1 Science and Religion: Is There a Conflict?

The scientific method is “the process of objectively establishing facts through testing and experimentation. The basic process involves making an observation, forming a hypothesis, making a prediction, conducting an experiment and finally analyzing the results” (Wright & Lavery, n.d.).

That this method has transformed and continues to transform the way we understand our world and act accordingly is beyond doubt. It is true that those who identify themselves as religious tend to trust science less than those who don’t when asked to rate their level of trust, although this level of trust differs around the world. “The perceived disparity between faith and science was highest in parts of Asia, with 64 percent of Christians in South Korea and 58 percent of Christians in Singapore reporting some conflict. It was lowest in Sweden, where just 15 percent of Christians saw conflict” (Shellnutt, 2020).

However, most religious individuals by their actions demonstrate significant trust in a scientific understanding of everything from how the body works and what we should do to regain/retain health, the types of cars we should drive and how they should be driven, how we should grow the food we eat and how that food should be consumed, and why we behave the way we do and how we should interact with each other accordingly.

In short, conflicts between science and religion are seldom based on the belief that the scientific method as a means of understanding our world is inherently flawed or even on the belief that this method doesn’t give us very helpful information about our world and how we should act within it the majority of the time. Actual conflicts arise when some who identify as religious believe there is another source of truth about our world, namely some form of divine/supernatural revelation. More specifically, conflicts arise for individuals when the truth about some aspect of our world is believed to have been revealed to them through sacred texts, the ability to discern truth through direct communication with the divine, and/or truth from the divine transmitted through trusted spiritual leaders is inconsistent with what they believe science is telling them about this aspect of our world.

The classic historical example is the conflict between Galileo’s scientific belief that the earth revolves around the sun and the church’s revelatory belief that the earth was the center of the universe. Another well-known example that still exists for some religious individuals is the conflict between the scientific belief that the universe began as just a single point about 13.7 billion years ago and has been expanding ever since and the revelatory belief that the universe was created ex nihilo (out of nothing) by God around 10,000 years ago.
Some conflicts based on competing sources of truth clearly remain today. For example, the scientific belief that there are fully natural explanations for all we experience conflicts with the revelatory belief that God at times intervenes in the natural order to bring about some state of affairs that would not have occurred as it did without some form of “supernatural” action.

However, we do not find this type of conflict related to genetic engineering—the process by which DNA in our cells can be modified to bring about changes in our bodies. That is, there are not, to my knowledge, any competing religious truth claims concerning the role that cells play in organisms, the roles that genes and DNA play in our cells, our ability to modify genes and thus cells in ways that impact the health and behavior of organisms, the increasingly sophisticated tools being developed to modify genes, or the increasing impact such modification can have on the future of humanity. There are, of course, differences of opinion on all of this within the scientific community. However, these disagreements aren’t based on religious versus scientific sources of truth. They are based on differing views on the science (the empirical data) and are as likely to arise among individuals (e.g., scientists) who happen to be religious and those who aren’t. We seldom, though, find religious individuals challenging the claims of science in this arena on revelatory grounds.

However, isn’t there a conflict between science and religion at an ethical (ought) level? Don’t science and religion conflict on the question of the extent, if any, to which it is ethically justifiable to engage in genetic engineering? As we will soon discuss in great detail, this is a very complex question. While it is, of course, true that those individuals who are religious often have at least in part a different basis (a revelatory basis) for the ethical principles that guide their thoughts and actions related to what is right or wrong than those individuals who are not religious, the actual ethical principles that guide the thinking of nonreligious individuals on ethical issues related to genetic engineering issues are often exactly the same ethical principles that guide the thinking of religious individuals on these issues. Or, to state this important point differently, in relation to the topic at hand, it isn’t even the case that the vast majority (or even in some cases the majority) who are nonreligious (including most scientists who are nonreligious) affirm significantly different ethical principles from the vast majority of those who are religious (including most scientists who are religious) on these issues.

This doesn’t mean that religion is irrelevant to an analysis of genetic engineering. It simply means, as we will see, that the relevance is different from and much more nuanced than our normal understanding of conflicts between science and religion.
2 Genetic Engineering and Religious Belief: How Ought We View Their Relationship?

There are various related, but distinct, ways of describing the relationship between genetic engineering and religion. Sometimes this relationship is approached as a comparative study of the percent of those adhering to various religions (or to no religion at all) who hold a certain position on genetic engineering in general or some specific aspect of genetic engineering.

For example, from one poll we learn that “57% of Protestants (62% of Evangelicals) oppose [genetic engineering technology] based on their religious or ethical views while 37% are in favor; Catholics followed closely behind with 52% opposed and 42% in favor. Among Muslims, 46% are opposed, with 32% in favor. Jews had the most favorable view of the technology, with 55% in favor and 35% opposed” (AgBiotechNet, 2001).

Another, more narrowly focused study of this type compared the views of Christians in twenty countries with their nonreligious neighbors on gene-editing technology. It was found, overall, that “believers lag behind non-religious neighbors in support for the technology.” More specifically, the study showed that “Christians in the US are half as likely as the religiously unaffiliated to believe scientific research on gene editing is an appropriate use of technology (21% vs. 47%), the widest gap among the countries surveyed.” In Canada, the UK, the Netherlands, Sweden, Italy, and Spain, believers “also lagged behind the unaffiliated, though both demographics disapproved of gene-editing research.” In France, “where approval levels were lowest, Christians and the unaffiliated felt about the same (16% vs. 15% said it was appropriate).” Finally, “few people, regardless of faith, considered it appropriate to alter genetic makeup to make a baby more intelligent; overall, 82 percent disapproved” (Shellnutt, 2020).

While interesting, this type of demographic information, itself, tells us very little about the relationship between religious belief and genetic engineering. The fact that someone who is affiliated with a religion holds a certain view on an issue doesn’t mean that the perspective held by the person is based on a religious belief – a belief grounded in the teachings or set of doctrines of the religion affirmed by this person. Some religious individuals hold their positions because they trust what they are told is true by respected religious authorities while others just intuit or sense what is right. In other words, we must make the important distinction between individuals who are religious and take a stance for and against an issue that doesn’t have any obvious, direct basis in the person’s religious beliefs/commitments and individuals who are religious and take a stance for or against an issue that does have its basis in a religious
intuition/belief/commitment the person holds. Furthermore, even if we assume that the person’s perspective on an issue is grounded in what the person understands to be beliefs (tenets) of the religion in question, such polling doesn’t identify for us what these beliefs are.

It is more helpful in this regard if surveys or studies give us insight into the specific religious beliefs that impact a religious person’s views on genetic engineering – for instance, the belief that it is wrong to “play God” and that those involved in human genetic engineering are playing God.

Some studies address part of this concern. For instance, a Pew Research Center poll measured the percent “of U.S. adults who say gene editing to give babies a much reduced risk of serious diseases and conditions” is either “no different than other ways we try to better ourselves” or “crosses a line, is meddling with nature.” An interesting finding was that the response of those who were religious differed significantly in relation to their standing on a religious commitment index – for example, on the frequency of prayer, the frequency of attendance at religious meetings, and how important religion is self-reported to be to them. While only 33 percent of those who were high on the index believed that the genetic editing of babies to reduce disease is no different than other ways we try to better ourselves, 49 percent of those who were medium on the index and 70 percent of those who were low on the index thought this to be the case (Pew Research Center, 2016a).

It is reasonable to assume that this correlation between index status and response can be attributed in part to the fact that those who are high on the religious commitment index ground their views more firmly in the teachings (beliefs) of their religion than do those who are medium or low on the index. We still, however, don’t learn from such studies which religious beliefs are responsible for this impact.

This limitation is in one sense addressed by those studies attempting to determine how the recognized (or sanctioned) beliefs of a religion relate to genetic engineering in general or specific aspects of this technology. In fact, some studies not only identify the key relevant beliefs of religions but do so in a comparative manner.

For example, one study shows that “a majority in all religious groups believes that humans should use their knowledge to improve the life of other humans.” In response to the question of whether God has empowered humans to use science to improve life or whether humans are “playing God,” what surfaced was that “a majority of all those polled felt [humans have] been empowered by God to improve life. Jews and Muslims agreed the most strongly with the statement on empowerment (62% and 61% agreed, respectively), followed by Catholics (55%) and Protestants (54%)” (AgBiotechNet, 2001).
Additionally, most polled, regardless of religion, felt that it is important to “improve the world or strike a balance between improving and preserving it. Jewish adults feel most strongly that humans have an obligation to improve the world (60%). Protestants are more likely than other religious groups to say that humans should strike a balance (43%), with nearly half of born-again Christians (48%) saying humans should strike a balance” (Pew Trust, 2001).

More recently, a study compared and contrasted the perspectives of Christianity, Judaism, Hinduism, Buddhism, and Islam on a variety of bioethical issues, including gene editing. Among the key findings was that while Judaism encourages caution in applying biotechnology, there appears to be “nothing prohibiting one from engaging in research and development . . . so long as policy makers and regulators take care to assure that the technology is put to beneficial use with appropriate safeguards.” Muslim and Hindu perspectives are similar: “there are no particular principles that could be seen as a basis for prohibiting biotech development.” More specifically, Buddhism, Judaism, Islam, and Hinduism consider an embryo a human life but are generally accepting of human embryonic stem cell research. Overall, the Christian perspective on biotechnology is more negative, especially among those Christians who believe life begins at conception and, thus, oppose any technology (such as embryonic research or editing) that normally results in the destruction of human embryos (Warmflash, 2019).

I still have a concern. Everyone agrees, including those conducting the polling in question, that there exists a variety of perspectives within any given religion. There is often an assumption, though, that there is in every religion a substantial set of core beliefs (doctrines) that are shared by most adherents to any given religion and that we can, therefore, look to these core theological and ethical beliefs when determining the stance of a religion on issues related to genetic engineering.

This seems to me a dubious assumption. First, as we’ll discuss in greater detail in Section 7.2.2, even if we assume there to be a set of core beliefs affirmed by most adherents in a religion, there is no guarantee that these adherents will agree on how these core beliefs should be applied now (or in the future) to genetic engineering.

The more significant problem here, as I see it, is the questionable assumption that there is, even at the most fundamental, general level, one set of sanctioned core beliefs for a religion. As I have stated elsewhere,

while there is obviously widespread diversity of thought among these monotheistic religions (theistic systems) on such fundamental issues as God’s nature and character, the relationship between divine control and human
freedom, the extent to which God unilaterally intervenes in our world, and how God would have us live, it is being increasingly recognized that widespread diversity of thought on all these issues also exists just as clearly, and in exactly the same sense, within religions. (Basinger, 2020a)

In fact, the perspective of a variant of a given religion on an issue is often more closely aligned with the perspective of variants of differing religions than with the perspective of other variants of the given religion in question. The stance of conservative Christians, for instance, is often more similar to the stance of conservative Muslims or conservative Jews than the stance of more liberal Christians. And this holds for issues related to genetic engineering – for example, on why disease exists and the acceptable methods for addressing it.

How then ought we to proceed? The best approach, I believe, is to consider the religious beliefs that actually serve as the basis for religious responses to genetic engineering without attempting to tie such beliefs to any specific religion or even a variant of a religion. Since most, if not all, of the religious beliefs we will consider are both affirmed and denied by proponents of variants within most religions, not tying any given belief to any given religion will allow us to assess such beliefs without making any determination about the “official” stance of any actual religion or its variant on the issues in question.

Or stated differently, while I will at times note what are seen by some as the basic tenets (sanctioned beliefs) of various religions and the views held by individuals who self-report as being affiliated with these religions or their variants, our main goal is to explore the religious beliefs (beliefs that have a religious basis) and related lines of reasoning on genetic engineering, regardless of the religion variants in which these beliefs are found or the extent to which individuals who self-report as religious or affiliated with a variant of a religion actually affirm these religious beliefs and related arguments. I will in conclusion, though, also share what I see as the most constructive approach to the current, often contentious religious dialog around these issues.

3 Genetic Engineering: An Overview

Genetic engineering focuses on genes, but what exactly are genes and what role do they play in the life of an organism? All organisms are comprised of a variety of cells that work together to help the organism function. In every cell is a molecule called DNA, which is specific to that organism (unless the organism has an identical twin). Genes are short sections of DNA in a cell that control the function that cell plays in the life of the organism. Humans, for example, have hundreds of different kinds of cells, each of which carries out the instructions from its genes to keep our various bodily systems functioning. In this role, genes
carry DNA instructions that determine, among other things, our eye and hair color and are contributing factors to such things as our weight, blood pressure, and cholesterol levels (Genes & Health, n.d.).

Genetic engineering is an attempt to alter the DNA within a gene to change the makeup of an organism – a plant, animal, or human. The most common and least controversial form of genetic engineering is that which is intended to “fix” a problem within an organism. This form of genetic engineering, often referred to as gene therapy, has as its goal to return a faulty gene (DNA) in a cell to its “normal” state.  

Gene inhibition therapy seeks to “eliminate the activity of a gene that encourages the growth of disease-related cells” (Yg Topics, 2021). Such therapy is used to treat cancer or inherited disorders. It’s also used to treat those cancers resulting from the over-activation of certain genes. “By eliminating the activity of that [gene] through gene inhibition therapy, it is possible to prevent further cell growth and stop the cancer in its tracks” (Yg Topics, 2021). Gene augmentation therapy seeks to add a “healthy copy of a gene to a cell where a faulty gene exists, so the healthy copy can override the negative effects caused by the faulty gene” (Gragnolati, 2022). This type of therapy is used to treat functional disorders such as cystic fibrosis. Finally, gene-killing therapy attempts to “insert DNA instructions into an unhealthy cell that causes the cell to die” (Yg Topics, 2021). This type of therapy is used to treat certain cancers.

There is, though, a different form of genetic engineering that is not intended to fix a problem with the genes in a cell but rather to modify the genes (DNA) in a cell – that is, to add, change, or remove certain DNA sequences in a cell – in order to increase the likelihood that the organism will exhibit some desired (enhanced) trait. This form of genetic manipulation is common at the plant level and becoming more common at the animal level as an alleged means to increase the quality and quantity of our food supply without increasing cost or harming the environment. As we will see, this form of enhancement engineering, while not yet widespread at the human level, is increasingly becoming the subject of intense scientific and ethical debate (Missouri School of Medicine, n.d.).

Before discussing the application of the various forms of genetic engineering in more detail, I want to introduce two relevant distinctions and also CRISPR: the recent gene-editing technique that has greatly increased our ability to edit genes in ways that hold great promise for all but raise (or heighten) significant ethical concerns for many.

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1 While the focus of this Element will be on DNA editing, it’s important to note in passing that RNA is another molecule in cells that converts the genetic information contained within DNA to a format used to build proteins. RNA editing is also gaining in popularity and importance (Reardon, 2020).

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One key distinction is between nonreproductive cells (somatic cells) and reproductive cells (germline cells). The modification of somatic cells will (hopefully) last for the life span of the organism but won’t be passed on to offspring of the organism (the changes are not inheritable) while the successful modification of germline cells will be passed on to the offspring of the organism (the changes are inheritable.) Not surprisingly, it is germline genetic engineering that has generated the greatest ethical concerns (Evans, 2021).

The other key distinction focuses on the source of the DNA used in cell modification. Most genetically modified organisms (GMOs) with which we are all familiar at the plant level are genetically modified by injecting DNA from another organism. However, the type of genetic engineering increasingly common today does not introduce DNA from another organism. The organism’s own DNA is edited.

This brings us to CRISPR, the exciting, relatively new technique that has revolutionized the way in which we edit (modify) an organism’s own genes.

An acronym for “clustered regularly interspaced short palindromic repeats,” CRISPR was adapted from a naturally occurring genome editing system and unveiled in 2012. Other gene-editing techniques have been in use for decades. However, CRISPR has made such editing faster, cheaper, and more accurate than other modern genome editing techniques. This technique can be used to introduce DNA from another organism. It’s best known, though, for its ability to allow us to locate a specific piece of DNA inside a cell and then alter the DNA sequence or turn genes on or off without altering the sequence. And since the changes are made to the DNA within the cells of an organism, as opposed to changes made by introducing DNA from another organism into the cell, the changes are more easily reproduced as the edited cells divide (NewScientist, 2022).

The potential impact of this technique on our future as humans cannot be overemphasized. Larry Locke states that “unless you were around to witness the development of immunology by Louis Pasteur in the 1870s, it is hard to imagine a biotechnology that has generated more acclamation than CRISPR” (Locke, 2020). Carolyn Brokowski and Mazhar Adli note that CRISPR technology is “the most versatile genomic engineering tool created in the history of molecular biology to date” (Brokowski & Adli, 2019). And in the words of Jennifer Doudna, who along with Emmanuel Charpentier “discovered” CRISPR, “The power to control our species’ genetic future is awesome and terrifying. Deciding how to handle it may be the biggest challenge we have ever faced” (Doudna & Sternberg, 2017, p. 240).
3.1 Genetic Engineering: Plants

This Element is primarily focused on the genetic engineering of humans. However, I’m going to briefly extend this discussion to the genetic engineering of plants and animals because of the impact such engineering does and increasingly will have on humans.

When we think of genetically modified plants (food), we normally think of GMOs. As we’ve seen, GMOs are organisms that have had their DNA genetically altered primarily by adding or inserting genes from other organisms. Currently most commercially available genetically modified food stuffs are GMOs. However, the use of CRISPR, which doesn’t insert DNA from other plants but rather edits the DNA within a plant, is gaining popularity. For example, using CRISPR to modify a gene in an apple, rather than the normal GMO technique that introduces foreign DNA, makes slices less likely to turn brown (Synthego, n.d.).

While various plants can and have been genetically modified, the major impact has been on crop plants. The three major crop plants genetically modified are corn, soybeans, and cotton, although such staples as potatoes, canola, alfalfa, apples, and sugar beets are also modified. The impact is pervasive in scope. In most cases, the majority of a crop has been altered. In some cases, over 90 percent of what is planted today is genetically modified (US Department of Agriculture, 2022).

The debate continues, though, over whether we ought to use (or continue to use) genetically modified crops in this way, with the “experts” on each side offering what they see as strong arguments (Conserve Future Energy, n.d.). Those favoring the continued and even expanded use of genetic engineering argue that genetically modified crops:

- Last longer and thus limit waste as there is more time for usable distribution.
- Are more resistant to pests, weeds, and disease, and thus have greater yields, which in turn means it is possible to grow more food on existing crop land.
- Need fewer pesticides and other chemicals and are thus better for the environment.
- Need less water and so can be grown in regions with less rainfall or irrigation.
- Are at least as nutritious, if not more so, than non-GMO foods.
- Are no more dangerous to health than non-GMO foods.

Those favoring diminished reliance on genetic modification argue that genetically modified crops:

- Are not necessarily safe. For instance, we can’t yet be certain that GMOs won’t increase allergic reactions or even cause (trigger) some forms of cancer.
- Have built-in pesticides (in GMOs) that may well produce “super bugs” that will be pesticide-resistant.
Can lead to monopolies (and thus higher prices) since only a few companies hold most of the patents. This also makes it difficult to engage in independent studies.

* Produce certain weeds that are resistant to herbicides and thus farmers can still lose crops.
* Create legal difficulties for farmers with GMO crops in fields near fields on which GMO crops are not grown since the GMO seeds can spread to these fields and GMO farmers have been held liable for compensation.

As we see, the arguments on both sides focus primarily on a cost-benefit analysis. Those supporting the increasing use of genetic engineering on plants (especially crops) argue that the pervasive use of this technology is clearly on balance good for humans and the environment, while those who argue for a diminished role for such genetic manipulation maintain just the opposite.

Most religious discussions of genetic engineering in the plant realm are similar in nature. Assuming as a normative religious principle that we ought to care for our environment and attempt to better the lives of the individuals inhabiting this environment, discussions focus primarily on the relative benefits and risks involved.

There is, though, one additional religious component in these discussions: the tension between the religious principle that we ought not to tamper too significantly with the natural processes in God’s creation and the religious principle that “we have been empowered by God to understand nature and use science and technology to improve the human condition,” including the natural environment in which we live (AgBiotechNet, 2001). While we will discuss this tension in greater detail later, I want to note now that many religious individuals struggle to find the right balance between these two fundamental religious principles in this and related contexts.

### 3.2 Genetic Engineering: Animals

Humans have been modifying animals for thousands of years to produce desired traits, mainly by selective breeding and cross-breeding. For example, dogs have been selectively bred for such traits as speed, reflexes, stamina, strong senses, trainability, size, strength, low gravity, and agreeableness. Cattle have been selectively bred for climate tolerance, increased size and muscle mass, increased milk production and udder size, and increased fat and protein content. Modifying animals in this manner, however, takes time and is inexact. By contrast, in the past few decades, we have been able to genetically engineer animals by directly modifying their DNA in a more exact and timely fashion. Animals that have been safely genetically engineered in research...