Articles

Why We Should Defend Gene Editing as Eugenics

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Abstract: This paper considers the relevance of the concept of "eugenics,"—a term associated with some of the most egregious crimes of the twentieth century—to the possibility of editing human genomes. The author identifies some uses of gene editing as eugenics but proposes that this identification does not suffice to condemn them. He proposes that we should distinguish between "morally wrong" practices, which should be condemned, and "morally problematic" practices that call for solutions, and he suggests that eugenic uses of gene editing fall into this latter category. Although when we choose the characteristics of future people we are engaging in morally dangerous acts, some interventions in human heredity should nevertheless be acknowledged as morally good. These morally good eugenic interventions include some uses of preimplantation genetic diagnosis. The author argues that we should think about eugenic interventions in the same way that we think about morally problematic interventions in public health. When we recognize some uses of gene editing as eugenics, we make the dangers of selecting or modifying human genetic material explicit.

Keywords: eugenics; gene editing; preimplantation genetic diagnosis; morally problematic practice; morally wrong practice; moral marketing

Gene editing offers an unprecedented power to genetically modify humans. This paper examines the ethical implications of gene editing in the light of a concept with a history that reaches back to the late nineteenth century—the concept of eugenics. The word "eugenics" was coined by Francis Galton, a cousin of Charles Darwin. It combines the Greek *eu*, meaning "good" or "well," with the suffix *-genēs*, meaning "born." In his 1883 book *Inquiries into Human Faculty and Its Development*, Galton presents eugenics as "the science of improving stock, which is by no means confined to questions of judicious mating, but which, especially in the case of man, takes cognizance of all influences that tend in however remote a degree to give to the more suitable races or strains of blood a better chance of prevailing speedily over the less suitable."[1]

There is much that is objectionable in Galton's definition. The racist separation of the more suitable from less suitable races or strains of blood is notable. Moreover, eugenics was offered as justification for some deeply morally reprehensible acts. Among these was the Nazi Aktion T4 program, which purported to eliminate "less suitable" strains of blood by murdering over 70,000 disabled people. As has been well documented, the Nazis were not alone in offering eugenics as the justification for morally offensive behavior.[2]

You might ask what value the objectionable anachronism of eugenics could have in understanding the latest developments in twenty-first century genetics? It is easy to see why those who seek the improvements that could result from editing human embryos would reject a label that carries such negative historical associations. I argue that it is important not to forget the moral lessons taught by eugenics, and we best learn these lessons when we acknowledge many of the uses that are proposed for gene editing as eugenics.

This paper focuses on eugenics as presented in Galton's original definition and proposes that we should understand it as having two central features.

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First, eugenics focuses on populations.[3] We should judge a eugenic measure to be a success or failure based on its effects on population health. A eugenic measure is a success if it leads to higher levels of health in the population in which it is implemented. Second, eugenics focuses on inherited influences. Population health would be improved by the selection or manipulation of hereditary influences. I suggest that we seek moral guidance on these selections and modifications by considering how we approach selections and modifications of influences on the other side of the developmental divide. Practitioners of public health seek to improve the health of human populations by intervening in environmental influences. They hope to achieve this goal by reducing the incidence of smoking or of sunburn, among other injurious influences on population health.

I argue that eugenics is morally problematic and that we should distinguish "morally wrong" interventions from "morally problematic" interventions. All instances of an intervention properly identified as essentially morally wrong are morally wrong. However, a morally problematic intervention is problematic precisely because it comprises *both* morally bad and morally good interventions. When we recognize an intervention as morally problematic, we understand it as requiring special effort to determine whether it is morally good or morally bad. The practice of eugenics in the early twentieth century offers many examples of morally wrong attempts to improve population health. What makes eugenics, considered as a whole, morally problematic is that some interventions properly identified as eugenic are morally good. I propose that these include some uses of preimplantation genetic diagnosis (PGD) and some hypothesized human applications of gene editing. I argue that eugenics is *essentially* morally problematic. When we identify eugenics as essentially morally problematic, we indicate that we do not expect moral progress to shift the issue from the morally problematic category to either the unproblematic morally right or the unproblematic morally wrong categories. We should expect decisions about the kinds of future people we bring into existence to remain philosophically vexing.

The Difference Between a Practice Being Morally Wrong and Being Morally Problematic

There is tendency to treat "morally problematic" and "morally wrong" as synonyms. We say things like, "The invasion of Iraq was so morally problematic!" when what we really mean is to condemn it. Conflating morally condemning a practice with identifying it as presenting a problem is unhelpful.

I suggest that we view morally problematic practices as presenting problems that call for solutions. There is a difference between those practices that call for solutions and those that we recognize as morally wrong. Slavery is unproblematically morally wrong. It was a morally problematic practice in Ancient Greece when there were arguments advocating the view that certain categories of human beings are "natural" slaves. One indicator of moral progress since those times is a general recognition that there are no natural human slaves and that it is always wrong for one human being to own, or claim to own, another. We rightly view arguments for the status of certain categories of human as natural slaves as misguided historical curiosities, not as serious attempts to advance moral understanding. There is a difference between saying that the *practice of slavery* is a solved moral problem and saying the *morality of slavery* is a solved problem. Human slaves exist in the early twenty-first century, which demonstrates that the practice of slavery clearly is not

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a solved problem. We nevertheless see evidence for the moral status of slavery as a solved problem in the efforts of those who continue to enslave humans to construct descriptions that disguise what they do. Rather than boldly stating, "I own slaves and stand before you as someone with a moral entitlement to own other human beings," they attempt to find ways to defend employment practices similar to chattel slavery as ones to which workers freely consent and which they are free to relinquish. Academic presses and journals are as rightly disinclined to publish books or articles that defend persons as property as respected geology journals are to offer publications purporting to vindicate flat earth theory.

Eugenics is presented here as morally problematic. The literature on the history of eugenics documents many morally wrong eugenic acts. I argue that some uses of preimplantation genetic diagnosis (PGD) and some potential uses of gene editing are both morally good and properly acknowledged as eugenics. Eugenics is not only morally problematic, it is essentially so. Earlier I suggested that slavery has shifted over time from being morally problematic to being unproblematically morally wrong. When we identify eugenics as essentially morally problematic, we deny that any moral advance or scientific discovery will turn the morality of eugenics into a solved problem. It will not turn a practice whose moral status is problematic into a practice that is unproblematically morally good or bad. Eugenic practices will always present moral problems. They involve the use of genetic technologies to select the attributes of future people. There will always be debate about how a society uses genetic technologies to select the characteristics of future members of that society. Technological advances are likely to bring some of these moral disputes into sharper relief. They will not solve them in the way that the sustained reflection on human dignity shifted slavery from the category of the morally problematic to the category of the unproblematically morally wrong. When a practice is identified as essentially morally problematic we know that we have a protracted process of moral assessment ahead of us. We understand the need for serious thought about whether it is morally permissible, impermissible, or obligatory.

It may seem perverse to use a term associated with indisputably bad historical practices for practices some of which we present as morally justified. The popular imagination tends to place eugenics together with the other offences of the Nazis. But there is value in persisting with a term that presents the use of genetic technologies as not only morally problematic but as potentially morally wrong in an especially dangerous way. This acknowledgment may reduce the likelihood that the crimes of the past will be repeated. It is a safer approach than seeking to obscure connections with historical wrongs by rebranding interventions in human heredity as "medical genetics" or "gene therapy." Rather than insisting that an intervention is not eugenics and therefore raises none of the issues raised by eugenic interventions in human heredity, we acknowledge that, as a eugenic intervention, it raises familiar problems about the selection and manipulation of human hereditary material. This history of attempts to use information about heredity to choose the attributes of future citizens contains some of the twentieth century's signal crimes. An awareness of these crimes must be at the forefront of the minds of those who make decisions about how genetic technologies should be used.

I have discussed the danger of forgetting past moral errors. Identifying eugenics as morally problematic, rather than an unproblematic moral wrong, helps to avoid another kind of moral mistake—the simplistic shortcut in moral thinking according to which we have only to identify an act as eugenics to dismiss it.

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The Difference Between Moral Philosophy and Marketing

This paper defends some current practices as eugenic. I should clarify what I mean by a *moral* defense of eugenics. There is a tendency in some quarters to conflate moral justification and marketing. We should distinguish between the assessment that a practice is, on occasion, morally justified and the varieties of advocacy that should be acknowledged as marketing.

Marketing a practice is understood as removing obstacles to its broader acceptance. The aim is essentially similar to marketing a product. Someone who markets a product seeks to direct the attention of potential purchasers toward attractive features of the product and away from undesirable features. The success of a marketing effort is registered in increased sales. We measure the success of a moral marketing campaign in the uptake of the marketed behavior. This differs from the moral assessment of a practice, in which the aim is an accounting of the full range of associated moral issues. A moral assessor can arrive at a variety of conclusions. Perhaps the practice is morally obligatory for all. Perhaps it is morally permissible for some but obligatory for others. Earnest moral assessments may not make the most exciting reading in that they lack the daring of attempts to market new ways to produce human beings. But they should demonstrate a serious attempt to grapple with the wide range of moral considerations attendant on the assessed practice. Earnest moral assessments should highlight potential dangers. Practices such as eugenics that we recognize as potentially justified but especially dangerous should be approached with caution that runs counter to marketing.

It is perfectly appropriate, once the moral assessment has been completed and a practice decided to be morally or prudentially obligatory, to begin marketing and disseminating it as broadly as possible. If we have decided that a practice is morally impermissible, then it is the responsibility of moral marketers to reduce its incidence as far as possible. In the case of slavery for example, moral marketers should make the claims by some people that they are entitled to own others as forcefully revolting as possible. If this results in besmirching the reputation of famous slave owners, then so be it. The responsibility of moral marketers is to discredit any proposals to redeem the institution of slavery. Claims that maintaining a way of life valued by slave owners depends on the continuation of slavery, or that slavery may, under some circumstances, be the most efficient way for a society to generate wealth could be relevant to a full moral assessment. But once we have concluded that slavery is, all things considered, very morally bad, moral marketers should take over and do their utmost to direct attention away from these potential costs of abolition.

Consider an example of prudential assessment. A prudential assessment of smoking should consider the habit's potential costs, together with its potential benefits. The "smoker's personality" in adolescents is associated with enhanced social standing and conveying the impression of someone who does not slavishly conform to social norms.[4] The James Dean image of smoking persists into the present day. These benefits must be considered alongside the established harms of smoking. If, as a moral marketer, you arrive at the reasonable conclusion that the costs of smoking significantly outweigh its benefits, your aim to create a campaign to reduce the incidence of smoking among teenagers would not include telling them, "Smoking may make you cooler and more sexually successful, but it can lead to quite serious problems later in life." In seeking to reduce the incidence of smoking the moral marketer would not highlight these potential social advantages.

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One area in which the distinction between marketing and moral philosophy is blurred is in defenses of transhumanism. According to one prominent definition, transhumanism is "the intellectual and cultural movement that affirms the possibility and desirability of fundamentally improving the human condition through applied reason, especially by developing and making widely available technologies to eliminate aging and to greatly enhance human intellectual, physical, and psychological capacities."[5] There are fascinating moral issues that arise with respect to enhancements of human intellectual, physical, and psychological capacities of great magnitude. I have discussed these at length elsewhere.[6]

Much of the work of transhumanist philosophers straddles the line that separates moral and prudential assessment of radical enhancement from the marketing of it. The goal of transhumanist philosophers seems largely to be focused on removing barriers to a greater commitment to developing technologies that radically enhance human capacities. Some transhumanist discussions of the future do point to potential problems.[7] But these problems tend to be viewed as hitches akin to the technological teething problems foreseen by advocates of driverless cars. They are problems to be overcome in the context of a push to implement technologies that we have assessed as morally and prudentially good. When problems are assessed as technical in nature, we expect technological fixes.

Here is a sample of the marketing campaign of the transhumanist philosopher Nick Bostrom:

> You have just celebrated your 170th birthday and you feel stronger than ever. Each day is a joy. You have invented entirely new art forms, which exploit the new kinds of cognitive capacities and sensibilities you have developed. You still listen to music—music that is to Mozart what Mozart is to bad Muzak. You are communicating with your contemporaries using a language that has grown out of English over the past century and that has a vocabulary and expressive power that enables you to share and discuss thoughts and feelings that unaugmented humans could not even think or experience. You play a certain new kind of game which combines VR-mediated artistic expression, dance, humor, interpersonal dynamics, and various novel faculties and the emergent phenomena they make possible, and which is more fun than anything you ever did during the first hundred years of your existence. When you are playing this game with your friends, you feel how every fiber of your body and mind is stretched to its limit in the most creative and imaginative way, and you are creating new realms of abstract and concrete beauty that humans could never (concretely) dream of. You are always ready to feel with those who suffer misfortunes, and to work hard to help them get back on their feet. You are also involved in a large voluntary organization that works to reduce suffering of animals in their natural environment in ways that permit ecologies to continue to function in traditional ways; this involves political efforts combined with advanced science and information processing services. Things are getting better, but already each day is fantastic.[8]

This passage is more an attempt at marketing than an earnest attempt to bring to light the morally salient aspects of creating posthumans. This is fine, so long as we acknowledge it for what it is.

What should happen in a moral assessment of radical human enhancement? It should weigh moral and prudential benefits and costs against each other.

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Benefits and costs should be made equally apparent. Only then can they be properly weighed and evaluated. Suppose it were to be determined that radical cognitive enhancement will weaken your bonds with friends and relatives who remain merely human. Defenders of radical cognitive enhancement must earnestly address these potential costs showing either that they are illusory or that they are outweighed by benefits. They should not use marketing ploys to distract readers' attention from these costs. The Bostrom passage quoted above refers to the wonderful friendships you will enjoy as a posthuman. But it is silent on what happens to bonds with the mere humans who were once your most creative and imaginative friends but whom you now dismiss as dullards.

It is probably expecting too much of transhumanists to think that they can purge marketing from their writings that they offer as moral and prudential assessments. What is called marketing here is, from the perspective of transhumanists, an expression of their enthusiasm for a possible future that they assess as very good. But they should recognize the appropriateness of counter-marketing by their bioconservative opponents that features stories in which the beneficiaries of enhancement technologies treat those who are unenhanced badly or find their new enhanced existences unexpectedly meaningless. Although it would be wrong to assume these outcomes to be inevitable consequences of enhancement, they are surely risks and there is no reason to believe them impossible. Bioconservatives who consider that they have good philosophical reasons to reject enhancement should engage in their own preferred varieties of moral marketing.

The moral defense of eugenics described here should not be interpreted as marketing. I present here as an ashamed, rather than an unashamed eugenicist. The crimes committed in the name of eugenics are terrible. We certainly do not need statues of Francis Galton that celebrate his prejudiced plans to improve population health by selecting hereditary influences.

What To Make of Eugenics' Ugly History

The failure of the eugenics programs of Galton and his followers can be traced to two kinds of mistake. First there were factual errors. According to Galton, the "more suitable strains of blood" tended to accumulate in the social classes and races that were perceived to be doing the best. He and his followers treated their age's prejudices as an efficient method of sorting hereditary material by quality. He criticized nascent social welfare programs because they promoted the survival and reproduction of those with poor quality hereditary material.

Advances in modern genetics expose the error in that position. We now know that there are many genetic variants that influence our susceptibility to disease. These distribute themselves without regard to the social standing of their inheritors. Belonging to certain ethnic groups may increase your likelihood of being diagnosed with specific genetic diseases. However, there is no support for the claim that some ethnicities have a greater overall burden of genetic variants that increase the likelihood of disease and should therefore be classified as globally worse in terms of heredity. There are no ethnicities or social classes that are genetically sickly, criminal, or feckless. Population health cannot be improved by managing reproduction—depressing or increasing the reproductive rates of chosen racial or social groups.

The fact that genetic influences on disease scatter themselves across human genomes without regard to popular assessments of quality is apparent if we apply

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today's understanding of genetics to the family that many of Galton's contemporaries would have called Britain's best. Queen Victoria was the carrier of a genetic variant for hemophilia. This genetic variant was passed on, with history-altering consequences, to Alexei, the son of the Russian Tsar Nicholas II.[9] The Queen's elevated social standing conferred no protection against genetic disease.

There is a further significant error in Galton's understanding of heredity. The event of inheriting a genetic influence that raises your susceptibility to disease does not make you diseased. Diseases are not "inborn" or, at least, not in the way that Galton thought.[10] Rather, they result from a complex interaction of genetic and environmental factors. Understanding of the environmental contributions can present opportunities to intervene, which could prevent the disease or significantly mitigate its consequences for well-being. For example, people with a genetic variation that increases their likelihood of getting type 2 diabetes can make lifestyle choices that prevent them from developing diabetes. This said, we must acknowledge the powerful grip on popular understanding of the overly simplified presentations of heredity that are too keen to trace disease back to inherited disease genes.

Galton added a distinctively moral error to this mistaken understanding of heredity. He aspired to manage human reproduction. The good-in-birth would be subject to an obligation to maximize the representation of their high-quality hereditary material in successive generations. They would be expected to have many children. The dysgenic would be subject to an obligation to refrain from reproducing. The smaller the contribution of their hereditary material in the next generation the better. There were many occasions on which these obligations to not reproduce were backed up by criminal sanctions.[11]

Both positive and negative reproductive obligations are starkly opposed to current moral beliefs about human reproduction. Today's liberal democracies grant great importance to reproductive freedom.[12] Individuals are expected to exercise control over their reproductive capacities. We are supposed to be protected in our choices about whether we reproduce, with whom we reproduce, when we reproduce, and so on. We oppose the laws that intrude on this protected space. We also resent the intrusion of moral obligations. We find offensive the mere suggestion that someone should have children to increase population health or should not have children to avoid reducing population health. We believe that people should have children because they want to and expect to love them, not to comply with some eugenic obligation.

There are philosophical disagreements regarding the strength of an obligation to respect the procreative choices of others. According to some philosophers, the freedom of individuals to make their own procreative choices is absolute and cannot be overridden by competing moral obligations.[13] Others will grant that, in extreme circumstances, an individual's freedom to make her own procreative choices can be cancelled by other moral considerations.[14] But procreative freedom is nevertheless such an important value that we demand a very high magnitude of harm and standard of proof before we permit this to happen. Speculations about the possible negative consequences for population health of someone's having children fall short of this standard.

The Eugenic Uses of Preimplantation Genetic Diagnosis and Gene Editing

The aspiration to increase population health by managing human reproduction fails on both factual and moral grounds. In this paper I have understood Galtonian

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eugenics as comprising moral and/or legal oblations regarding whether and how a person reproduces. I now advance a non-Galtonian eugenics program free of these obligations. It shares Galton's focus on human heredity; but it achieves the end of improving population health in ways that reflect modern understanding of heredity and respect procreative freedom.

Two technologies unavailable to Galton enable the improvement of population health in ways that respect procreative freedom and other established liberties. One of these technologies is available to prospective parents today—this is preimplantation genetic diagnosis (PGD). The second means is a set of technologies not yet available but possibly available soon—gene editing.

In PGD, a number of embryos are created by in vitro fertilization. These embryos are tested for the presence of genetic variants that elevate the risk of a disease that parents might seek to avoid. Embryos free of variants associated with the elevated risk can be used to initiate a pregnancy. PGD is available in many countries; and in most jurisdictions its use is restricted to the avoidance of serious genetic disease. In contrast, at the time of writing—early 2018—gene editing is not available to prospective parents. It involves the use of a variety of techniques to directly modify genetic sequences. The idea of gene editing is certainly not new. Ever since Francis Crick and James Watson described the genetic code in 1953, there has been speculation about fantastical technologies that might permit human genes to be rewritten. Recent advances in gene editing appear to have brought this closer to reality. Most commentators envisage gene editing's use in human reproduction beginning with in vitro fertilization. One or more embryos would be tested for the presence of a genetic variant or genetic variants linked with a disease or diseases. The tools of gene editing could then be used to edit out the disease-linked sequence and replace it with a healthy sequence.

We can imagine PGD in the context of the reproductive obligations posited by Galtonian eugenics. The state would impose PGD on everyone, or perhaps only on those whom its officials judged to be genetically suspect. The state would decide which conditions to test for and select embryos that could be used to initiate pregnancies. It is also apparent how Galtonian eugenicists would approach gene editing. The state would require individuals to use gene editing to eliminate sequences its experts deemed to confer too high a risk of disease. In both cases, these approaches constitute intolerable infringements of reproductive freedom.

However, there is another approach that permits these technologies to improve population health while respecting procreative freedom. This approach is exemplified by the provision of PGD in many societies. Although societies differ regarding the conditions for which PGD is available, there is no current society in which prospective parents deemed to be at risk of passing on a genetic disease are required to use PGD. Their freedom to have children without using tests capable of determining hereditary risks is respected. Were parents at risk of passing on serious genetic disease to be obligated to use PGD, then the technology might improve population health to a greater extent. Under the current approach, some parents pass on genetic diseases that might have been avoided had they been compelled to use PGD. But the fact that, under a liberal regime, PGD does not increase population health by the maximum amount possible for the technology does not mean that it does not improve population health at all. In societies in which PGD is made available to individuals at risk of passing on a genetic disease, it can improve population health.

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We can imagine there might be rare individuals who seek to use PGD to reduce population health and defend their choices as expressions of procreative liberty. Suppose they sought to use the test for Huntington disease—a serious neurodegenerative disorder—to select for the condition rather than against it. These prospective parents would aim to initiate pregnancies using embryos that genetic tests reveal to have a higher risk of disease. They might offer some idiosyncratic justification for this preference. The mere fact that this choice is eccentric should not suffice to condemn it. Liberals defend the eccentric choices of individuals elsewhere. This notwithstanding, I suggest that, were some parents to claim values that justified these choices, the state would be entitled to refuse to collaborate. The state respects procreative liberty by granting intending parents the option of using PGD if they are at risk of passing on a serious disease. When it does so, it makes clear that PGD is a tool of medicine. It would no sooner permit this tool to be used to deliberately cause disease than should an oncologist accede to a patient's request that she cause cancer rather than treating it. The oncologist will allow that she has no control over any carcinogenic activities once her patient exits the consulting room, but she can nevertheless insist that her expertise not be used to deliberately cause the disease. By analogous reasoning, the state can insist that PGD be viewed as a medical tool and not be used for the purpose of reducing population health. The same reasoning applies to gene editing.

Comparing Eugenics and Public Health

So far, I have argued that our current practice of PGD achieves the end of improving population health in ways that respect procreative freedom. In this section, I present a comparison that supports the current approach that has the additional advantage of suggesting limits on the state's use of PGD to improve population health.

The earlier discussion of the interactionist view of development that has replaced the genetic determinism favored by Galtonian eugenicists indicates where to find practices to compare with eugenics. According to the interactionist view, our traits emerge out of a complex interaction between genetic and environmental influences. The same moral questions should be asked about attempts to use PGD to improve population health as are asked of attempts to improve population health by intervening in environmental influences. Fortunately for our purposes, there is an established branch of medical inquiry that deals specifically with these threats to population health. This is public health. Practitioners of public health seek to improve population health by negating or ameliorating injurious environmental influences. Their measures include attempts to reduce the incidence of smoking, reduce excessive exposure to the sun, reduce obesity, and so on. They measure the success of their interventions by looking for subsequent reductions in the incidence of disease. The eugenic use of PGD seeks to eliminate some genetic contributors to disease. Public health practitioners focus on influences on the environmental side of the developmental divide.

Discussion about limits on the use of public health measures can inform decisions about limits on eugenic measures. In mounting public health campaigns to reduce environmental contributors to ill health, we must be wary of

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the danger of stigmatization. Some public health campaigns targeting obesity in young people risk portraying overweight adolescents as worthless or disgusting.[15] The goal of instilling in young people a strong desire not to emulate their obese classmates can come at significant cost to the self-worth of obese students. There is also a danger of stigmatization from PGD. The measures that the state makes available to prospective parents to avoid disease may make people who live with the disease condition feel less worthy. In the cases of both public health and eugenics, we must counterbalance an interest in reducing the incidence of disease with an interest in supporting the interests of people who live with the disease.

It is important to acknowledge that the concepts of health and disease are themselves problematic. Just as the history of eugenics teaches important lessons about attempts to improve health by selecting or manipulating genes, so too does the history of the concept of disease. Homosexuality was once viewed as a disease, and doctors hoped to improve population health by treating or preventing it. It is only to be expected that the concepts of health and disease will continue to be problematic. There will likely always be debates about what constitutes states of health or disease. An example is the current debate about how to think about Asperger syndrome. Is Asperger syndrome a psychiatric disorder that we should seek to treat or prevent, or should it be embraced as a valued part of human variation?[16] This controversy should make us cautious in our application of PGD or gene editing. But we should not overstate the significance of these controversies. The existence of borderline cases that are not clearly located within our categories of disease or health does not mean that there are not conditions that are uncontroversially diseases. Suppose we could edit out a genetic variant that significantly increased the risk of pancreatic cancer and had no other identified effects. Pancreatic cancer is a clear inclusion in the category of disease. It would be wrong to reject this therapy on the grounds that the category of disease has vague boundaries. One way to respond to worries about the boundaries of the category of disease would be to restrict the uses of PGD and gene editing to clear inclusions. We would await clarification and consensus before we sought to apply them to conditions such as Asperger syndrome, whose status as a disease is uncertain.

Concluding Comments

This paper explores the relevance of the concept of eugenics to PGD and the editing of human genomes. In it, eugenics is defined as the attempt to improve population health by selecting or modifying hereditary influences. I argue that we should acknowledge eugenics as morally problematic and that this makes eugenics well suited as a tool to guide PGD and gene editing. It is important to distinguish the moral assessment of eugenic technologies from marketing. Marketers have the simple goal of increasing uptake of a practice. A good moral assessment of a practice should proceed from an even-handed account of the practice's moral credits and debits. The concept of eugenics helps to make explicit the dangers in the selection or modification of human genetic material. I argue that we think about the ethics of eugenic uses of PGD and gene editing in the same way that we think about attempts to improve population health by selecting or modifying environmental influences on population health. Practitioners of public health are rightly wary of the tendency of some of their measures to stigmatize people. Eugenicists must be similarly wary of these effects of PGD and gene editing.

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Notes

1. Galton F. *Inquiries into Human Faculty and its Development*. London: Macmillan; 1883 at 17, fn 1.
2. For two excellent histories of eugenics see Kevles D. *In the Name of Eugenics: Genetics and the Uses of Human Heredity*. Cambridge MA: Harvard University Press; 1998 and Paul D. *Controlling Human Heredity: 1865 To the Present*. Atlantic Highlands NJ: Humanity Books; 1995.
3. The view about eugenics advanced here, therefore, differs from the view I have earlier defended. The focus of the liberal eugenics presented in Agar N. Liberal eugenics. *Public Affairs Quarterly* 1998;12(2):137–55 and Agar N. *Liberal Eugenics: In Defence of Human Enhancement*. Oxford: Blackwell; 2004 is on individual procreators. In those works, I argued that prospective parents should have a constrained freedom to choose some of the characteristics of their future children. I focused on the populations of which those individuals are a part only when considering potential limits on exercises of reproductive liberty. The focus of this paper is on populations. Individuals may be the proximal recipients of benefits or harms, but the goal of eugenics is a healthier population. It is thus a closer match with Galton's original formulation. For an earlier presentation of this line, see Agar N. What was right about eugenics. *Medical Ethics* 2015:4–5.
4. Gladwell M. *The Tipping Point: How Little Things Can Make a Big Difference*. New York: Little Brown; 2000:chapter 7.
5. See the entry on transhumanism at https://ieet.org/index.php/tpwiki/transhumanism/
6. Agar N. *Humanity's End: Why We Should Reject Radical Enhancement*. Cambridge MA: MIT Press; 2010. Agar N. *Truly Human Enhancement: A Philosophical Defense of Limits*. Cambridge MA: MIT Press; 2013.
7. Take, for example, the second clause of Bostrom's definition: "the study of the ramifications, promises, and potential dangers of technologies that will enable us to overcome fundamental human limitations, and the related study of the ethical matters involved in developing and using such technologies."
8. Bostrom N. Why I Want to Be a Posthuman When I Grow Up. *Medical Enhancement and Posthumanity*, Gordijn B, Chadwick R. eds. Dordrecht: Springer; 2009 at 111-112.
9. Massie R. *Nicholas and Alexandra: An Intimate Account of the Last of the Romanovs*. New York: Atheneum; 1967.
10. For an accessible presentation of the recent science of development see Parrington J. *The Deeper Genome: Why There Is More to the Human Genome than Meets the Eye*. Oxford: Oxford University Press; 2016.
11. See Kevles D. *In the Name of Eugenics: Genetics and the Uses of Human Heredity*. Cambridge MA: Harvard University Press; 1998 and D. Paul *Controlling Human Heredity: 1865 To the Present*. Atlantic Highlands NJ: Humanity Books; 1995.
12. See Robertson J. *Children of Choice: Freedom and the New Reproductive Technologies*. Princeton: Princeton University Press; 1994.
13. Jurgen Habermas states that once one commits oneself to a liberal approach to enhancement, "it virtually goes without saying that decisions regarding the genetic composition of children should not be submitted to any regulation by the state, but rather should be left to the parents." Habermas J, *The Future of Human Nature*. Cambridge: Polity Press; 2003 at 76.
14. Robertson J. *Children of Choice: Freedom and the New Reproductive Technologies*. Princeton: Princeton University Press; 1994 argues that procreative liberty establishes a presumption in favor of free procreative choices. For exploration of the implications of this presumption, see Agar N. How to defend genetic enhancement. In: Gordijn B, Chadwick R. eds. *Medical Enhancement and Posthumanity*. Dordrecht: Springer; 2009:55–67.
15. For one campaign targeting childhood obesity that sought to trade of stigmatization against effectiveness at reducing obesity, see the State of Georgia's controversial "Stop Sugarcoating" run in 2011. Critics charged that it went too far in stigmatizing young obese people.
16. See Silberman S. *NeuroTribes: The Legacy of Autism and the Future of Neurodiversity*. New York: Avery Publishing; 2015.

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