

# Against Genetic Enhancement: The Precautionary Principle and Memory Enhancement

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The words “genetic enhancement” call forth a feeling of aversion in most of us. This initial feeling, usually without good foundation, is what John Harris refers to as the “yuck factor.” Genetically enhanced foods are what first introduced most of the general public to this burgeoning technology. Animals, most often pigs, chickens, cows, and sheep, have been genetically modified for such ends as increased productivity and the production of leaner meat. The case of the “Beltsville” pigs is a well known example in which pigs were “given a human growth hormone gene”; the pigs did in fact grow more quickly and produced leaner meat (Reiss and Straughan 174). However, the pigs were riddled with problems such as ulcers and even blindness (Reiss and Straughan 174). Needless to say, these genetically modified foods have not always been well received by the public.

Attention has shifted in recent years to the application of similar genetic modification procedures to humans. There have already been numerous successful genetic modification procedures performed on humans, for example, sex selection of embryos. There is great curiosity to see what we might be able to accomplish if such technologies were developed further. Many have pointed out the potential benefit of these kinds of procedures. Perhaps we could cure Alzheimer’s disease, Down’s syndrome, or maybe even cancer and AIDS. If we have the ability to isolate specific faulty genes, and replace them with functional genes, there would seemingly be no limit to what we could do with the

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individual human body or our species as a whole. But this technology can go a step further than rehabilitation. If we have the potential to rehabilitate or replace genes, couldn't we also use similar procedures to *enhance* genes, i.e. make them stronger and above average? That is, we would no longer be returning a particular gene to functionality but taking the gene's existing functionality and increasing it. The possibilities seem enticing. Imagine baseball players hitting 550ft. home runs or track stars running three-minute miles. Think of children who can read more quickly and retain more information. All of this sounds great.

The possibility of using such technology on humans, however, has roused similar suspicions to those raised by genetically modified foods. So, why is it that this prospect seems so appalling to many people? Is it because people fear that this technology will alter the very meaning of what it is to be human? Are people worried about effectively "designing" their children because it might interfere with their child's autonomy? Are sports fans concerned with demeaning the games that they love and watching their favorite athletes become more like machines? These are questions that many opponents of genetic enhancement have asked. But do such questions move beyond the unconvincing utterances and arguments that Harris rightly dubs the "yuck factor"? To adequately articulate our concern with the use of these new technologies, we need something more substantial than a simple, emphatic "yuck." That is exactly what this paper is concerned to do. Through careful analysis of the many issues that come along with weighing ethically the different facets of genetic enhancement, I will show that it would not be prudent to plunge straightforward into genetically enhancing ourselves.

To keep the focus of the paper as centered as possible (as there are quite a few tangential issues that one runs into when discussing genetic enhancement), I will examine the potential risks and benefits of genetic enhancement technology as they might apply to the specific case of memory enhancement. I will also discuss the problematic but important distinction between what we think of as therapy and what we think of as enhancement. The precautionary principle (PP) will provide the foundation for my argument that one should not endorse genetic enhancement where there are serious and plausible threats

presented by the procedure. Rather than arguing from the standpoint of public policy decisions, I will argue these points from the perspective of an individual moral assessment. To begin, I will first examine just what we mean when we say something is an enhancement and how these enhancements differ from therapeutic procedures.

### **I. The Therapy/Enhancement Distinction**

A common argument among detractors of genetic enhancement turns on the distinction between therapies and enhancements. Many argue that technologies can justly be applied in cases where we are curing a debilitating disease. But employing those same technologies to *enhance* an individual's abilities is, according to this line of argument, morally unacceptable. However, proponents of genetic enhancement have suggested that this objection is unsound because it seems that most cases of therapy are equally qualified to be cases of enhancement. To navigate around this argument, I propose a more modest approach to the distinction than the one sketched above. I will suggest that the distinction can do some important moral work for us, but it is not until we apply the PP that the distinction shows its true worth. But first, we must determine if there is a discernable distinction.

There has been much debate as to whether or not there is a clear distinction between therapy and enhancement. Intuitively, there does seem to be a difference. Roughly, we can say that therapy is the treatment or rehabilitation of a particular trait that is functioning improperly. We can think of enhancement, on the other hand, as improving an otherwise normally functioning trait. As this distinction pertains to genes, we can say that a case of gene therapy is a case in which we discover that a faulty gene is hindering normal functioning; we isolate the faulty gene and return it to normal functioning or replace it with a correctly functioning gene. Cases of genetic enhancement would be cases in which a gene that is functioning normally is isolated and improved upon so that it functions in a way that is better than its previous state of functioning. (It is worth noting that the relationship between traits and genes is complex. We may return a trait to normal functioning by making a different gene function beyond its normal range.) These formulations seem adequate, but many philosophers and scientists who have thought about the ethical implications of genetic enhancement have sought to either dispense with or sharpen

the distinction. In the rough formulation of therapy, the main tenet is a return to a trait's normal range of functioning. However, Harris objects to this conception of therapy. He suggests, for example, that it is normal species functioning for the elderly to be more susceptible to illness and more likely to die from illness. Thus to try to cure an elderly person of a particular disease would be to interfere with normal species functioning. In this way, Harris argues that "normalcy plays no part in the definition of harm and therefore no part in the way the distinction between therapy and enhancement is drawn" (46). His argument here is forceful; but it is also misleading.

We can distinguish between two senses of the term enhancement: the narrow sense and the broad sense. Narrowly, enhancement fits into our original, intuitive definition. However, the broad sense of the term would incorporate both the narrow sense of the term as well as all successful cases of therapy. Thinking of enhancement broadly, we can grant the assertion Harris makes, that rehabilitating the elderly, for instance, is indeed a case of enhancement. The power of this argument depends on his use of the broad sense of enhancement, but these cases of enhancement remain morally acceptable since they are also therapeutic. Thus Harris' argument poses no threat to the therapy/enhancement distinction. But the question remains: can this distinction actually do any moral work?

In their article on memory enhancing drugs, Wim Dekkers and Marcel Olde Rikkert, tell us that "at first glance, the distinction between therapy and enhancement seems a useful way to distinguish between the central task of medicine and its marginal activities in enhancing 'normal' bodily and mental capabilities" (146). They eventually argue, however, that "the distinction...is ultimately inadequate for the moral analysis of the use of memory enhancing techniques" (146). Dekkers and Rikkert also take issue with the ambiguity of the definition of enhancement. It may be argued, for instance, that someone suffering from dementia who is subsequently cured through medicines or a medical procedure could be said to have been enhanced relative to the patient's previous state of mind (Harris 44). But as we have previously shown, this is only the case if one is operating with the broad sense of enhancement. Harris, Dekkers and Rikkert share the belief "that relying on the distinction between therapy and enhancement in order

to decide on the moral acceptability of a particular intervention...will not succeed” (Dekkers and Rikkert 146). And so it seems that Harris, Dekkers and Rikkert want to dispense entirely with the distinction. I think this is a mistake. I agree that this distinction, by itself, is insufficient to determine whether an intervention is morally acceptable, but I believe that these thinkers are suggesting that the distinction should be able to do more work than we actually need it to do. We can make use of the distinction without thereby claiming that *all* cases of therapy are permissible and *all* cases of enhancement are not. The parameters of the distinction remain vague; I make no claim to sharpen them. For the purposes of this paper, we can acknowledge the two different senses of enhancement we have identified and operate with our original, narrow definitions of therapy and enhancement. Typical cases of therapy will cover examples such as curing or preventing Alzheimer’s, and typical cases of enhancement will cover examples such as increasing memory retention beyond current average levels. Again, I am not employing the distinction as our sole guide to a moral assessment of enhancement; the distinction cannot do this on its own. To get any kind of moral assessment, we need to pair the therapy/enhancement distinction with the PP. What follows is a brief exposition of the PP and the particular conception of the principle that I will be employing.

### **The Precautionary Principle**

There have been numerous formulations of the PP over the years. Perhaps the most well known formulation of the PP was penned at the 1992 United Nations Conference on Environment and Development: “Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation” (qtd. in Resnik, “Precautionary” 284). This version was drafted as part of the effort to combat climate change, but I think we can easily see how this formulation can also be applied to cases of genetic enhancement. However, this conception, as David Resnik points out, is too vague and is not readily applicable. Resnik initially takes issue with the notion of “scientific certainty.” He notes that “scientific knowledge may be confirmed, verified, proven, accepted, justified, reliable or entrenched, but it is not certain” (“Precautionary” 285). To maneuver around this dilemma, Resnik offers the less problematic notion of “scientific

proof” (“Precautionary” 285). Scientific proof is here to be understood probabilistically, for “to offer proof, in science, is to offer evidence that has some bearing on the degree of probability assigned to a statement or hypothesis” (“Precautionary” 285). A lack of scientific proof implies that one will be making a decision under ignorance, and this plays an important role in the application of the PP and its selection over other decision making strategies. I will explain this point further later in this essay.

Resnik supplies us with a much shorter but clearer and less problematic definition of the principle: “One should take reasonable measures to prevent or mitigate threats that are plausible and serious” (“Precautionary” 290). I think Resnik’s most important revision of the PP is his notion of reasonableness. This tenet makes the PP an ideal candidate for application in decision making situations. We can think of this notion as a kind of umbrella term that encompasses many different facets of application. Couched within this one term are factors like cost-effectiveness and risk assessment. This tenet is designed to “use a level of protection proportional to the level of threat [that also] balances benefits and costs” (“Precautionary” 289). To show this idea in action, consider an objection.

It could be argued that the PP allows for an excessive amount of threats and responses to be conceived, impeding any progress. Suppose that biking is my only means of transportation, but I am afraid that if I ride my bike down a busy highway, I will be struck by a vehicle. So, I decide to stay home and never travel. The threat meets our conditions of plausibility and seriousness but the response seems unwarranted. The PP would suggest that other, more reasonable responses should be explored such as finding a safer bike route. The provision of reasonableness in the PP will leave us with the safest possible outcome while not impeding progress.

At this point we might ask ourselves what makes the PP so special. Why does this principle take precedent over other decision-making strategies in the case of genetic enhancement? To see why the PP is particularly useful when considering cases of genetic enhancement, it is helpful to contrast the PP with some other decision-making frameworks.

A popular method for decision-making is decision theory or, as it

is sometimes referred to, expected utility theory. Under this model, our basis for making decisions would be explicit probabilities of outcomes. For example, say a person is attempting to decide what kind of car to buy. Through field testing, these cars have been safety tested, and we can assign probability to the chances of the cars rolling over. If the person buys a Jeep, there is a forty-five percent chance that the car will flip. If the person buys a BMW, there is only a fifteen percent chance that the car will flip. Under the decision theory model, it is obvious that the customer should not purchase the Jeep. It seems that this model has in this case produced a reasonable and desirable outcome. So why can it not be used in cases of genetic enhancement? The most important reason is that we cannot assign specific probabilities to possible outcomes of genetic enhancement. In the previous example, there were field tests that could be conducted in order to assign specific probabilities to outcomes. As it stands at the moment, not enough research and testing has been done to produce this kind of empirical data for genetic enhancement procedures.

Problems encountered by applying decision theory to cases of genetic enhancement are similar to problems faced by risk assessment models of decision-making. Here, too, we need explicit empirical data to make any kind of assessment. On this model, assessing which car to buy might depend on safety tests conducted using dummies. Through a series of crash tests, the effectiveness of the air bags could be determined and the frequency of failure could be exposed. This model works well when we can conduct such empirical testing. But it is quite obvious that presently we cannot conduct these kinds of tests to determine specific probabilities in cases of genetic enhancement. Thus, decisions pertaining to genetic enhancement would be decisions made under ignorance, that is, we cannot assign specific probabilities to possible outcomes. To compensate for the lack of objective probability, we must introduce the tenet of plausibility.

With the notion of plausibility, we are able to assess risk in a preventative manner without scientific proof. To illustrate how this might work, let us take an example. Suppose you are driving through a school zone at the end of the school day. If you were driving faster than the posted speed limit, it would be reasonable to suppose that you might hit a child. The posted speed limit is as low as it is so as

to reduce the risk of harm to the school children. (Clearly, we would not conduct an experiment in order to discover the risks involved with posting a higher speed limit. Attempting to obtain the relevant objective probability data would be unethical; but this should not prevent us from exercising methods for reducing risks.) In this case, we can assign no objective probability to the chance that you will hit a child, but, given the volume of children walking across roads in school zones, there is a significant chance that you will. Of course, the risk averse measure would be to drive at a speed in accordance with the posted limit. The PP works in this way. The threat of hitting a child is both plausible and serious. There is no scientific proof or objective probability indicating that you will indeed hit a child, but reasonable steps to avoid the risk of doing so, e.g. complying with the posted speed limit, could and should be taken to prevent it.

It is important to note that the PP is not in competition with other decision-making models like decision theory or risk assessment. That is, the PP does not always take precedence over other strategies. Rather, the claim I am making is that the PP is especially useful in making decisions under ignorance. Now that we have an adequate conception of the principle we will be working with, we can begin to think about how the principle might be applied to the specific case of memory enhancement. First, I will briefly explain what a memory enhancement might be and discuss how other thinkers have treated this prospect.

### **Memory Enhancement: For and Against**

Plenty of research studies have already been conducted in hopes of discovering how our memory faculties work and how they might be manipulated. The amygdala has been identified as the part of the brain that plays a crucial role in the encoding of memories. It is in the amygdala that important emotional associations are made in response to certain memories. Researchers experimenting with rats discovered that if epinephrine were injected into the amygdala, a particular memory would be strengthened. If beta-blockers were introduced into the amygdala, memories would be weakened (President's Council on Bioethics 222). The results of this research indicate how memories are generally formed, associated, and recalled. In *Beyond Therapy: Biotechnology and the Pursuit of Happiness*, the President's Council on Bioethics points out that "when a person experiences especially shocking or violent



events...the release of stress hormones may be so intense that the memory-encoding system is over-activated” (222-23). Such cases can lead to the development of disorders such as post-traumatic stress disorder (PTSD) as memories of the stressful event are more likely to persist and be remembered more vividly. Researchers and scientists have developed certain drugs to combat disorders like PTSD, but as these drugs increase in effectiveness and power, we may begin to wonder if only people with PTSD and similar disorders should be given access to these drugs. Thus, with the development of such drugs and procedures come some ethical problems.

Given the results of the research conducted on memory encoding and association, we can point out three different ways in which our memories might be enhanced or manipulated. Building upon our knowledge of how epinephrine injections work to strengthen emotional association with particular memories, we may be able to enhance our faculty of memory by increasing retention. In similar fashion, we may be able to use what we know about strengthening memories in a therapeutic sense to combat diseases like Alzheimer’s. And thirdly, with the further development and use of beta-blockers, we can dull or perhaps even erase troublesome memories. Each of these cases is ethically distinct, and we must think about them carefully to determine which, if any, of these cases is morally permissible. To begin thinking about how to articulate our unease regarding genetic enhancement, let us first take a look at how other thinkers have argued for and against genetic modifications and pharmaceutical enhancements.

The Council notes that “drugs that erase memories or alter our temperaments and emotional outlooks deal with that which is most us, our hearts and minds” (213). Indeed, our memories make up a large part of our sense of self. A main argumentative point for the Council is how our memories are intrinsically tied to our identities. They repeatedly espouse the notion that “if enfeebled memory can cripple identity, selectively altered memory can distort it” (212). From this perspective, any tampering with one’s memory is tampering with one’s identity and should be avoided. This set of arguments echoes the position developed in Michael Sandel’s *The Case against Perfection*. (This is not surprising as Sandel was himself a member of the Council at the time of *Beyond Therapy*’s publication.) In his own account, Sandel

gives special priority to what he calls the “giftedness” of life, that is, recognizing “that our talents and powers are not wholly our own doing, nor even fully ours, despite the efforts we expend to develop and to exercise them” (27). To undermine this notion of giftedness is, Sandel thinks, a mistake. Sandel’s general position suggests that “rather than employ our new genetic powers to straighten ‘the crooked timber of humanity,’ we should do what we can to create social and political arrangements more hospitable to the gifts and limitations of imperfect human beings” (97). The argument for both the Council and Sandel seems to be that genetically enhancing our cognitive powers would significantly degrade our unique character. For Sandel, to think of ourselves as masters of our own fates is to miss an important part of the gifted nature of life. The Council suggests that enhancing ourselves would be to change our very identities and would thus render our pursuit of happiness a defunct enterprise. Its positions raise some interesting and important considerations, but its arguments fall victim to critical analysis.

As Harris points out in his strong but often uncharitable critique of Sandel, “why...do we have to recognize and accept the gifted nature of normalcy but not the gifted nature of disease?” (112). Harris directly attacks Sandel’s notion of giftedness, objecting to the assumption that it is permissible to treat a disease with genetic technologies but objectionable to use those same means to manipulate the “normal.” If Sandel wants us to accept the giftedness of life then he must, to some degree, be prepared to accept the giftedness of disease and painful experience as well. A similar objection can also be given in response to the Council’s formulation of this position. The Council claims that memory is an integral part of our identities and crucial to the fulfillment of our happiness. This seems to imply that our memories can supply us with a correct narrative of the happenings of our lives, yet the Council themselves point out that “astonishingly, memory itself selectively retains and deletes, reconfigures and reintegrates, the experiences that comprise who we have been and, therefore, *are*...Yet despite all the changes, thanks to the integrating powers of memory, our identity also, remarkably, persists as ours” (215). While the integrating powers of our memories may allow us to retain ownership of our identities, it is not clear that, on this basis, we should refrain from manipulating our

memories ourselves. If our memories are already constantly changing and being reconfigured, why can we not consciously manipulate them? It does not seem to follow that, simply because I have increased my retention or erased a single painful memory, my identity would be diminished. When my memory automatically reconfigures itself or erases a particular memory, I am not aware of it and my identity persists. Presumably, then, if I were to erase a memory of my own accord through a genetic modification, I would not be any more aware of the modification, and my identity would remain intact.

Harris' own position on this matter is a permissive one. He argues very strongly for the development and implementation of genetic enhancement technology. Harris thinks that "enhancements are so obviously good for us that it is odd that the idea of enhancement has caused, and still occasions, so much suspicion, fear, and outright hostility" (36). Indeed, Harris argues that enhancement is actually a moral duty (19). He appeals to ongoing research in genetic enhancement technologies, e.g. David Baltimore's attempts to engineer resistance to HIV/AIDS (22). His overarching claim is that anyone who would deny research and further development of genetic enhancement technology would in effect be denying the possibility of curing devastating diseases such as Alzheimer's. But as I have already pointed out, much of the force of Harris' arguments for enhancement rests on the broad conception of enhancement. Recall that when enhancement is construed broadly, cases of therapy can be categorized as enhancements, which I am content to accept. Cases of enhancement conceived of narrowly are cases where certain traits are pushed beyond their normal range of functioning. The problem with Harris' argument is that he uses the broad sense of enhancement to argue for both narrow and broad versions of enhancements.

Neither the Council's nor Sandel's arguments against genetic enhancement can withstand some of the more forceful charges made against them. While their respective positions have strengths of their own, a more formidable argument against genetic memory enhancement requires a stronger foundation. The PP will provide that foundation, and the remaining analysis will show how to apply the PP to the three different cases of memory modification that we have identified. I will then respond to some objections that may be raised

against the application of the PP.

### **The Precautionary Principle and Memory Enhancement**

To begin our analysis of the PP and its application to memory enhancements, let us think about a specific case of enhancement, increased retention. Suppose your child is in grade school. She is an average student, and she is currently memorizing state capitals for a geography class. She must pass an examination testing her knowledge of the capitals in order to pass the class, but she cannot seem to remember them when it comes time for her to take the test. Now, suppose that there have been some recent developments in genetic technology, and doctors can now perform an experimental procedure that manipulates the amygdala so that one can form strong emotional associations with events that are otherwise ordinary, thus increasing one's level of retention and one's ability to recollect a particular memory. You want your daughter to do well in school, but should you volunteer your daughter for this new procedure? In this case, we cannot assign any objective probability to outcomes of the procedure as it is experimental, so the decision must be made under ignorance. To think about this question, recall our formulation of the PP: One should take reasonable measures to prevent or mitigate threats that are plausible and serious. There are several threats that are posed by this case of memory enhancement. There is the threat of emotional stress being placed on your daughter (and yourself for that matter) by undergoing a new procedure with some possibly unforeseen consequences. This threat does not seem too serious. Such anxiety is usually overcome. But there looms a much more significant threat. If you and your family decide that it would benefit your daughter for her to undergo the procedure and it is carried out, there is a very serious threat of your daughter's emotional response to an event being disproportionate to the actuality of the event. Your daughter's faculty of memory would become a container not only for significant events--events that play a role in her sense of self and relationship to the world around her--but also for quite forgettable events. Her level of retention might increase to a point to where it is no longer an enhancement but a hindrance. This threat is both plausible (through research, it has been proven that manipulation of the amygdala can affect memory formation in this way) and serious (your daughter would not properly associate different

emotions with different types of experience). Given the possibility for other reversible and less intrusive techniques to help your daughter remember the capitals, e.g. studying more often or hiring a tutor, the PP would advise you not to enhance your daughter's memory. Of course, we cannot say positively that her emotional association with events and memories would be affected in such a way as this, but it would not be reasonable to proceed with this procedure with the possibility of such a severe consequence.

Now that we have seen how the PP might be applied to a case of enhancement (increasing memory beyond its normal capabilities) we must apply it to a case of therapy (restoring a malfunctioning memory to its normal range function). The obvious example is Alzheimer's disease. This is a debilitating disease that is emotionally painful not only for the one afflicted but also for the family and friends of the person with the disease. At present there is no cure for the deterioration of one's memory brought about by Alzheimer's. But suppose researchers have developed a procedure that can halt memory deterioration. If signs of Alzheimer's are caught early enough, through genetically modifying a part of the brain, doctors may be able to stop the onset of the disease and leave the patient's memory intact. In this case there seems to be no significant threat that we need to consider save the outside chance that something goes wrong with the procedure (which is a possibility with any medical procedure). The risks of not going through with the procedure (e.g. loss of memory) are much greater than the possible risks the patient might run if the patient opted to receive the treatment. So for this case, the PP would advise that the patient receive the treatment.

We have now seen the PP at work in both a case of enhancement and therapy. So what are we to make of our third case?

The erasure of a memory is a peculiar case for us to think about. At first glance, it does not appear to fall under the category of either therapy or an enhancement. Of course, arguments that it is in fact a case of therapy or enhancement can be supplied. It might be considered a therapy, for instance, if the removal of a traumatic memory cures someone of PTSD. By the same token, it could be considered an enhancement (in the broad of the term) because it has improved the mental condition of the person afflicted with PTSD.

But we are operating with the narrow definitions of these terms. So, for our purposes, it seems that this is a kind of fringe case. It is not explicitly therapy and it is not explicitly an enhancement. So how will the PP handle this case?

First consider the hypothetical factors. Suppose you and your spouse are happily married, but during the course of a long and heated argument, your spouse says something to you that puts the status of your marriage into question. The statement was so hurtful and filled you with so much doubt about your relationship that you consider a divorce. But what if you had the option to erase this particular memory so that you would no longer doubt your relationship, and you could go on as you had before the argument? This might at first seem like an ideal solution. It would be a quick answer to your problem, and you might never know the difference; but consider, again, the PP. If you were to erase the memory, you would risk not knowing something very important about your spouse. Perhaps ignorance is bliss, but this instance might be a pivotal moment in the relationship with your spouse, perhaps even strengthening it. Application of the PP would suggest that it would not be a reasonable decision to erase the memory because there are other solutions to the problem, e.g. counseling, talking through it with your spouse, or actually getting a divorce. To erase the memory might be to simply postpone the conflict until some future point when your spouse would again hurt you in a similar way. Erasure of the memory might be to risk the reoccurrence of the emotional pain you felt the first time. Of course, you could repeat the process and continue to erase your memories. But the risks to your relationship and to your own personal development seem too great to endorse such a procedure.

### **Objections to the PP**

Now that we have seen how the PP can be applied to these various types of cases, we can consider some possible objections to the application of the PP.

One charge made by Harris is that calls for the restriction of genetic enhancements impinge upon one's freedom. He appeals to the democratic presumption to make his point. He says, "The presumption is that citizens should be free to make their own choices in the light of their own values, whether or not these choices and values are acceptable

to the majority” (72). His argument here rests on the premise that what one does to one’s own body is a strictly private matter, and to suggest that someone should not be able to receive a genetic enhancement would be to deny that person their right to liberty. His task is to prove that arguments against genetic enhancement do not “point to dangers or harms of sufficient seriousness or sufficient probability or proximity to justify the limitation on human freedom that they require” (72). I will argue that the PP does reveal dangers of sufficient seriousness that should be considered, if only by the individual. Harris claims that:

those who would curtail freedom have to show not simply that [enhancement] is unpopular, or undesirable, or undesired, but that it is seriously harmful to others or to society and that these harms are real and present, not future and speculative, for if they were not, the presumption in favor of liberty would be at risk whenever imaginative tyrants could postulate possible, but highly unlikely, future harms. (74)

Harris suggests that considerations of future harms are ridiculous. He seems to be suggesting that, for instance, it would be unreasonable for a woman to get a mammogram simply because her family has no history of breast cancer and the threat is not immediately present. Harris makes the false assumptions that myself and other opponents of enhancement seek to “curtail freedom” and that we are “imaginative tyrants.” However, the PP’s tenet of plausibility is sufficient to refute Harris’ claim that I am simply imaginative. The cases I have envisioned are not entirely matters of speculation. The dangers considered are quite plausible given our current knowledge of how memory works and how research and testing in the field is progressing. Furthermore, Harris’ charge of tyranny is irrelevant to my claims because I am interested in how these considerations apply on a strictly individual moral basis. I am not making a plea for public policies to be drafted to prevent genetic enhancement technologies. Harris assumes that I do not agree with the assertion that “what consenting adults do in private, and particularly what they do to themselves, is (almost always) their own affair” (73); however, I think it is of the utmost importance for people to be able to make their own choices regarding their lives and bodies.

The above objection reveals another, quite serious problem with our conception of the PP. It may be charged that reasonable judgments are purely subjective. That is, what I might judge to be a reasonable response in a given situation, you might judge to be unreasonable. However, I do not think that reasonable judgments are entirely subjective. Resnik cites the European Commission stating that “the measures taken in response to a threat should be proportional to the level of the threat, consistent with other measures already taken, and based on an examination of potential costs and benefits of responding to the threat, including economic costs and benefits” (qtd. in Resnik, “Precautionary” 288). If the response to a given threat is to be “consistent with other measures already taken,” then we must have some kind of objective criteria on which to base our standard of reasonableness. A judgment of consistency may ultimately be left up to a governing institution (and thus be considered subjective), but previous cases provide objective data for all to evaluate. Our standard of reasonableness also takes into account other objective features such as cost-effectiveness and safety. I argue that unreasonable responses are ones that do not consider such criteria and opt for courses of action that are perhaps unsafe or are excessively expensive.

Finally, it has been argued that the PP halts productive research and is excessively risk-averse. Hugh Wise has claimed that the PP is “the application of junk science to phantom risks to make them seem plausible” (qtd. in Resnik, “Is the Precautionary” 330). However, the PP’s tenet of reasonableness can provide an adequate response to such objections. In our test cases, we were not making the relevant threats merely *seem* plausible. Rather, we gauged the threats on actual plausibility. That is, we considered threats that were serious possibilities, given our corpus of knowledge. And, in response to those threats, the PP advised us to take the most reasonable course of action. It does not suggest that genetic enhancement technology not be used or that genetic enhancement research be stopped. Rather, the principle states that one must consider the relevant threats and take reasonable (i.e. cost-effective, practical etc.) steps to mitigate those threats. In some cases, as in the Alzheimer’s example, an enhancement procedure may prove to be the best course of action.



## Conclusion

The expanding field of genetic research is proving to be a fruitful endeavor. We are learning important things about ourselves and, among other discoveries, developing new ways to combat disease. However, genetic manipulation, while having the potential to provide great benefits, is a powerful tool. Its use should be thought about seriously. I have argued that the PP provides a good framework for weighing the moral issues that are a part of our worries about genetic enhancement. The PP allows us to articulate our concern adequately and in a way that does not halt productive research. The PP provides a foundation for argument against certain cases of enhancement, e.g. increased memory retention, while allowing for the use of genetic technology in cases that are relatively low risk and can provide significant benefit, e.g. the treatment of Alzheimer's disease.

The rapidity with which this new technology is developing gives us little time to think about all of the ethical concerns that should be considered before technology is made publicly available. Given how little we know at present about genetic enhancements and their possible effects, the PP is ideal for making decisions regarding this technology. However, with all of the uncertainty surrounding genetic enhancement technology, one thing is certain: the technology is coming and we will have to deal with it one way or another. As some of the examples in this paper move closer toward being realized and we have more empirical evidence to apply to our decisions, we may be able to employ other methods of thinking about these cases, e.g. decision theory or risk assessment modeling. However, until that time comes, I think that the PP could and should play a major role in our considerations about the use of genetic enhancement technology.

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