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The Ethical Limitations on Scientific Research

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A perennial question that arises concerning the relationship between scientific research and society is whether there should be any limitations on scientific research and if so, what are the justifications and how far do they extend? Over the years such prohibitions have included sanctions against dissection of cadavers, invasive surgery, and the introduction of X-rays. From a modern perspective these prohibitions seem mistaken. In the twenty-first century increasingly we are bombarded by new biomedical technologies that confront us almost on a monthly basis. Most controversial among these are: A. scientific research trials (particularly pharmaceutical studies) that seem to offer hope for medical treatment but at the possible cost of ethically devaluing the participants, and B. protocols that would affect the germ line of humans, animals, and plants such that we may be in the process of altering life on earth in a significant way.

We, by our actions as humans, may become one of the most significant variables in how species on our planet evolve from here on out. This is an awesome responsibility. Are we up to the task? This is the question on most peoples' minds as they open the morning newspaper, listen to the radio, watch television, scan the home page of their web browser, or absorb the latest tweet. How should we think about such discoveries? If we're uncomfortable, is this just a sign of intransigent, Luddite stodginess? Is our future mission on this planet one that mirrors the television show, 'Star Trek': to go forth (without restraint) and seek out new truths (civilizations) and to boldly go where no man has gone before?

In order to get a handle on how to think about this conceptual model, let us begin our interdisciplinary excursion by examining the very limits of science, itself. In order to achieve a perspective on the possible ethical restraints on new science, most of this chapter will cite examples in the recent history of science in order to make its point. A few contemporary examples will then be brought forward in order to match them against the derived ethical principles.

The structure of our short exploration will revolve around a foundational concept called the Principle of Plenitude. This concept is fundamental to our value-directed exploration of the work of science.

The Principle of Plenitude

Many readers will be familiar with the Principle of Plenitude as discussed by Arthur O. Lovejoy in his classic work, *The Great Chain of Being*.¹ Lovejoy intended a kind of ‘possibility implies normative assent’ thesis. This translates to ‘what can be known should be known’. When one applies this to the scientific realm, it rings almost like religious dogma. ‘Whatever can be known about the physical world should be known.’

I once quizzed some scientist colleagues at the US National Institutes of Health (a national research center in bio-medical research) about this principle and could not find a single objector to the proposition.

Who could argue with such a thesis? There have been some. In the seventeenth century it was an issue of contention. John Milton expresses this view in *Paradise Lost*:

Heaven is for thee too high
To know what passes there; be lowly wise:
Think only what concerns thee and thy being. (Bk. 8, ll. 172–4)

The seventeenth century was the age of scientific revolution. Entire paradigms of thinking were altering.² As in all changes there is an ‘upside’ and a ‘downside.’ Some of the upside had to do with more accurate scientific theories that had greatly expanded explanatory power. From Galileo to Newton the century was alive with discovery.

The downside had to do with the social unrest that may have been a consequence of challenging established authority. The English Civil War and increased turbulence on the Continent are only two examples of what may be attributable to social unrest. The age of the magisterium of the Roman and English Catholic/Anglican Churches was matched by a corresponding emphasis upon the individual.³ John Locke wrote about individual human rights that were logically prior to those that the State chose to recognize. The seeds of the American and French Revolutions were sown here.

Now many would say that such movements were very positive in the grand scope of things. They may have been, but there was much that was lost as well. Rapid change tends to reward first those opportunists who have established themselves in the vanguard. The ordinary people are often left in an onerous holding pattern (that may be worse than it was before) as things adjust.

The limits of science

It is characteristic of many scientists that they are consciously or unconsciously blind to the possible consequences of their actions. Since the mission ('What can be known, should be known') dangles before their eyes, they often feel that whatever it takes to get there (the means) is justified by the lofty goal (the ends). Few moral theories will say that the ends *always* justify the means. Not even utilitarianism professes this in every case (since such an action creates a precedent that, itself, can have severe negative utility).⁴

It is entirely plausible that the thesis of plenitude is not always true. There may be instances in which we should refrain from exploring certain research strategies. These include: (1) instances in which the means of obtaining the scientific ends are immoral; and (2) instances in which the ends themselves may clearly be seen to be involved in a larger context that is, itself, immoral.

Let us examine these in order. *First, there is the instance of immoral scientific means.* This, in turn comes in two varieties: relative immorality and *per se* immorality. In relative immorality one may not have the technological means to do something humanely at the moment, but 'in principle' it may be possible in the future. An example of this is the observation of human organs as they function within a living organism. In ancient times the only means available to obtain this scientific end was vivisection. Celsus reports that vivisection was performed by Erasistratus and Herophilus upon condemned prisoners.⁵ The explicit purpose of vivisection (the surgical exposure of the internal organs of a live person without anesthetics of any kind) was to learn more about how the human organs functioned. This scientific end is indeed a valuable one. Under the plenitude principle what can be known should be known, ergo let's cut up another poor soul!

Of course, vivisection is cruel and inhumane – even when performed upon people condemned to death. This is because inflicting severe pain upon another human at will produces (from the recipient's point of view) gratuitous suffering. Inflicting gratuitous suffering upon any human, at will, is to fail to respect their dignity. This is because tied up with dignity is a fundamental sense of rights to primary basic goods of agency (food, clothing, shelter, and freedom from dehumanizing and degrading violence).⁶ All humans have a claims right to the primary basic goods of agency.⁷ Thus, to fail to provide another person with the primary basic goods of agency (when it is in your power to do so) or to deny another the primary basic goods of agency, is to fail to respect their human dignity. Since all people have a moral claims right to the primary basic goods of agency, then to deny another of her primary basic goods of agency is immoral. Therefore, since performing vivisection in ancient times was an instance of denying another of the primary basic goods of agency, then vivisection was an instance of failing to respect human dignity and thus immoral.

If performing vivisection is the only means of obtaining the scientific end, then that end should be forsworn. Scientists should decide that they will *not* pursue the end (contra to the Principle of Plenitude) because the only way that they can do so is to employ immoral means.

However, in this instance the immoral means are relative. That is, they are relative to a particular stage of scientific development. In Galen's time up until a little more than a century ago, it would have been impossible safely and humanely to surgically examine a patient in order to understand the physiology of his organs. Once the technology progressed to the point where surgery could proceed without being cruel and inhumane (thus failing to respect the human dignity of the subjects), then surgery could become a legitimate means of pursuing the end of physiological discovery.⁸

An example of a *per se* immoral means would revolve around cases in which the scientific end inextricably entails pain and suffering. For example, if a scientist wished to know the stages in which a disease killed people (in a controlled setting), then the means would necessarily require taking a group of humans inflicted with a fatal disease and watch them die without providing them with any real (available) cures or significant palliative care (such as they exist at some moment in time). This is because such 'intervention' might skew the pure view of the disease's progression and the effects upon humans. The researcher distances herself from the project and merely observes and records people in the various agonizing stages of death.

This scenario is not too far removed from the infamous Tuskegee experiment in which patients infected with syphilis were not properly treated so that they might be observed in their pain and suffering.⁹ The scientific end of understanding the 'natural' progressions of a fatal disease among a large controlled sample group is a valuable one for advancing scientific knowledge. However it can only be achieved through immoral means. Thus, the scientists should have forsworn this research plan.¹⁰

Similar infamous research designs were carried out by Nazi Germany, Tojo's Japan, and Stalin's Soviet Union. In each case, scientific ends that *only* could be carried out by immoral means should have been avoided. This is yet another instance in which the Principle of Plenitude is flawed.

Henry Beecher also brought to the fore The Jewish Chronic Disease Hospital Case in which patients without known relatives or advocates were subjected to blatant deception in order to engage in cancer research and the mechanism of transplant rejection. These patients without advocates, who did not have cancer, were injected with live human cancer cells in order to view how the human body would react. Obviously, this put these patients at risk of getting cancer. This patent disregard for research subjects is reminiscent of the Tuskegee experiment.¹¹ Ezekiel Emanuel and Christine Grady show that the most egregious violations of research ethics occur under a worldview approach of *researcher paternalism*. Under this paradigm the 'what can be known, should

be known' approach is unchecked. Ergo, the immoral means are allowed to go forward. The authors suggest that a check on these immoral means can occur through a mix of regulatory protectionism, participant access, and community partnership.¹² The result is some transparent accountability.

A final group in this category concerns scientific discovery in realms in which double blind testing creates an unethical context. The most common among this category comes from the pharmaceutical industry. A key example of this is the testing of HIV/AIDS medication in Thailand and some other Third World countries. Problems occur when: First, trial protocols give different groups who are at risk various mixtures of the AZT medication (in order to see whether lower levels of the drug might still work so that the more affluent countries of the world might be able to save money.¹³ Stolberg 1997). Women were given progressively lower doses in order to discover whether the standard dosage could be lower and still work. Trials were continued even when the research subjects showed clear deleterious effects that included advancement to full-blown AIDS and death. However, proponents say this is the only way to be sure of the exact dosage necessary. The only way to get this exact information is to fail to recognize the dignity of research subjects, which is unethical.¹⁴ In this case the means to acquiring scientific knowledge are unethical and should not be pursued in this way.

Secondly, a second breach of research ethics occurred when testing HIV/AIDS vaccines. In this case a sexually active population was chosen (also in Thailand and other Third World Countries). The trials were double blind. They were continued past the point in which in-progress results were not sufficiently positive to continue in the face of the demonstrable negative medical side effects to study participants¹⁵ as well as probable negative social side effects.¹⁶ In addition to these problems, putting research populations at risk when there is an available treatment just because they are of a lower socio/economic class or because they reside in a Third World Country and thus have no standing in compensatory law suits, is also unethical on the same grounds.¹⁷ However, the benchmark for medical certainty (.05 of the null set) could not be achieved except by marginalizing these women. They were treated as 'means only' for the sake of a standard of medical knowledge. It is my contention that the use of these protocols is immoral. They disregard the dignity of the human research subject. All of these aforementioned examples are centered on HIV/AIDS vaccine trials in stages I, II, and III. The information necessary to create a vaccine for a world epidemic disease seems to involve unethical research methods if full double-blind testing is used as the model. Double-blind testing is the gold standard for medical research (if one wants to achieve the most reliable results). However, early testing of AZT in the United States used a rather more informal technique of clinical trial and error. The patient population was dying of AIDS. This group of patients would search for any hope and were ready to try an experimental drug. In this case the informal trial was successful. However, in

the longer term this sort of research method in this context is more expensive and less reliable – because it yields less exact scientific knowledge. However, it is this author's opinion that ethics trumps efficiency. No scientific knowledge should be obtained via unethical means.¹⁸ Less exact knowledge procured ethically is to be preferred to more exact knowledge procured unethically. This is a key limitation on scientific knowledge.

There are those who contend that some of these ethical-means problems occur because of the different roles of physician and researcher. The argument goes as follows. The physician is an advocate for her patient. However, the scientific researcher has a different imperative that is not patient centered.

It is, in fact, probably a better situation that the physician and the biomedical researcher be separate. This is because their respective missions are not identical. The physician is concerned with the well being of the patient and in doing no harm. Her duty is to focus upon the patient and his recovery. The researcher is concerned with expanding our understanding of nature and benefiting humankind. This mission may lead him in a different direction. The mission of the physician is different. When the physician and researcher are one and the same person, a conflict of mission may occur.

However, I am not advocating an absolute prohibition against the physician and researcher being one and the same person, but merely to point out that since the missions of each are different, potential conflicts may arise. For this reason, institutional review boards (IRBs) should take this into account using the following standard: it will be assumed, *prima facie*, that the researcher and attending physician will not be the same individual. One would need a compelling argument to get approval otherwise.

Obviously, this sanction would not apply to medical clinical research that is observational only: a physician reporting on his cases under the latitude of approved patient care. Because of this latitude, some modifications of care can be published as clinical research. It is only when the course of treatment becomes experimental (beyond the standard of approved patient care) that the two roles become controversial.

Conceptually, what stands behind this limitation on scientific research is that the means to some scientific truths are unethical. If one cannot know exactly *how* one dies from syphilis (for example) without setting up a situation in which individuals are allowed to go through all the stages of the disease to death (when there are effective treatments available), or how certain sorts of cancer spread (when there are effective treatments available), or creating an HIV/AIDS study to test a vaccine that requires a placebo group who will die (when there are effective treatments available), then – if this is the only way to acquire such scientific information – such knowledge should be outside our ken. Its acquisition can only be acquired by unethical means. It thus stands as an exception to the principle of plentitude.

The second category of exceptions to the Principle of Plenitude involves instances in which the ends themselves may clearly be seen to be involved in a larger action or context that is very risky to the public good to such an extent that it becomes immoral. This second category seeks to examine the character of the proposed end of the scientific principle being explored. Fundamental to the exploration of this second category is the admission that science does not exist in a vacuum. As much as many researchers might like to think of themselves as in a protective cocoon of pure intellectual speculation, this is really a pernicious fantasy that often blinds scientists to the actual uses of their research.

In this category I will examine two cases: 1. The proposed protocols for Germ-Line secondary goods Enhancement, and 2. The development of the Atomic Bomb.

In the first case we are involved with possible protocols for germ-line genetic secondary goods enhancement. At first blush, it might seem like genetic enhancement might be a good thing. We could create a new species, *homo melior*. These creatures could be the best possible of all genetically engineered hominoids. So, who could possibly have a problem with this? Doesn't this sound like the perfect actualization of the principle of plenitude?

Although the promise of improving humans in a number of areas sounds very fine, the devil is in the details, and the details are not as optimistic. First, one must remember that there is a difference between *somatic treatment* in which genetic engineering will seek a treatment or cure when otherwise there is no hope and *genetic enhancement* in which the germ line is altered in such a way as to affect future generations. When the risk factor is just a single individual, the stakes are different from risking countless offspring to come (potentially all of humanity over time). In genetic enhancement there is a new context that is being created. This context could be very deleterious. The reason for this is that genetics is enormously complicated. For example, what was taken as 'junk DNA sequences' just a few years ago now is seen to have some mechanical functions (though they are not very well understood). There have also been a number of unforeseen consequences in recent years during genetic therapy that have resulted in outcomes worse than the underlying condition and traditional treatments – including death.¹⁹ If somatic genetic therapy is extremely risky, think of the extended unforeseen consequences when the germ line is affected. Each mistake will be multiplied many times over.

Despite the tight controls on genetic engineering for somatic treatment, the track record has not been sterling. The principle of precautionary reason would suggest in such a situation that researchers forego therapy except in otherwise hopeless situations until the level of science improves – a relative prohibition.²⁰ But genetic treatment or enhancement that would affect the germ line seems to this author as having enormous risk for unintended consequences. Is this just a case of science not being up to a possible new standard where all will

be possible? Or is it a case of the three-ball problem in Newtonian physics (a conundrum with *per se* problems due to inherent complexity that can never be solved)? No one knows for sure. Because of this uncertainty, moving forward in this arena should deserve special analysis. In order to think about this let us separate two sorts of enhancements: (a) those that are concerned with ‘knocking out’ deleterious DNA base sequences that are responsible for genetically inherited diseases, and (b) those that seek to improve the species by adding new capacities.

In the first case, we may be in the situation of a relative prohibition (such as the prohibition of the surgical study of physiology above). The model is analogous to vaccine inoculations. Though the track record for genetic therapy has not been the best, we can imagine a future in which some skill might be obtained so that we might be able to eliminate Tay-Sachs, for example. This is logically possible, and it fits into the historical mission of medicine. However, because of the immense complications involved, at the very least if we are governed by the principle of precautionary reason, then we have voluntarily taken on many limitations upon the principle of plentitude. This means that we must proceed at a very slow pace that follows the highest standards of research ethics. It may be the case that we will never be competent enough to pull this off. It might be that we have a case of the ‘three ball problem’ in Newtonian mechanics. The use of ‘knock-out’ strategies in genetic therapy (except as an experimental last hope at this juncture in history) should be avoided. We will move forward (if at all) on the robust informed consent of those who feel they have no other options.

The second form of enhancement does not seek to protect from future harm (much on the model of vaccine inoculations), rather it seeks to improve us to *homo melior*. The strongest case against this is that it creates a context of typology (here understood as secondary goods).²¹ We seek to create preferred *types* that represent the ‘perfect’ person. This drive toward homogeneity is radically against the acceptance of diversity among peoples and against the viability of those who have various forms of disabilities (now defined as against the perfect phenotype). Will everyone have a certain facial construction, skin color, sexual orientation, and brain configuration (including values and tastes)? Such a social context would be radically against diversity (considered by biologists to be essential to evolution and by some ethicists to be a key element in social justice).²² Therefore, genetic enhancement for the sake of improving the capabilities of the species (as opposed to knocking-out deleterious genetic diseases) is a valid instance of a *per se* limitation on scientific knowledge.

The second case of a *per se* resultant immoral context concerns the research into weapons of mass destruction. In the United States, the former Soviet Union, and many smaller countries around the world there has been research into chemical and biological warfare.²³ Sometimes the country says to its scientists that they are investigating ways of deploying nerve gas or anthrax as a way

to create defenses against such weapons that might be used against them. This is the ploy of many leaders: We only want to create an effective *defense*. No one wants to admit that they are engaged in anything that might be construed as *offensive*. When Nazi Germany invaded Poland it was on the pretext that they were responding to earlier injustices. Later conquests were likewise linked to past grievances that needed to be settled. Likewise, with so many other countries, the US invasion of Iraq, various conflicts in Middle East, wars in south central African, unrest between Pakistan and India *et al.* – all of these were sold to their peoples as being somehow defensive.

Who, after all, is going to approach his people and say, ‘Today we are about to engage in a grand offensive land/property heist because I, as your leader, think it my manifest destiny to garner as much money and power as possible because that is my personal mission in life’?

A classic case that covers the essential elements in the weapons of mass destruction scientific paradigm is that of the Manhattan Project. If you were a scientist asked to head the atomic bomb project in the early 1940s, what *would* you say, and what *should* you say?

On the one hand, you might think that here is a chance to be funded to perform basic research that will alter how particle physicists understand the nature of matter. What a grand opportunity! We now have a chance to demonstrate that the very word ‘atom’ (meaning in ancient Greek ‘un-cuttable’) is wrong. The atom can be split, and you are on a research team that will do it. This is a chance to extend the boundaries of science: to know whatever can be known (the Principle of Plenitude).

On the other hand, you might realize that this research is for the purpose of creating a bomb that can have no other purpose but to kill civilian non-combatants – in unthinkable numbers.²⁴ This bomb is so devastating that it could never be used in accordance with the recognized ‘rules of war’ that assert that armies only attack armies. Non-combatants and civilians are not fair game in the rules of war, but since the atomic bomb’s effects were so pervasive, it would not be possible to deploy it without violating these rules of war. Whenever it was used, it would be a weapon of mass destruction. As such, it would be a vehicle of killing that would re-define warfare. The way warfare would be re-defined is through the inclusion of mass killing of civilians on a scale that the world has never known before. What this means is this:

- 1 Warfare is morally justified only on the principle of generalized self-defense – Assertion
- 2 Self-defense is defined as committing minimal effective force against an aggressor to protect oneself – Fact
- 3 In the case of war, the aggressor consists of the attacking army and/or those civilians actively engaged in fabricating armaments – Assertion

- 4 Warfare only morally justifies the killing of combatant soldiers in the army and/or those civilians actively engaged in fabricating armaments – 1–3
- 5 Civilians living in the countries engaged in war are (except for armament workers) materially separated from the act of aggression – Assertion
- 6 Anyone materially separated from an act of generalized aggression is to be considered innocent – Fact
- 7 Civilians living in the countries engaged in war are (except for armament workers) are morally innocent – 5–6
- 8 Murder is defined as the killing of an innocent without just cause – Fact
- 9 The killing of soldiers or civilians engaged in armament fabrication can be morally justified in a defensive war, but the killing of other civilians is murder – 4,7,8.²⁵

The practical end of the Manhattan Project was to create a weapon of mass destruction. A weapon of mass destruction will necessitate the deaths of thousands of innocent civilians. This entails that the practical end of the Manhattan Project was murder. Is being a part of the Manhattan Project as a contributing physicist something that *you*, as a scientist, should accept? You may pretend that you do not see the real end, but it is there nonetheless. One possible reason a scientist might blind himself to this intersubstitution of ends in the causal chain is because the scientist may view the proposition as opaque. However, this does not wash because we are not talking about mere substitution of terms, but of logical relationships that exist when anyone enters a causal process.²⁶ This point can be illustrated by the following example. If Mary is an accountant for a pharmaceutical company (that is adulterating its products with impotent fillers in order to make more money), and if Mary knows this (or could have reasonably figured it out), then she cannot throw up her hands and claim innocence when someone dies from taking the medication. She cannot say that all she was doing was keeping the books according to the highest standards of accounting practice and that one cannot connect her to the ultimate end because the context is opaque. No, Mary is responsible for understanding that she acts in a context and bears some responsibility for the reasonably foreseeable outcomes of that context. If the end leads to a foreseeable immoral outcome, then scientists should not join. On this line of analysis (instances in which the ends themselves may clearly be seen to be involved in a larger action that is, itself, immoral); no scientist should have signed on to the Manhattan Project (or other like projects that had immoral ultimate ends). Under this line of argumentation, the second limit of science is not to participate in research projects that will or probably will create an immoral context in their implementation.

There are, however, two rejoinders to my argument. A. What if the immoral ends are less immoral than some other end? B. What if an individual joined in the project that had an immoral end with the purpose of sabotaging it?

Both of these suggestions are challenging. Let us address each of these in order. The first suggestion is that there are gradations of unethical conduct. If one were to do *x* (where *x* is an unethical action), then *x* might be *less* unethical than some other consequence *y*. In this situation, one might be confronted with a dilemma situation (meaning that without any prior wrongdoing on the agent's part he might be put in the situation in which he must perform an unethical action). If one holds that dilemma situations can occur, then performing the lesser of two evils may be the most moral alternative. In order to enter this style of reasoning we have to consider all lives as equally at risk: combatants and non-combatants. Under standard accounts of just war theory combatants in war are fair game while non-combatants are not, but under this rejoinder, that sort of reasoning is rejected.

Returning to our example, if creating an atomic bomb that will kill more than three hundred thousand people,²⁷ is compared to a land invasion that will mean the aggregate deaths of two million people, then (if human life is additive) it would be better to drop the atomic bomb than to attempt a land invasion.

This style of analysis is highly dependent upon a consequentialist calculation that ignores the distinction between combatants and non-combatants. It assumes that the rightness or wrongness of any given human action depends upon the net result of utility consequences as seen over a reasonable time period.²⁸ Some would see this as an instance of the Trolley Problem. In the Trolley Problem one is asked whether it is more ethical to kill a fewer number of people than a greater number of people.²⁹ This speaks to the question of whether human life is additive or whether it is not. If human life is additive (and if the additive assumptions are correct, viz., that non-combatants and combatants are to be viewed as equally viable military targets), then clearly dropping the atomic bomb is morally justified. However if human life is not additive (meaning that it is just as horrific to kill one immorally as to kill ten immorally) or if there is a hard and fast distinction between combatants and non-combatants, then there are no moral criteria to justify dropping the atomic bomb.

One might effectively ask whether any scientist recruited at the beginning of the Manhattan Project would have the sort of information that President Franklin Roosevelt cum President Harry Truman did when he made the executive order to drop the bombs. For all these scientists might have known, the death toll could have been in the tens of millions. All that they knew was that they were engaged in the creation of a weapon of mass destruction. How many people might be murdered or killed in violation of the rules of war was entirely unclear. Also, it is unclear how many soldiers would have been killed if the United States adopted another strategy. In 2001 during a Faculty Ethics

Seminar I co-ran, one participant was a former general in the Air Force who said that she had studied a US Military generated account of an alternate strategy of setting an extended siege and conventional bombing campaign against military targets in natural-resource-poor Japan before setting forth on a land invasion. The numbers of American soldiers to be killed under this strategy were fewer than 100,000 – far less (even under the aggregative strategy) than dropping the two atomic bombs.³⁰

Thus, if even the best argument for the development and deployment of the atomic bomb is suspect, the scientists must have seen what they were doing as either an instrument of very heinous evil or else as part of a marginal call (at best). Be this as it may, the first rebuttal against the sanction of scientists on the Manhattan Project would be one of consequential comparative advantage.

The second rebuttal centers around a person who joined the project with the purpose of sabotaging it (at least from the most evil excesses). This sort of ‘fifth column’ approach works like this. Mr. X is invited to be a part of the Manhattan Project. He knows that though the proximate guise of the project is to extend basic research in Physics, but the ultimate goal is the creation of a weapon of mass destruction. Mr. X believes that the creation of a weapon of mass destruction is an immoral ultimate goal, but he also realizes that if he checks out of the project, there will be many others who are anxious for admittance. These others may be morally blind to what they are doing. They may be so wrapped up in the proximate ends of advancing fundamental knowledge in Physics (the Principle of Plenitude) that they do not contemplate the implications of what they are ultimately doing (viz., creating a weapon of mass destruction). Because of this moral blindness, such scientists may allow the worst possible scenarios to occur. If the team contains at least a few people of good faith (i.e. ethical scientists who are sensitive to how their research is being put to use), then it is possible that – even if bad politicians try to misuse the atomic bomb – the scientists of good faith (members of the fifth column) might be there to sabotage the process.

The fifth column approach has been occasionally used in the political sphere. In one prominent case, Dietrich Bonhoeffer (a Protestant Christian Theologian) pretended to be a Nazi in order to join in a plot to kill Adolf Hitler. Unfortunately for Bonhoeffer, the plot failed and Bonhoeffer was executed.³¹

The problem with the fifth column approach is that (at least in the short run) a person participates and supports a system that has an immoral end. Because of this the saboteur is in the position of having to defend that which is really evil. He works and helps bring about evil, and if he, like Bonhoeffer, is unsuccessful in his act of sabotage, then the net effect of his action is actually to have promoted evil.

This can be particularly troubling in cases in which there is a significant resistance movement that has taken it as their mission to work *outside* the system in order to bring about its demise. If the resistance movements are

almost effective, but need just a few more committed individuals, then the fifth column advocates deny the resistance fighters their point of inertia. In the Manhattan Project, J. Robert Oppenheimer might be called a fence sitting fifth column advocate. Oppenheimer forever felt some conflict about his role as scientist and as a man of conscience who might engage in a fifth column effort to abort the project.³²

This author would say that there may be situations in which the strategy of the fifth column may seem to be the only way to overturn the immoral system (or research program), but it is a highly risky tactic that has many inherent drawbacks.

In the contemporary context, some of these principles can be readily applied. For example, instances of relative immoral ends might include the cloning of whole humans. Because the present (2011) state of cloning of whole organisms is so crude, it would be immoral to saddle an infant with the probability of a quick and painful death simply to satisfy the principle of plenitude. It is possible that some time in the future that this approach will be perfected on other animals such that the application to humans no longer poses such risks. In this event, cloning may simply be another (albeit very costly) option for infertile couples or single women. This is a case of ‘relatively’ immoral ends that are relative when measured against our current state of knowledge.

When one envisions the cloning of another person (generally a twin of a sibling needing a vital organ) merely as a means of saving a brother or sister when that sacrifice entails the cloned donor’s own death, then we are engaged in a *per se* immoral end. If we all agree to the principle that all people count equally, then to bring a new person into the world solely to harvest his or her organs for the sake of a sibling is to fail to respect the donor’s basic rights. Just as in the Tuskegee case, the end is absolutely immoral and therefore should not be pursued. Protocols that seek to explore this sort of organ transplant strategy ought not be pursued.

In conclusion, though the Principle of Plenitude is very alluring because it appeals to the mind’s eternal quest for knowledge, it is not conclusive. There are moral constraints upon the quest for scientific knowledge. These include: (a) instances in which the means of obtaining the scientific ends are immoral; and (b) instances in which the ends themselves may clearly be seen to be involved in a larger context that is, itself, immoral. Both of these situations dictate that scientists should take the advice of Odysseus who ordered his men to stop their ears with beeswax and bind him to the mast of the ship as they passed the region of the Sirens. Odysseus knew that knowledge had its limits and though he was compelled to listen to the melody, he took precautions against his ability to act.³³ Odysseus knew that there are limits to the Principle of Plenitude. Modern scientists must also learn this lesson.