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Should We Make Attempts To Change The Human Genome?

On the 25th of November 2018, a Chinese biophysicist by the name of He Jiankui revealed days before the Second International Summit on Human Genome Editing that he had edited the genes of two human embryos and brought them to term, sparking outcry from scientists globally. Although Jiankui's actions were highly unethical, they had a silver lining: the scientific community united under one banner to criticise his work and call for a moratorium on heritable genome editing, in an attempt to responsibly regulate themselves. With such powerful tools like CRISPR now at humanity's disposal, we have a responsibility to come to a consensus on our future with modifying the human genome. The issue is this: progress in the field has been swift. In 2011, there were fewer than a hundred papers on CRISPR. Now, there are over 17,000. With such rapid development in the field, it has been impossible for the conversation around its ethics and potential impact on society to keep up. It is pivotal that our dialogue catches up soon, as our decision will affect the future of humanity forever.

Firstly, it is important to distinguish between the two ways in which we can alter our genome. Somatic gene editing only target genes of cells of specific types, with the edited gene remaining only within the cells of the targeted cell type and no other types of cells being affected. Germline editing, on the other hand, is a modification made to the genes in a reproductive cell. Somatic cell therapies are highly regulated and have been used for several years now; however, germline editing is a different story. Due to the heritability of the modifications made, germline editing brings vast ethical and safety implications to process.

The permanence of any changes made is an issue we must consider. Genetic disease has been shown to be present in at least 10% of adults worldwide. With time, germline editing could allow us to eradicate most of these. Heritable diseases from Sickle cell anaemia to Huntington's could be removed not only from an entire family line, but from humanity entirely, making some of humankind's worst afflictions a thing of the past. However, with permanence comes clear issues. If a mistake is made while changing a germline cell, this change will stay forever, spreading through our populations. Before we alter the human genome, we must make sure we have considered all of the possible risks and thoroughly examined the safety of doing so.

Although we have made leaps and bounds in some areas of genetics, progress in others has been slower. We have the capability to edit any gene in our body, but we lack the knowledge required to help us understand the potential risks associated with this. For starters, we are still uncertain as to what a fifth of our genes code for. On top of this, our genome is a complex ecosystem and we do not yet fully understand how individual genes interact with one another. Practically, this brings problems when it comes to actually editing our genome. There is a possibility that we may be targeting the wrong gene for the condition we want to eliminate, or that editing a single desired gene could have dire off-target consequences. It is crucial that we fill our gaps in knowledge before we make any real attempts to alter our genome.

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However, one issue this problem does solve is that of 'designer babies.' As we now know that most of our characteristics are defined by multiple genes working together, it is unlikely that wealthy parents will be able to modify their unborn children to have the characteristics they desire anytime soon, if ever. Desirable traits like athleticism, height and intelligence, for example, are the product of thousands of genes and so not only is it unlikely that we will be able to make moves to enhance our children for years to come, but the potential risks associated with editing the sheer number of genes involved in enhancing certain traits will likely be enough to deter any parents from trying to modify their children.

The fact that 'designer babies' is what comes to the forefront of most people's mind when altering the human genome is mentioned is a failure on the part of science communication and the media. By constantly referring to technology like CRISPR as 'molecular scissors' and other oversimplifications, we give the illusion that the gene editing process is cleaner and easier than it really is. This in turn can lead us to gloss over not only the potential risks, but also some of the more achievable, useful applications of this technology. It is essential that we draw the focus away from this science fiction notion of 'designer babies' so that we can focus on the incredible things we can do thanks to the versatility of CRISPR.

While He Jiankui serves the rest of his three-year jail sentence, we must make more progress on this topic. We simply do not know enough at this moment to safely alter the human genome. This is why we must shift our focus to using the technology at our fingertips to research our gaps in knowledge. In the meantime, we must also continue to have international discussions about the ethics of altering the human genome, looking at issues surrounding its permanence and consent. Once we have answered these questions, as well as questions about safety, we have a duty to use this technology to put genetic diseases in the past. Just as we developed antibiotics to eliminate bacteria and radiation to tackle cancer, the next step for medicine is gene therapy. If we have a shot at eradicating genetic disease, we must take it.

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