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Design constraints for the post-human future

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ABSTRACT

A variety of objections to human germ-line genetic engineering have been raised, such as the claim that we ought not to place individuals at significant risk without their consent. It has also been argued that it is paternalistically objectionable to confer significant benefits on individuals without their consent. As well as imposing a risk of harm to non-consenting parties, there is the risk of harm to others. This paper evaluates these and related objections to germ-line genetic engineering. While a complete prohibition on human germ-line genetic engineering is rejected it is argued that acceptable germ-line engineering (a) should at least expand and enrich rather than restrict and constrain the choices for individuals affected, and (b) should not seek to change basic human dispositions and values ('human nature')

Introduction

The powerful technologies of genetic engineering provide opportunities for immense benefits, both personal and commercial. These possibilities however have sharply polarised opinion. On the one hand, the radical possibilities are enthusiastically embraced. Agriculture is being reshaped with genetically modified (GM) crops. Gene farming ('pharming') enables the harvesting of a wide range of valuable pharmaceutical and other products by exploiting the capabilities of the miniature chemical factories which we call cells. There is also the capability for developing sophisticated medical diagnostic tools. We are developing the capability to grow replacement organs for human transplants in tissue cultures and in animal hosts. And on a grander scale, there is the prospect of taking charge of our evolutionary destiny by radically reshaping the human genome — replacing the crooked timber of humanity with something perhaps a little closer to the gods.

There are also risks. Anthropogenic genetic change may impoverish gene pools and reduce biodiversity, or — deliberately or inadvertently — release rogue pathogens into the environment, whose impact is difficult or impossible to assess. The prospects have therefore been variously characterised as exciting and alarming, and both claims are probably right. We are not very good at risk assessment, and that is an important part of the problem.

On the micro-level, genetic technology provides us with *information*: importantly, the means to detect diseases for treatment, as well as the drugs which provide the cure. It expands screening procedures, providing prospective parents with an opportunity to abort foetuses with undesirable — or, more controversially, undesired — genetic properties. In addition to these informational functions, it provides the means for *therapeutic* measures (both germ-line and somatic, and corrective and enhancing) to combat deadly, disabling and disfiguring conditions, or to effect enhancements, such as producing so-called designer babies.

On the macro-level, biotechnology provides the means to rapidly and radically transform the biosphere, together with its human and non-human occupants. After several billion years of, on the whole, leisurely evolutionary development by a process of chance mutation and natural selection, we have abruptly seized the knowledge, and the Promethean power, to reshape our human and our planetary destiny. This is the most significant technology since the control of fire. Moreover, the biotechnology juggernaut is almost certainly unstoppable. It is driven by billion dollar market opportunities as well as by the (very dubious) prospect of delivering what religion once promised — personal immortality.

There is an enormous range of ethical issues to be addressed, and an important subset of these issues concerns our obligations to our human, or post-human, descendants.[1] Given that there is an extensive and still indeterminate range of possible changes, are there any constraints which human genomics need to respect? That is the topic which I want to consider in this paper.

The aim of molecular biology is to interpret biological performance in terms of molecular structure.[2] The aim of what I shall call *heroic* post-humanist genetic engineering is to revise molecular structures to enhance or, better, to perfect biological performance.

One of the most radical, ambitious and entertaining articulations of the heroic post-humanist project is provided in David Pearce's blueprint for "paradise engineering". Pearce's project is to fabricate a post-Darwinian world. Pearce is a techno-optimist who believes that the transition to this world is "conceptually simple, technically feasible and morally urgent".[3] Biology, Pearce believes, has now enabled us to identify the molecular roots of our ill-being. It is or duty to eliminate the tyrannical effects of DNA which "ensure that cruelty, pain, malaise are endemic to the living world". We are the first fortunate generation of beneficiaries to view the post-Darwinian panorama and the prospect it provides of allowing us to "rewrite the vertebrate genome; redesign the entire global ecosystem; deliver genetically pre-programmed well-being to everyone who wants it".

According to Pearce, "a naturalistic, secular paradise of effectively everlasting happiness is biotechnically feasible". Biotechnology can make us "smarter, happier — and nicer. Post-Darwinian superminds can abolish physical and mental pain altogether". Pearce's warm enthusiasm calls to mind the lines of William Wordsworth:[4]

Bliss was it in that dawn to be alive,
But to be young was very heaven! —

Pearce suggests that "Darwinian evolution has powerfully favoured the growth of ever more diverse, excruciating, but also more adaptive varieties of psychophysical pain. Its sheer *nastiness* effectively spurs and punishes the living vehicles of genetic replicators". Kant observed that if happiness is the purpose of human existence, we then have a constitution which is exceedingly ill-designed for achieving that end,[5] and Pearce (and his radical post-humanist supporters) most surely agree.

At the other extreme, there are opponents of any tinkering with our genetic heritage. Sometimes it is suggested that any such interference is 'playing God'; that is, arrogating to ourselves the prerogatives of the deity. However, the wholesale opposition to tinkering with the human genome is implausible, and the religious basis commonly appealed to in support of this opposition is, to put it no more strongly, problematic.[6]

Prima facie, we can distinguish between negative (therapeutic) engineering which aims to restore normality and correct dysfunction and disease and positive (or enhancement) genetic engineering which might aim, for example, to produce a healthier, smarter, more capable, more robust and longer-lived human individual or population. While negative (corrective) engineering is generally thought to be ethically unproblematic, positive (enhancement) engineering in general is not. The division between positive and negative genetic manipulation which features centrally in many discussions is indicated by the horizontal line in Figure 1. This line turns out to be far from sharp, and the distinction is problematic. Attempts to draw up a normative division between the approved and the unapproved, in terms of the notions of normality, dysfunction, and disease, all turn out to be fraught with difficulty.

	Somatic engineering	**Germ-line engineering**
Negative (corrective)	Permissible	Contested
Positive (enhancement)	Contested	Forbidden

Figure 1. Categories of human genetic engineering.

A second important distinction can be drawn between somatic and germ-line engineering. This is indicated by the vertical line in Figure 1. The possibility of tinkering with the germ-line has raised additional misgivings about the technology of genetic engineering, which I will come back to. In general, there appears to be broad support for tolerance towards (or even encouragement of) negative (therapeutic) somatic engineering, opposition to germ-line (enhancement) engineering, and no clear consensus position with respect to the other two possibilities. The germ-line genetic manipulation of non-humans raises additional ethical concerns which will not be considered here.

Defining 'disorder'

If the positive-negative line is used to separate permissible and impermissible applications of genetic technology, we need a workable way to distinguish between *corrective treatment* and *enhancement.* This problem is not restricted to the case of genetic engineering. It may be difficult in a particular case to decide, for example, whether the use of plastic surgery is for *therapeutic correction* of a disfiguring condition or for *cosmetic enhancement.*

One suggestion is to explicate corrective therapeutic treatment in terms of *disorder.* However, if the boundary between what is and what is not a disorder turns out to be blurred, then there will be no consistent and effective way of deciding what is and is not permissible.[7] Writers like Jonathan Glover acknowledge that the positive-negative distinction is problematic:

> The positive-negative distinction is not in all cases completely sharp. Some conditions are genetic disorders whose identification raises little problem. Huntingdon's chorea or spina bifida are genetic 'mistakes' in a way that cannot be seriously disputed. But with other conditions the boundary between a defective state and normality may be more blurred.[8]

There are several things to note from this passage. First, the vagueness of the boundary is not taken by Glover to be a serious problem in many cases. This is clearly right: there are many unproblematic cases where corrective measures are plainly justified. Secondly, disorder is, or appears to be, understood in terms of *normality.* But there are plenty of normal conditions we want to avoid — mild infections, dental caries, anxiety, presbyopia, male pattern baldness — and which we are happy to correct therapeutically. This raises the difficulty of distinguishing between what is corrective and what is enhancing, on the basis of the notion of normality.

It is problematic to distinguish between corrective and enhancing in terms of notions of 'normality', 'dysfunction' or 'disease'. Each of these turns out to be problematic. Moreover, the line dividing the normal from the abnormal may change dramatically over time. As medical knowledge and therapeutic power expand, there will be an increasing number of conditions which will be considered 'abnormal'.

'Normality' therefore seems to be a contingent and an arbitrary way to try and separate the permissible from the impermissible. Normal, by whose standards? And even conditions which are normal by everyone's standards might be ones which we would like to correct. Also, problematically, not every dysfunctional state is disvalued. Neurologist Oliver Sacks, for example, has described a number of cases illustrating exceptional abilities linked with significant and even serious disabilities — autism with precocious artistic or mathematical ability.[9] Efforts to eliminate or palliate the disability often eliminate the ability as well.[10] The appropriate treatment of disability in such cases is far from straightforward.

Some universal conditions, moreover, might be thought to be disabilities. For example, we lack — presumably because at some stage our ancestors lost — the capacity to metabolise certain amino acids. We could splice into the human genome the mouse gene for synthesising ascorbic acid — perhaps in mega-doses for disciples of Linus Pauling. Would this be therapeutic correction of a universal disability or a case of metabolic enhancement? The answer is not clear.[11]

There are dangers in thinking of genetic characteristics in isolation. Certainly, prospective parents offered a choice of eliminating a gene for Tourette's Syndrome would probably do so, overlooking the synergistic and interactive features of genetic characteristics and the way in which apparent dysfunction or abnormality might confer unobvious benefits.

'Slippery slope' objections

If we cannot easily draw a line which demarcates the acceptable from the unacceptable, is it all or nothing? That is the conclusion of so-called 'slippery slope' arguments. Slippery slope arguments come in two flavours, which Bernard Williams has called the 'horrible result' argument and the 'arbitrary result' argument.[12] The horrible result version objects to a particular practice because of where it is likely to eventually lead. The arbitrary result version objects that there are likely to be inconsistent applications of a principle. The difficulty of finding any sharp line separating correction and enhancement is an 'arbitrary result' objection to genetic engineering. The distinction between somatic and germ-line engineering, on the other hand, is clear enough — and objections to germ-line engineering are frequently 'horrible result' objections.

The general strategy for dealing with the arbitrary result problem generated by normative vagueness is to sharpen the normative concept. There are plenty of cases where we have to make a decision to draw a line that differentiates between cases that we want to treat differently and those where there is no possibility of separating the cases on each side of the line.[13] We set effective boundaries, even though there is no significant difference between cases on each side of the line. They are decisions which are *arbitrary* but *reasonable.*[14] If it is reasonable to draw a line separating categories of cases, and if the line may as well be here, then it is no objection to a line that it could equally well have

been drawn somewhere else.

Limit-setting, then, is perfectly as reasonable in genetic engineering as elsewhere, and the fact that we are likely to confront a spectrum of cases which taken pair-wise are morally indistinguishable, is no reason here — just as it is no reason in other cases — for concluding that either *anything* goes or that *nothing* goes. What the boundary is to be and who is to be responsible for setting it are, of course, separate issues.[15]

If we accept that each of us should have sovereignty over our own genetic domain, then somatic gene therapy should be permitted. We should be permitted freedom of choice in respect of purely self-regarding actions, provided at least that they do not involve serious risk, even if that involves the expression of bizarre choices — like red eyes and green hair. In the case of self-regarding choices, the onus of justification lies with those who would impose restrictions on such choices.

Objections to germ-line engineering

There are a number of (very uneven) objections to germ-line engineering.[16] Some of the objections relate to the need to respect the dignity and autonomy of persons: we ought not to place individuals at significant risk without their consent. Moreover, it could be argued that while having an obligation not to harm, we also have no right — because it is paternalistically objectionable — to confer significant *benefits* on individuals without their consent. As well as imposing a risk of harm to non-consenting parties, there is the risk of harm to others. There are also arguments from uncertainty and ignorance which appeal to the precautionary principle.[17] Jeremy Rifkin is a notable exponent of this often somewhat alarmist assessment.[18] Rifkin believes that genetic engineering reduces humanity to chemical codes, reducing us to technologically designed products, which has the potential to lead to a new caste system in which social role is linked to genetic make-up. A common expression of these misgivings is in terms of a mystical (or perhaps spiritual) belief that we should preserve the sanctity of the gene pool, which is the product of 'natural' processes or divinely intended. It is often suggested that we are embarking on a hazardous Promethean adventure which involves appropriating knowledge which is properly the province of the gods. Indeed, 'playing God' has become a cliché for vilifying proposals to modify the human genome.[19]

A more secular argument is that biological processes and products that have evolved over a geological time scale have thereby proven their robustness. They come with the quality assurance of a billion years of testing under searching conditions. There are also good practical arguments based on the (self-interested) desirability of maintaining biodiversity which imply that we should take care to ensure that our genetic tinkering does not reduce this diversity. As Aldo Leopold remarked, the first law of intelligent tinkering is to save all the pieces.

However, why (one might ask) should we favour the slow, fitful,

chancy, piecemeal, small-scale, incremental processes of natural evolutionary change above the rapid and radical changes made possible by genetic technology? Not everyone is satisfied with the product of several billion years of groping by the "blind watchmaker".[20] Techno-optimists such as Pearce, we have already noted, argue that it is our duty to re-jig the entire vertebrate genome and to give the course of evolution an improving nudge in a more favourable direction.

Alarmists also present disturbing possibilities of monstrous hybrids, such as human-chimpanzee hybrids ("chumans"), as illustrating the need for restrictions and controls. We could imagine the possibility of cults — the Moonies or the Hare Krishnas — deciding to go off and establish not just their own distinct cultural identity but their own distinct biological identity as a separate species. What (if anything) is wrong with that? There is a serious worry that such a group choice would place an unacceptable restriction on the range of choice for their offspring. The first general design constraint I propose is that *acceptable germ-line engineering should at least expand and enrich rather than restrict and constrain the choices for individuals affected.*[21]

One of the complications for germ-line engineering proposals is the difficulty in identifying the individuals who might be adversely affected by the choices. The identity of the individuals is determined, at least in part, by the choices made.[22].That is, genetic changes do not merely alter the properties of an individual, but actually determine which individual it is. In these circumstances, it is at least difficult for an individual to complain about choices which may have affected them, because had alternative choices been made, that individual would not have existed.[23]

Another problem which needs to be addressed concerns the question of which or whose standards should be used to assess particular genetic changes. There is a problem in trying to imagine, from our *pre-post-human* perspective (so to speak), what the consequences of radical changes might be, and what the appropriate values that should be used to evaluate the changes are. We might improve the level of satisfaction of individuals, either by enhancing the levels of performance or by lowering standards for gratification. This might be called the problem of value distortion of experiential enhancement. It might be possible to engineer happy 'vegetables' — persons for whom ecstatic states of well-being is guaranteed. While such states might be subjectively perceived as enhancements, they appear — from what we regard as normal experiential perspectives — to be impoverished. This suggests a second general design constraint: *acceptable germ-line genetic engineering should not seek to change basic human dispositions and values ('human nature').*

Conclusion

Slippery-slope objections to germ-line genetic engineering should be resisted, and are no more convincing in these cases than they are in other cases. If we could, for example, eliminate a severely disabling or

potentially lethal gene by germ-line alteration without significant risk, then surely this should be done. Genetic errors are often obvious transcription errors, and the required correction is therefore obvious even though it may be technically difficult. The genetic basis for complex capabilities (such as intelligence, sociability, musical or athletic skill) is much more complex and almost certainly depends upon an orchestrated interaction of a large number of genes. For this reason, enhancement is a great deal more problematic technically as well as ethically.

The potential risks to individuals, to society and to biological systems associated with genetic manipulation are too grave to be allowed to proceed without regulation and control. There is a prima facie case to be permissive with respect to purely self-regarding decisions. After all, if we allow people to mutilate themselves — up to a point — with body-piercing and tattoos, we should also allow them to program themselves genetically to grow green hair or to make even more bizarre choices.

Germ-line engineering provides bizarre and troubling possibilities. However, the potential benefits are of such magnitude that we can expect a cautious progressive incremental extension of these techniques. But in cases where there is a good chance of very great benefit and no great harm, it seems reasonable to proceed, even into the "forbidden zone" of Figure 1. The precautionary message that emerges is: *proceed, but with caution.* The gaining of genetic knowledge proceeds with breathtaking speed.[24] We must be careful to ensure that it is accompanied by the gaining of genetic wisdom.[25]

ENDNOTES

1 I prefer to talk of our obligations to the future, rather than of the rights of future generations. See Grey W, 'Possible persons and the problems of posterity', *Environmental Values*, vol. 5, 1996, pp. 161-179.

2 Medawar P, *Plato's Republic: incorporating the art of the soluble, and induction and intuition in scientific thought*, Oxford: Oxford University Press, 1984.

3 Pearce D, *The hedonistic imperative*, 1996, at URL: http://www.hedweb.com/ All following quotes from Pearce are from this source.

4 Wordsworth W, 'The prelude', Book xi, in *The complete poetical works*, London: Macmillan & Co., 1888.

5 Kant I, *The moral law*, H. J. Paton (trans.), London: Hutchinson, 1948. Kant of course drew a very different conclusion from this shared premise.

6 See Grey W, 'Playing God', in R. Chadwick (ed.), *Encyclopedia of Applied* Ethics, vol. 3, San Diego: Academic Press, 1998, pp. 525-30.

7 One response to this might be to ask whether, and why, we should demand precision or determinacy in our decisions. I am going to assume that a reasonable degree of precision and determinacy is necessary if normative categories are to be effectively action-guiding.

8 Glover J, *What sort of people should there be?*, Harmondsworth: Penguin, 1984, p. 31.

9 Sacks O, *The man who mistook his wife for a hat*, London: Pan Books, 1985. In another case discussed by Sacks, a mathematician experienced periodic crippling episodes of migraine, which were preceded by inspired periods of intensely creative research. Curing the headaches also cured the inspiration. Of course, what was valued was not the migraine but the realisation that it came as part of a package deal which had a very highly valued component.

10 There is also a contextual problem. Some conditions are ordinarily considered to be disabilities even though there are contexts in which that may become problematic. Take dwarfism: it was reported on the Australian Broadcasting Corporation program 'The Science Show' in 1995 that some prospective 'dwarf' parents wanted to ensure that their children were 'normal' by their standards. By their lights they may have been correcting a disability of giantism; what grounds might we have for denying their preferred choice? Similarly, members of a Deaf community have sought sperm donors likely to create offspring who are sensorily 'normal' by their standards, i.e. deaf. This theme is developed in Wells HG, *The country of the blind*, London: Thomas Nelson, 1911, where the normally sighted are treated as seriously disabled by a blind community. See Grey W, 'The ethics of human genetic engineering', *Australian Biologist*, vol. 9, 1996, pp. 50-56.

11 Another example of an abnormal and apparently disabling condition being valued by its subject is provided by a (probably apocryphal) story about Shostakovich, who is said to have had a metallic splinter (a mobile shell fragment) in his brain in the temporal horn of his left ventricle. "Since the fragment had been there, he said, each time he leaned his head to one side he could hear music. His head was filled with melodies—different each time—which he then made use of when composing." See note 9, Sacks O, *The man who mistook his wife for a hat*, p. 135.
A further illustration is the case of the Touretter 'Witty Ticcy Ray', whose brilliance at jazz improvisation and ping pong was linked with his disability. "'Suppose you could take away the tics', Ray said, 'What would be left?'. 'I consist of tics — there'd be nothing left'.". See Sacks O, *The man who mistook his wife for a hat*, op. cit., p. 92. Ray settled for a compromise, 'curing' his disability with medication (a dopamine antagonist, "haldol") during the working week, and enjoying the delights afforded by his 'disability' at weekends. Dysfunction may be a necessary condition for wanting to eliminate a particular characteristic but it is certainly not sufficient.

12 Williams B, 'Which slopes are slippery?', in M. Lockwood (ed.), *Moral dilemmas in modern medicine*, Oxford: Oxford University Press, 1985, pp. 126-137.

13 In Australia there is a blood alcohol limit of 0.05% prescribed for drivers even though there is no significant difference in impairment between a driver with a level of 0.049% and 0.05%. But while there is no significant physiological difference between 0.049% and 0.05% there is very significant legal difference. Again, in Australia, persons under 18 are refused admission to certain categories of film even though, in general, 17-year-olds are not significantly less mature than 18-year-olds.

14 It would be much less reasonable to set a zero threshold for blood alcohol or to refuse admission to violent films to everyone or no one. Similarly, setting limits in genetic experimentation — such as the limit of 14 days for experimentation on human embryos in Britain — may be arbitrary, but it is reasonable if we are to have a workable policy.

15 That is, the fact that the boundary between cases of treatment and cases of enhancement is fuzzy is no reason for concluding that either anything goes or nothing goes. Gene therapy for diseased or abnormal somatic cells may provide effective treatment for some hereditary diseases. It may be possible, for example, to treat the lung tissue of sufferers of cystic fibrosis. Other possibilities are more bizarre or more controversial. Perhaps instead of nicotine patches, ex-smokers could have a gene inserted to produce nicotine or its active metabolite. A genetic 'cure' for male pattern baldness is undoubtedly one of the multi-billion-dollar pots at the end of some gene technology rainbow. Is that therapeutic correction of a disabling or disfiguring condition or cosmetic enhancement? The authority of Aristotle seems to support the view that it is cosmetic rather than therapeutic. Baldness, Aristotle claimed, is not a mutilation or deformity. See Anscombe GEM & Geach PT, *Three philosophers*, Oxford: Blackwell, 1961, p. 4.

16 It is a social policy issue being addressed in many countries, some of which prohibit or plan to prohibit inserting genes into fertilised human egg cells. Such a prohibition would preclude some forms of both somatic and germ-line engineering. Arguments concerning germ-line genetic engineering in non-human species will not be considered in any detail.

17 Nature knows best, it is said, and appeal is made to the alleged wisdom of the evolutionary process.

18 Rifken J, *Algeny: a new word – a new world*, New York: Penguin, 1983; Rifken J, *The biotech century*, New York: Penguin, 1988.

19 See Grey W, 'Playing God', *art. cit.*

20 'Blind watchmaker' was coined by Richard Dawkins, *The blind watchmaker*, London: Longman Scientific & Technical, 1986, to designate the impersonal process of evolution. The metaphor alludes to the version of the design argument famously articulated by William Paley, in *Evidences of the existence and attributes of the Deity, collected from the appearances of nature*, London: Faulder, 1802.

21 Whose standards of enrichment, ours or theirs? It has to be ours. This points to another design constraint.

22 This is a problem that also arises in other contexts — it points to the inadequacy of formulating a principle of beneficence purely in a person-affecting form. This problem is illuminatingly discussed by Parfit D, *Reasons and persons*, Oxford: Clarendon Press, 1884. I have addressed these problems in Grey W, 'Possible persons and the problems of posterity', *art. cit.*

23 This problem also arises problematically in so-called wrongful life cases where it is claimed that an individual's existence is the result of negligence on the part of another. See Jeff McMahan, 'Wrongful life: paradoxes in the morality of causing people to exist', in Coleman & Morris (eds), *Rational commitment and social justice: essays for Gregory Kavka*, Cambridge: Cambridge University Press, 1998, pp. 208-247. Revised and abridged version in Harris (ed.), *Oxford readings in bioethics*, Oxford: Oxford University Press, 2001.

24 It has been estimated that genetic knowledge is doubling every two years.

25 I am grateful to discussants at the Transvision 2003 conference at Yale, where an ancestor of this paper was presented, and to an anonymous referee from the *Monash Bioethics Review* for helpful suggestions which have led to improvements to the text.