**DIRECTIONS: Read the following articles. Write a paragraph stating your opinion on whether or not scientists should pursue genome editing in humans. Provide at least TWO evidences from the text.**

**Ethics of Designer Babies** by Sarah Ly

<https://embryo.asu.edu/pages/ethics-designer-babies>

A designer baby is a baby genetically engineered in vitro for specially selected traits, which can vary from lowered disease-risk to gender selection. Before the advent of genetic engineering and in vitro fertilization (IVF), designer babies were primarily a science fiction concept. However, the rapid advancement of technology before and after the turn of the twenty-first century makes designer babies an increasingly real possibility. As a result, designer babies have become an important topic in bioethical debates, and in 2004 the term “designer baby” even became an official entry in the Oxford English Dictionary. Designer babies represent an area within embryology that has not yet become a practical reality, but nonetheless draws out ethical concerns about whether or not it will become necessary to implement limitations regarding designer babies in the future.

The prospect of engineering a child with specific traits is not far-fetched. IVF has become an increasingly common procedure to help couples with infertility problems conceive children, and the practice of IVF confers the ability to pre-select embryos before implantation. For example, preimplantation genetic diagnosis (PGD) allows viable embryos to be screened for various genetic traits, such as sex-linked diseases, before implanting them in the mother. Through PGD, physicians can select embryos that are not predisposed to certain genetic conditions. For this reason, PGD is commonly used in medicine when parents carry genes that place their children at risk for serious diseases such as cystic fibrosis or sickle cell anemia. Present technological capabilities point to PGD as the likely method for selecting traits, since scientists have not established a reliable means of in vivo embryonic gene selection.

An early and well-known case of gender selection took place in 1996 when Monique and Scott Collins saw doctors at the Genetics & IVF Institute in Fairfax, Virginia, for in vitro fertilization. The Collins’ intended to conceive a girl, as their first two children were boys and the couple wanted a daughter in the family. This was one of the first highly publicized instances of PGD in which the selection of the embryo was not performed to address a specific medical condition, but to fulfill the parents’ desire to create a more balanced family. The Collins’ decision to have a “designer baby” by choosing the sex of their child entered the public vernacular when they were featured in Time Magazine’s 1999 article "Designer Babies". Though the Collins’ case only involved choice of gender, it raised the issues of selection for other traits such as eye color, hair color, athleticism, or height that are not generally related to the health of the child.

Prior to the Collins’ decision to choose the sex of their child, The Council on Ethical and Judicial Affairs released a statement in 1994 in support of using genetic selection as a means to prevent, cure or specific diseases, but that selection based on benign characteristics was not ethical. Some ethical concerns held by opponents of designer babies are related to the social implications of creating children with preferred traits. The social argument against designer babies is that if this technology becomes a realistic and accessible medical practice, then it would create a division between those that can afford the service and those that cannot. Therefore, the wealthy would be able to afford the selection of desirable traits in their offspring, while those of lower socioeconomic standing would not be able to access the same options. As a result, economic divisions may grow into genetic divisions, with social distinctions delineating enhanced individuals from unenhanced individuals. For example, the science-fiction film Gattaca explores this issue by depicting a world in which only genetically-modified individuals can engage in the upper echelon of society.

Other bioethicists have argued that parents have a right to prenatal autonomy, which grants them the right to decide the fate of their children. George Annas, chair of the Department of Health Law, Bioethics, and Human Rights at Harvard University has offered support for the idea of PGD, and the designer babies that result, as a consumer product that should be open to the forces of market regulation. Additionally, other arguments in favor of designer baby technologies suggest that parents already possess a high degree of control over the outcome of their children’s lives in the form of environmental choices, and that this should absolve some of the ethical concerns facing genetic selection. For example, parents keen on establishing musical appreciation in their children may sign them up for music classes or take them to concerts on a regular basis. These choices affect the way a child matures, much like the decision to select certain genes predisposes a child to develop in ways that the parents have predetermined are desirable.

The increased ability to control and manipulate embryos presents many possibilities for improving the health of children through prenatal diagnosis, but these possibilities are coupled with potential social repercussions that could have negative consequences in the future. Ultimately, designer babies represent great potential in the field of medicine and scientific research, but there remain many ethical questions that need to be addressed.

**Scientists Call for a Summit on Gene-Edited Babies** By Antonio Regalado on March 19, 2015

*Nobel Prize winners raise alarm over genetic engineering of humans.*

New gene-editing tools are raising the possibility of human gene engineering.

A group of senior American scientists and ethics experts is calling for debate on the gene-engineering of humans, warning that technology able to change the DNA of future generations is now “imminent.”

In policy recommendations published today in the journal Science, 18 researchers, including two Nobel Prize winners, say scientists should accept a self-imposed moratorium on any attempt to create genetically altered children until the safety and medical reasons for such a step can be better understood.

The concern is over a rapidly advancing gene-editing technology, called CRISPR-Cas9, which is giving scientists the ability to easily alter the genome of living cells and animals (see “Genome Surgery”). The same technology could let scientists correct DNA letters in a human embryo or egg cell, for instance to create children free of certain disease-causing genes, or perhaps with improved genetics.

“What we are trying to do is to alert people to the fact that this is now easy,” says David Baltimore, a Nobel Prize winner and former president of Caltech, and an author of the letter. “We can’t use the cover we did previously, which is that it was so difficult that no one was going to do it.”

Many countries already ban “germ line” engineering—or changing genes in a way that would be heritable from one generation to the next—on ethical or safety grounds. Others, like the U.S., have strict regulations that would delay the creation of gene-edited children for years, if not decades. But some countries have weak rules, or none at all, and Baltimore said a reason scientists were speaking publicly now was to “keep people from doing anything crazy.”

The advent of CRISPR is raising social questions of a kind not confronted since the 1970s, when the ability to change DNA in microorganisms was first developed. In a now famous meeting in 1975, in Asilomar, California, researchers agreed to avoid certain kinds of experiments that were then deemed dangerous. Baltimore, who was one of the organizers of the Asilomar meeting, says the scientists behind the letter want to offer similar guidance for gene-engineered babies.

The prospect of genetically modified humans is surprisingly close at hand. A year ago, Chinese researchers created monkeys whose DNA was edited using CRISPR (see “10 Breakthrough Technologies 2014: Genome Editing”).

Since then, several teams of researchers in China, the U.S., and the U.K. have begun using CRISPR to change the DNA of human embryos, eggs, and sperm cells, with an eye toward applying the technology at in vitro fertility (IVF) clinics. That laboratory research was described by MIT Technology Review earlier this month (see “Engineering the Perfect Baby”).

Last week, in Nature, representatives of an industry group, the Alliance for Regenerative Medicine, recommended a wider moratorium that would also include a cessation of such laboratory studies, which it termed “dangerous and ethically unacceptable” (see “Industry Body Calls for Gene-Editing Moratorium”).

But that position was rejected by the authors of the current Science editorial. Instead, they said basic research on germ line engineering should move forward, including efforts to determine “what clinical applications, if any, might in the future be deemed permissible.”

Today’s statement was organized by Jennifer Doudna, a University of California, Berkeley, biologist who codiscovered the CRISPR technology. She confirmed that the group supports using it to edit the DNA of early-stage human embryos if it’s for scientific research.

That recommendation could come as a bombshell to critics of germ line engineering, as well as religious groups. Some believe an ethical “bright line” should separate humanity from the kind of gene-tinkering used on plants, microbes, and animals. If so, what is the point of testing the technology in human embryos?

But some authors of the Science editorial believe basic research must be given a free hand. “Science should not be impeded in its earliest stages by concerns that improvements in, and validations of, certain parts of the technology are opening the door to eugenics,” says Paul Berg, a professor emeritus at Stanford’s medical school, who also signed the letter. Berg said he supported research aimed at “perfecting the technology in preparation for the time when society could sanction germ line modification in medicine.”

A growing industry has already sprung up around gene editing, which is being applied to lab animals and farm species, and is being contemplated as a way to treat adults with diseases like muscular dystrophy or HIV infection. Such treatments of sick individuals are known as somatic gene therapy, and were not the subject of the current editorial, or the call for a moratorium.

Theoretically, germ line editing could correct genes that lead to lethal diseases before birth. For instance, if a person had Huntington’s disease, caused by a single faulty gene, CRISPR could be used to eliminate the mutation from that person’s children.

One biotechnology company, OvaScience of Cambridge, Massachusetts, has invested more than $2 million dollars investigating whether gene-editing could be used in IVF procedures. OvaScience did not respond to a request for comment.

While correcting inherited disease genes could prove medically useful, the authors of the Science editorial said much remained unknown. “Even this seemingly straightforward scenario raises serious concerns,” they said of editing disease genes back to their healthy form. That is because scientists are unable to predict all the consequences of changing DNA letters in a person, especially if multiple genes were corrected at once.

“You would be making changes in generations to come, in ways that are very hard to predict,” says Baltimore.

In their editorial, the researchers call for high-level technical forums to discuss CRISPR, as well as convening a “globally representative” group of government agencies, ethics experts, and scientists to recommend policies. In the meantime, they say, scientists must refrain from actually producing genetically engineered babies, even though the opportunity to do so now exists.

“Scientists should avoid even attempting, in lax jurisdictions, germline genome modification for clinical applications in humans,” they write.