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The Iron Test-Tube: Is a Substantive Debate about Biotechnology Possible?

Summary

Biotechnological issues – especially those concerning genetic engineering – are one of the most pressing political challenges of the 21st century. We are deeply divided about how to make policy decisions in this field because of the disagreement in our philosophical and religious worldviews. This paper considers whether – and if so how – substantive debate in this area is possible. It will argue that despite differences in worldviews substantive claims have little hope of succeeding in today's world, because of two countervailing impulses: the technocratic (the desire on the part of many scientists to have a free hand in their work) and the libertarian (that regulation be left to market forces). These impulses drive policy decisions regarding biotechnology to be based on purely formal rational calculations, on means rather than ends. However it will further be argued that although praxis must take a certain priority over theory – policy decisions regarding biotechnology need not await consensus on all sides regarding substantive claims – it *is* possible, and highly favorable, to escape the certain aspects of the narrowly rationalistic debate that currently prevails.

Keywords
Biotechnology, Genetic Engineering, The Politics of Eugenics, Regulation of GMO

ŻELAZNA PRÓBÓWKA: CZY MERYTORYCZNA DEBATA O BIOTECHNOLOGII JEST MOŻLIWA?

Streszczenie

Można przyjąć, iż zagadnienia z zakresu biotechnologii, zwłaszcza dotyczące inżynierii genetycznej, stanowią polityczne wyzwanie dzisiejszych czasów. Ze względu na różnice światopoglądowe oraz różne podejścia filozoficzne mamy do czynienia z głębokimi podziałami uzasadniającymi sprzeczne decyzje podejmowane w ramach polityki społecznej w tej dziedzinie. Celem przedstawionych tu rozważań jest ocena, czy, i jeżeli tak, to w jakiej mierze możliwa jest debata dotykająca sedna problemu. Jak się wydaje, pomimo prezentowanych, odmiennych stanowisk światopoglądowych, taka debata w dzisiejszych warunkach ma nikłe szanse powodzenia, a to z powodu dwóch dominujących tendencji: technokratycznej (dążenie wielu naukowców, aby dać im wolną rękę w ich pracy) i libertariańskiej (aby wszelkie regulacje pozostawić prawom wolnego rynku). Te tendencje sprawiają, iż decyzje dotyczące sfery zagadnień biotechnologicznych oparte są na czysto formalnych, racjonalnych kalkulacjach, bardziej na środkach niż celach. Aczkolwiek, mimo iż *praxis* ma na ogół pierwszeństwo w stosunku do teorii, istotne, polityczno-społeczne decyzje w dziedzinie biotechnologii niekoniecznie muszą stanowić wynik konsensusu w tych sprawach, lecz, jak to jest postulowane w dalszej części rozważań, wydaje się możliwe, a nawet wysoce wskazane odejście od wąsko rozumianej, dominującej obecnie, racjonalistycznej debaty.

Słowa kluczowe:
biotechnologia, inżynieria genetyczna, polityka eugeniki, regulacja GMO

We are living in a time when advances in biotechnology are raising moral issues that public officials whether judges, legislators, or administrators can scarcely help but confront. Even if they want to avoid addressing these issues, they increasingly encounter situations that require them to make policy, in one form or another. Not surprisingly,

this has led to the creation of advisory groups and commissions specifically designed to advise on such matters – particularly on the moral issues at stake. These biotechnological issues, in other words, bring into the sharpest possible focus one of the most pressing challenges we face in political theory today, which is how to make policy decisions when we are deeply divided about the substantive religious and philosophical claims that underlie them.

One common response is to say that since we are so deeply divided the only fair thing to do to grant everyone – scientists, clinicians, ordinary citizens – as much freedom as possible to develop and make use of the relevant technologies. As appealing as that proposal may sound at first blush it is striking that it is rarely, if ever, actually adopted by policy-makers. Why? Undoubtedly one reason for resisting the lure of this kind of thinking is the following countervailing consideration: the actions people take in developing and utilizing biotechnologies are rarely purely self-regarding. They affect the lives of other people, sometimes profoundly. And since it can scarcely be taken for granted that the results of such actions will always be beneficial, laws need to be enacted to make sure that the interests of all affected parties are protected. On what basis, then, should such laws be created? Must policy decisions wait for consensus on the substantive claims being forwarded? If we disagree profoundly about the relevant philosophical or religious issues at stake here, how can we ever hope to reach a consensus?

It will be argued in this paper that substantive claims, even when they are well-grounded have little hope of succeeding in today's world, because of two countervailing impulses: the technocratic (the desire on the part of many scientists to have a free hand in their work) and the libertarian (that regulation be left to market forces). These impulses drive policy decisions regarding biotechnology to be based on purely formal rational calculations, on means rather than ends. However it will further be argued that although praxis must take a certain priority over theory – policy decisions regarding biotechnology need not await consensus on all sides regarding substantive claims – it *is* possible, and highly favorable, to escape the certain aspects of the narrowly rationalistic debate that currently prevails.

I. THE IRON TEST-TUBE

Max Weber famously introduced the sociological concept of the "iron cage," by which he referred to the increased rationalization inherent in social life, particularly in Western capitalist societies [Weber 2003]. According to the German sociologist, this cage traps individuals in systems based purely on teleological efficiency, rational calculation and control. Formal rationality replaces the substantive kind; deliberation is no longer about ends, only the maximization of means.

John Evans recently applied this Weberian critical analysis to the debate over biotechnology. His sociological analysis of the current state of the debate described in *Playing God* reveals the triumph of a formal rationalism. Given the current jurisdictional control held by bioethics commissions (scientists and bioethicists), Evans argues, it is very difficult for any reasons other than formally rational ones to be considered acceptable forms of argumentation and thus to hold sway in political decision making, even if they are philosophically justifiable, ethically sound and persuasive [Evans 2002, p. 8]. Bioethics commissions have successfully stacked the odds in favor of a thin, formally rational debate over the maximization of means. As far as political decision-making over biotechnology is concerned we are trapped in an iron test-tube.

Evans, like Weber, is critical of this state of affairs. Unlike Weber however who appears resigned in the face of modernity, Evans holds out hope that the biotechnology debate can return to deliberate about substantive ends if the public is given more jurisdictional control in the decision-making process. An example of this he thinks has been the overwhelmingly substantive character of the abortion debate in the United States [Evans 2002, p. 178]. He is certainly right that the greater public engagement is more likely to shift the debate towards deliberating substantive ends, however such a shift requires more than a simple "handing over" of jurisdictional control to the public. For if Weber is correct and we are indeed stuck in the iron grip of a reasoning confined to the maximization of ends, even our most pious desires to the contrary will not change this state of affairs. Evans submits that "the thinning of the HGE debate might have been prevented if actors at various points had been able to keep decision making in the hands of the public" [Evans 2002, p. 178]. The larger

problem however, is that the societal realities of modern life constrain all individuals – whether they be bioethics commissioners or members of the general public – to make arguments that comply with a certain kind of narrow formal rationality.

In order to reason in a substantive fashion, that is to deliberate about ends in a manner that might lead to consensus, we need to escape the technocratic and libertarian impulses of our thinking. But how is this possible? Two alternatives present themselves. The first is to "break out," meaning that we continue to talk about substantive ends in the hope of converting our listeners by the sheer force of our arguments. The second, to borrow another Weberian phrase, is a process of "disenchantment," which means that we seek to debunk the legitimacy of formally rational reasoning by showing its strength to be illusory. The first method has been adopted in the biotechnology debate by a number of so-called bioconservatives, including Leon Kass, Jeremy Rifkin and Francis Fukuyama. The second method has been underutilized and, it will be argued in this paper, that it has much greater potential for releasing us from the strictures of formal rationality, integrating the formal rationality with a substantive debate about the ends of biotechnology and ultimately achieving some sort of consensual basis on which political decisions can be made.

II. OVERCOMING EVOLUTION

One of the central substantive questions in the biotechnology debate has centered around whether human beings should attempt to "seize control of their own evolution." This, of course, is not the only end that biotechnology could pursue; others include strictly therapeutic ends (i.e. to cure disease) as well as overtly totalitarian ones (i.e. to create new forms of social control). In the initial debates over human genetic engineering (henceforth HGE), consensus was quickly reached that therapy was, at least in principle, an end that ought to be pursued (as long as it could be done by morally legitimate means) and that social control was an end that ought to be avoided (whether or not the means themselves were moral). Where consensus has proved impossible is over the question of whether evolutionary control is *in principle* a good or bad thing.

Before considering this issue more closely it will be good to narrow the scope of the present inquiry. Biotechnology is not limited to HGE. It covers procedures as diverse as the transgenic modification of plants and animals for agricultural purposes and DNA fingerprinting in the field of forensics. Similarly, many proposed human enhancement technologies and therapeutic techniques do not engage genetic or cell/tissue technologies; prominent examples of these include the development of psychotropic drugs as well as robotics, cybernetics and nanotechnology. The debate over whether to take charge of human evolution is only concerned with techniques that seek to alter an individual's genotype with the aim of attaining certain characteristics in the phenotype. In fact the debate only concerns a further subset of HGE; that is, germline not somatic engineering.

Somatic HGE involves adding or manipulating genes in cells other than germ cells (egg or sperm), and is typically used to cure a genetic disease. However because somatic engineering is non-inheritable, i.e. the new gene would not be passed to the recipient's offspring, it does not alter the human genome. Germline engineering, by contrast, involves changing genes in human eggs, sperm, or very early embryos. This type of engineering is inheritable, meaning that the modified genes would appear not only in any children that resulted from the procedures, but also in all succeeding generations. The goal of controlling or "taking charge of" human evolution therefore only applies to procedures that engage in germline engineering.

Evans charts how the substantive debate over the legitimacy of pursuing this end shifted to a formally rational one. The period of 1959-1974 was one in which vociferous dispute between eugenicists and theologians ensued about whether the scientific control over evolution ought to be pursued at all. The question was not is it *possible* to direct evolution in a manner that is safe, cost-effective, does not impinge upon autonomy or exacerbate inequalities but is this end *worth pursuing* at all. Authors like Dobzhansky thought that Watson and Crick's discovery of the structure of DNA in the 1950's would mean that:

> Evolution need no longer be a destiny imposed from without; it may conceivably be controlled by man in accordance with his wisdom and his values [Dobzhansky 1962, pp. 346-347].

They also believed that this was a good thing. Theologian Paul Ramsey disagreed. He, like many others, insisted that coming up with a program for the reconstruction of mankind or "playing God" was an illegitimate end because it ultimately only served to weaken the human good [Evans 2002, p. 52].

In the mid-1970's, a new argument was introduced. It was deemed that the current debate was so intractable, our philosophical and religious divisions so deep that a consensus about substantive ends would never be reached. What was needed was a common ethical language that respected the plurality of values present in contemporary liberal democracies. The thought was that the substantive charges against the validity of the end in question could be circumvented by coming up with a list of correct principles. These principles would ensure that those who did want to pursue control over human evolution could do so in a manner that was acceptable to all (even though some individuals may decide that this was not an end in which they personally wanted to engage). In other words, the debate became a formally rational one, as enshrined by the principles of the Belmont Report [1979]. This report proffered four standards according to which the moral legitimacy of an intended procedure was to be judged: beneficence, nonmaleficence, autonomy and justice.

These ethical principles, which began as guidelines for the protection of human subjects of medical research, were transposed directly onto the issue of HGE. They centered on the following major issues: safety and effectiveness, individual freedom and equality. Firstly, it was to be ensured that any HGE technologies avoided causing unnecessary harm or injury to the individuals who underwent them and they were to positively benefit their well-being instead. Secondly, these technologies were not to transgress the individual's autonomous choice, exacerbate existing inequalities or open the possibility for new forms of social control.

It ought to be stated at the outset that these principles are not only eminently sensible but they allow for the adoption of a range of technological and political safeguards in order to uphold them. Therefore even those people who are broadly in favor of HGE call for certain procedures to be regulated and even restriction of in order to comply with the Belmont principles.

All are agreed about the primacy of safety; that is why even a staunch supporter of biotechnology such as Ronald Bailey calls for a restriction on reproductive cloning [Bailey 2005, pp. 144-145]. The problem with mammalian cloning, as was evidenced in the attempts proceeding the cloning of Dolly the sheep, is that a vast number of clones develop severe abnormalities before the procedure can be perfected. In fact many scientists believe that barriers to safe cloning are not merely technical in nature. Rudolph Jaenisch argues that there are biological barriers which hinder the faithful reprogramming of somatic cells which would definitively preclude the use of somatic cell nuclear transfer (SCNT) in humans as a safe reproductive procedure [Jaenisch 2004]. Other authors suggest restricting the *kind* of characteristics that can be selected for future progeny on the grounds of safety. For example they say that parents should not be able to make a child disabled by design as this would transgress the principle of nonmaleficence.[1] Another advocate of genetic engineering, Nick Bostrom, suggests that society should only incentivize genetic modifications, which bring about intrinsic goods and not merely positional ones. He wishes to uphold the principle of beneficence by restricting HGE to increase health rather than, say, height which is merely a relative good. i.e. it may be advantageous if I am taller than someone else but there is no immediate benefit to all of society being 10cm taller.

A further series of social measures is proposed in order to meet concerns over autonomy and justice. One aspect of autonomy is the presumed right to reproductive freedom, a right that takes precedence over any coercive state measures. This is supposed to be the major difference between liberal and non-liberal forms of eugenics. In fact transhumanist Julian Savulescu goes so far as to say that "not offering selection for nondisease genes would indirectly interfere (in people's reproductive decisions)" [Savulescu 2001, p. 16].Therefore the lesson he would have us take from the practice of non-liberal eugenics is that society should not only be loath to interfere in reproductive decision making but should actively seek to increase the

1 Sandel refers to the recent controversy stirred by a deaf couple who wanted to select an embryo that would develop into a deaf child [See Sandel 2007, pp. 2-4].

range of reproductive choices available to individuals. HGE would transgress the principle of autonomy if the state were to mandate modifications contrary to the wishes of the parents but, so this argument goes, as long as the parents could make decisions about their own reproduction, autonomy would be preserved.

It ought to be noted that couching the issue of autonomy in terms of the reproductive decisions of the parents is itself an attempt to side-step the issue of a lack of informed consent on the part of the future child, but this issue should not detain us now, as the point is that most advocates of HGE are keen to adhere to the Belmont principles (or at least their interpretation of them).

Bostrom also suggests social policies that could be implemented to counteract some of the inequality-increasing tendencies of enhancement technology. One such policy might be to subsidize or provide free genetic enhancements to the offspring of poor parents: in cases where the enhancement has considerable positive externalities, such a policy may actually benefit everybody, not just the recipients of the subsidy. In other cases, we could support the policy on the basis of social justice and solidarity [Bostrom 2003, p. 502]. This social measure of genetic subsidies is supposed to assuage fears that HGE will increase social stratification by creating a new class system of the "enhanced" and "unenhanced." Since if such a division came to pass it would certainly transgress the Belmont principle of justice.

Technological means for aiding the adherence to the Belmont principles have also been proposed alongside the social and political ones. For example, concerns about transgressing the autonomy of the future person hope to be circumvented by the addition of an "on-off" switch added to the designer gene. This technological solution envisions that the individual with the new gene would have to take a drug as an adult in order to activate it, and by being in control of this decision he or she would retain informed consent over his or her genetic endowment. Scientists are even trying to work on "self-destruct" features in the designer genes, so that while the genes would affect the entire body of the future person they would self-destruct in the sperm or egg cells of that person so that they could not be passed on to future descendants [Evans 2002, p. 186]. Such a procedure would mean that the autonomy of future generations was not being transgressed.

Both the social and the technological proposals delineated above are examples of attempts to make HGE accord with the Belmont principles. The debate over these principles is not a simple one. There are important questions concerning the hierarchy of principles when they come into conflict with each other. For example should we be prepared to limit the reproductive freedom or autonomous choices of parents through legislation in order to reduce social inequalities or do the autonomous choices of parents take precedence even if they exacerbate inequalities?

There are also important interpretative questions. For example, assuming there is a gene for homosexuality, would it be a transgression of nonmaleficence to design a gay child? Clearly this will depend on whether we view homosexuality as some sort of disability or not. Both of these are examples of serious questions that those engaged in the debate are asking themselves. And there are strong arguments on both sides. However, it ought to be clear by now that a debate conducted in the terms described above only gives weight to certain types of objection against HGE – ones which point out that the procedures in question are not safe, do not enhance well-being, transgress autonomy or exacerbate social inequalities. As Bostrom concedes such a debate will even consider concerns about the psychological and cultural effects of commodifying human nature to be legitimate ones [Bostrom 2003, p. 500].

However any objections based on the idea that there is something inherently wrong or morally suspect about using science to manipulate human nature will be excluded from the debate. Note that the reason for this is not that a consensus has been reached about the worthiness and legitimacy of "taking charge of our own evolution," rather it is argued that since consensus on this question can never be reached in today's pluralistic societies, it is best to keep it out of public debate and focus on the maximization of ends. In this sense critiques such as the one proposed by Michael Sandel fall on deaf ears. As Sandel understands it, the moral objections to germline engineering cannot be captured by the language of autonomy and equality:

In liberal societies, [men and women] reach first for the language of autonomy, fairness, and individual rights. But this part of our moral vocabulary does not equip us to address the hardest questions posed by cloning, designer children, and genetic engineering…we

need to confront questions largely lost from view in the modern world-questions about the moral status of nature, and about the proper stance of human beings toward the given the world [Sandel 2007, p. 9].

Given the Weberian conclusion about the triumph of formal rationality it is worth asking whether a substantive public debate of the kind Sandel seems to favor – one which goes beyond the maximization of ends – is even possible in today's liberal democracies. Is it possible to escape the confines of the iron test-tube, even if we would like to do so?

III. THE FICTION OF INTELLIGENT DESIGN

As has already been suggested there are two ways in which to attempt such an escape. The first is to insist upon a return to substantive argumentation. In this specific case it means demonstrating with the sheer force of argument that there are good reasons not to take charge of our own evolution. A number of bioconservative authors have adopted this strategy in their critiques of HGE.

Leon Kass, Chairman of the President's Bioethics Commission has been one of the most outspoken critics of what he sees as attempts to "play God" [Kass 1981, quoted by: Evans 2002, pp. 113-114]. Interpreted in a strictly theological fashion this objection argues that there is a God who has set out a (presumably good) plan for the world and has put forward certain commands for us to observe, and it is morally wrong of us mortals to interfere with that plan. The end of "overcoming our own evolution" is therefore at odds with the end of "accepting God's will." Such an objection however, relies on a number of presuppositions each of which can is highly questionable: that there is a God (understood as an omniscient, omnipotent, and infinitely good Being), that He has made certain commands or set out a specific plan for the world, and that these are incompatible with using biology for HGE, though they are (presumably) compatible with the practice of medicine for curing diseases.

Other authors have leveled similar accusations against HGE in a non-theistic fashion. As C.A.J. Coady has rightly argued "the allegation of playing God need not be the preserve of only religious

critics" [Coady 2009, p. 155]. The arguments proposed by critic of germline engineering Michael Sandel would fall under this description. Sandel emphasizes the importance of remaining "open to the unbidden" and the appreciating life as a gift; ends he thinks are both undermined by the desire to "overcome evolution." Genetic engineering may in this sense be viewed as the ultimate expression of our resolve to see ourselves astride the world, the masters of our nature. But that vision of freedom is flawed. It threatens to banish our appreciation of life as a gift, and to leave us with nothing to affirm or behold outside our own will [Sandel 2007, p. 100]. Sandel like Kass is troubled by man's Promethean impulse, which drives the desire for enhancement. He argues that the kind of "enhancements" that can be achieved through HGE undermine the real end for which we ought to be striving; namely the achievement of human flourishing. Human flourishing requires taking seriously the connection between the giftedness of life and the solidarity we feel towards fellow human beings. These cannot be achieved through genetic engineering and are in fact undermined by it.

There are many objections that can be made against Sandel's argument. We do not intend to dwell on them here but nor do we wish to endorse the stifling of such substantive claims, whether they are couched in theological or non-theological terms. We can unearth deep wisdoms from these admonitions. However two problems arise with the submission of these kinds of claims. The first is vagueness. In a pluralistic society in which citizens do not share a common worldview or ethical vocabulary, the metaphors of "playing God," "openness to the unbidden" or "life as gift" are not necessarily understood by all debating parties and are open to a variety of interpretations.

It is worth mentioning by way of an aside that the above criticism is often overstated; in many cases the supposed lack of understanding is in fact attributable to ill will. As any foreign language learner can testify, understanding cannot occur without the prior desire to understand, if we are not motivated to learn the new language we never will. However, as the experience of every child learning its mother tongue proves, an earnest desire to communicate followed by much practice leads us to grasp and even become proficient in what once seemed totally unfathomable. And the ability to speak a language

is not just something that a few of us possess we all have it. In the same way the ability to understanding religious or moral reasoning, though it may require habituation and familiarity with the language is at least in theory possible for us all, and not restricted to a narrow cabal. It can be said that although citizens of pluralistic societies, diverse religions and philosophical outlooks may not readily exchange a stock vocabulary it seems that we can often understand each other better than we are willing to admit when it is expedient for us not to do so. All it requires is the desire to understand and practice.

But there is a second, more troublesome problem. Even if the aforementioned metaphors retain a certain *cache* in the vernacular they can be readily dismissed, in a neo-positivistic move, as being devoid of meaning. Recently the concept of "human dignity" has come under such an attack. Professor of medical ethics Ruth Macklin, together with other bioethicists, has dismissed "human dignity" as a useless concept that can be eliminated from medical ethics without any loss of content [Pinker 2008; Macklin 2003, pp. 1419-1420]. In a similar vein John Harris maintains that criticisms of germline engineering on the grounds that they would alter or destroy human nature are not only unsustainable but devoid of meaning [Harris 2007]. These examples can be multiplied.

It is for that reason that we wish to explore an alternative means of escape. Rather than trying to break out of the confines of formal rationality by the force of substantive reasoning, these confines can be debunked by showing that even if the means are maximized, the end in question can never be reached. This, if successful, compromises the entire effort of formal rationality. This is an essentially critical endeavor not undertaken to prove the truth of a specific substantive end, although it is compatible with such an effort, but to reveal the illusory nature of the strictures that keep the debate over biotechnology within the boundaries of formal rationality.

Applied directly to the present debate, we hope to reveal that the idea that "we can take charge of our own evolution" is an entirely fictional one. Proposing principles according to which HGE could be deemed morally licit and then judging procedures against those principles is nothing more than an exercise in deception – whether well-meaning or cynical – because of the sheer impossibility of taking charge of our own evolution.

This critique is related to, but substantially different from, the argument that taking control of our own evolution is undesirable because what is sometimes socially valuable might not be worthless or damaging from an evolutionary perspective. The elimination of "socially bad" traits, so that argument goes, is misguided because any limiting of the gene pool is bad from an evolutionary point of view. According to this view it might be said that the first *homo sapiens* who stood upright put himself at a social disadvantage vis-à-vis his fellow species members (i.e. since he couldn't climb trees as well as them), but although standing upright it was not socially valuable at the time it ended up being "biologically valuable." There may be something to this argument as a critique of human genetic engineering. Indeed by developing certain traits based on their current social desirability we may be eliminating things that are highly desirable from a biological perspective – violence, aggression and competitiveness are a few prominent examples.

This is a separate issue however that will not be considered at present. The main critique being undertaken here is that the very idea of taking charge of our own evolution is illusory. It is based on a series of false assumptions, the most prominent of which is the false understanding of evolution as the gradual accumulation of gene mutations, which evolve into new characteristics and eventually new species. Authors of *Beyond Biotechnology* Chris Holdrege and Steve Talbott are right that such an understanding of evolutionary theory is at odds with the results of developmental genetics. Evolution is not the gradual accumulation of new genes by change caused to existing gene by mutations – either naturally or via engineering – rather "the evolving organism utilizes «old» genes in new ways to realize new developmental characteristics" [Holdrege, Talbott 2008, pp. 78-79].

What this means, in other words, is that genes are context dependent. The way in which they function and are expressed varies significantly from organism to organism – the Pax 6 gene for example expresses eye development in fruit flies, but governs tentacle growth in squid and the central nervous system in fishlike lancelets. More importantly, Holdrege and Talbott argue that genetic engineering has been premised on the fact that every individual organism is considered as a vehicle for gene expression, which in turn can be designed

to exhibit the desired phenotypal traits. This view is mistaken. The authors draw attention to the fact that the organism operates as a whole and that genes have their own internal functioning which is responsive both to the organism in question and the environmental conditions in which it finds itself. The point then is that while genetic engineering might allow us to make certain changes to an individual organism's genome, the outcomes of these changes will never be fully predictable or stable. This is not just a technical problem to be overcome but part of the internal structure of genes, which are more than just "building blocks" to be endlessly arranged and re-arranged. If Holdrege and Talbott are correct, the notion that we somehow "take charge" of our evolution begins to lose all credibility.

In their own words: "[through genetic engineering] we may arbitrarily in the destinies of our fellows in countless novel ways, and we may count isolated alternations as «improvements» but we will not be engineering superior human beings" [Holdrege, Talbott 2008, p. 89]. Change, certainly; control, certainly not.

Holdrege and Talbott's persuasive argument about the illusory nature of "controlling evolution" through genetic engineering can be re-stated in terms of the following four reasons. First, "taking charge of our own evolution" would only be possible if we could both manipulate genes according to our own design and ensure that non-designed mutations did not occur. The fact is that random genetic mutations will continue to occur; in fact even an engineered gene could mutate and begin to control for traits or take on functions for which it was not "designed." Moreover multiple studies have shown that genetic mutations are not just spontaneous but arise in response to changing environmental conditions. These so-called "adaptive mutations" show that the environment actually *induces* genetic changes in organisms [Holdrege, Talbott 2008, p. 63]. Since evolution properly understood is an interaction between an organism and its environment, to "control" human evolution would require the complete control over our environment, which is impossible.

Second, not only are the ways in which genes respond to the environment or mutate spontaneously beyond our control, but the notion of "fixed genetic dispositions" is itself false. There is no such thing as genetic determinism. As the members of the President's Bioethics Council make clear in their report on genetic enhancement;

> Most of the traits for which parents might wish to engineer improvements in their children-appearance, intelligence, memory – are most certainly polygenic, that is, traits (or phenotypes) that depend on specific genes or their variants at several, perhaps many, distinct loci. In such cases the relationships and interactions among these genes (and between one's genes and the environment) are certain to be enormously complex [President's Bioethics Council 2004].

This is commonly interpreted to mean that genes only predispose a child to have a high IQ or be a good athlete, but they must still study or train to actualize these potentialities. This is certainly true, but there is a more fundamental problem in yielding the sought-after results. Even traits, which appear to be monogenic such as height, skin or eye color, the genetic contributions to sexual orientation or basic temperament, might not express themselves in the ways expected. This is not a question of new or modified genes being incorrectly administered but due to the fact that what appears to be a "fixed genetic disposition" is actually only one of its possible appearances (phenotypes). The expression of the phenotype will depend heavily on environmental conditions and the entirety of the organism of which the gene is part.

Again, as Holdrege and Talbott make clear:

Two things we can know for sure: these genes will not function immune to the changing circumstances, and things will happen that no one will foresee… Genes have their own robust nature, but it is part of this nature to be in interaction with the world [Holdrege, Talbott 2008, p. 63].

This means that the while genes can be manipulated and recombined in order to fulfill certain ends – for example genes from bacteria have been introduced to plants to make them pest-resistant and jellyfish genes have been used to make cats, rabbits and even pigs glow in the dark – the attempt to "take control" over evolution is simply not possible because genes are not parts of a mechanistic whole but elements within a living organism that always maintains a certain wholeness.

Third, capacities are not endlessly expandable. The organism itself is a limiting context. In a sense it could be said that the organism takes ontological priority over the genetic framework on which it is built. There are certain capacities that can be changed or stretched this way or that, but the overall organism maintains an integrity

that if pushed too far simply cannot sustain life. Some capacities are incommensurable; one set of trait develops at the cost of another. For example the propensity of fast-twitch muscle fibers in rodents depends on having a light skeletal structure that can support them; speed comes at the cost of strength. In this context the transhumanist vision such as the one proposed by Bostrom is that we can not only change the parameters of our capacities but also radically expand the area they cover, is simply not corroborated by science[Bostrom 2003, p. 494]. On the contrary, there is *every* reason to think that the "human mode of being" is not free nor will ever be of the limitations imposed by our biological nature.

The final reason why control over our evolution is not possible is that it would require almost complete reproductive control. In fact germline engineering advocates such as Ronald Bailey use this fact in order to soft-peddle claims that the pursuit of genetic enhancements would eventually transform the human genome. We might be able to change evolutionary trends he argues, only if millions of people underwent germline engineering procedures and that is highly unlikely. People are not only going to reproduce sexually, but they will continue to have offspring that has not been genetically modified. So although we might create the "option" of genetic enhancements for those who want them, this is not the same as shaping evolution. Bailey is right, controlling our reproduction the extent needed to transform the human genome is highly improbable, but the question which then arises is if control over our evolution is impossible what is the true end being pursued via HGE?

IV. MONEY AND POWER

If it is the case that we cannot control our own evolution, then deliberation about the means leading to its maximization in the most ethically legitimate way seems to be a futile exercise as well. On closer inspection, "taking charge of" or "shaping our own evolution" actually masks two rather more mundane ends. The first of these is the desire to further science, which means both the satisfying of our intellectual curiosity as well as increasing the power that comes with this new knowledge. The second is the desire for the economic gain,

which comes by turning scientific knowledge into a desirable product that can be marketed and sold. Again it ought to be noted that HGE can be pursued for the sake of other potential ends such as health, at one end of the spectrum, and the imposition of social control at the other. But we have already eliminated these ends from the discussion because a consensus has been reached in their regard; pursuing health is in principle good while pursuing social control over others is, in principle, bad. The debate that remains around the pursuit of these ends is properly a formally rational one; namely a deliberation about how best to pursue health and how best to avoid social control. The ends having been decided and agreed upon, only a debate about the most appropriate means remains.

The end about which consensus has not been reached is whether we should take control over our own evolution. Deliberation about the validity of this end has been cut short on the grounds that since consensus on this question cannot be reached it is best to replace it with a formally rational debate about means. The claim that we have been making throughout this essay is that the end of evolutionary control is itself illusory. It cannot be circumvented or replaced by formal reasoning, instead we should seek to uncover the real ends that are wrongly described under its name and ask whether consensus about their pursuit can be reached.

What then are the ends being sought under the guise of "shaping our own evolution?" The satisfaction of intellectual curiosity is one, the benefits of monetary profit is another. For what could be more appealing to the scientist than learning how to arrange and rearrange the building blocks of life? And what better way to secure economic gain form this new knowledge than by building technological dependency into the enhancement procedures that are developed in the process? The genetic engineering thus far conducted on plants and animals has indeed been highly intellectually appealing to the scientific and non-scientific communities alike, but the medium term effect of these genetic interventions has also been that of necessitating further interventions in order to maintain hyper-productivity and stave off new the diseases and ailments that have arisen as a result of the initial procedures.

This has already been evidenced in a number of cases – the most high profile of which have been those of so-called "wonder-foods."

Golden rice is a good example of these. It was produced though genetic engineering to create a grain that contained high levels of beta-carotene or the precursor to pro-vitamin A. This fortified food was supposedly developed in order to combat the vitamin A deficiency from which many people in the developing world currently suffer. Like other GMO crops it laudably sought to stave off poverty and malnutrition in the third world, or so it said.

However, critics denounced the rice as a Trojan horse that threatened both human health and biodiversity [Enserinck 2008, pp. 468-471]. More importantly, opponents such as *Greenpeace* have argued that its cynical imposition on the Third world poor for financial gain is a major obstacle to the implementation of truly sustainable solutions to global malnutrition. The chief problem with golden rice, they argued, is that it is a useless product. That does not mean that it does not deliver its promise on vitamin A (although some critics argue that this is the case), but that it is absurd to offer this food as a "cure" for vitamin A deficiency when there are plenty of safe and radically more economical sources of vitamin A such as green vegetables or unpolished rice. As the audit of the Institute of Science in Society put it "to offer the poor and malnourished a high-tech «golden rice» tied up in multiple patents that has cost US$100 million to produce and may cost as much to develop is worse than telling them to eat cake" [*The Golden Rice*]. Moreover the instability of GM lines is well known – inserted genes can lose their activities or cease to function altogether in subsequent generations, to say nothing of their potential health risks.

In the same way many proposed human genetic interventions are useless – it may be wacky and wonderful to be able to created blue-eyed, blonde babies, or potentially, to make them glow in the dark or grow scales. But these new characteristics or traits serve no real purpose. They can either already be done in a low-tech, vastly more economical ways – like using coloured contact lenses and hair dye – or they are traits which are unnecessary for human beings – until that is someone markets them as things we *have* to have.

Back to the case at hand, it might be asked why then was golden rice developed? There are many ends to which the production of golden rice was a means – satisfying intellectual curiosity was one such end, potential financial gain was another. It is clear however

that the end of "solving world malnutrition" did not motivate the production of golden rice; rather it was co-opted as an end once the technology was already being developed and researchers needed to persuade potential funders into supporting them. As a result we now have an ingenious product, which, by selling it to Third World farmers, claiming royalties on its patents and selling new technologies to "fix" the problems that may result from the initial product has huge potential for commercial exploitation. What we do not have is anything close to a real, affordable, safe and sustainable solution to malnutrition.

A similar kind of example is that of stem-cell research. If the end that is being sought is progress in the field of regenerative tissue technology then all the current scientific evidence shows that adult stem-cell research is yielding positive results. So far, embryonic stem-cell research has not led to any new regenerative tissue technologies. That is not to say that there are not good reasons to pursue embryonic research – intellectual curiosity is one of them (i.e. how do embryonic stem-cells function) and potential economic gain (once we understand how they function we can try to turn our research results into a marketable product). But this is manifestly not the same as saying we are seeking ways in which to regenerate damaged human tissue (that is our agreed end), what kind of stem-cell research is best allowing us to reach this end.

These examples do not discredit HGE outright they merely show that the substantive ends it seeks are often economic gain and the satisfaction of intellectual curiosity. Neither of these are morally illicit ends but they cannot be considered *in principle* good ends in the same way that health is. By their very nature these ends are beneficial only to a small subset of interested parties (scientists and developers of HGE technologies), who can easily exploit their potential clients by moving the debate away from one about substantive ends. Not, as they claim, because consensus can never be reached about whether we should control our own evolution or not, but because controlling our own evolution is a fictional end that masks others about which public consensus could quite easily be reached. Full cognizance of this state of affairs can help the increase the demand from the public to return to a substantive debate about ends.

CONCLUSION

We need not expect wholesale consensus on substantive ends given the plurality of worldviews in contemporary liberal democracies but consensus can be reached on ends that are to be excluded – one of these as we saw was the use of biotechnology for purposes of totalitarian social control, another should certainly be ends that are illusory such as "control over our own evolution." This leaves us with the question of whether "economic gain" or "intellectual advance" are ends intrinsically worthy of our pursuit or whether they are in need of qualification.

Of course even when consensus is reached about an end which is desirable *in principle* – as is the case with health and disease prevention – a great deal of space is left open for debate – what counts as health, at what cost can it be pursued and so on. But it is vastly different from the question of whether we ought to be taking charge of our own evolution. Health has definite boundaries – it aims at restoring to a condition that is normally found in most members of the species – and not at surpassing or determining what are the proper characteristics of that species. A utopian project, by contrast is one where there are no circumstances under which it can be realized. This is the case with the attempting to determine the direction of human evolution or even to overcome it.

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