An Exploration of the Effects of Gene-Editing Technology on Human Identity

Ava E. Allwardt*

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INTRODUCTION

Genes are the most foundational physical unit of a human, coding for every phenotypic characteristic that a human exhibits.[1] Thus, some view the editing of genes as the alteration of one's physical nature. The extent to which gene-editing, using technology such as CRISPR, alters one's identity is an open issue. Answering this question requires exploring what constitutes human identity (physical or mental forms, or both) and the role DNA plays. This philosophical question concerns the role of the body in the conception of oneself and how fundamental changes to one's body alter that conception. As gene-editing technologies continue to be refined and implemented in humans, this question is especially relevant. Its answer can alter the decisions society makes about the use of gene-editing technology in humans. Alterations to one's physical form through gene-editing change one's physical makeup. Gene-editing causes modifications that span both realms of one's sense of self because physical identity can affect mental identity. This paper explores philosophical approaches to identity and the relationship between body and mind, arguing that physical changes have significant capacity to alter emotions and mental status in ways that may shape identity.

I. CRISPR and Gene-Editing Capability

Scientists can use gene-editing to rectify the genetic flaws that cause genetic disorders. Trisomy 21, or Down Syndrome, for example, is caused by an additional 21st chromosome in a person's genome. Deletion of this extra chromosome through gene-editing would erase the disease, changing the person's genomic foundation and life. They would no longer need to manage the effects of trisomy 21. Gene-editing in the case of trisomy 21 impacts identity. An analysis of perspectives on the link between trisomy gene-editing and identity revealed a split between those who viewed trisomy as separate from identity and those who viewed it as fundamental. Participants favoring a connection between trisomy and identity were more likely to oppose gene-editing, as they believed it would bring fundamental changes to who the person is.[2]

* Ava E. Allwardt, Saint Andrew's School

Discussion of the extent to which gene-editing impacts identity is important in informing these opinions and, in turn, the policies society implements on the use of gene-editing. Somatic gene-editing, performed in existing people rather than an embryo, proposes a unique case. Many view somatic editing as "similar to other medical treatments" rather than a complete alteration to one's identity because it is only used in cells in specific tissues to fix symptoms, not the entire disease. For trisomy 21, somatic gene-editing will only be possible in specific tissues and cells of the body, such as in the nerve cells that cause muscle weakness in Down Syndrome patients, since it is not yet possible to change every cell carrying the genetic flaw.[3] Researchers can treat other diseases more completely with gene-editing. To fix the single nucleotide mutation that causes sickle cell disease, for example, researchers can edit the red bone marrow cells extracted from patients, edit them using CRISPR, and reintroduce them into the patient.[4] Gene-editing enables a more comprehensive solution for sickle cell disease in existing people, but it entails the same genome editing as with trisomy. Regardless of the disease or somatic or germline cell targeting, gene-editing alters the DNA a human carries. By exploring the most basic implications of that alteration on human identity, this paper will define the relationship between gene-editing and identity.

II. Views on Physical Identity

Some may view a human's physical nature as their only nature and thus the sole component of identity. Reductive physicalism proposes that the world is made of only physical components.[5] Reductive physicalists challenge the existence of the mind or a higher power by arguing that all processes can be broken down into their physical components. By this reasoning, humans are a collection of atoms and molecules compartmentalized into cells that perform all human functions. By suggesting that humans are entirely physical in nature, this theory proposes that one's physicality must constitute identity. In *A Treatise of Human Nature*, David Hume alludes to the essential role of physicality in identity. Although Hume also discusses the role of a non-physical mind in the processing of perceptions, Hume states that "after the dissolution of my body, I should be entirely annihilated."[6] The destruction of one's being, one's identity, when one ceases to physically exist reinforces the idea that humans are solely physical in nature. Applying reductive physicalism, the dependence of identity on physicality supports that changing one's physicality through gene-editing will change one's identity.

In *Being and Nothingness*, Jean-Paul Sartre argues that a human confirms his existence when he sees "the other" looking at him, becoming an object rather than a subject. Describing one's sudden self-consciousness and resulting shame, Sartre poses "the look" as essential in one's formation of a sense of self.[7] Since the body is recognized by "the other," the pre-reflective cogito suggests that, without the body, one would not be able to recognize their own existence. Under Sartre's argument, a physical body is a precursor to identity. However, gene-editing by altering the physical characteristics of a human, such as the shape of red blood cells in sickle cell disease patients, generally leaves the body intact. One would still be perceived by "the other" after gene-editing and have their identity confirmed. Sartre's "the look" reinforces the importance of the body. Yet gene-editing would not impact one's being an object of another.

III. Mind and Body Combine in Human Identity

In philosophy, mind-body dualism means that humans are composed of mental and physical substances. These forms of an individual are distinct yet inextricably interconnected.[8] René Descartes introduced mind-body dualism to argue the existence of a mind without disputing the existence of a body. In his Cogito Theory, Descartes states, "I think, therefore I am." According to Descartes, the mind is an indivisible substance that coexists with but is distinct from the body because it lacks shape and physicality.[9] Descartes confirms his existence by the fact that his mind is a "thinking thing" rather than by the other's recognition

of one's body, as Sartre does. The idea of a non-physical aspect to humans challenges reductive physicalism and provides the space for something more than the body to define a human. The mind confirms existence and thereby grants identity, suggesting not only that the mind exists, but also that it is more central to identity than the body. This view aligns with current views about identity. Since Descartes regards the mind and body as two distinct substances, in his view, the physical changes caused by gene-editing do not directly influence the mind. Gene-editing alters the molecules in genes, but according to dualism, the mind is not composed of atoms like the body is. A genetic change would not penetrate the mind. The distinction between the mental and physical aspects of identity demonstrates how gene-editing may not have substantial power over one's identity. Since Descartes prioritizes the mental aspect of identity over the physical, gene-editing's effect on identity appears even more limited.

IV. Mind-Body Philosophies

Other philosophical viewpoints further support a mental aspect of human identity. In *De Anima*, Aristotle delineates that the body is a manifestation of the mind, which is a manifestation of the soul.[10] Although the mind and body are two essential, coexistent aspects of a human, the body comes from, and thus relies on, the mind. Aristotle frames the mind, the origin of the body, as more central to human existence. This postulates that the changes to physical identity induced by gene-editing technologies may not directly influence the mental aspect of identity because the mind does not stem from, and thus is not dependent on, the body. The mind's more direct connection to the soul cements its larger role in identity because non-secular philosophy views the soul as the core, eternal aspect of a human. The superiority of the mind over the body regarding identity demonstrates gene-editing's limited influence on identity.

In *A Treatise of Human Nature*, Hume suggests that identity is formed based on perceptions, reinforcing the role of the mind. Perceptions, which originate as a physical sensation, inspire feelings and thoughts, an aspect of one's mind. Hume gives the example of feeling the warmth of a fire.[11] The emotions that arise are processed and stored in the mind. The accumulation of perceptions from different experiences shapes one's identity. A traumatic event or significant accomplishment often becomes part of one's sense of self because of the perceptions one acquires. Hume's proposition that successive perceptions forms the mind, which are important to identity, further demonstrates that the mind is an aspect of identity. Under such a viewpoint, gene-editing would appear restricted in its ability to change identity, as it alters the body but not the mind. DNA cannot change the experiences and thoughts encoded in one's mind. One may argue that scars on one's body, rather than thoughts in one's mind, are the marks of one's perceptions, like a burn mark from touching a hot stove. However, the memories and emotions of an experience that a scar represents are deeper than the scar itself. A scar on a person has more meaning than a scar on a wax figure, a purely physical being, because of the mental associations with the scar in the person's mind. Thoughts residing in the mind contribute to one's identity, highlighting the role of the mind in a human's sense of self.

Although gene-editing in non-neuronal cells cannot directly alter one's thoughts, the processing of perceptions to form mental identity depends on the physical aspect of humans. Hume proposes that the body mediates the outside world and the mind, detecting stimuli and relaying information to the mind. This communicative relationship between the mind and the body, expressed in mind-body dualism, proposes that physical changes caused by gene-editing could affect how and when external stimuli are detected. This indirect consequence that gene-editing can have on the mind opens the discussion of how physical genetic changes could affect mental identity despite the immaterial nature of the mind.

V. Current Scientific Understanding of the Mind-Body Relationship

There is significant medical research on the relationship between the physical body and emotions like happiness, anger, and depression. Modern science sees many emotions as linked to the physical. Although gene-editing does not directly change the mind, it can be affected by those physical changes. It is well-known that there is a "functionally integrated relationship between mind and body."[12] This "relationship" suggests that the mind and body do not function separately but rather influence each other. For example, replacing bad gut bacteria with good gut bacteria in animals and humans can "significantly alter mood and emotional functions."[13] Gut bacteria is a purely physical component of the body, while mood and emotion are more mental. The influence of the physical on the mental illustrates the effect of the body's state on the mind. The two-way communication that the mind and body exhibit have important consequences for the role of DNA in identity. Genetic alterations caused by CRISPR, for example, may affect the mental aspect of identity. Researchers can use CRISPR to cure a sickle cell disease patient by changing just one nucleotide in a human's genome.[14] The editing of the patient's genome changes their physical identity because genes are a physical component of humans, but mental changes can also result. No longer suffering from the debilitating pain of a chronic disease, the patient's mood and outlook on life may shift. The integrated mind-body relationship suggests that gene-editing may have a broader impact on identity than anticipated, affecting both the body and, indirectly, the mind.

VI. Mind and Brain Philosophy

The effects of gene-editing on the mind can be more direct when the genes edited are associated with the brain. One theory explaining this phenomenon is the Mind-Brain Identity Theory. This theory postulates that "states and processes of the mind are identical to states and processes of the brain" even though the mind is non-physical.[15] Therefore, changes to the brain will correlate with changes to the mind and, in turn, affect mental identity. Using CRISPR to correct the genes that cause Huntington's Disease, for example, would improve the physical conditions in the brain that cause its symptoms. According to the Mind-Brain Identity theory, it would improve one's mental state as a result. If a mistake occurs and the condition worsens, or researchers edit beyond correcting the disorder, the negative consequences in the brain would correlate with a worsened state of mind. The direct correlation between the mind and brain increases the risks of gene-editing. The Mind-Brain Theory amplifies gene-editing's effect on identity because it suggests physical changes can not only indirectly, but also directly, impact mental identity.

CONCLUSION

Gene-editing alters the physical body. Due to the integrated mind-body relationship, it can also directly and indirectly modify mental identity. Mind-body dualism, as opposed to reductive physicalism, yields an understanding of identity that parallels the way mind-body connections are currently understood. Current science suggests that mood and emotion may be more squarely tied to the physical. Identity likely depends on some combination of the physical and mental. Framing mental aspects, including emotions, personality, and thoughts, as immaterial and genes as physical could lead to the overuse of gene-editing technology for physical purposes like disease prevention, solutions, or enhancement. Mind-body dualism forms the foundation for gene-editing's nuanced, far-reaching impact on one's sense of self. Identity defines an individual, both to themselves and others. The potential for unknown or undesired effects of gene-editing on identity calls for balancing the technology's benefit to human health with its potentially negative impact on identity. The philosophical and ethical underpinnings should help inform public policy and scientific engagement as gene-editing becomes more influential in medicine.

[1] "The predominant current day meaning of genotype is some relevant part of the DNA passed to the organism by its parents. The phenotype is the physical and behavioral traits of the organism, for example, size and shape, metabolic activities, and patterns of movement." Taylor, Peter and Richard Lewontin, "The Genotype/Phenotype Distinction", *The Stanford Encyclopedia of Philosophy* (Summer 2021 Edition), Edward N. Zalta (ed.), URL = <https://plato.stanford.edu/archives/sum2021/entries/genotype-phenotype/>.

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