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Germ-Line Genetic Enhancement and Rawlsian Primary Goods

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Abstract

Genetic interventions raise a host of moral issues and, of its various species, germ-line genetic enhancement is the most morally contentious. This paper surveys various arguments against germ-line enhancement and attempts to demonstrate their inadequacies. A positive argument is advanced in favor of certain forms of germ-line enhancements, which holds that they are morally permissible if and only if they augment Rawlsian primary goods, either directly or by facilitating their acquisition.

The moral permissibility of genetic intervention in humans is met with considerable skepticism. Of all the interventions, germ-line genetic enhancement is considered the most morally contentious. In this paper, I argue for the moral permissibility of some forms of germ-line genetic enhancement. I first consider several arguments against genetic intervention more generally, all of which I think either can be rejected outright or are only contingently valid given scientific limitations. I further suggest that the latter class of arguments will become impotent as the relevant technologies develop over time. I then present a positive argument in favor of certain germ-line genetic enhancements, which holds that such interventions are morally permissible if and only if they serve to augment Rawlsian primary goods, either directly or by facilitating their acquisition.

In discussing human genetic intervention, it is helpful to acknowledge two common distinctions. First, one can distinguish between somatic and germ-line cells. Somatic cells, such as skin or muscle cells, contain 23 chromosomal pairs and do not transmit genetic information to succeeding generations. Germ-line cells, which are the egg and the sperm cells, contain 23 unpaired chromosomes and provide genetic information to offspring, as well as to the future generations descended from those offspring. Second, one can distinguish between genetic therapy and genetic enhancement – alternatively referred to as negative and positive genetic engineering, respectively, although these expressions have become less fashionable. Genetic therapy aims at the treatment or prevention of a disease, whereas genetic enhancement aims at the enhancement of some capability or trait. Accepting these distinctions, there are four categories of genetic intervention: somatic cell gene therapy, somatic cell genetic enhancement, germ-line gene therapy, and germ-line genetic enhancement.[1]

Presumably, ethical enquiry could proceed independently for each of these categories. Somatic cell intervention, which affects only the subject of the intervention, is most likely less morally contentious than germ-line intervention, which will affect all future generations (in the absence of any further interventions). Germ-line intervention is consequently more extreme in scope and, furthermore, will come to affect individuals who have not consented to the procedure. One also might think that gene therapy is less morally contentious than genetic enhancement. Various arguments have been advanced in favor of this position, which include, but are not limited to: genetic enhancement is closer to "playing God," runs contrary to the goals of medicine, risks the priority of love for genome over love for child, and so forth. Although these arguments are of varying merit, it is at least worth observing that most of us feel that curing Huntington's chorea through germ-line gene therapy is less morally problematic – and more morally incumbent – than creating taller or faster children through genetic enhancement. I feel that the strength of this intuition alone provides good reason to suspect that genetic therapy is less morally contentious than genetic enhancement. Given these two results, one might postulate the following order, from least morally objectionable to most morally objectionable: somatic gene therapy, germ-line gene therapy or somatic cell genetic enhancement, and germ-line genetic enhancement. In the literature, the endorsement of these practices generally has followed the expected pattern; somatic gene therapy is the least contentious, germ-line genetic enhancement is the most contentious, and, although there are substantial debates on the intermediate practices, it seems most bioethicists, under appropriate conditions, ultimately would support both germ-line gene therapy and somatic cell genetic enhancement.

It is worth noting that the therapy/enhancement – or, alternatively, the positive/negative – distinction can be challenged. For example, an individual

might be depressed either by virtue of some genetic defect, such as limited serotonin production, or because she happens to have a difficult life – e.g., death of several close relatives, loss of job, and the like. In the latter case, she could be genetically "normal" and any genetic intervention would constitute enhancement rather than therapy. However, in the former case, intervention would constitute therapy. Insofar as the therapy/enhancement distinction is supposed to be morally relevant, one might question it on the grounds that it suggests that the same genetic intervention is deemed more morally appropriate in one case than in the other. Certainly the depression could be qualitatively identical for both women and each is entitled to relief; the therapy/enhancement distinction focuses solely on the etiology of the affliction and wholly ignores the degree of suffering. Furthermore, this distinction inevitably leaves one with hard cases in which it is difficult to ascertain whether a given intervention qualifies as a treatment or as an enhancement.[2]

Nevertheless, I think it is safe to assume that most bioethicists accept this distinction, although perhaps hesitantly or in a qualified manner. In many, or even most, cases, one legitimately can view the therapy/enhancement distinction as morally relevant, and, in most cases, it will not be tremendously difficult to draw the line between what constitutes therapy and what constitutes enhancement. When difficult cases do arise, principles exist to help make the determinations. Norman Daniels, for example, has argued for the use of "quasi-statistical concepts of 'normality' to argue that any intervention designed to restore or preserve a species-typical level of functioning for an individual should count as treatment, leaving only those that would give individuals capabilities beyond the range of normal human variation to fall outside the pale as enhancement" (see Juengst and Walters 2003, p. 579; also Daniels 1992). Alternatively, Eric Juengst (1997) has proposed that therapies aim at pathologies that compromise health, whereas enhancements aim at improvements that are not health-related. In most cases, either proposal will help determine what would count as a treatment and what would count as an enhancement. So, although the therapy/enhancement distinction is not above discussion, I propose to accept it for the sake of this paper, particularly because of its general intuitive resonance and its conceptual appeal.

Finally, discussions of genetic intervention frequently begin – and sometimes even end – with an evaluation of scientific limitations. There is no doubt that genetic intervention is currently in its nascent stages and, although some reasons exist to be optimistic about its future, there still are *tremendous* obstacles that must be overcome before it will be able to fulfill its potential promise. These obstacles include, but probably are not limited to, our limited knowledge regarding the human genome and the functioning of individual genes, our limited knowledge of the optimal procedural techniques, and our inability to address – or

even conceive of – the inordinate economic costs of both research and practice. These issues are so daunting that it has been suggested that no "serious organized discussions" regarding genetic intervention can even take place for several years to come (Neel 1993).[3]

Although these issues obviously are critical to the ultimate success of genetic intervention, I fail to see how they impugn upon enquiry into its *moral* dimension. Furthermore, it is imperative that this moral dimension be investigated *before* the scientific limitations are overcome. As we have recently seen in the cloning debate, it is possible that the science can develop ahead of – or independently of – a healthy moral discourse.[4] When this happens, society is left to "catch up" from both a moral and a policy standpoint; advance discussion could preclude this disadvantage and ensure the appropriate readiness for scientific advance. Finally, in the case of genetic intervention, it is certainly not the case that any dialogue will be conceptually bankrupt or be wholly fruitless – we have a good idea of the relevant issues, and we can get to work on those now.

Arguments against (germ-line) genetic enhancement

Of the four categories of genetic intervention introduced above, I think that it is fairly clear that germ-line enhancement is the most morally contentious. Certainly, there are those who would object to the other categories. However, these objections often reflect theological concern, scientific limitations (see, e.g., Danks 1994),[5] or involved risk (see, e.g., Anderson 1990).[6] Insofar as we live in an increasingly secular society, this first type of concern may be partially allayed or marginalized. The second type of concern will abate in the wake of scientific progress, which is bound to ensue; in the event that scientific limitations do persist, this objection would remain valid, although only contingently so. Finally, no rational proponent of genetic intervention would propose that we move forward until the potential benefits outweigh the potential risks, a development that one might reasonably assume to be inevitable, even if distant. (In his classic book, Jonathan Glover (1984, pp. 42-43) proposes a "principle of caution" that would hold that "we should alter genes only where we have strong reasons for thinking the risk of disaster is very small, and where the benefit is great enough to justify the risk." There might, of course, be epistemic issues but, conceptually, this is, I think, right.)

Although there have been other objections to genetic intervention, I take these to be the three most common strains, and I further take it to be the consensus among most bioethicists that somatic cell interventions (both therapy and enhancement) as well as germ-line therapies are, or could be, morally permissible. Somatic interventions can most obviously be defended on the grounds of autonomy; so long as a rational, autonomous agent consents to the alteration of his genome,

there is at least a *prima facie* reason to not preclude him from doing so. There might, of course, be other relevant and countervailing issues – e.g., safety, fairness, and the like – but, *prima facie*, somatic interventions seem morally permissible. Germ-line gene therapy also seems to be *prima facie* morally permissible. Consider, for example, Huntington's chorea, which results from a single defective gene. In this particular case, the problem stems from a single gene – on chromosome 4 – that issues excessive calls for glutamine production, and deletion of an appropriate string of the gene would wholly preclude this terrible affliction. In such cases, and presupposing safe and effective procedures, it would be entirely unreasonable to deny the moral legitimacy of the therapy. Even those who stand somewhat opposed to genetic interventions would grant that "it would be cruel, if not stupid, to suggest that we ought never to use genetic technology to heal the sick" (Parens 1995, p. 151).

But, although there seems to be general support for somatic cell interventions and germ-line therapy, germ-line enhancement remains highly contentious, and perhaps even unpopular (see, e.g., President's Commission 1982; President's Council 2003). One problem with enhancement in general, as opposed to therapy, is that the scientific prospects are extremely daunting. Treatment of Huntington's chorea, for example, requires intervention at a single and known genetic locus. And, in fact, many treatments would involve intervention at single genetic loci. Enhancements, however, are far more difficult since hardly any human trait or capability is influenced by one, or even a small number, of genes.[7] Not only does the number of relevant genes frequently approach or exceed 100, the genes also contribute unequally to the development of any given trait or capability (Clark and Grunstein 2000, pp. 82-94). For an enhancement to work, not only must all, or at least many, of the genetic loci be established, but their relative contributions must be ascertained. This is a *tremendous* scientific obstacle, and one that is not likely to be overcome in the near future. Nevertheless, I am concerned with the moral, rather than the scientific, problems of germ-line enhancement. Again, I assume that the scientific limitations eventually will be overcome. Once these developments are realized, what moral objections will remain?

One argument offered to impugn the moral legitimacy of genetic enhancement holds that such practice inevitably would lead to unjust outcomes. Although different opinions exist as to what constitutes this injustice, a plausible suggestion is that genetic enhancement would be available only to a wealthy few and not to the vast majority of society. These wealthy few could augment their own abilities, or those of their progeny, through genetic enhancement and consequently widen the gap between the rich and the poor and/or leave the "have-nots" unable to compete in an integrated society. This injustice should be avoided; genetic enhancement, which would lead to this injustice, is therefore morally problematic.

In response to this argument, I propose that we differentiate between genetic enhancement *itself* and its *distribution*. Insofar as the preceding scenario is unjust, society could adopt a different pattern of distribution. On the pure libertarian model, the rich presumably could claim some entitlement to their resources and pursue genetic enhancement that would lead to the above effects (Nozick 1974). But other models of distribution exist. A Rawlsian, for example, could argue that the upper class may make themselves better off – as measured against a battery of primary goods that could include genetics – only insofar as they improve the situation of the least well-off class (Rawls 1999). Perhaps the genetic enhancements of the few would create a larger social product such that everyone would benefit. Or perhaps genetic enhancements for the wealthy would only be permissible if the wealthy subsidized the genetic enhancements of the nonwealthy. There are, of course, other distributive schemes as well. One could hold lotteries for genetic enhancements; nobody would be allowed to be genetically enhanced unless s/he won the lottery.[8] Perhaps part of the tax revenue could fund the procedures in the event that the lottery winner was unable to pay for the intervention.

Regardless, the obvious point is that genetic enhancement procedures alone will not lead to unjust results; there would have to be an unjust distributive scheme to enable the injustice to come about. If we can determine what constitutes a just distributive scheme, then genetic enhancement, as a good or service, can be distributed according to the principles of that scheme. So, in response to the would-be critic, I would point out that it was never the justice of genetic enhancement to which she was objecting, but rather to a specific distributive scheme. Of course, it is the case that the distributive scheme currently in place in the United States could, and perhaps would, lead to distributions of genetic enhancement that some people consider unjust. But this could change; we are many years ahead of the viability of genetic enhancement and have time to prepare for its disbursement by making appropriate policy adjustments.

There are, however, several plausible arguments that could be made directly against genetic enhancement in general or germ-line genetic enhancement more specifically. Some of these have received formulation from Erik Parens (1995; 1998) who, I think, makes the arguments about as compelling as they can be made. First, Parens considers whether genetic enhancement will compromise important facts about human existence and consequently detract from some of the aesthetic value of human experience. If, for example, genetic engineering could be used to speed up aging and circumvent the turmoil of adolescence or allay the pains of growing old, we might feel compelled to use it for these purposes. But he thinks that these processes, or our "fragility" more generally, have value and that there is at least a *prima facie* problem with interfering with them.

Clearly Parens holds a worldview that some would deny: at least it is not intuitively obvious that there is necessarily anything bad about accelerated aging, nor that there is necessarily anything good about aging, death, or human fragility. Rather, many people might think that the use of genetic enhancement to address these issues would be valuable. But other people would agree with Parens. Nevertheless, this does not impugn genetic enhancement *in general*, but rather only its use for those purposes that society, through consensus, determines to be unpalatable. In the next section, I offer a positive argument in favor of specific forms of genetic enhancement, but here it is sufficient to observe that it need not be either permitted or banned categorically; presumably, there are moral principles that can help to determine which sorts of genetic intervention should be allowed. Even Parens grants this; his point is only to establish that in *some* cases, there are reasons to think that genetic enhancement is a bad idea. This is no reason, however, to think that there are *no* cases in which genetic enhancement would be valuable.

Second, Parens wonders whether genetic enhancement would detract from accomplishments, making them less noteworthy or laudable. To use his example, we are less impressed with an athlete who performs with steroids than another athlete who turns in a comparable performance without the help of steroids. Similarly, one can imagine two athletes, one with genetic enhancement and one without. Presumably the accomplishments of the latter would be more impressive than the comparable accomplishments of the former.[9] The former accomplished the same results with fewer "resources" and is therefore more deserving of respect and awe. The question, however, is whether the potential to undermine accomplishment is a legitimate reason to avoid genetic enhancement.

I do not think so. First, successive generations always have more resources available to them than previous generations, and this fact alone does not mean that the current generation is less deserving of respect or awe than previous ones merely because its members have accomplished what they have with more resources. Consider, for example, the Olympians of classical Greece. Their athletic accomplishments, although tremendous at the time, could be duplicated now by even the most average inter-collegiate athlete. In the intervening millennia, we have amassed a huge knowledge regarding nutrition, training techniques, sports medicine, and the like. This corpus of knowledge allows athletes to train in much more sophisticated manners and to perform in ways that would have been impossible long ago.

Certainly we would not want to say that current athletes *accomplish* less simply because they have advantages over their ancient Greek counterparts. More logically, one might say that the *standards of evaluation* have changed; the ancient Greeks were judged against certain criteria (relative to what was possible

and expected at the time), and current athletes are judged against different criteria (relative to what is possible and expected now). Excellence and accomplishment is measured relative to some standard, and that standard is dynamic. The existence of comparative advantage cannot preclude accomplishment, it can only affect the standard against which accomplishment is measured.

Although I think that this argument alone shows that advantages do not impugn accomplishment, the same point can be made more specifically with respect to genetic – versus epistemic or social – advantages. Obviously many current professional athletes have genetic constitutions that give them tremendous advantages over the rest of us. Nevertheless, this does not diminish the respect and awe that we afford them. Certainly I do not watch Michael Jordan execute a 360° slam dunk and denigrate the feat on the grounds that his genetics made it more likely that his 6'6" frame could pull it off while my 6'0" frame had little hope. Obviously these athletes train exceptionally hard but, even if most of us were to train with comparable intensity, we would be unable to perform at their levels. The reason is that many of their talents and capabilities are genetically endowed or enabled and, as such, are beyond the reach of the average person. So I would maintain that we respect athletes *regardless* of their genetic superiority. If this is right, then genetic enhancement should not be morally contentious *merely* by virtue of the fact that it would augment performance.

A plausible response to this line of reasoning is to posit a morally relevant distinction between natural and "unnatural" (in the sense of interventionistic) genetic advantages. The reason that one scoffs at the sprinter on steroids is because he *cheated* by augmenting his actual abilities by taking drugs. Michael Jordan on the other hand, merely utilizes his natural endowments, and therefore is not deserving of any disapprobation. If this is true, then it might be a reason to disallow "unnatural" genetic enhancement. But I think that this conclusion misses an important point: most of our talents and abilities are developed through intervention. One certainly would not say that the accomplishments of a leading moral philosopher are less impressive because he was trained at the best institutions and under the best professors. Nor would one say of an athlete that her accomplishments are less valuable because she spends so much time in the gym and on the track (see Glover 1984, p. 45).

The critic would have to hold that education and exercise are morally legitimate interventions – or serve to augment our abilities and talents in a morally legitimate way – whereas genetic interventions are not. And what justification could be offered for this nonhomogenous theory regarding the moral legitimacy of intervention? That the genome is "special"? That education and exercise facilitate developments allowed by one's natural genetic endowments whereas genetic enhancement changes those endowments and is therefore immoral?

Certainly these arguments would not be ridiculous, but they seem, at a minimum, to be *ad hoc* and/ or undermotivated. Furthermore, they seem to be based on the premise that "natural is good," which is probably false. For example, many natural phenomena, such as aging, disease, rape, and murder are *not* good. And, to return to a continuing theme, even *if* one thought that some genetic enhancement would undermine achievement, a conclusion I am inclined to deny, it does not logically follow that *all* genetic enhancements would be ruled out.

One final argument to consider against genetic enhancement is whether genetic enhancement is problematic because its pursuit demonstrates a failure to accept our place in nature. There is, I think, a sentiment that genetic enhancement is nefarious on the grounds that it shows a discontent with what humans have been given – whether through divine providence or through natural selection – and that this sort of dissatisfaction is unpalatable. On this line of reasoning, it is better to accept our limitations and to be content with what we have than to try to change what we are. Relatedly, we can ask what sort of people we would be if we tried to alter ourselves. Perhaps trying to do so would be demonstrative of inhumility or could be characterized as vicious in some other way.[10]

I do not think that either of these suggestions can undermine the moral legitimacy of genetic enhancement. With regard to the first, I simply do not view the pursuit of genetic enhancement as an expression of dissatisfaction with ourselves. Rather, I look at it as a chance to *improve* ourselves, and improvement is certainly not morally dubious. We undergo all sorts of processes that aim to improve the human experience: we pursue education; we exercise; we do research. Why should genetic intervention be viewed any differently? As I said above, I do not see any compelling moral distinction that can be drawn. Would it be because, most fundamentally, our genomes are what we "are," and other pursuits do not affect this fundamental fact about ourselves? Certainly I do not think that my genome is what constitutes me. I view myself as a rational, autonomous agent capable of pursuing ends that I find valuable. I also disagree that genetic enhancement would be vicious. Genetic enhancement would aim, *most fundamentally*, at the improvement of the human experience. What end could possibly be more noble than that? Genetic enhancement surely could be applied to nefarious ends, and we always must be vigilant against such abuses. But there is no reason to think that it would be intrinsically evil, the only way that genetic intervention could manifest evil would be through misapplication.

The positive argument

Thus far, I have attempted to reject or undermine arguments that could be made against genetic enhancement. But an important task remains: to establish a strong argument in favor of it. Probably the most obvious way to argue for genetic

enhancement would be to proceed on utilitarian grounds. Look, one might say, this practice has the potential to increase human capabilities that, when exercised, will increase total aggregate happiness. If people can be made smarter, for example, they could do more good with less effort and in less time. Certainly any means to this end is, at least *prima facie*, morally laudable. Of course, the critic would want to interject that there is tremendous potential for disutility: there is scientific risk and uncertainty; there is the problem of distribution; and so forth. But, as I already have argued, these factors need not impugn the hedonic calculus. Nobody has argued that genetic intervention should proceed when the risks outweigh the benefits. Rather, we must wait, however long, until the balance sheet comes up positive, and there is no reason to think that this will not happen eventually. And, if certain distributive schemes will lead to strife and angst, then society must adopt a differing distributive scheme – surely at least one will mitigate these disutilities. Given these responses, I am quite confident that genetic enhancement could be justified quite easily on utilitarian grounds.

Nevertheless, I think that one can do better than a simple utilitarian argument. For one thing, many people are not utilitarians, so they will be unlikely to be swayed by such a line of reasoning. In addition, utilitarianism can be rather insensitive to the notions of rights and of justice, both of which should be taken seriously. To this end, one might want to consider future generations more directly, particularly as pertains to one moral feature frequently evoked against germ-line genetic enhancement: the fact that their consent is never given for the interventions (see, e.g., Lappé 1991).[11] Presumably this concern derives from Kant's moral philosophy, most specifically from the second formulation of the categorical imperative and its edict to treat individuals as ends and never merely as means or, more simply, to treat them in ways to which they would rationally consent. Technically, of course, unborn generations lack rational nature and therefore do not participate in humanity. Therefore, I think, Kant would not object to genetic intervention on the grounds that it fails to respect their (nonexistent) autonomy. Regardless, one certainly may adopt a neo-Kantian line of reasoning wherein all humanity (present and future) should be treated ways to which its members would rationally consent, were they able to do so.

Germ-line genetic enhancement will, of course, affect *all* future generations – although perhaps to a diminishing extent as the genetic contribution from a single generation dissipates in future generations – as long as its effects are not reversed or superceded by other interventions. So, to honor the Kantian principle, genetic intervention would be morally permissible only if *every* future generation would rationally consent to the genetic alterations made in the germ-line. Can this criterion be satisfied? Absolutely. More interestingly, however, the answer suggests which sorts of germ-line enhancements are morally permissible and which are not.

To see why some enhancements are morally permissible, I invoke John Rawls's notion of primary goods. Primary goods are those things that every rational person should value, regardless of his conception of the good: rights, liberties, opportunities, income and wealth, health, intelligence, imagination, and the like (Rawls 1999, pp. 54-55). These are the things that, *ex hypothesi*, everyone should want; it would be *irrational* to turn them down when offered. Nobody could be better off with less health or with fewer talents, for example, regardless of her life goals.[12] Building off of Rawls's concept, I propose that germ-line genetic enhancements are morally permissible *if and only if* they augment primary goods or create abilities that would lead to their augmentation.

To defend this claim, I must establish both directions of the biconditional. First, consider whether germ-line genetic enhancements are morally permissible *if* they augment primary goods. The notion of moral permissibility I am concerned with here is the Kantian one, so the central question is whether those affected by the genetic interventions would rationally consent to the enhancements, were they able to do so. Since primary goods are those that, by definition, any rational agent would want regardless of his conception of the good, *all rational agents would consent to augmentation of their primary goods*. Because rational consent is sufficient for moral permissibility, on the Kantian model, one direction of the biconditional is established.

Perhaps more interestingly, one even could argue that these enhancements would be *required* by Kant. Kant speaks of a duty to develop one's own talents; so, if genetic enhancement would consist in the development of talents, Kant might consider its pursuit to be a duty. Of course, in this case, it would not be *self*-development of talents, which is the case Kant considered, but rather someone else developing the talents of the (potential moral) agent. Nevertheless, I think that failure to develop the talents of one's progeny plausibly could yield a contradiction in will, and, if so, genetic enhancements would be required by Kant. But the prospect of a moral obligation to enhance is made even stronger by Rawls (1999), who writes: "[I]n the original position . . . the parties want to insure for their descendants the best genetic endowment. . . . The pursuit of reasonable policies in this regard is something that earlier generations owe to later ones." Athough I am tempted by these lines of argumentation, I limit my investigation here to the *permissibility* of genetic enhancement.

To establish the second half of the biconditional, I must show that genetic enhancements are morally permissible *only if* they augment primary goods. In doing this, I also address a common and legitimate concern against germ-line genetic enhancement, namely that it will lead to the creation of "designer babies,"

such that parents might try to create, for example, the next Michael Jordan. Certainly such a use would be unpalatable. However, many of the enhancements requisite for the creation of Michael Jordanesque abilities do *not* satisfy my criterion of augmenting primary goods. For example, many great basketball players are quite tall, and prospective parents might contemplate editing their germ lines to increase the potential height of their progeny. But height is not a primary good: rational people easily could prefer not to be tall. Although height helps basketball players, it can be inconvenient with respect to entering doorways, physiological strains, and unwanted attention. Skin color, eye color, and even sex would be off limits as well for genetic intervention since none of these features constitute primary goods nor would necessarily lead to their acquisition. Rational people could disagree as to which instantiations of these characteristics would be most valuable. But why would these interventions be *immoral*? Since interventions that augmented these non-primary goods would not be desired by all rational agents, not all rational agents would consent to them. Because rational consent is a necessary condition for moral permissibility, these interventions would be immoral. Having now established the second direction of the biconditional, I have shown that genetic enhancements are morally permissible *if and only if* they augment primary goods, or create abilities that which would lead to their augmentation.

For emphasis, I shall briefly reflect on the extent of interventions that *would* be morally permissible on my view. Certainly any intervention that would make progeny more healthy is morally permissible.[13] But I want to extend the argument beyond the permissibility of mere therapies (such as curing Huntington's chorea) and to authorize enhancements. Genetically engineering greater resistance to disease obviously would be morally permissible, even if the subject of the intervention already has a level of disease resistance commensurate with that of a "normal" human. There are a number of other physical enhancements that I think also would be morally permissible insofar as they would augment talents or capabilities: for example, improvements to eyesight, speed, strength, and the like. All of these characteristics have genetic bases, although environment obviously plays a substantial role as well, and I think that enhancements aimed at improving them are morally permissible. Furthermore, there are a number of mental characteristics that contribute both to our talents and to our overall intelligence. If there ever were a way to enhance mental acuity, mathematical and spatial reasoning, language faculties, creativity, musical abilities, and the like, I would propose that we should do so.[14]

Obviously these enhancements are, for now, scientifically impossible. And, to vanquish the specter of genetic determinism, I willingly concede that genetics are only part of the picture. The talents, capabilities, and physical traits of an adult cannot be read off of his or her genome; we have free will to decide which of our

potential talents we choose to develop,[15] and our environments affect our physical traits as well as our opportunities to develop talents and capabilities.[16] Nevertheless, genetics can confer at least the potential to develop in certain ways and some of these potentialities are more valuable than others, both prudentially and morally.

In conclusion, I think a strong argument can be made to support the moral permissibility of certain types of genetic enhancement in general and germ-line genetic enhancement in particular. Specifically, such interventions are morally permissible if and only if they serve to augment Rawlsian primary goods, either directly or by facilitating their acquisition.

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Notes

1. Beauchamp and Walters (2003, pp. 454–56) provide a good introduction to genetic intervention.

2. For a an excellent and detailed discussion of the therapy/enhancement distinction, see Buchanan et al. (2000, pp. 104–55).

3. Neel is particularly concerned with the dialogue over germ-line therapy, although I think that he would not object to the extension of his view to genetic enhancement as well. See also Walters and Palmer (1997, Ch. 3) for another response to Neel.

4. More specifically, I am thinking here of the surprise announcement of Dolly's creation and the quick and uncritical condemnation issued against cloning both by the public and by politicians. If there had been a more open forum prior to this announcement, I suspect that the reaction would have been quite different. Alternatively, the open forum might have generated a critically informed indictment of cloning in which case there might have been legitimate pressures to abandon research.

5. For an assessment of the existing scientific possibilities, and consideration of

some moral arguments, see Gordon (1999). Gordon's article is, however, a few years old and scientific possibilities are growing rapidly.

6. Anderson also argues against the moral dangers of genetic intervention.

7. The fact that (most) enhancements would require intervention at more genetic loci than (most) therapies is even intuitively obvious. Consider a car: there are a vast number of singular malfunctions that could cripple a car's normal functioning, yet there are very few, if any, singular interventions that could enhance it. To substantially improve a car most likely would require redesign of at least one entire system. Similarly, with human genetics, a vast number of malfunctions could substantially lower the welfare of an individual (and therefore open the door for genetic therapy), yet there are few singular interventions that could substantially *enhance* an individual's welfare – to use the vernacular of the biologist, most traits are highly multigenic and quantitative.

8. This idea has been proposed by Maxwell Mehlman and Jeffrey Botkin (1998) and further developed in Mehlman (2000).

9. Although I am concerned particularly with whether genetic enhancement can be said to undermine accomplishment, Juengst and Walters (2003) offer a related discussion as to whether genetic enhancement constitutes a form of cheating. They are inclined to think that it does not, but admit that it might force institutions – be they athletic, educational, and the like – to reconceive their standards of evaluation, to redesign the "game," or else to prohibit certain enhancements.

10. In an article that I very much like, Thomas Hill (1983) argues for environmental consciousness on the grounds that we would not be good people if we did not care about our environment. If, for example, we decimate forests to build strip malls, we display an arrogance and an attitude that is morally blameworthy. Although I agree with his argument as pertains to the environment, I do not think that it can be extended to impugn genetic enhancement.

11. Juengst and Walters (2003) offer a good discussion of other rights-related issues for germ-line intervention.

12. Someone might object to the categorical value of some primary goods, such as intelligence or talents, on the grounds that their possession brings about higher expectations and greater pressures. Although such an objection risks regression to Mill's swine, one, nevertheless, could grant that, insofar as expectations and pressures are undesirable, the goods that would lead to them are not primary since some rational agent would disapprove of them. Even though this concession might undermine certain proposed goods, such as intelligence, it is unlikely to impugn others, such as health. But, more fundamentally, I am tremendously skeptical that *any* of Rawls's proposed primary goods could make someone worse off. Although one might not like the pressures associated with increased intelligence, for example, the intelligence *itself* is certainly desirable.

13. Walters and Palmer (1997) also argue that interventions aimed at health are morally permissible. However, I think additional enhancements are legitimate as well.

14. Although some people might be reluctant to accept the relationship between genetics and mental abilities, such a relationship most certainly exists. (As importantly, there is no moral cost to acknowledging such a relationship, since doing so has no normative implications.) For discussion of the genetic basis of cognitive ability, see Clark and Grunstein (2000, pp. 221-238); Bouchard (1998); Bouchard and McGue (1981); Plomin et al. (1994); and Daniels et al. (1998).

15. For discussion of the relationship between genetics and free will, see Clark and Grunstein (2000, pp. 265-70); Pinker (2002, pp. 174-85); Ridley (1999, pp. 301-13).

16. For discussion of the interactions between genes and the environment, see Clark and Grunstein (2000, pp. 218-20, 253-65) and Ridley (1999, pp. 65-75).

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