

## While Bioethics Fiddles

*Brendan P. Foht*

Last September saw the announcement from scientists of the first manufacture of human egg cells in the lab. As surprising as it may sound, the creation in a lab of human sex cells using stem cells has been in the works for over a decade, with earlier experiments succeeding in deriving primordial germ cells, the cells of an early embryo that eventually give rise to sperm and egg cells.

In the past, embryonic stem cells were used for these experiments. But researchers have begun to favor a relatively recent innovation: induced pluripotent stem cells, which have essentially the same properties as embryonic stem cells but are created by manipulating ordinary adult cells rather than by destroying embryos. For reproductive applications, creating egg or sperm cells using stem cells taken from adult patients would be more desirable than using embryonic stem cells, since patients would be able to use the resulting cells to make children genetically related to themselves, rather than to destroyed embryos.

Despite the apparent breakthrough, it will be years yet before lab-created sex cells are ready for use in human reproduction. But the development nonetheless raises the question of whether it is a milestone on the road toward a world of dramatic technical powers over human reproduction—a world of cloning, designer babies, and children with four genetic parents. Indeed, a phalanx of prophets have for years been eagerly awaiting this very news.

A century after the heyday of eugenics, morally obtuse advocates for human enhancement, along with a collection of libertarians and assorted cranks, continue to hold out hope for its return in a redeemed form, one that is voluntary and medical rather than state-controlled and racist. While they posture as hard-nosed technocrats or bold advocates of reproductive freedom, the schemes they endorse are poorly thought through and plainly inspired by the crazed dreams of the original eugenics movement. Their shallow view of the moral problems posed by eugenic control—which for them begin and end at the possibility of state coercion—ignores the many ways that prejudice and social pressure can also shape the decisions of parents. And their outlook offers no sense whatsoever that the

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transformation of procreation into a manufacturing process, subject to strict quality control, might undermine the unconditional love we expect and value between parents and their children.

### **In Vitro Eggs**

Before egg cells derived from stem cells change the way people have babies, they will likely accelerate existing forms of embryo research. Scientists trying to conduct human cloning experiments have long been frustrated by the difficulty of acquiring human egg cells, and a reliable source of stem cell–derived egg cells would be a boon to the struggling field of human cloning. But cloning is not the only kind of embryo research that stem cell–derived eggs would make easier. Scientists are already using the gene-editing tool CRISPR to tinker with human embryos to better understand embryology and genetics, and if it becomes easier to acquire human egg cells, and hence to make embryos, such experiments will only become more common. Making cloning or CRISPR experiments on human embryos easier to conduct will in turn make it easier for scientists to push these techniques toward use in assisted-reproduction clinics. While these practical considerations perhaps make it a higher priority for scientists to manufacture egg cells than sperm cells, researchers have also been working on ways to derive male sex cells, even though there have not yet been reports of the successful creation of sperm cells comparable to the recent breakthrough with egg cells.

If stem cell–derived gametes (the general term for egg and sperm cells) do come to be used for human reproduction, many of the already troubling aspects of in vitro fertilization (IVF) will likewise be made more extreme. Reproduction will become even more like a manufacturing process, with doctors producing greater numbers of embryos and subjecting them to more rigorous “quality control” and selection—discarding ever more embryos considered to be defective or simply to have undesirable traits.

Stem cell–derived gametes would also make the direct genetic engineering of children easier: Rather than attempting to genetically modify embryos, doctors can genetically engineer the colonies of stem cells used to make the gametes. More speculative possibilities—like the derivation of sperm from the cells of women, or eggs from the cells of men—might allow same-sex couples to have biologically related children, or could allow single individuals to breed with themselves. Even more disturbing is the prospect of “multiplex parenting,” where babies are produced from

the genetic material of more than two parents. If two couples wanted to have a baby together, they could each have IVF embryos created, which would then be destroyed to create stem cells. From each of the two stem cell lines, new gametes could be generated, which could then be used to create a new embryo that would be related to both of the two couples, who would, genetically speaking, be that embryo's grandparents, with its genetic parents being the embryos destroyed to create the stem cells.

Despite the cliché that “science is moving so fast that ethics just can't keep up,” there has been plenty of ethical commentary on the implications of stem cell–derived gametes over the past ten years. But looking at how ethicists have in fact reflected on the use of stem cell–derived gametes, we can see some of the recurring themes in discussions of reproductive technology: schemes for human enhancement that are plainly influenced by the old-line eugenics movement, updated versions of eugenics as an ideology of parental choice and technocratic management, and contrarian defenses of morally repugnant reproductive arrangements in the name of autonomy. We find ethicists and scientists acting with what Paul Ramsey characterized as the “frivolous conscience”—raising “ethical” questions without taking seriously the possibility that the answer to those questions would be that a technological development or line of research is wrong.

### **The Old Eugenic Dream, Again**

With their schemes for human enhancement, transhumanists are bound to pay attention to any new biotechnology, and stem cell–derived gametes are no exception. A good example of a human enhancement scheme inspired by stem cell–derived gametes is the “iterated embryo selection” proposed by transhumanist philosopher Nick Bostrom in his 2014 best-seller *Superintelligence*.

His proposal is to use stem cell–derived gametes as part of a strategy for conducting eugenic selection for intelligence on dozens or hundreds of generations of embryos. (As the book's name suggests, intelligence is the trait Bostrom is interested in, but the strategy could work with whatever heritable traits the eugenicist wants to propagate.) The in vitro eugenicists would first make embryos, either from stem cell–derived gametes or through old-fashioned IVF, and then do genetic diagnosis to find the embryos with genes for intelligence. Instead of allowing these embryos to grow into intelligent babies, the embryos would be destroyed to make stem cells, which would, in turn, be used to create gametes from which a new

generation of embryos could be created, which could then be once again selected for intelligence. This process could go on for dozens of generations and would be akin to the old dream of the eugenicists—controlling human breeding the way farmers control the breeding of their animals, and with the same dramatic results.

The old eugenicists tried to do this with humans, but they were unable to succeed—most people don't want their own reproductive choices made for them by government scientists, even if too many in the twentieth century were happy enough to see the state sterilize thousands of women and men who were deemed unfit or undesirable. Some writers, like ethics professor Nicholas Agar, have argued that reproductive technologies such as pre-implantation genetic diagnosis could allow for a "liberal eugenics" that "will allow prospective parents to look to their own values in selecting improvements for future children." But for Bostrom the appeal of the technology of iterated embryo selection is more about its vastly greater efficiency, making it "possible to accomplish ten or more generations of selection in just a few years." His goal is not to expand human procreative choice, but to enhance the intelligence of biological human beings so that we will stand a chance against the super-intelligent robots of the future—a scenario that makes the usual concerns accompanying reproductive technologies, like the desire of parents for genetically related children, seem rather secondary.

This kind of mass farming of human embryos to create genetically enhanced children who would be dozens of generations removed from any living human ancestors certainly introduces new ethical problems even as it avoids the moral problems of mass sterilization that characterized earlier eugenic efforts. And Bostrom acknowledges that "some countries might prohibit its use altogether, on moral or religious grounds," though he predicts that eventually, "many of the initially reluctant might join the bandwagon in order to have a child that is not at a disadvantage relative to the enhanced children of their friends and colleagues."

But even setting aside the grim moral implications of "iterated embryo selection," the whole scheme is ridiculous on its own terms, and is based on an elementary misunderstanding of the power of natural selection in evolution and of artificial selection in animal breeding. In both natural and artificial selection, what gets selected is not some combination of DNA but a heritable trait—say, size or intelligence. When nature "selects" animals to succeed in survival and reproduction, she certainly doesn't know anything about their DNA; all that nature "knows" is that this rabbit escaped all the foxes trying to eat it while that rabbit didn't. If the rabbit managed

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to escape because of genes disposing it to be faster, or better camouflaged, then those genes will be passed on to future generations. When a farmer selects for bigger cows, he just measures his cows and picks the biggest ones to breed. He doesn't need to know anything about what particular genes might be involved in size. If there is some heritable genetic element related to size, then selection for size will, over the generations, result in bigger cows being born.

But Bostrom's "iterated embryo selection" can't work like this. A pre-implantation human embryo won't exhibit any of the traits that the eugenicist would be interested in selecting for. You can't tell if an eight-day-old human embryo will grow up to be particularly intelligent, strong, healthy or whatever else, except by looking at its DNA. In other words, you could only select for combinations of DNA that you *already know* are related to the trait you are looking for. But the advantage of artificial selection is that it can work without this kind of complete understanding of molecular genetics and developmental biology. It just requires rough estimates of the heritability of different traits and the ability to measure those traits. If we already knew exactly what kinds of combinations of DNA gave rise to traits like intelligence, why not just edit the genome of either the embryo or the stem cells to have such DNA?

Bostrom doesn't seem to acknowledge this limitation of embryo selection, though he does suggest that eventually "it may become possible to synthesize genomes to specification, obviating the need for large pools of embryos." Of embryo selection, however, Bostrom claims that it "does not require a deep understanding of the causal pathways by which genes, in complicated interplay with environments, produce phenotypes [traits]: it requires only (lots of) data on the genetic correlates of the traits of interest." Knowledge of genetic correlates can only go so far, and certainly won't work to produce the "superintelligence" Bostrom seeks: If all we have to go on are the genetic correlates of intelligence as it is found in existing human populations, we would not possibly be able to identify the genetic correlates of the super-human or "posthuman" intelligence Bostrom is after.

Beyond its practical problems, there are myriad ways the farming of embryos and stem cells for hundreds of generations could go wrong. Deriving gametes from stem cells dozens or hundreds of times introduces just that many more chances for errors and accidents in the procedures used to manufacture these cells. We can also easily imagine unpredictable complications: For example, at the same time as scientists are conducting artificial selection on generations of embryos for traits like intelligence, there would also be a kind of natural selection at work. Not all attempts

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to derive embryonic stem cells from embryos are successful, and it may be that there are genetic factors that make some embryos easier to turn into stem cell lines. Over dozens of generations of turning embryos into stem cells and back into embryos, genetic variants that dispose embryos to make good stem cells might then start piling up. But the genes that make a stem cell thrive might have very different effects in an adult. Consider that some of the genes we know are highly active in stem cells are also highly active in cancer cells, which means it is possible that “iterated embryo selection” also inadvertently increases the chances a person develops cancer. Of course, scientists would select against embryos with potentially cancer-causing variants in the genes we do know about, but there could be any number of genetic variants that doctors wouldn’t be ready to identify until it’s too late. With all of this selection operating on days-old embryos and stem cells kept in the lab, any genes that have negative effects at later stages of development will go unnoticed.

Any of the moral concerns raised by directly editing genes apply even more so to genetic selection, and all the more so to the iterative genetic selection proposed by Bostrom: The noxious attitude that a person’s worth is determined by his or her genetic endowment, which gene-editing might foster, could not be expressed more clearly than by selectively throwing away dozens or hundreds of embryos deemed genetically unfit. And whether a baby’s DNA is selected or edited, that child is being treated as an object to be designed in accordance with its parents’ whims, rather than a gift to be unconditionally loved.

Bostrom’s embrace of selective breeding on a mass scale—albeit at the level of embryos and stem cells—reveals the enduring attraction of the old eugenic dream.

### **Parental Technocracy: The New Eugenics**

This brings us to the more respectable side of the bioethics profession, represented by Stanford law professor Henry Greely, who got in on the provocative-title racket with his 2016 book *The End of Sex and the Future of Human Reproduction*. What Greely predicts is that stem cell-derived gametes will make IVF so cheap and easy that essentially everyone who chooses to have a baby will use it. Part of the reason stem cell-derived gametes will be so attractive is that they will allow couples to use IVF without having to collect egg cells from the mother, which is an expensive, uncomfortable, and even dangerous part of the process. Also, allowing doctors to produce hundreds of eggs rather than collecting just a

dozen or so means that many more embryos can be created, which, along with increasingly cheap and reliable DNA sequencing, will mean that the very best, most healthy embryos could be picked. And all this will be paid for by insurance companies or governments, since it will save millions in paying for the medical costs imposed by genetic disease.

In the book, Greely doesn't make a strong argument in favor of this set of developments, taking instead a posture of thoughtfully asking questions and making serious predictions about where science is taking us. He makes a few modest recommendations for regulating this technology, writing for instance that "I would largely ban making someone a genetic parent without his or her consent." He also finds people who want to become a "uniparent"—a single person making a baby from both sperm and egg cells derived from their own stem cells—"outrageously egomaniacal and just plain silly," although he is "not sure that is a good reason to ban the process." He does, however, think that "uniparents" should probably be required to use pre-implantation genetic diagnosis to weed out any defective embryos among the inbred batch they create.

Even these modest recommendations, however, are undermined by Greely's impassioned argument that any rules governing these techniques be regularly updated by a standing commission charged with monitoring the stem cell-derived gametes, and that rules passed today should have "sunset" provisions built into them. Greely believes that any efforts at regulating these technologies should have such limitations because he has "few principles I am confident should apply in all cultures, to all situations, and over all of time."

The principle that parenthood matters enough that it should not be forced on a person without their knowledge or consent is, however, one that we can be confident should apply over all of time. We can perhaps imagine a culture that abandons this principle, one where people would select genetic material for future generations by considering how to provide children with the most desirable traits. Biological parenthood in such a culture might become a meaningless and arbitrary relation that comes with no expectations of duty or affection. In such a culture where procreation, love, and family are all severed from one another, it might be quite acceptable to use genetic material from the best and brightest to manufacture future generations, without any expectation that the donors of this material know about it or not, so depersonalized would be the begetting of offspring. To imagine such a culture—where parenthood is held as such a cheap bond that making someone a genetic parent without consent is considered acceptable—is to be horrified. But in this

horror we can see why governing reproductive technology matters. The decisions we make today are meant precisely to preserve humanity from such degradation.

While Bostrom the transhumanist clearly wants to defend the old eugenic dream of putting the unguided process of human evolution under rational control, Greely the respectable, serious-minded law professor updates the eugenics project in a more insidious way. In his vision of the future, eugenic control is exercised by parents, but under the gently paternalistic nudging of governments or health insurance bureaucracies. Such control is not exercised for grandiose projects of transforming the human species, but is rather just another technocratic set of market-oriented reforms to human reproductive choices, meant to help bend the cost curve. It's a truly bleak vision of the future, where compassion for the sick is replaced by cold, efficient selection, and where moral clarity is replaced by a cloying relativism.

### **The Case for the “Yuck Factor”**

Perhaps even more disturbing than the prospect of creating gametes from individuals without their knowledge or consent is the way stem cell-derived gametes could be used to create children with multiple genetic parents. Such “multiplex parenting” is almost a caricature of a slippery-slope argument against using stem cell-derived gametes. It's such a creepy and bizarre idea that it's almost impossible to imagine anyone wanting to carry it out. Using reproductive technologies to select or engineer “better babies” may be disconcerting, but it is easy to see the temptation. But surely there aren't pairs of couples out there who are interested in creating genetic grandchildren together through experimental reproductive technologies.

Indeed, there doesn't seem to be a real demand for this kind of application of stem cell-derived gametes, and so we might expect the idea to be just a straw man built up by Luddites to scare people into opposing the technique. And yet, there are already ethicists defending this practice against the Luddites. In a 2017 paper on the ethics of stem cell-derived gametes, Annelien L. Bredenoord and Insoo Hyun described multiplex parenting as “the most paradigm-shifting use of stem cell-derived gametes.” They acknowledge that such applications “will inevitably trigger ‘this is unnatural’ type of objections, or appeals on the ‘yuck factor,’” before noting that such objections “have been proven flawed and morally prejudiced in earlier discussions.”

If “morally prejudiced” here refers to the sentiments characteristic of people who have a sense of morality, as distinct from the ideas and attitudes of those who do not, then the authors’ assessment is fair. What is important to Bredenoord and Hyun, however, is that we avoid calling stem cell–derived gametes “artificial” or “synthetic,” since “these labels may give the pejorative impression that stem cell–derived gametes are ethically inferior to other types of ART [assisted reproductive technologies].” To make sure that multiplex parenting is implemented responsibly, it will be necessary to conduct “sociological research to evaluate the long-term welfare of children born through these techniques.”

It is hard to know what to make of this kind of defense of a morally repellent way of making babies, except to speculate that these ethicists have become so committed to opposing Leon Kass’s decades-old argument—that there is wisdom in the repugnance most people feel at reproductive technologies like cloning—that they reflexively defend repugnant ideas for their own sake. Even the way the authors talk about how multiplex parenthood might “trigger” objections from ordinary people makes it sound like they are more interested in trolling than in serious moral analysis. What makes this kind of reaction especially unfortunate is that these two ethicists occupy relatively important positions in the field of stem cell research: Both are members of the International Society for Stem Cell Research’s ethics committee, for which Hyun was even once the chairman.

The ISSCR’s ethics advisory committee is important for the oversight of reproductive technologies like stem cell–derived gametes, and particularly so in the United States, which doesn’t have any legal framework for regulating applications of such technologies. The National Institutes of Health won’t fund research on any experiments that actually create embryos—though experiments that just create human egg cells without making embryos out of them would probably be eligible for federal funding. The Food and Drug Administration might decide to stop doctors from using stem cell–derived gametes for reproduction until they can be shown to be safe. But if these techniques are found to be safe, the FDA probably wouldn’t have the authority to prohibit “multiplex parenting” or “in vitro eugenics.” In place of open public debate and democratically accountable decisions from elected representatives about the moral implications of radical changes to human procreation, our political system has left these questions to bureaucrats, scientists, and professional ethicists.

The scientists actually working on these techniques are focused on the more reasonable applications of their technologies, like helping infertile

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patients, or are just interested in what they can find out about human embryology and development. But the people who are setting the ethical standards for these scientists are already casting about to find the most repellent applications of this technology in order to justify them. And for what? Is “multiplex parenting” so urgently in need of moral defense? Do we really need to conduct a decades-long sociological research program to find out whether outcomes for children created in the lab by a polycule—a network of polyamorous relationships—are as good as for children raised in a two-parent household? (And considering that we already haven’t bothered implementing such a program for children conceived by donors, or for that matter even conducting any serious medical follow-up with children conceived using IVF technologies, why should we expect such a research program would be implemented in this case?)

There has been too little political will to seriously regulate and restrict the development of reproductive technologies. For too long the moral problems raised by them have been left to professionals with warped priorities. In the case of stem cell-derived gametes, laws should be passed sooner rather than later outlawing their most outrageous uses. Any legitimate clinical applications, such as helping to restore fertility to people who lack the ability to produce sperm or egg cells, will be overshadowed by the prospects of multiplex parenting and in vitro eugenics. The community of professional bioethicists may find such laws ill-advised or extreme, but given their morally frivolous record, there is little reason to trust them to provide meaningful oversight for these technologies—and so direct prohibitions are necessary.