

*This article has been accepted for publication in the American Journal of Bioethics 2022, the Version of Record can be accessed online at <https://www.tandfonline.com/doi/full/10.1080/15265161.2022.2105424>*

## **Epigenetics, harm and identity**

Dr Joonas Räsänen<sup>1</sup> & Prof Anna Smajdor<sup>2</sup>

<sup>1</sup>Centre for the Experimental-Philosophical Study of Discrimination, Department of Political Science, Aarhus University, Denmark.

<sup>2</sup>Department of Philosophy, Classics, History of Art and Ideas, University of Oslo, Norway.

Robert Sparrow (forthcoming) argues that genome editing is unlikely to be person-affecting for the foreseeable future and, as a result, will neither benefit nor harm edited individuals. We regard Sparrow's claim as being plausible – up to a certain point. However, Sparrow overlooks the role of epigenetics when it comes to determining our identity.

Gene editing, as Sparrow suggests, would likely involve complex intervention, either at the gamete stage, or at the blastocyst stage. Since gene editing may result in 'mosaicism', where the amended genes are only active in a subset of the embryo's cells, anything that focuses on one individual embryo would be fraught with uncertainty. It is currently very difficult if not impossible to control and predict the degree to which the change will permeate the organism. Also, in practice, in order to check the accuracy of the editing, genome editing will involve creation of, and selection from amongst, multiple embryos.

These are some of the reasons Sparrow suggests genome editing is unlikely to be person-affecting. In all these regards, we suggest that his argument is compelling. Nevertheless, in his treatment of identity and the way it relates to questions about gene editing, the picture is considerably more complex than even Sparrow recognizes.

Environmental factors, including our own behavior, and the behaviour of our parents, can cause changes that affect the way our genes work (Hens 2017). If genes are an important aspect of our identity, epigenetic changes, as they are called, are *also* important; perhaps even more so, since they determine which of our genes are actually expressed. Therefore, epigenetics must also be taken into account when considering whether certain medical interventions harm or benefit specific individuals.

Since Parfit (1984) wrote about the non-identity problem, it has been widely accepted by many bioethicists that the essence of identity lies in the genes of the resulting offspring. It is this that makes it true that when Jane chooses to postpone having her child until she is cured of syphilis, she does not benefit that child, but gives birth to a different child. The egg and sperm that create the offspring are different in each case, therefore the child is genetically distinct from whatever child Jane might have had if she hadn't waited.

If identity is, as is commonly held, essentially connected with genes, then any intervention that alters genes raises the question of identity. Sparrow claims that bioethicists have assumed that genetic intervention would be person-affecting (rather than identity changing). Yet it seems strange that this should be the case. After all, if our focus is on genes, it would seem to

follow that altering those genes does in fact change the identity of the organism. Thus, there can be no therapeutic genetic intervention, whether one is an adult, child, embryo or gamete.

However, perhaps it is a question of degree: altering a few base pairs might not be identity changing, while swapping out a whole 23 chromosome's worth of sperm contribution might be deemed too much. Intuitively there may be some appeal in this approach, but it does very little actually to resolve the question. This is because - if there is some threshold beyond which one becomes literally a new genetic person - the next challenge would be to establish, sensibly, where that threshold is. It seems very hard to know even where to start with such a project. Alternatively, one could suggest that it is possible to be partly the same person – a conclusion that seems very counter-intuitive.

With the focus on genes as the basis of identity, there has been a tendency to overlook what genes really are and what they *do*. Genes code for proteins. These proteins are then taken up by the body and feed into its appearance, functionality and behaviour. But what makes the genes produce proteins is not the bare fact of their presence in the cell. It is determined by whether they are turned off or on (or something between).

Therefore, even if we accept genes as the essence of identity we need to consider how epigenetics is linked to our identity (Boniolo & Testa 2012; Lewens 2020). Perhaps genes should be regarded as the keys on a piano. Epigenetics can be viewed as the tune being played. Crucially, this can help us make sense of the problem of identical twins: even though they share the same DNA they are not the same person because identical twins start out as the same organism, but from the moment they separate, the epigenetic changes they undergo start to come into play. Thus, despite having the same genetic complement, so to speak, different subsets of those genes are actually in play. In this way, twins, as we know, may become more and more different over time. In fact, there are known to be cases where genetically identical twins, raised in the same family with the same environment, have different sexual orientations (Watts 2018) – or even more profoundly, the genetically identical twins could identify with different genders (Diamond 2013). If their genes are the same, and the environment is the same, what is left to explain their profound differences is probably the epigenetics (Rice et. al 2012).

If we take epigenetics into account and revert to the question of interventions around or prior to conception, it seems we can ask whether genetic changes at that point are sufficient to alter identity? If we accept the idea that identical twins are different people for largely epigenetic reasons, it seems that we must also accept that any intervention in the expression of genes also results in the creation of a new individual, rather than benefiting that organism.

Moreover, since epigenetic effects occur throughout our lives, it seems that anything that brings about the activation or de-activation of a gene could be construed as identity-altering. Epigenetic changes arise from a wide array of environmental influences: the people we meet, the jobs we do, the amount of stress we experience, the food we eat, the hobbies we have, the pollution and the toxins we inhale and digest. If identity depends on genetic essentialism combined with epigenetics, our identities are profoundly unstable, in a constant state of flux, altered by all we experience.

This may seem a rather strange view. Yet its implications are highly significant. The moral justification for nearly all forms of medical intervention is that they benefit the subject. If

gene editing results in the creation of a new subject, it is not clear how, if at all, the intervention fits within the commonly accepted scope of medicine.

As Sparrow notes, one way to interpret this is that the intervention is simply not intended to benefit the offspring at all, but to fulfil the desires of the prospective parent(s). For all the discourse on unconditional parental love, becoming a parent is often highly conditional. People want a child who fulfils certain requirements: who is conceived with gametes obtained from themselves and often a specific person; who has certain attributes, features and traits (often similar to those of the parents). People send their children to music lessons, or play sports with them, take them to church or the theatre in order to ‘mould’ them. It is no surprise therefore that people who are not yet parents have wishes about what sort of offspring they want to have – and create. Perhaps genome editing is not that different from other ways people alter their children. In any case, it seems that epigenetics should not be forgotten when we consider whether genome editing harms an existing individual or create a new individual.

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