in advance whether or not the *viable* progeny of the procedures of *in vitro* fertilization, culture, and transfer of human embryos will be deformed, sterile, or retarded. Even if we would wish to practice abortion on all the misbegotten foetuses, we are not and will not be able to identify (by prenatal diagnosis) many if not most of them. Neither can we count on "nature" to spontaneously abort all of them for us.

I have dwelled at length upon the problem of risks and mishaps that accompany the experimental phase of this new technology, first, because it is a problem widely and remarkably ignored, and, second, because it provides a powerful moral objection sufficient to rebut the implantation experiments. Moreover, this moral objection can and should be widely shared; it does not rest upon arguments about the will of God or about natural right. It rests instead upon that minimal principle of medical practice, "Do No Harm." In these prospective experiments upon the unborn, it is not enough not to know of any grave defects; one needs to know with confidence *that there will be no such defects*—or at least no more than there are without the procedure. Professor Paul Ramsey, in his book *Fabricated Man,* puts the matter quite forcefully and, I think, correctly: "The decisive moral verdict must be that we cannot rightfully *get to know* how to do this without conducting unethical experiments upon the unborn who must be the 'mishaps' (the dead and the retarded ones) through whom we learn how."[8]

It may be objected that all new medical technologies are risky, and that the kind of ethical scrupulosity I advocate would put a halt to medical progress. But such an objection ignores an important distinction. It is one thing voluntarily to accept the risk of a dangerous procedure for yourself (or to consent on behalf of your child) *if the purpose is therapeutic.* Some might say this is not only permissible, but obligatory, in line with a duty to preserve one's own health. It is

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[8] The matter of mishaps is completely ignored by Edwards and Sharpe (the latter, an American professor of law), in their recent article in *Nature* surveying some of the social and ethical issues attending research in human embryology. Feigning neutrality, these authors reveal their prejudices—and their misconception of medical ethics—when they invoke the principle "Do No Harm" to justify, rather than to oppose, the use of *in vitro* techniques for making babies: "The beginning of medical ethics, however, is *primum non nocere;* this permits alleviation of infertility, and has been stretched to cover destruction of foetuses with hereditary defects, but would it permit the more remote techniques like modifying embryos?" "Do No Harm" is a principle which can only justify *omitting* a medical intervention; it does not permit, let alone justify, committing an intervention. Rightly understood, it can enter medico-moral argument only *in opposition to* risk-filled technologies for making babies.

quite a different thing deliberately to submit a child to hazardous procedures which can in no way be considered therapeutic for him, and are "therapeutic" for you only in that they "treat" your desires (albeit unobjectionable ones). This argument against non-therapeutic experimentation on children applies with even greater force against experimentation "on" a hypothetical child (whose conception is as yet only intellectual). One cannot ethically choose for him the unknown hazards he must face and simultaneously choose to give him life in which to face them. This judgment could be set aside only under a strongly pro-natalist ethic—much more pro-natalist that Roman Catholicism ever was—which would hold that parents have either a preeminent duty or a preeminent right to have their own biological child by whatever means.

The question of "informed consent"

While on the subject of the ethics of experimentation, let me add a few comments concerning the adult participants. Most of the scientific reports on human embryo experimentation are strangely silent on the nature of the egg donors and on their understanding of what was to be done with their eggs. This is surprising considering the growing sensitivity of the scientific community to the requirement of informed consent, and especially surprising given the kind of experiments here being performed. Who are these women and how did they come to "volunteer"? In the report describing the first successful fertilization and cleavage of human eggs obtained via laparoscopy, there are only several passing references to "patients," and the one-sentence abstract of the paper only increases our confusion by its use of the word "mother": "Human oocytes have been taken from the mother before ovulation, fertilized *in vitro* and grown *in vitro* to the eight- or sixteen-celled stage in various media." If the women were indeed patients for infertility, then "the mother" is surely the one thing that they are not. In the recent *Scientific American* article by Edwards and Fowler there is this solitary comment: "Our patients were childless couples who hoped our research might enable them to have children." We are not told, and can therefore only guess as to what these women were in fact told. From the report that the women and their husbands had hopes, we can surmise that they considered themselves to be *patients*. But for the present, they are *experimental subjects*. One wonders if they were told this.

Only one of the many scientific articles, that describing the use of

the laparoscopic surgery to recover human oocytes, tells us anything more about the persons used as experimental subjects (in this case, for perfecting the laparoscopy technique), and about how they were informed: "The object of the investigations was fully discussed with the patients, including the possible clinical applications to relieve *their* infertility" (emphasis added). Though welcome, this statement leaves many questions unanswered. Were the couples also told that the much more likely possibility was that it would be future infertile women, rather than they themselves, whose infertility might be "relieved"? Were they told about alternative possibilities, such as surgery on the blocked oviduct, or adoption? Since the same article tells us that three out of 46 "infertile" women became pregnant—by the "old," customary method—*during the first month after the laparoscopy,* we can only wonder about the criteria used for subject selection. Were all other possibilities exhausted before bringing these couples into this uncertain program of experimentation? Finally, we are left to wonder how the discussions were conducted, especially in the light of the following quotation attributed to R. G. Edwards: "We tell women with blocked oviducts, 'Your only hope of having a child is to help us. Then maybe we can help you.'" (Remarks made at a scientific meeting in West Berlin, as reported in *Medical World News,* April 4, 1969.)

It is altogether too easy to exploit, even unwittingly, the desires of a childless couple. It would be cruel to generate for them false hopes by inflated publicity of the sort that some of these researchers have promoted. It would be both cruel and unethical falsely to generate hope, for example, by telling women that they themselves, rather than future infertile women, might be helped to have a child, in order to secure their participation in experiments. That this may have already occurred is suggested by the following extract from a news report by Patrick Massey of Reuters:

> Dr. Patrick Steptoe, who heads the team of doctors working on the experiment, disclosed on television that he had extracted an ovum from a 34-year-old housewife and fertilized it with her husband's sperm. The woman, Mrs. Sylvia Allen . . . said *she hoped the fertilized ovum would be implanted in her womb in the next two to six weeks,* meaning that the world's first baby conceived in a test tube could be born by the end of 1970. (Story in *The Washington Post,* March 3, 1970; emphasis added.)

The implantation was never performed.

Let me also raise some questions concerning experimentation done with eggs obtained from women undergoing ovarian surgery for

clinical reasons. Do and should these women know what is going to be done with their eggs? To whom belong the rights governing ordinary tissue removed at surgery? Is reproductive tissue a special case? Surely, if the eggs were going to be implanted in another woman, one would think that the donor's permission should be obtained. Then what about their simple fertilization? If the woman from whom the eggs are taken has religious or other objections against *in vitro* fertilization which would lead her to refuse permission if asked, is she wronged by not being asked or informed? No matter how worthy the research and how well-intentioned the investigator, *ethical* experimentation on human subjects and their tissues requires that persons be treated as ends and not merely as means, and hence that their wishes be considered and respected.

The case of the surplus embryos

So far, I have discussed ethical questions surrounding attempts to generate a normal child by transferring a laboratory-grown human embryo into the uterus of an infertile woman. But what about all the embryos that are not so implanted? Dr. Donald Gould, editor of the British journal, *The New Scientist,* has asked: "What happens to the embryos which are discarded at the end of the day—washed down the sink? There would necessarily be many. Would this amount to abortion—or to murder? We have no law to cope with this kind of situation."

I don't wish to mislead anyone. At this state of the art, the largest embryo we are talking about is a blastocyst, barely visible to the naked eye. But the moral question does not turn on visibility, any more than it does in the case of murder committed by a blind man. The embryos are clearly biologically alive, even at the blastocyst stage. At some future date, improved techniques will permit their growth to later stages, someday even viable stages. Before then, however, the question of discarding will have to be faced. Since there is a continuity of development between the early and the later stages, we had better face the question now and draw whatever lines need to be drawn.

When in the course of development does a living human embryo acquire *protectable humanity*? This is a familiar question which I shall not belabor. But the situation here, though similar, is not identical to that of abortion. For one thing, we don't start with a foetus already *in utero,* which one reluctantly destroys, hopefully only for good reasons. Here, nascent lives are being deliberately created

despite certain knowledge that many of them will be destroyed or discarded. (Several eggs are taken for fertilization from each woman, the extra ones being available for experimentation). The foetuses killed in abortion are unwanted, usually the result of so-called accidental conception. The embryos discarded here are wanted, at least for a while; they are deliberately created, used for a time, and then deliberately destroyed. Moreover, unlike abortion, the continued life of the laboratory embryo is in conflict with no one; no claim or right of its "mother" can be invoked to justify overriding its claim or right to life. Even if there is no intrinsic wrong done by discarding at the blastocyst stage—and I am undecided on this question—there certainly would be at later stages. (Those who disagree should at least be concerned about the effects on the attitude toward and respect for human life engendered in persons who are engaged in these practices.)

There is a second, related difference between abortion and discarding laboratory-grown embryos. Who decides what are the grounds for discard? What if there is another recipient available who wishes to have the otherwise unwanted embryo? Whose embryos are they? The woman's? The couple's? The geneticist's? The obstetrican's? The Ford Foundation's? If one justifies abortion on a paramount right of the woman to decide about her family size and spacing, or even on that unbelievable ground that a woman has a paramount right to do what she wishes with her body,[9] whose rights are paramount here? Shall we say that discarding laboratory-grown embryos is a matter solely between a doctor and his plumber?

But the unimplanted embryos raise even more profound problems. Bad as it may be to discard them, it would be far worse to perpetuate them in their laboratory existence—especially when the technology arrives that can bring them to "viability" *in vitro*. Will they then still be considered fit material for experimentation? Or are they then to be released from the machinery and admitted into the human fraternity or, at least, into the premature nursery? Who will the children be, and who their parents, and what their social definition? The need for a respectable boundary "defining" protectable human life can not be overstated. The current boundaries, gerrymandered for the

[9] Even if such a right exists, it does not govern actions involving the foetus, because the foetus is simply not a mere part of a woman's body. One need only consider whether a woman can ethically take thalidomide while pregnant to see that this is so. It is distressing that seemingly intelligent people would sincerely look upon a foetus whose heart was beating, and which had its own EEG, as indistinguishable from a tumor of the uterus, a wart on the nose, or hamburger in the stomach.

sake of abortion—namely, birth or viability—may now satisfy both Women's Liberation and the United Methodists, and may someday satisfy even a future pope, but they will not survive the coming of more sophisticated technologies for making babies.

One thing leads to another

Having discussed so far only one serious moral objection to *implantation* of embryos and having raised some questions about the *discarding* and *perpetuation* of unimplanted ones (and deliberately neglecting the ethics of *creating* the embryos in the first place), I suspect that I have persuaded no one not originally opposed to, or, at least, doubtful about, *in vitro* fertilization. Furthermore, the first objection may become a vanishing objection. Since the experimentation will in all likelihood proceed, the problem of risks and mishaps may eventually be eliminated as the technique is perfected. The discarding issue will hardly get a fresh hearing in a society which has so recently converted to foeticide.[10] Moreover, apart from these questions I can find no *intrinsic* moral reason to reject the intramarital use of *in vitro* fertilization and implantation—at least no reason that would not also rule against artificial insemination (husband). But the argument does not stop here, for we must consider both the likely other uses and abuses of this procedure, and also the other and more objectionable procedures that this one makes possible.

Some may object to my making an argument based upon likely or possible misuses and abuses. After all, there are few if any powers, technological and non-technological, that cannot be abused. Many of us would prefer arguments from principle concerning intrinsic rightness or wrongness, arguments that abstract from the difficult task of predicting and of weighing consequences, often quite remote and intangible ones. Nevertheless, we can ill afford such intellectual purism, especially for technologies that touch the foundations of man's biological nature. No technology exists autonomously or in isolation; each arises in the context of other technologies and, more importantly, in a complex and heterogeneous world of men whose proclivity for mischief and folly we cannot in good conscience ignore. We would ourselves display such folly were we to

[10] Some may object to my use of the term foeticide, but I am opposed to hiding behind euphemisms. If we are going to be brave enough to practice abortion, let us at least not be cowardly in describing it. Even if foeticide were made legal everywhere, and even if it were morally justified, it would still be killing (though not necessarily murder, which is "wrongful killing").

justify the introduction of each new technology simply because *some* good use can be found for it.[11]

Once introduced for the purpose of treating intramarital infertility, *in vitro* fertilization can then be used for any purpose. There is no reason why the embryo need be implanted in the same woman from whom the egg was obtained. An egg taken from one woman (the biological mother) could be donated to another woman (the gestational mother), either before or after fertilization—the former has been termed "artificial inovulation (donor)," the latter, "embryo transfer (donor)" or "prenatal adoption." Since obtaining eggs for donation is more difficult than obtaining sperm, and requires surgery on the donor, this might not seem a likely occurrence except on a small scale. However, procedures for freezing and storing eggs or young embryos will circumvent this program. (In the past six months, a method has been reported for freezing and storing mouse embryos, with little loss of viability on thawing.) Egg and embryo banks will almost certainly be established—as are sperm banks today—partly to avoid having to do repeated operations on the same woman, and also because there is money to be made. Indeed, enterprising financiers and scientists, with the blessing of the new techno-theologians, are perhaps at present organizing under one corporate canopy, The Chaste Rational Bank and Union: The Logical Semenary.

There are enough women whose infertility is due to reasons other than blocked oviducts to make it extremely likely that donation of eggs and embryos will be attempted, i.e., that the technique will not be confined to those intramarital cases in which it was first used. Clinical use of *in vitro* fertilization will probably rely mainly on donor eggs in a manner closely analogous to donor insemination. And why stop at couples? What about single women, widows, or lesbians? If adoption agencies now permit these women to adopt, are they likely to be denied a chance to bear and deliver?

The converse possibility will also follow, namely the use of one woman simply to incubate and deliver another woman's child. If the previous practice might lead to new business ventures advertised under "eggs for sale," this practice might lead to one advertised under "wombs for rent." Women with uterine abnormalities which preclude normal pregnancy may seek surrogate gestational mothers,

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[11] I doubt if many readers would find acceptable as a reason sufficient to justify the development of chemical and biological weaponry the fact that it may be more humane to use non-lethal gas on an enemy soldier than to kill him, without first asking whether we can foreclose the further consequences to human civilization and the human race of introducing such military technology.

as may women who don't want pregnancy to interfere with the skiing season. There are certainly enough poor women available to form a caste of childbearers, especially for good pay. The public is already being introduced to this prospect, as the following excerpt from a *Washington Post* news story indicates: "A prominent British embryologist, Dr. Jack Cohen, suggested that the process of impregnation, once perfected, might lead to a system of volunteer 'host' mothers, who would bear other people's children for a fee. Cohen suggested that 2,000 pounds ($5,000) a birth might be a reasonable sum, especially for an actress eager for the joys of motherhood without the cares of interrupting her career or distending her figure during pregnancy."

The more sentimentally minded will point out that these twin forms of foster pregnancy can be humanely and respectfully practiced. A woman may wish to donate an egg or an embryo to her sister, or may agree out of generosity to gestate a friend's embryo. It can be argued that no one should stand in the way of such acts of love.[12] But it is simply naive to think the practice would be limited to these more "innocent" cases. Moreover, there are psychological and ethical reasons for thinking that these cases may not be so innocent. What are the psychological consequences for the womb-lending sister (and the others) of giving birth to her nephew? Will she feel like giving him up? Whose child is he? Confusion and conflict would seem to be almost inevitable. If the donor of sperm has no claim over a child born after artificial insemination, why should the donor of ova, especially if there is a later dispute between the two women? These acts of love cannot be kept anonymous; the visible and continued presence of the progeny might chronically stimulate such conflict. Also, might not female relatives be under intolerable pressures to donate eggs or to lend wombs, once the first such acts of "kindness" are well publicized (just as relatives now often feel constrained to serve as transplantation donors of kidneys)? And is a person morally justified in allowing her body to be used as a "hot house," as a human incubator? Indeed, is not a decisive

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[12] The current sentimentality which endorses all acts done lovingly because lovingly done leads to some strange judgments. A teacher friend recently asked one student who was having difficulty appreciating the crimes of Oedipus, what she would think if she discovered that her sister was having an affair with their father. The girl replied that, although she was personally disgusted by the prospect for herself, she thought that there was probably nothing wrong with it "provided that they [sister and father] had a good relationship." It is unlikely that an individual or a whole society that is unable to find reasons (other than genetic ones) for rejecting incest will be willing to appreciate any of the questions raised in this paper.

objection to the extramarital use of these techniques that it requires and fosters, both in thought and in deed, the exploitation of women and their bodies? And is not a second decisive objection that it fosters the notion that children are property, and encourages the practice of child buying and selling? (The further question concerning the separation of procreation from sexual love and marriage will be treated later.)

Use of these technologies need not be confined—nor is it likely to be confined—to the scale of individual couples making private decisions, nor to treatment of infertility. Indeed, several proposals for additional uses have already been placed before the public. As suggested in these proposals, and as I noted at the start, these techniques could serve eugenic purposes. Artificial insemination with semen from selected donors, the (positive) eugenic proposal of Herman Muller, could now be supplemented with the selection of ova as well. For many people, these prospects raise the fear of directed breeding programs under the dictates of a totalitarian regime. Such programs need not be coercive, since the desired donors of egg and sperm, as well as the foster mothers of the regime, might be handsomely paid and highly honored. But, perhaps perversely, in a time when suspicion and fear of governmental abuse of power are high and growing, I am not very worried about government-directed breeding by these methods. The eugenic advantages of this method, if there are any, are also available—and more cheaply too—simply by directed sexual intercourse. A regime could more easily compel or induce this less troublesome, more enjoyable practice. While those who hold to the demonic theory of politics may think me naive, I expect that artificial fertilization and embryo culture would add very little to the already large arsenal of those who would practice mischief and evil.

We stand in much greater danger from the well-wishers of mankind, for folly is much harder to detect than wickedness. The most serious danger from the widespread use of these techniques will stem, not from desires to breed a super-race, but rather from the growing campaign to prevent the birth of all defective children, in the name of population control, "quality of life," and the so-called "right of every child to be born with a sound physical and mental constitution, based on a sound genotype." Thus continues the retiring (but not reticent) President of the American Association for the Advancement of Science, geneticist Bentley Glass, in his presidential address (1971): "No parents will in that future time have a right to burden society with a malformed or a mentally incompetent

child." These are not the words of a dictator, but of a gentle biologist. Even granting the desirability of his end—optimum children of no burden to society (except from their "perfection")—just consider what it would require in the way of means. This perfect condition is to be accomplished not by infanticide, not just by prenatal diagnosis and abortion of defectives, but by the laboratory growth and implantation of human embryos:

> The way is thus clear to performing what I have called 'prenatal adoption,' for not only might the selected embryos be implanted in the uterus of the woman who supplied the oocytes, but in that of any woman at the appropriate time of her menstrual cycle. Edwards cautiously limits the application of his developing techniques to the provision of a healthy embryo for a woman whose oviducts are blocked and prevent descent of the egg. It should be obvious that the technique can be quickly and widely extended. The embryos produced in the laboratory might come from selected genotypes, both male and female. Preservation of spermatozoa in deep frozen condition could permit a high degree of selectivity among the sperm donors, who so far have been limited to the husbands of the women donors of the oocytes. Sex determination of the embryos is possible before implantation; and embryos with abnormal chromosome constitutions can be discarded. By checking the sperm and egg donors with a battery of biochemical tests, matching of carriers of the same defective gene can be avoided, or the defective embryos can themselves be detected and discarded.

I leave it to the reader to consider the ethical, social, legal, and political implications of Professor Glass's proposal, and to elaborate his own favorite objections. My point here is simply to show that even before Edwards or Shettles opens Pandora's box, there are well-meaning, decent men already at work to find good uses for its contents.

A similar camel's-nose-under-the-tent argument was advanced by opponents of artificial insemination. Ironically, some of the same people who made light of these arguments in defending artificial insemination are now defending the camel's neck while again dismissing the camel's nose argument. It is true that the practice of artificial insemination has thus far been confined to the treatment of infertility, and has not, to my knowledge, been malevolently, despotically, or even frivolously used. But I am no longer talking about the problem of misuse or abuse of a given technique, but rather about the fact that one technical advance makes possible the next, and in more than one respect. The first serves as a precedent for the second, the second for the third—not just technologically, but also in moral arguments. At least one good humanitarian ground can be found to justify each step. For

these reasons, we must try to see more than a few feet in front of us before we set forth.

It was this kind of foresight which prompted Professor James D. Watson, co-discoverer of the structure of DNA, to bring before the public his concern over one technological prospect, the cloning of human beings, which Edwards's work makes very much more possible. In his very sober and careful testimony (before the Panel on Science and Technology, Committee on Science and Astronautics, United States House of Representatives), Professor Watson concluded a discussion of the work on *in vitro* fertilization as follows:

> Some very hard decisions may soon be upon us. For it is not obvious that the vague potential of abhorrent misuse should weigh more strongly than the unhappiness which thousands of married couples feel when they are unable to have their own children. Different societies are likely to view the matter differently and it would be surprising if all come to the same conclusion. We must, therefore, assume that techniques for the *in vitro* manipulation of human eggs are likely to be general medical practice, capable of routine performance throughout the world within some ten to twenty years.
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> The situation would then be ripe for extensive efforts, either legal or illegal, at human cloning. . . .
>
> Moreover, given the widespread development of the safe clinical procedures for handling human eggs, cloning experiments would not be prohibitively expensive. They need not be restricted to the super-powers —medium-sized, if not minor countries, all now possess the resources needed for eventual success. There furthermore need not exist the coercion of a totalitarian state to provide the surrogate mothers. There already are such widespread divergences as to the sacredness of the act of human reproduction that the boring meaninglessness of the lives of many women would be sufficient cause for their willingness to participate in such experimentation, be it legal or illegal. Thus, if the matter proceeds in its current nondirected fashion, a human being—born of clonal reproduction—most likely will appear on the earth within the next twenty to fifty years, and conceivably even sooner, if some nation actively promotes the venture.

I now turn to consider this second new method for making babies, asexual reproduction, or cloning.[13]

Cloning, or asexual reproduction—state of the art

In genetic terms, asexual reproduction is distinguished from sexual reproduction (whether practiced in bed or in the test tube) by the

[13] The discussion which follows is adapted from another essay, devoted entirely to cloning, entitled "Freedom, Coercion and Asexual Reproduction," which will appear in *Freedom, Coercion, and the Life Sciences,* edited by Daniel Callahan and Leon R. Kass (to be published by the Harvard University Press in 1972).

following two characteristics: The new individuals are, first, derived from a single parent, and second, are genetically identical to—are identical twins of—that parent. Asexual reproduction occurs widely in nature, and is the normal mode of reproduction of bacteria, many plants, and some lower animals. By means of a technique known as nuclear transplantation (also called nuclear transfer), experimental biologists have artificially achieved the asexual reproduction of organisms which naturally reproduce only sexually (so far, frogs, salamanders, fruit flies). The procedure is conceptually simple. The nucleus of a mature but unfertilized egg is removed (by microsurgery or by irradiation), and replaced by a nucleus obtained from a specialized somatic cell of an adult organism (e.g., an intestinal cell or a skin cell). Since almost all the hereditary material (DNA) of a cell is contained within its nucleus, the renucleated egg and the individual into which it develops are genetically identical to the organism which was the source of the transferred nucleus. Thus, the origin of the new individual is not the chance union of egg and sperm, with the generation of a new and unique genetic arrangement or genotype, but rather the contrived perpetuation into another generation of an already existing genotype.

An unlimited number of identical individuals, all generated asexually from a single parent—that is, a clone—could be produced by nuclear transplantation. An adult organism comprises many millions of cells, all genetically identical, each a potential source of a nucleus for cloning. In addition, techniques for storage and subsequent laboratory culture of animal tissues permit the preservation and propagation of cells long after the deaths of the bodies from which they were removed. There would thus be the possibility of a virtually unlimited supply of genetically identical nuclei for cloning.

The extension of nuclear transplantation to mammals has not yet been achieved, although several people have been trying for a few years. The difficulties are technical; there is no *theoretical* reason to believe that clonal reproduction is not possible in mammals, including man. The technical problems when this work began included the following: (1) obtaining of mature mammalian eggs; (2) removal of the egg nucleus; (3) insertion of the donor nucleus; (4) transfer and implantation of the renucleated egg into the uterus of a female at the right stage in her menstrual cycle. As a result of the work on *in vitro* fertilization, the first and fourth problems have been solved for rabbits and mice, and will be solved for humans when and if Edwards or someone else succeeds. Recently,

chemical methods have been perfected to remove the nucleus from mammalian cells in tissue culture, methods which can probably be used to enucleate egg cells. The only serious difficulty which remains is the introduction of the donor nucleus. And this difficulty may also be short-lived, since there are now very simple methods for fusing almost any two cells to produce a single cell containing the combined genetic material of both original cells. Fusion of an enucleated egg cell with a cell containing the donor nucleus might provide the method for getting the nucleus into the egg. In fact, Dr. Christopher Graham at Oxford has already succeeded in fusing mouse eggs with adult mouse cells. The fused egg divides several times but has thus far not gone on to form a blastocyst. Given the rate at which the other technical obstacles have fallen, and given the increasing number of competent people entering the field of experimental embryology, it is reasonable to expect the birth of the first cloned mammal sometime in the next few years. This will almost certainly be followed by a rush to develop cloning for other animals, especially livestock, in order to propagate in perpetuity the champion meat or milk producers.

With the human embryo culture and implantation technologies being perfected in parallel, the step to the first clonal man might require only a few additional years. Within our lifetime, possibly even as early as 1980, it may be technically feasible to clone a human being.

Among sensible men, the ability to clone a man would not be sufficient reason for doing so. Nevertheless, the apologists and the titillators have been at work, and the laundry list of possible applications keeps growing, in anticipation of the perfected technology: (1) Replication of individuals of great genius or great beauty to improve the species or to make life more pleasant. (2) Replication of the healthy to bypass the risk of genetic disease contained in the lottery of sexual recombination. (3) Provision of large sets of genetically identical humans for scientific studies on the relative importance of nature and nurture for various aspects of human performance. (4) Provision of a child to an infertile couple. (5) Provision of a child with a genotype of one's own choosing—of someone famous, of a departed loved one, of one's spouse or oneself. (6) Control of the sex of future children (the sex of a cloned offspring is the same as that of the adult from whom the donor nucleus was taken). (7) Production of sets of identical persons to perform special occupations in peace and war (not excluding espionage). (8) Production of embryonic replicas of each person, to be frozen

away until needed as a source of organs for transplantation to their genetically identical twin. (9) To beat the Russians and the Chinese, and thus to prevent a "cloning gap."

Cloning—some ethical questions

Some of the ethical and social questions raised in connection with *in vitro* fertilization apply also to cloning: questions of experimenting upon the unborn, discarding of embryos, problems of misuse and abuse of power, questions concerning the camel and the tent. I will not repeat what has gone before, except to call special attention to the point about the ethics of experimentation. A significant number of grossly abnormal creatures has resulted from the frog experiments, and there is no reason to be more optimistic about the early attempts in humans. If the attempts to clone a man result in the production of a defective "product," who will or should care for it, and what status and rights will it have? If the offspring is subhuman, are we to consider it murder to destroy it? The twin issues of the production and disposition of defectives provide sufficient moral grounds for rebutting any first attempt to clone a man. Again, there is no ethical way for us to get to know whether or not human cloning is feasible.

There are, however, other questions which apply specifically to cloning and not to the techniques discussed earlier. Among the most important are questions concerning identity and individuality. One problem can be illustrated by exploiting the ambiguity of the word "identity": The cloned person may experience serious concerns about his identity (distinctiveness) because his genotype, and hence his appearance, stand in a relationship of identity (sameness) to another human being.

The natural occurrence of identical twins in no way weakens the argument against the artificial production of identical humans; there are many things which occur accidentally that ought not to be done deliberately. In fact, the problem of identity faced by identical twins should instruct us and enable us to recognize how much greater the problem might be for someone who was the "child" (or "father") of his twin. I cannot improve upon Paul Ramsey's reflections on this subject:

> Growing up as a twin is difficult enough anyway; one's struggle for selfhood and identity must be against the very human being for whom no doubt there is also the greatest sympathy. Who then would want to be the son or daughter of his twin? To mix the parental and the twin

relation might well be psychologically disastrous for the young. Or to look at it from the point of view of parents, it is an awful enough responsibility to be the parent of a son or daughter as things now are. Our children begin with a unique genetic independence of us, analogous to the personal independence that sooner or later will have to be granted them or wrested from us. For us to choose to replicate ourselves in them, to make ourselves the foreknowers and creators of every one of their genetic predispositions, might well prove to be a psychologically and personally unendurable undertaking. For an elder to teach his "infant copy" is a repellent idea not because of the strangeness of it, but because we are altogether too familiar with the problems this would exponentially make more difficult.

Perhaps this issue can be pressed even farther, beyond such concerns for undesirable psychological consequences. Does it make sense to say that each person has a right not to be deliberately denied a unique genotype? Is one inherently injured by having been made the copy of another human being, independent of *which* human being? We should not be deterred by the strangeness of these questions, a strangeness due largely to the fact that the problem could not have arisen before.

Central to this matter is the idea of the dignity and worth of each human being. The question we must ask is this: Is individual dignity undermined by a lack of genetic distinctiveness? One might argue, on the contrary, that indistinctiveness in appearance and capacity might produce a greater incentive to be distinctive in deed and accomplishment. Certainly the latter are more germane to any measure of individual worth and self-esteem than the former. On the other hand, our personal appearance is, at the very least, symbolic of our individuality. Differences in personal appearance, genetically determined, reinforce (if not make possible) our sense of self, and hence lend support to the feelings of individual worth we seek in ourselves and from others. Some put it more strongly and argue that a man not only *has* a body, but *is* his body. By this argument, a man's distinctive countenance not only makes possible his sense of self, but is in fact at one with that self. Membership in a clone numbering five to ten would no doubt threaten one's sense of self; membership in a clone of two might also. To answer the question posed above: We may *not* be entitled, in principle, to a unique genotype, but we *are* entitled not to have deliberately weakened the necessary supports for a worthy life. Genetic distinctiveness would seem to me to be one such support.

A second and related problem of identity and individuality is this: The cloned individual is not simply denied genetic distinctive-

ness; he is saddled with a genotype that has already lived. He will not be fully a surprise to the world; people are likely always to compare his performance in life with that of his alter ego. He may also be burdened by knowledge of his precursor's life history. Imagine living with the knowledge that the person from whom you were cloned had subsequently developed schizophrenia or suffered multiple heart attacks before the age of 40. For these reasons, the cloned individual's belief in the openness of his own future may be undermined, and with it, his freedom to be himself. Ignorance of what lies ahead is a source of hope to the miserable, a spur to the talented, a necessary support for a tolerable—let alone worthy—life for all.

But is the cloned individual's future really determinable or determined? After all, only his genotype has been determined; it is true that his environment will exert considerable influence on who and what he becomes. However, isn't it likely that the "parents" will seek to manipulate and control the environment as well, in an attempt to reproduce the person who was copied? For example, if a couple decided to clone a Rubinstein,[14] is there any doubt that early in life young Artur would be deposited at the piano and "encouraged" to play? It would not matter to the "parents" that the environment in which the true Rubinstein blossomed can never be reproduced or even approximated. Nor would it matter that no one knows what is responsible for the development of genius, or even for the appearance of ordinary talents and traits for which other people might have elected to clone. Such ignorance would not deter the "parents." Why else did they clone young Artur in the first place?[15]

Thus, although the cloned individual's future is probably not determinable according to his "parents'" wishes, enough damage is done by leading him to believe otherwise and by their believing otherwise. His own potential will in all likelihood be stunted and his outlook warped as he is forced into a mold he neither fits nor wants. True, some parents are already guilty of the same crime, but many more are

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[14] Frequently mentioned candidates for cloning are musicians and mathematicians, such as Mozart, Newton, and Einstein, whose genius is presumed to have a large genetic component. But all such suggestions ignore the wishes of these men. I suspect that none of them would consent to having themselves replicated. Indeed, should we not assert as a principle that any so-called great man who *did* consent to be cloned should on that basis be disqualified, as possessing too high an opinion of himself and of his genes? Can we stand an increase in arrogance?

[15] These reasons make it clear that it will probably prove impossible to keep the knowledge of his origin from the child, especially in the early cases when the geneticist's need to claim credit for his success will also be a factor.

restrained by their impotence in determining the raw material. The opportunity to clone would not only remove this restraint, but would openly invite and encourage more outrageous efforts to shape our children after our own desires.

Although these arguments would apply with even greater force to any large scale efforts at human cloning, I find them sufficient to reject even the first attempts at human cloning. It cannot be repeated too often that these are human beings upon whom these eugenic or merely playful visions (shall I say hallucinations?) are to be worked.

Thus far, I have dealt separately with two technological prospects —one now upon us, the other on the horizon and fast approaching— in an effort to reason about and evaluate each piece of technology one at a time. I have been at pains to analyze the morally relevant features of each, in order to show that real and important distinctions can and should be drawn among different technologies, that the practice of one should not *ipso facto* justify the introduction of another. I am far more concerned that this approach be found reasonable and useful than that of any of my specific arguments be found convincing.

Yet despite its practical utility, this piece-by-piece approach has grave deficiencies. It ignores the great wave upon which each of these techniques is but a ripple. All of the new technologies arise from and are part of the great project of modernity, the "conquest of nature for the relief of man's estate." They go beyond many earlier techniques in that they seek to relieve man's estate by directly changing man himself. We must therefore raise some broader questions concerning this project as these questions arise in connection with the technologies discussed above. Here, I am far more concerned that my arguments be found convincing than that they be found useful.

Questions of power

Though philosophically debatable, the Baconian principle "knowledge is power" is certainly correct when applied to that knowledge which has been sought under that principle. The knowledge of how to begin human life in new ways is a human power to do so. But the power rests only metaphorically with humankind; it rests in fact with particular men—geneticists, embryologists, obstetricians. The triumphant proclamation of "man's" growing power over nature obscures the troublesome reality that it is individual men who wield

power. What we really mean by "man's power over nature" is a power exercised by some men over other men with the knowledge of nature as their instrument.

While applicable to technology in general, these reflections are especially pertinent to the technologies of human reproduction and genetic manipulation with which men deliberately exercise power over future generations. Ultimately, as C. S. Lewis points out in *The Abolition of Man,*

> If any one age really attains, by eugenics and scientific education, the power to make its descendants what it pleases, all men who live after it are patients of that power. They are weaker, not stronger: For though we may have put wonderful machines in their hands we have preordained how they are to use them. . . . The real picture is that of one dominant age . . . which resists all previous ages most successfully and dominates all subsequent ages most irresistibly, and thus is the real master of the human species. But even within this master generation (itself an infinitesimal minority of the species) the power will be exercised by a minority smaller still. Man's conquest of nature, if the dreams of the scientific planners are realized, means the rule of a few hundreds of men over billions upon billions of men. There neither is nor can there be any simple increase in power on man's side. Each new power won *by* man is a power *over* man as well.

Please observe that I am not yet speaking about the problem of the misuse and abuse of power. My point is rather that the power which grows is willy-nilly the power of only some men, and that the number of these powerful men tends to grow fewer and fewer as the power increases.

I suggest that this is also true with respect to our topic. Recall that there is a new partner in these new procedures for making babies—the scientist-physician. The obstetrician is no longer just the midwife, but also the sower of seed. Even in the treatment of intramarital infertility, the scientist-physician who employs *in vitro* fertilization and laboratory culture of human embryos has acquired far greater power over human life than his colleague who simply repairs the obstructed oviduct. He presides over many creations in many patients. And once he goes beyond the bounds of marriage, he is not simply the Fertilizer General but the Matchmaker as well —as in the practice of artificial insemination (donor), where a small number of physicians have already arranged for the fathering of several hundred thousand children, many of them, nepotistically, by their professional offspring, the medical students. I am not at present questioning this practice; my point is rather to illustrate how the new technologies lead to the concentration of power.

Both a cause and an effect of the growing power of biomedical technologists is the growing complexity of scientific knowledge, and the related fragmentation of disciplines and extreme specialization of their practitioners. Science understands and explains the world in ideas and language which the layman cannot understand. I am not speaking now about the problem of jargon, but rather about a more fundamental matter. The phenomena of nature as they present themselves to us in ordinary experience are understood by the scientist in terms of abstract concepts such as molecules and genes, and ultimately in terms of mathematical formulae. This is to the layman a new cabala, but a cabala with a difference, a cabala that can create new life in test tubes and can send men to the moon. Small wonder that the scientists and technologists have become for many people the new priesthood.[16]

Because this new priesthood has promised its rewards here on earth, it faces perhaps a heavier responsibility—especially when it fails to deliver. The public has acquired high expectations for technology, from which impatience and frustration are easily bred. This point has been surprisingly overlooked, but I think this is what is meant every time someone starts to complain, "Well, if they can put a man on the moon, why can't they . . .?" Given this general disposition with regard to science and technology, is it not likely that the expectations of an infertile couple will be much higher for any baby given them by the rationalized, disinfected procedures of the laboratory, than for a baby born in the usual way and obtained via adoption? Even with adequate warnings, it will be hard to get the science-worshipping patient to face the reality of possible disastrous outcome. Imagine the heartache, and then the outcry, if the child conceived *in vitro* turns out to be hemophiliac or retarded (even for reasons unrelated to the use of the procedure). On this ground alone, prudence dictates caution.

The problem of the specific abuses of specific powers cannot be overlooked. However, because it is more widely appreciated, I will

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[16] At a recent meeting, scientists were summarizing for a group of educated laymen the current state of knowledge in human genetics and the promising fields for the future. At the conclusion of a summary of studies on mutation, a woman rose in the audience to ask about the meaning of one of the findings for the chance of her having an abnormal child. The answer came back that the matter was complicated, involving some function of "one over the square root of the mean." The woman seated herself with a look of bewilderment on her face, but shaking her head affirmatively, "Amen."

There is of course a revolt in progress against this new priesthood, but primarily because it has been selling indulgences to the Pentagon or because its blessings are not biodegradable. Very few are questioning the intellectual foundations of the modern scientific conception of the world.

spend little time on it. It is sufficient merely to mention the prospects of involuntary breeding programs, the cloning of tyrants, and the production of whole cadres of "gammas" and "deltas" to handle the onerous tasks of an advanced civilization, or the more modest abuses of cloning quintuplets for the circus, for five complete sets of spare organs, or for partners in crime who can always have an alibi. Nevertheless, while events which have occurred in our lifetime should warn us not to dismiss these possibilities, I think we have greater reason to be concerned about the private, well-intentioned, and voluntary use of the new technologies. The major problem to be feared is not tyranny but voluntary dehumanization.

Questions of dehumanization

Human procreation not only issues new human beings; it is itself a human activity (an activity of embodied men and women). The new forms of baby making discussed earlier represent in themselves a radical change in human procreation as a human activity. As already noted, the new beginnings occur in a new locus, the laboratory, and involve a new partner, the scientist. Moreover, the techniques which at first serve merely to provide a child to a childless couple will soon be used to exert control over the quality of the child. A new image of human procreation has been conceived, and a new "scientific" obstetrics will usher it into existence. As one obstetrician put it at a recent conference, "The business of obstetrics is to produce *optimum* babies." The price to be paid for this optimum baby is the transfer of procreation from the home to the laboratory, and its coincident transformation into manufacture. Increasing control over the product is purchased by the increasing depersonalization of the process. (In this continuum, artificial insemination represented the first step.) Perhaps for some techniques used for some purposes, e.g., artificial insemination (husband) to circumvent infertility, the benefits outweigh the costs. But let us not say that there are not costs. The complete depersonalization of procreation (possible with the development of an artificial placenta), and its surrender to the demands of the calculating will, would be in themselves seriously dehumanizing no matter how "optimum" the product.

Human procreation is not simply an activity of our rational wills. Men and women are embodied as well as desiring and calculating creatures. It is for the gods to create in thought and by fiat ("Let the earth bring forth . . ."). And some future race of demigods (or

demimen) may obtain its survivors from the local fertilization and decanting station. But *human* procreation is begetting. It is a more complete human activity precisely because it engages us bodily and spiritually, as well as rationally. Is there possibly some wisdom in that mystery of nature which joins the pleasure of sex, the communication of love, and the desire for children in the very activity by which we continue the chain of human existence? Is biological parenthood a built-in "device" selected to promote the adequate caring for posterity? Before we embark on new modes of reproduction, we should consider the meaning of the union between sex, love, and procreation, and the meaning and consequences of its cleavage.

My point is almost certain to be misunderstood. I am not suggesting that one can be truly human only by engaging in procreation. I think there is a clear need for curtailing procreation, and have no objections to the use of any and all contraceptive devices. I am not suggesting that there is something inhuman about adopting children instead of getting them through the pelvis, nor do I think that the most distinctively human activities center in the groin. My point is simply this: There are more and less human ways of bringing a child into the world. I am arguing that the laboratory production of human beings is no longer *human* procreation, that making babies in laboratories—even "perfect" babies—means a degradation of parenthood.

There will be some who object to my calling the new technologies forms of manufacture. I mean "manufacture" in quite a literal sense —*hand made*. It matters not whether we are talking about small- or large-scale manufacture. With *in vitro* fertilization, the natural process of generating becomes the artificial process of making. In the case of cloning, the artistry is taken one step further. Not only is the process *in hand,* but the total genetic blueprint of the cloned offspring is selected and determined by the human artisan. To be sure, the subsequent development is still according to natural processes, and no so-called laws of nature have been or can be violated. What has been violated, even if only slightly, is the distinction between the natural and the artificial, and at its very root, the nature of man himself. For man is the watershed that divides the world of the familiar into those things which belong to nature and those things which are made by men. *To lay one's hands on human generation is to take a major step toward making man himself simply another one of the man-made things.* Thus, human nature becomes simply the last part of nature which is to succumb to the modern techno-

logical project, a project which has already turned the rest of nature into raw material at human disposal, to be homogenized by our rationalized technique according to the artistic conventions of the day.

The family: a final solution?

If the depersonalization of the process of reproduction and its separation from human sexuality dehumanize the activity which brings new life, and if the manufacture of human life threatens its humanness, both together add up to yet another assault on the existence of marriage and the human family. Sex is now comfortably at home outside of marriage; child rearing is progressively being turned over to other institutions: the state, the schools, the mass media, the child-care centers. Transfer of procreation to the laboratory undermines the justification and support which biological parenthood gives to the monogamous (or even polygamous) marriage. Cloning adds an additional, more specific, and more fundamental threat: The technique renders males obsolete. All it requires are human eggs, nuclei, and (for the time being) uteri. All three can be supplied by women.

Curiously, both those who welcome and those who fear the new technologies for making babies agree that they will pose serious threats to marriage and the family. Indeed, one of the reasons, not always explicitly admitted, that the new technologies are endorsed in some quarters is precisely that they will help lay these institutions to rest. The congregation of deliberate family wreckers includes persons eager to remove all restraints from human sexuality or to render obsolete the biological differences between the sexes, others who see the destruction of marriage as a needed step in limiting population growth, and yet others who find the modern nuclear family a stifling and harmful institution for education and child rearing. I will not deny that the modern nuclear family shows signs of cracking under various pressures. It may have intrinsic limitations which make it seem, even at best, ill-fitted for modern technological society. But perhaps this should be viewed as a problem of modern technological society rather than of the family. We really ought to be less frivolous and journalistic in discussing such matters, and should keep in mind the essential question: Are we to accept as desirable the final solution which eliminates biological kinship from the foundation of social organization? Yes, laboratory and governmental alternatives could be devised for procreation and child bearing. But at what cost? How much stunting of our humanity

would result from the totalitarian orientation that these alternatives require and foster?

Some of the important virtues of the family are, nowadays, too often overlooked. The family is rapidly becoming the only institution in an increasingly impersonal world where each person is loved not for what he does or makes, but simply because he is. The family is also the institution where most of us, both as children and as parents, acquire a sense of continuity with the past and a sense of commitment to the future. Without the family, most of us would have little incentive to take an interest in anything after our own deaths. It would be a just irony if programs of cloning or laboratory-controlled reproduction to improve the genetic constitutions of future generations were to undermine the very institution which teaches us concern for the future. These observations suggest to me that the elimination of the family would weaken ties to past and present, and would throw us even more on the mercy of an impersonal, lonely present. The burden of proof should fall upon those believing our humanness could survive even if the biological family does not.

Dehumanizing the scientist

Finally, there may well be a dehumanizing effect on the scientist himself, and through him, on all of us. The men who are at work on new beginnings in life are out to subdue one of the most magnificent mysteries, the mystery of birth and renewal. To some extent, the mystery has already been subdued. Those who do *in vitro* fertilization are in the business of initiating new life. To the extent that they feel that there is nothing unusual or awesome in what they are doing, to that extent they have already lost the appreciation of mystery, the sense of wonder. The same can be said of the heart surgeon who sees the heart simply as a pump, the brain surgeon who sees the brain simply as a computer, or the pathologist who sees the corpse simply as a body containing demonstrable pathology. The sense of mystery and awe I am speaking of is demonstrated by most medical students on their first encounter with a cadaver in the gross anatomy laboratory. Their uncomfortable feeling is more than squeamishness. It is a deep recognition, no matter how inarticulate, that it is the mortal remains of a human being in which they are to be digging; ultimately it is a recognition of the mysterious phenomena of life and death. The loss of this sense of awe occurs in a matter of days or weeks; mastery drives out mystery in all but a very few.

There is, I admit, no reason in principle why the sense of mystery needs to be lost by the increase of knowledge or power. And, indeed, in the case of the great men of science knowledge served to increase rather than to decrease their sense of wonder and awe. Nevertheless, for most ordinary men of science and technology, and probably for most men in this technological age, once nature is seen as or transformed into material and given over to their manipulation, the mystery and the appreciation are gone. Awed by nothing, freed from all so-called superstitions and so-called atavistic beliefs, they practice their power without even knowing what price they have paid.

Consider in this connection these excerpts from an editorial in *Nature* ("Premature Birth of Test Tube Baby," Vol. 225, p. 886, March 7, 1970) concerning adverse public reaction in Britain to the announcement (apparently erroneous) that Drs. Edwards and Steptoe were at that time about to do the first transfer of a laboratory-grown human embryo into a woman's uterus to circumvent her infertility.

> What has all this to do with the test tube baby? In terms of scientific fact, almost nothing at all. The test tube baby, as this phrase is usually understood, refers to the growing of a human embryo to full term outside the body and the chief obstacle to this feat (not that anybody has proclaimed it as a goal) is the formidable problem of maintaining the embryo after the stage at which it would normally implant in the uterus. The Oldham procedure concerns only the pre-implantation embryo which, except in the trivial sense that fertilization is carried out *in vitro,* can hardly be equated with the test tube baby. Moreover, it is difficult to see that the wastage of embryos occasioned by the procedure raises moral problems any knottier than those to do with IUCD, a device that probably prevents the embryo from implanting in the womb. What then was all the fuss about? . . .
>
> A curious feature of the public debate is that the letter-writing segment of the public, at least, seemed to believe that human life was about to be created from nothing in the test tube. For example, a correspondent in *The Times* voiced the fear that "The ability of scientists to develop the technique of creating life in a test tube is so serious that I feel human beings should be given the opportunity to express their views on whether or not this line of research should be pursued . . . [sic] Personally I find the idea of creating life at man's will terrifying." These are indeed dark and atavistic fears which have been nurtured, perhaps, by the views of Dr. Edmund Leach that scientists have usurped the creative powers and should assume the moral responsibilities formerly attributed to gods. Whatever the merit of Dr. Leach's thesis, those who are engaged in research that is at all liable to be misinterpreted will doubtless take the present episode as a warning of the misunderstandings that can arise,

particularly if the true facts are not readily available from authoritative sources. There is always the danger that lack of information or misinformation may convert legitimate public concern about new knowledge into a paranoia that impedes research.

The moral is clear. Research, the supreme value, is to be protected from the dark "atavistic" fears of an ignorant public by the "authoritative" dispensation of (only) the "true facts."

The first paragraph of the excerpt contains the hard, cold, technical facts, presented "scientifically" by the scientist-editor of *Nature.* That editor finds it "curious" that the public had a somewhat different view of what was done; he erroneously attributes this difference to the public's lack of the "true facts." The source of the difference, however, is not the lack of information, but rather a difference in interpretation; the real reason for the difference is that the editor of *Nature* lacks, whereas the correspondent in *The Times* does not, a sense of mystery and awe concerning the initiation of new life. The editor is correct in distinguishing *in vitro* fertilization from full extracorporeal gestation, and partly correct in analogizing the question of disposal of embryos to the question concerning the IUCD (but not in thus disposing of the question). But by calling "trivial" the fact that fertilization has occurred *in vitro,* and embryonic development has been initiated, he displays his own human impoverishment. I do not insist that the embryo created is a human life worthy of protection; but it surely is alive, and it surely is potentially human. To look upon these embryos as anything less than potential human life in human hands is a misperception so gross as to be alarming.

We have paid some high prices for the technological conquest of nature, but none perhaps so high as the intellectual and spiritual costs of seeing nature as mere material for our manipulation, exploitation, and transformation. With the powers for biological engineering now gathering, there will be splendid new opportunities for a similar degradation in our view of man. Indeed, we are already witnessing the erosion of our idea of man as something splendid or divine, as a creature with freedom and dignity. And clearly, if we come to see ourselves as meat, then meat we shall become.

"Humanization"—man as self-creator

Among those who would take strong exception to my remarks on dehumanization are those who argue that the new biomedical technologies, including those which make possible new methods for

making babies, provide the means for human self-modification and therefore improvement. They see man as imperfect, unfinished, but endowed with creative powers to complete and perfect himself. Included in this group are scientists such as Robert Sinsheimer:

> For the first time in all time a living creature understands its origin and can undertake to design its future. Even in the ancient myths man was constrained by his essence. He could not rise above his nature to chart his destiny. Today we can envision that chance—and its dark companion of awesome choice and responsibility. . . . We are an historic innovation. We can be the agent of transition to a wholly new path of evolution. This is a cosmic event.

And theologians, such as Karl Rahner:

> Freedom enables man to determine himself irrevocably, to be for all eternity what he himself has chosen to make himself.

We note in passing that the theologians have done the scientists one better. Many scientists take the fatalistic view that "what can be done, will be done." Those theologians-turned-technocrats sanctify the new freedoms: "What can be done, should be done."

The notion of man as a creature who is free to create himself, as a "freedom-event," to use one of Rahner's formulations, is problematic, to say the least. It is an idea that is purely formal, not to say empty. It provides no boundaries that would indicate when what was subhuman became truly human, or when what was at first human became less than human. Moreover, the freedom to change one's nature includes the freedom to destroy (by genetic manipulation or brain modification) one's nature, and thereby the capacity and desire for freedom itself. It is, literally, a freedom which can end all freedom. Nor can it provide standards by which to measure whether the changes made are in fact improvements. Evolution simply means change—to measure "progress" requires a standard which this view cannot in principle supply.

The new technologies for human engineering may well be the "transition to a wholly new path of evolution." They may, therefore, mark the end of *human* life as we and all other humans have known it. It is possible that the non-human life that may take our place will be in some sense superior—though I personally think it most unlikely, and certainly not demonstrable. In either case, we are ourselves human beings; therefore, it is proper for us to have a proprietary interest in our survival, and in our survival *as human beings.* This is a difficult enough task without having to confront the prospect of a utopian, constant remaking of our biological nature with all-powerful means but with no end in view.

A matter of wisdom

I had earlier raised the question of whether we have sufficient wisdom to embark upon new ways for making babies, on an individual scale as well as in the mass. By now it should be clear that I believe the answer must be a resounding "No." To have developed to the point of introduction such massive powers, with so little deliberation over the desirability of their use, can hardly be regarded as evidence of wisdom. And to deny that questions of desirability, of better and worse, can be the subject of rational deliberation, to deny that rationality might dictate that there are some things that we can do which we must never do—in short, to deny the need for wisdom—can only be regarded as the height of folly.

Let us simply look at what we have done in our conquest of nonhuman nature. We shall find there no grounds for optimism as we now consider offers to turn our technology loose on human nature. In the absence of standards to guide and restrain the use of this awesome power, we can only dehumanize man as we have despoiled our planet. The knowledge of these standards requires a wisdom we do not possess, and what is worse, we do not even seek.

But we have an alternative. In the absence of such wisdom, we can be wise enough to know that we are not wise enough. When we lack sufficient wisdom to do, wisdom consists in not doing. Restraint, caution, abstention, delay are what this second-best (and maybe only) wisdom dictates with respect to baby manufacture, and with respect to various other forms of human engineering made possible by other new biomedical technologies. It remains for another time to discuss how to give practical effect to this conclusion: how to establish reasonable procedures for monitoring, reviewing, and regulating the new technologies; how to deal with the undesirable consequences of their proper use; how to forestall or prevent the introduction of the worst innovations; how to achieve effective international controls so that one nation's folly does not lead the world into degradation.

Fortunately, there are no compelling reasons to proceed rapidly with these new methods for making babies. Though it saddens the life of many couples, infertility is hardly one of our major social problems. Moreover, there are other means of circumventing it that are free of the enormous moral and social problems discussed earlier. At a time when we desperately need to limit population growth, it may be a questionable sentimentality which seeks to provide every couple with its own biological child rather than

continue the practice of adoption. But it would be a foolish sentimentality to unleash baby-making technologies for this purpose, especially before there are means to limit and control their use. The same arguments apply, with equal force, to the use of these technologies for the eradication of genetic disease. We probably do not know enough about the genetics of man, despite our well-meaning desires, to prevent genetic disease by the practice of eugenic abortion (e.g., following amniocentesis). We certainly don't know enough to escalate our tinkering by the eugenic use of the new baby-making techniques.

I am aware that mine is, at least on first glance, not the most compassionate view (although it may very well turn out to be so in the long run). I am aware that there are some who now suffer who will not get relief, should my view prevail. Nevertheless we must measure the cost—I do not mean the financial cost—of seeking to eradicate that suffering by any and all means. In measuring the cost, we must of course evaluate each technological step in its own terms—but we can ill afford to ignore its place in the longer journey. For, defensible step by defensible step, we could willingly walk to our own degradation. The road to Brave New World is paved with sentimentality—yes, even with love and charity. Have we enough sense to turn back?

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Irving Kristol, Editor