

Teaching Genetic Science and Policy within Communities of Faith: The Unique Challenges at a Catholic College

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Abstract:

Emerging genetic technologies, especially those that result from the Human Genome Project (HGP), continue to raise ethical, legal, and social implications (ELSI) that need to be addressed. Exploring these concerns within a community of faith, in particular a Catholic college, present special challenges. The Catholic Church not only has specific stands on certain issues, but it also has laid down guidelines for how teaching should be conducted in light of being a Catholic institution. Our unique teaching situation complicated things somewhat, since it was an interdisciplinary course taught by professors from two different disciplines, biology and theology. We will focus on how we navigated, in the teaching of our interdisciplinary course, “God, Science, and Designer Genes,” the tension between upholding academic freedom while simultaneously respecting the Catholic identity, tradition, and teaching of our institution, with regard specifically to issues in genetics. This paper will first provide some introductory background on the authors’ involvement in the ELSI project. Second, we will explore the concept of a community of faith by focusing in general on Catholic identity in higher education. Third, we will examine the concept of mission overall, and in particular the mission of our own institution. Fourth, we will explore the concept of academic freedom, and how this freedom can be balanced within a community of faith. Fifth, we will demonstrate how we presented this balance in our class practically, in the specific pedagogical techniques that we utilized. Finally, we will offer some suggestions in general for teaching genetics in a community of faith and offer some concluding comments.

I. Introduction

We both work as associate professors at Alvernia College, located in Reading, Pennsylvania, Spence in the field of Biology and Donna in the field of Theology. Our institution, a small Catholic college, has been in existence for 50 years. Rooted in the Franciscan tradition, it was created by an order of Bernardine Franciscan sisters as a school of education for nuns. Since 1958, it has blossomed into an institution which now has programs at both the undergraduate and graduate levels, with the addition just last year of a Ph.D. program in Leadership. We have approximately 2,000 students in our undergraduate programs and approximately 800 students in our graduate programs, which include education, community counseling, liberal arts, and business.

We began to first work together on genetics research when we applied for and received a grant from Dartmouth College, through the National Institutes of Health (NIH). Thus, in June of 2004 we spent five days at Howard University in Washington, D.C. to work with a group of 18 other scholars interested in exploring the ethical, legal, and social implications (ELSI) of the Human Genome Project (HGP). One of the overarching goals for those in the workshop (which eventually totaled 180 professors over the three-year

grant period) was to disseminate the ideas which we learned, in particular through the development of a section of a course or a course itself to issues related to genetics. There was special interest in teams of professors who would be willing to create an interdisciplinary course at their institutions. We already had permission and support from our dean to develop and teach such a course, and found that the workshop launched a very fruitful research agenda for us. As a result of this grant and workshop, in the course of three years, we have taught our course twice, presented papers at two national conferences, presented papers at two smaller conferences, published an essay forthcoming in a book resulting from the ELSI grant, and have a book proposal under serious consideration.

The HGP and the resulting (and yet to come) technologies raise many serious ethical concerns for society in general, for medicine in particular, and certainly for our students, who are likely to be more affected by these developments than we may be. There are, of course, the ethical questions related to specific issues themselves, such as cloning, embryonic stem cell research, reproductive technologies (especially related to genetic enhancement and sex selection), genetic privacy and discrimination, as well as many others. But these emerging technologies also raise questions about the intersection of religion and science as well. Given our respective disciplines, as we considered the ethical, legal, and social implications of the HGP, we wanted to focus in our teaching on the relationship broadly between religion and science, and more narrowly, between biology and theology. What is or should be the relationship between religion and science, biology and theology? Are there or should there be limits in terms of what science can do? At what point do we cross the line into “playing God” versus “using the brains God gave us?” How can we balance scientific research with the ethical dilemmas that may be created by them? Thus began the development of our course, “God, Science, and Designer Genes.”

We offered this interdisciplinary course, which students could take to fulfill their theology or ethics requirement. But one of the most important questions that we had to address was how to teach such a course within the confines of a Catholic institution. The Catholic Church has very strong and specific stands on many issues in medical ethics, and is certainly concerned with the implications of genetic science and developments for the faith. As is said in their document, *The Charter for Healthcare Workers*, “Not everything technologically possible is morally permissible” (reprint, 1999, #44). We had to give serious consideration to how we could respect the tradition of our institution while also allowing our students and ourselves the freedom of dialogue necessary to plumb the depths of these complex issues. Therefore, in our paper, we will focus on how we navigated, in the teaching of our interdisciplinary course, “God, Science, and Designer Genes,” the tension between upholding academic freedom while simultaneously respecting the Catholic identity, tradition, and teaching of our institution, with regard specifically to issues in genetics. We will explore the concept of a community of faith by focusing in general on Catholic identity in higher education, and in particular on the mission of our own institution. Subsequently, we will explore the concept of academic freedom, and how this freedom can be balanced within a community of faith. Then we will demonstrate how we presented this balance in our class practically, in the specific

pedagogical techniques that we utilized. Finally, we will offer some suggestions in general for teaching genetics in a community of faith and offer some concluding comments.

II. Community of Faith

As of 2002, in the United States, there were 238 Catholic colleges and universities, with 724,000 students (Steinfels, 2003, p. 30), constituting about 5% of the nation's college and university enrollment (Steinfels, 2003, p. 131).¹ All of these institutions would constitute a community of faith, including Alvernia College. Begun by a religious order, its flavor always has been and still continues to be "Catholic" in every sense of the term. The student body is pretty evenly divided between Catholic and Protestant students, with just a smattering of non-Christians. But it is not the demographics alone that define an institution as Catholic; rather, it is the infusion of Catholicism throughout campus life, especially spiritually, intellectually, and morally. It is the intellectual and moral climate of Catholic institutions, though, that make it challenging to teach courses such as ours, which raise troubling ethical issues with which the Church has serious moral concerns. In order to understand better the complexities of teaching our course, we will provide some background on the Catholic Church and higher education.

With regard to Catholicism and higher education, it is important to understand several concepts: the role of the Magisterium, the concept of Catholic identity, the relationship between faith and reason, what is meant by "T/truth," and the specific place of theological truth and the theologian. It is crucial to understand the role of the Magisterium in Catholicism. Sometimes referred to as the "hierarchical Magisterium," it constitutes that arm of the Church hierarchy that has oversight for all Catholic institutions, and which also has the right, responsibility, and authority to interpret God's Word for the Church, and to a certain extent, for the world. "In particular, Catholic theologians, aware that they fulfill a mandate received from the Church, are to be faithful to the Magisterium of the Church as the *authentic interpreter of Sacred Scripture and Sacred Tradition*" ([italics mine] *Ex Corde Ecclesiae*, 1990, Art. 4, #3). The Church historically developed institutions in health care, social work, and education at all levels, and has always been concerned that these institutions truly reflect their "Catholic" flavor. In fact, Catholic institutions of higher education can only be established by or with the permission of the Church hierarchy. With regard to Catholic colleges and universities,ⁱⁱ the Church has attempted to provide guidelines to safeguard their Catholic identity through the issuing of a number of ecclesial documents. *Gravissimum Educationis* (1965) was one of the earlier ones, which dealt with Catholic educational institutions in general. With regard to higher education in particular, the document emphasized the importance both of having schools located throughout the world, and of providing educational opportunities to students who would ordinarily not be able to afford it (#10). *Sapientia Christiana* (1979) addressed specifically ecclesiastical universities whose degrees are bestowed by pontifical authority. The *Code of Canon Law* (updated, 1998) has some sections devoted to Catholic higher education. However, the most recent and significant documents are *Ex Corde Ecclesiae* (1990 - addressing guidelines for Catholic universities in general and the role of the theologian in particular), the *Application of Ex Corde Ecclesiae for the United States* (2000), *Guidelines Concerning the Academic Mandatum*

in *Catholic Universities* (2001), and *Instruction on the Ecclesial Vocation of the Theologian* (1990). Rather than simply summarizing the documents, materials have been drawn from them in an attempt to illustrate the Church's position overall with regard to higher education.

The issue of religious identity is one that many universities with religious roots are struggling with, and frankly, sometimes trying to distance themselves from. Thus, for many religiously-affiliated institutions, the question of identity is not a pressing one. However, it has been in the Catholic Church since the Second Vatican Council. Before then, there was general agreement as to what constituted a Catholic institution. Now there are many disparate voices clamoring for a different interpretation or simply trying to carve out a religious identity for an institution rooted more and more in a secular society.ⁱⁱⁱ The reasons for the struggle with Catholic identity are more sociological and pragmatic rather than theological, and they have been identified by various writers. A main reason is the transition in Catholic leadership at many Catholic universities, having moved to primarily lay leadership post-Vatican II as opposed to religious leadership and a strong religious presence on many campuses pre-Vatican II. Second is the new clientele of these universities, many of whom are not Catholic themselves. Third, funding is now often a mix of public and private sources, which puts certain pressures on Catholic institutions (Steinfels, 2003, p. 111). In spite of these problems, though, the document *Ex Corde Ecclesiae*, in Part I on Identity and Mission, spells out what the nature of a Catholic university is and should be: "Every Catholic University, as a university, is an academic community which, in a rigorous and critical fashion, assists in the protection and advancement of human dignity and of cultural heritage through research, teaching, and various services offered to the local, national, and international communities" (#12). There are four essential characteristics of a Catholic university:

1. "A Christian inspiration not only of individuals but of the university community as such;
2. a continuing reflection on the light of the Catholic faith upon the growing treasury of human knowledge, to which it seeks to contribute its own research;
3. fidelity to the Christian message as it comes to us through the Church;
4. an institutional commitment to the service of the people of God and of the human family in their pilgrimage to the transcendent goal which gives meaning to life." (#13)

The overall mission of every Catholic institution, including those of higher education, is the work of evangelization (*Ex Corde Ecclesiae*, #s48 and 49). With regard to the mission of universities in general, *Ex Corde Ecclesiae* states, "The basic mission of a University is a continuous quest for truth through its research, and the preservation and communication of knowledge for the good of society" (#30). But Catholic universities must carry out all of their activities "with Catholic ideals, principles and attitudes" (*Ex Corde Ecclesiae*, General Norms, Article 2, #2). It is crucial for Catholic universities to have a mission statement or other public document which attests to its Catholic identity (*Ex Corde Ecclesiae*, General Norms, Article 2, #3).^{iv}

Even with its specific understanding of its mission in the world, the Catholic Church has always recognized the importance of drawing upon both faith and reason in one's search

for truth, and this would be particularly true at Catholic universities. Faith and reason should complement each other, and one of the famous early definitions of theology by Anselm was “faith seeking understanding.” What does the Church mean by accepting the notion that faith and reason complement each other, with regard to Catholic universities? First, it acknowledges that reason is a capacity given to us by God and is something that should be both sought and utilized. But, combined with the notion of free will, it is also acknowledged that humans will not always make the right choice (hence, the theological concept of “sin”). Second, individuals must draw upon all sources of knowledge in order to arrive at truth, especially with regard to the sciences: “This task requires persons particularly well versed in the individual disciplines and who are at the same time adequately prepared theologically, and who are capable of confronting epistemological questions at the level of the relationship between faith and reason” (*Ex Corde Ecclesiae*, #46).^v Third, this search for truth via reason necessitates having scholars well-trained in their respective disciplines but who also know how to engage in dialogue with other disciplines: “Each individual discipline is studied in a systematic manner; moreover, the various disciplines are brought into dialogue for their mutual enhancement” (*Ex Corde Ecclesiae*, Introduction, #15). Fourth, interdisciplinary studies are especially encouraged, as they can contribute to a more complete understanding of reality: “While each discipline is taught systematically and according to its own methodology, *interdisciplinary studies*, assisted by a careful and thorough study of philosophy and theology, enable students to attain an organic vision of reality and to develop a continuing desire for intellectual progress” (*Ex Corde Ecclesiae*, Nature and Identity, #20). Finally, the Church recognizes that new challenges/issues/problems will present themselves in society requiring some answers which, for the Catholic university, will necessitate a religious approach: “A specific priority is the need to examine and evaluate the predominant values and norms of modern society and culture in a Christian perspective, and the responsibility to try to communicate to society those *ethical and religious principles which give full meaning to human life*” (*Ex Corde Ecclesiae*, Service to Church and Society, #33). It may even require that the Church at times “must have the courage to speak uncomfortable truths which do not please public opinion, but which are necessary to safeguard the authentic good of society” (*Ex Corde Ecclesiae*, Service to Church and Society, #32). With regard to our course on ethical issues in emerging genetic technologies, we are on very safe ground in exploring issues deeply, aided by reason, from the perspective of our disciplines of theology and biology. However, it is the Catholic understanding of truth that can challenge this process.

The Catholic Church is very committed to the concept of and search for truth. For the Church, it is essential that this “Truth” have a capital “T.” What this means is that they believe that there is an ultimate truth which can be discerned by human minds and through revelation, but which is also uniquely understood within the Catholic tradition. These truths fall into the areas of both doctrine as well as ethics. Thus, a basic doctrinal truth is that Jesus died for our sins and rose from the dead. An ethical truth would be that the use of embryonic stem cells is immoral because it results in the destruction of human life, which the Church presumes begins at the moment of conception. It is the existence of these ethical norms which make it tricky to navigate courses that deal with the ethical issues in genetics. While these capital “T” truths are especially binding on Catholics, the

Church also believes that this truth is, in essence, the truth for everyone. A Catholic university, then, must continually be on a quest for truth: “It is the honor and responsibility of a Catholic University to consecrate itself without reserve to the *cause of truth*... .By means of a kind of universal humanism a Catholic University is completely dedicated to the research of all aspects of truth in their essential connection with the supreme Truth, which is God” (*Ex Corde Ecclesiae*, Introduction). Thus, truth is a seamless garment with many interwoven strands, all ultimately pointing to God, the grounding of all Truth. However, this understanding of truth should not interfere with freedom of inquiry or research, since it “means an openness to accepting the truth that emerges at the end of an investigation in which no element has intruded that is foreign to the methodology corresponding to the object under study” (*Instruction on the Ecclesial Vocation of the Theologian*, #12). In essence, this means that academic freedom must be an essential component of a Catholic University, which should be provided for professors by their institutions, and which should be respected by Bishops (*Application of Ex Corde Ecclesiae*, Part. Norms, Art. 2, #s 2-3).^{vi} This academic freedom extends to both students and faculty.

But the place of the discipline of theology, and the role of theologian, is a bit more complex. While theology is acknowledged as a discipline alongside all of the others, including with regard to freedom of inquiry, this freedom is subject in a special way to the Catholic hierarchy, since theologians must “respect the authority of the Bishops, and assent to Catholic doctrine according to the degree of authority with which it is taught” (*Ex Corde Ecclesiae*, The Catholic University in the Church, Identity and Mission, #3). While the Church would like all Catholic universities to hire mostly Catholic professors in all disciplines, who would be aware of and committed to the Catholic nature of their institutions (*Application of Ex Corde Ecclesiae*, Faculty, #s a and b), it also realizes that not all teachers of Catholic theology are indeed Catholic, though likely most of them are. Therefore, an important distinction is made between non-Catholic and Catholic theologians. The key phrase, and perhaps one of the most controversial in the *Application of Ex Corde Ecclesiae in the United States*, is this: “Both the university and the bishops, aware of the contributions made by theologians to the Church and academy, have a right to expect them *to present authentic Catholic teaching*” ([italics mine] Faculty, #d). This is usually interpreted to mean that all theologians must attempt to fairly and correctly present the Catholic Church’s teaching on the subjects at hand, but does not necessarily require that they assent to them. Catholic theologians, however, in addition are required to have a *mandatum*, granted by the Church hierarchy, in which they acknowledge this to be the case. (Since non-Catholic theologians are not per se under the religious authority of the Church, they cannot be required to have one.) The *mandatum* is defined as follows: “...is fundamentally an acknowledgement by Church authority that a Catholic professor of a theological discipline is a teacher within the full communion of the Church” (*Application of Ex Corde Ecclesiae*, Faculty, #e, #i). Its purpose is as follows: “The *mandatum* recognizes the professor’s commitment and responsibility to teach authentic Catholic doctrine and to refrain from putting forth as Catholic teaching anything contrary to the Church’s Magisterium” (*Ibid*, #iii).^{vii} The Church recognizes that even Catholic theologians may not always agree with the Church’s teaching, and there is even acknowledgement that the Magisterium might need

to explore an issue further in light of issues raised by theologians, but the primary attitude of the theologian should be one of submission. The guideline for tensions that may arise between Catholic theologians and the Church hierarchy is “unity of charity” for those differences which do not jeopardize the communion of faith, and “unity of truth” for those that might (*Instruction on the Ecclesial Vocation of the Theologian*, #26). The Magisterium certainly has the authority to intervene with regard to errors. But the Church distinguishes between those differences of opinion that a theologian may arrive at, from the more troublesome issue of dissent. The latter can be divided into two kinds: that which aims to change the Church, and that which declares that theologians do not need to adhere to any Magisterial teaching unless it is declared to be infallible (*Instruction on the Ecclesial Vocation of the Theologian*, #33). In certain cases, the Magisterium can intervene and even revoke a theologian’s canonical mission to teach (Ibid, #37). However, the essence of the Catholic institution, both for theologians as well as all others who work at Catholic universities, generally is outlined in its mission statement. In the section that follows we will consider the concept of mission broadly construed and also in particular with regard to Alvernia.

III. Mission

Mission statements are public pronouncements that distinguish institutions and assist them in remaining true to their basic purpose while strategically responding to external and internal forces (Commission on Higher Education, 1991). American higher education is characterized by a wide range of institutional types with mission statements that reflect their sources of authority — public, independent sectarian, and independent non-sectarian (Newsom and Hayes, 1990; Stober, 1997). It is generally believed that this diversity of institutional types contributes to the success of our post-secondary educational system (Birnbaum, 1991). A study of colleges and universities accredited by Middle States demonstrated that public college and university mission statements were most likely to define a geographic service area, and they distinguished themselves by using words such as *educational, goals, services, opportunity, public, state, need, skills, and support*. Non-sectarian colleges described their mission using words such as *society, knowledge, arts, sciences, and excellence*. Sectarian colleges, on the other hand, described their mission using words such as *Christian, values, life, tradition, and faith*, (Stober, 1997). Catholic colleges in particular emphasize the necessity of a mission statement: “A responsibility of every Catholic university is to affirm its essential characteristics, in accord with the principles of *Ex Corde Ecclesiae*, through public acknowledgement in its mission statement and/or its other official documentation of its canonical status and its commitment to the practical implications of Catholic identity...” (*Application of Ex Corde Ecclesiae*, Part 2, Art. 2, #5). Whether mission statements translate into practice is an ongoing question. But one thing is for sure, as societal needs change and competition increases, colleges and universities are challenged to balance applied intellectual pursuits and pure inquiry without entirely succumbing to economic forces (Bok, 1990).

Alvernia College’s mission statement is a good example of the kind of document that attests to our Catholic identity:

Guided by Franciscan values and the ideal of “knowledge joined with love,” and rooted in the Catholic and liberal arts traditions, Alvernia is a rigorous, caring, and inclusive learning community committed to academic excellence and to being and fostering broadly educated reflective professionals, engaged citizens, and ethical leaders with moral courage to learn, to love, to serve. (<http://www.alvernia.edu/about/mission.htm>, retrieved 06/22/07)

The phrases *rooted in the Catholic tradition* and *guided by Franciscan values* are a clear indication of institutional values, and the phrase *inclusive learning community* sends a message that those with diverse values are welcome. “The university (in particular, the trustees, administration, and faculty) should take practical steps to implement its mission statement in order to foster and strengthen its Catholic nature and character” (*Application of Ex Corde Ecclesiae*, Part 2, Art. 2, #6) A practical extension of Alvernia’s mission statement is through the office of Mission and Ministry at the College. Excerpts below are taken from Alvernia’s webpage for *Mission and Ministry*, and these statements reflect the College community’s devotion to a faith-based mission while at the same time fostering a spirit of ecumenism.

Campus Ministry seeks to enrich and advance the larger mission of Alvernia College . . . to uphold the Franciscan values of prayer, fellowship, and service . . . students, faculty, and staff, are called to deepen their faith through relationship with God. While rooted in the spirituality of the Roman Catholic Church, the Office of Mission and Ministry recognizes the Christian call for inclusiveness and welcomes persons of all faith backgrounds, encouraging a spirit of ecumenism and inter-faith dialogue . . . we all walk together, sharing a common humanity . . . to advance peace and social justice initiatives in the world around them. (<http://www.alvernia.edu/ministry/index.html>, retrieved 06/22/07)

The phrase *encouraging a spirit of ecumenism* is taken seriously at our College. For example, it supports teachers as we foster balanced discussions in our classrooms (and campus community) regarding ethical dilemmas created along with new genetic technologies (e.g., stem cell research). A free and open discussion can occur only if a broad spirit of ecumenism exists on campus. Parker Palmer (1987) reminds us that “knowing and learning are communal acts that require a continual cycle of discussion” (p. 25). Students, faculty, and staff must feel free to share their own values. A willingness to “speak out” depends on what has happened to others who spoke out. Thus, the wrath of a vocal majority in a classroom can seriously restrict discussion. As an extreme example, students who support “human cloning” (and sometimes only for the sake of argument) will surely experience the wrath of a vocal majority saying no!^{viii} We as professors must seek ways to mitigate this challenge in our classroom and in the academic arena in general. We have already considered what it means to be a Catholic community of higher education and the importance of mission. We now need to see how this fits in with the concept of academic freedom, which the Church also values.

IV. Academic Freedom in a Community of Faith

In teaching complex issues in genetics, it seems crucial to have an atmosphere in which academic freedom is respected for student and teacher alike. This is true even and perhaps especially for a community of faith. The concept of academic freedom is meant

to foster open intellectual inquiry. Several issues need further explication: the definition of academic freedom, the relationship between academic freedom and the common good, the relationship between academic freedom and truth, and maintaining academic freedom in a Catholic college.

First, we need a definition of academic freedom. The American Association of University Professors (AAUP) regularly publishes the “Red Book”^{ix} containing the 1940 “Statement of Principles on Academic Freedom and Tenure.” The statement was developed in cooperation with the Association of American Colleges (currently the Association of American Colleges and Universities, AACU) and now includes “Interpretive Comments” developed in 1970. The AAUP and AACU hope to promote public understanding of academic freedom and to establish guidelines for colleges and universities. Academic freedom is a concept that is best described in terms of rights and associated responsibilities. The AAUP/AACU statement speaks to (1) the right to full freedom in research and publication with a responsibility to also perform adequately in other academic duties, (2) the right to openly discuss one’s subject in the classroom with a responsibility to avoid controversial topics of no relation to their subject, and (3) the right as citizens to freedom from institutional censorship and discipline with a responsibility to be accurate, exercise appropriate constraint, and clarify whether one is speaking as an individual, as a member of the profession, and/or for the institution (AAUP, 2006, p. 3-6).

The academic arena should afford responsible scholars the right to seek truth for the common good, according to AAUP:

Institutions of higher education are conducted for the common good and not to further the interests of either the individual teacher or the institution as a whole. The common good depends upon the free search for truth and its free exposition. (AAUP, 2006, 3)

This statement has been “on the books” for many years and interpretations vary. The pursuit of “truth” is generally considered to be in the interest of society and it is believed that academic freedom is necessary to seek “truth” for the “common good.” The term “common good” in the AAUP definition is open to interpretation. For the sake of this brief discussion, we consider “common good” to be the task of working to benefit all members of society with a respectful balance of individual rights and utilitarian ideals. The *Catechism of the Catholic Church* (1994) defines the “common good” as “the sum total of social conditions which allow people, either as groups or as individuals, to reach their fulfillment more fully and more easily. The common good concerns the life of all” (#1906). The common good contains three essential elements: respect for the person as such, the *social well-being* and *development* of the group itself, and *peace* (stability and security of a just order)” (#s 1907-1909). This respectful balance of individual and group needs, while influenced by the Church, is subject to political organization. Recognizing the public-sectarian dynamic, the Catechism makes this recommendation:

“Each human community possesses a common good which permits it be recognized as such; it is in the political community that its most complete realization is found. It is the role of the state to defend and promote the common good of civil society, its citizens, and intermediate bodies.” (# 1910)

In American colleges and universities the Constitution attempts to strike this balance with states and accrediting bodies taking responsibility for education. The governance structures of public institutions vary, but in general they share responsibility for the “common good” with the state. Governing boards of independent institutions vary in their sources of authority, but in the case of Catholic institutions, the Church has significant influence in promoting the “common good” through the many Catholic colleges and universities. The AAUP is also independent of the state and its policies are generally considered to be good practice by the vast majority of institutions. Thus it is clear that Catholic institutions and the AAUP share a concern for the “common good;” however, an even bigger challenge arises when we consider the concept of “truth.”

Whether “truth” is absolute (with a capital “T”) or relative (with a small “t”) causes controversy. Our academic duty^x requires us to continue our teaching, scholarship, and service even when seeking answers to difficult questions becomes contentious. In an ideal world, academic freedom affords faculty and students the protection necessary to seek truth. Is this freedom at risk? To explore this question it is necessary to first consider the epistemological differences between biology and theology. According to Thomas L. Haskell (1996), academic freedom can be viewed as defending the authority (or competence) of the traditional academic disciplines. He suggests that academic freedom may be at risk because the epistemological assumptions of traditional academic disciplines are eroding. In our disciplines (biology and theology), professional standards and epistemological assumptions set parameters as to how biologists work to explain the natural world, and how theologians work to understand both the natural and spiritual worlds. It is generally agreed that biology as a science seeks an objective reality (Truth) and that theology seeks a reasoned understanding of the natural world and a spiritual reality (Truth). Interdisciplinary work such as ours (e.g., attempting to make reasoned decisions with students in the classroom regarding ethical, legal, and social implications of emerging genetic technologies) might by its methods and content generate knowledge that is relational (truth) and not absolute (Truth). This could be viewed by some to be an epistemological erosion of the traditional disciplines of biology and theology, and thus is similar to concerns raised by Evelyn Fox Keller (1996) regarding “science studies.”^{xi} An example of how this might affect academic freedom is the possibility that an assistant professor specializing in the interdisciplinary study of ethical dilemmas surrounding stem cell research might find it difficult to gain tenure in a traditional biology department (reasons given that it is not of scientific relevance, etc.). Fortunately AAUP has not defined “truth” absolutely and the academic disciplines are becoming more tolerant of alternative considerations (we will discuss a solution later).

“Community of faith restrictions” may also limit academic freedom. As background, consider the following sentences from the original 1940 AAUP/AACU statement on academic freedom, and subsequent 1970 interpretive comments.

“Limitations of academic freedom because of religious or other aims of the institution should be clearly stated in writing at the time of the appointment.” [1970 interpretive comments follow.] “Most church related institutions no longer need or desire the departure from the principle of academic freedom implied in the 1940 Statement, and we do not now endorse such a departure” (2001, 3).

Thus, since 1970 the AAUP/AACU expects all institutions of higher education to support the principles of academic freedom. We must consider sources of authority to understand academic freedom in a faith-based learning community. If academic freedom, as defined earlier by Haskell, is defending the authority of traditional disciplines, then the source of competence for these communities must be considered. For example, both theologians and biologists are judged using professional competence standards for their respective professions, and these standards transcend their university. But their academic freedom may be limited in different ways at an institution sponsored by the Catholic Church. For example, a biologist might not receive institutional review board approval for research with the potential to destroy human embryos, and the theologian must present authentic Catholic teaching. The Charles E. Curran story is probably the best example of the impact of the Magisterium upon academic freedom.^{xii} In 1986, the Vatican Congregation for the Doctrine of Faith concluded that Father Curran was “neither suitable nor eligible” to be a professor of Catholic theology at the Catholic University of America (McBrien, 2001, p. 15). Thus, the concept of academic freedom is much more complex in Catholic universities, but especially for those that are considered pontifical institutions.^{xiii} The Catholic Church has a long history of sponsoring fine institutions of higher education, and surely these challenges are not limited to Catholic institutions.

V. Pedagogical Considerations

Pedagogy, and in particular the classroom, is where theory meets practice. How can one teach the ethical, legal, and social implications of emerging genetic technologies in a community of faith? How can one find the right balance between academic freedom and institutional mission? We gave both of these questions serious consideration in the planning for and teaching of our course, “God, Science, and Designer Genes.” We will now explain how we tried to navigate practically the theoretical considerations raised above. We will provide a brief background on the courses themselves, describe some of our pedagogical techniques with relation to teaching issues in genetics in a community of faith, and provide a couple of examples of how we assessed student attitudes.

We taught our course twice, in Spring 2005 and Spring 2007. Both times it was offered as an interdisciplinary undergraduate honors class, open to graduate students in our Masters of Liberal Arts program as well. The course met once a week in the evening, for 2 ½ hours. Both times we wound up with approximately 20 undergraduate and 3 graduate students. Some of our students were Biology majors, but the rest came from a variety of disciplinary backgrounds. Since it was an interdisciplinary course in Biology and Theology, we allowed it to fulfill one of the following requirements: a Theology elective, an Ethics requirement, a graduate program requirement, or a General Education Biology requirement (without a lab); it also counted as an Honors class for Honors students. Our course description, found in our syllabus, was as follows:

Modern genetic science is at the state where we can now control our genetic destinies. This course will address both the science behind this phenomenon, as well as some of the ethical and theological concerns, such as: Are we playing God? What is the relationship between religion and science? Issues such as cloning, stem cell research, gender selection, genetic discrimination, as well as other emerging technologies, will be explored through a variety of teaching

methods, including videos, case studies, group activities, readings, and discussions.

There were several important pedagogical considerations and practices that we brought to bear on our course, given its unique subject matter and our milieu as a Catholic institution of higher education. First, the course was truly interdisciplinary. We thought it important that we devote approximately half of the time to the science behind the technologies we were discussing, as well as the ethical and theological questions raised by them. Because it was team-taught, we divided up the class time fairly evenly between the two areas of religion and science. The biologist would begin with approximately an hour-long lecture on science. For example, when we were studying human cloning, he demonstrated how it already operated in nature, at least with regard to plants. Then, the theologian would address what implications this might have for theology as a discipline, such as when do we cross the line and begin “playing God?” This part of the class included lecture as well as student feedback in a variety of ways. We also thought it critical to have both of us in the classroom at all times, so that we could foster a true dialogue between the disciplines rather than have them compartmentalized. It also enabled the unique domain of each discipline to present itself in the presence of the other. We felt that this interdisciplinary approach fit in very well with the Catholic emphasis on the pursuit of truth and engaging in intellectual inquiry by drawing upon all sources of knowledge.^{xiv} In addition, it was consonant with the Catholic Church’s own commitment to interdisciplinary studies.

Second, we made explicit reference to Alvernia College’s mission in our syllabus. We wanted to make it clear that we intended to respect the tradition of our institution. Thus, we did not want to create any kind of dichotomy in the minds of our students between Alvernia’s mission and what we hoped to achieve in the classroom. As was mentioned above, every Catholic institution is supposed to have a mission statement, and those involved with the institution need to be acquainted with what it is. Third, we considered it important to outline in the syllabus all of the relevant topics that we planned to address, even those controversial ones. (Of course, with regard to genetic science, virtually all of the topics are controversial!) Particularly with regard to the theologian, the Catholic Church in various documents has emphasized that controversial topics not be introduced just for the sake of controversy, but given the nature of our course, we thought it important to be up-front with what we planned to address. The specific topics included: introduction to science, and religion and science; inheritance of genes and selective abortion; sex selection; DNA structure and privacy issues; multifactorial traits and choosing for disability; genes and behavior, and DNA evidence; genetic modification of humans and animals; cloning and the Genographic Project; gene therapy and genetic discrimination; reproductive technologies and stem cell research; and gene mutation and chromosomes, and evolution. The students were expected to not only read the assigned readings each week, but to respond to them in the form of a dialogue journal. Our addressing these issues in a straight-forward manner resonated with the Catholic Church’s challenge for the discipline of theology and humans in general to engage in dialogue not only with culture but with new developments in science and technology.

Fourth, we made a concerted effort to infuse the classroom with a true openness for discussion and respect for the opinions of others, both in large group and small group situations, for our students. We wanted to allow in every way for critical thinking to take place. Early in the semester, we distributed a handout entitled “The Ten Commandments of Small Group Discussion,” which included commandments such as: “Thou shalt not engage in *ad hominem* attacks,” and “Thou shalt consider other points of view.” We emphasized that it was important that all voices be heard, and be heard respectfully. Another way we tried to foster openness was through the use of the dialogue journal.^{xv} The purpose of this assignment was to allow students to write in a more conversational style, as they “dialogue” with the authors presenting certain ideas in the texts. Most weeks we would choose in advance a couple of different students to read their journals aloud, and we chose readings that were on opposite sides of issues in order to foster dialogue. We also had small group discussions on the issue covered in a particular class, and we tried to stimulate discussion by providing students with either a set of questions or with a theoretical case study. We would then have an open discussion, making every effort to make sure all sides were heard. We believe that this emphasis on freedom of expression on the part of students fits in well with the Church’s emphasis on the importance of a search for truth, as well as that of academic freedom, even for students.

Finally, we also tried to create a spirit of openness by the way in which we conducted ourselves and related to each other in our role as teachers in the classroom. We made an explicit effort to model open dialogue by how we related to each other in front of our students. Although we tried to divide time evenly between our disciplines, we had regular dialogue between ourselves, and between ourselves and our students, even as we were presenting our own subject matter. We would often ask each other questions to clarify material, or even challenge assumptions of the other’s discipline and/or approach to specific issues. We also sometimes engaged in role-playing, in particular by playing “devil’s advocate,” through taking unpopular stands, especially when students were almost unanimously in agreement on a position, such as on a ban on human cloning. The most creative way we did this, though, was through the use of baseball caps which we ordered specifically for the course, one saying “Biology” and the other saying “Theology.” During class we would often wear the hats of our disciplines to highlight our unique perspectives, but we would also often strategically remove our hats, indicating to our students that we were stepping outside of our usual “role.” Overall, though, the role of the theologian as theologian was trickier to maneuver than that of the biologist. Of course, as mentioned above, all faculty at a Catholic institution must be respectful of the Church’s itself, its hierarchy, and in particular, its stance on particular issues. But the theologian, whether a Catholic or non-Catholic, must make every effort to present “authentic Catholic teaching,” and do so fairly and with respect. In the context of issues in genetics, therefore, the theologian had to make an effort to present the Catholic Church’s positions on particular issues when it had them. For example, when dealing with embryonic stem cell research, it was incumbent upon the theologian to explain the Church’s position on when life begins, what the status of the embryo is, and why the technology currently available is not acceptable from a moral perspective. However, as is indicated by the title of our paper, our constant tension was to balance academic freedom for ourselves and for our students, with the requirements for teaching theology

in a Catholic university. We believe that we were successful in doing this by the techniques outlined above.

It is expected that student attitudes change as a result of discussion in a well run classroom that encourages students to openly discuss ideas without fear of retribution. We used pre-semester and post-semester questions to examine changes in student attitudes regarding ethical dilemmas examined throughout the semester. A full discussion of outcomes is beyond the scope of this paper, but we will briefly consider two questions used in our Spring 2007 *God, Science, and Designer Genes* class. When asked if we are “playing God” by altering the genetic makeup of humans, student responses were 1-no, 2-not sure, and 21-yes, at the beginning of the semester, and by the end of the semester the responses were 2-no, 4-not sure, and 18-yes.^{xvi} While this change is not significant in a statistical sense, we would like to think these responses were an outcome of assigned readings and class room discussion of the phrase “playing god.”^{xvii} When asked how responsible we are for a behavioral action if it is our genetic tendency, the responses were 6-no, 8-not sure, 10-yes, at the beginning of the semester, and by the end of the semester responses were 1 no, 3 no sure, and 20 yes (a significant deviation from the pre-semester responses [χ^2 (24) = 17.3, $p < 0.01$]). This observed shift in student attitudes may be in part a result of class discussions around the nature/nurture question and the concept of free will. Particular attention was given to discussions regarding sexuality, risk taking, and other behaviors considered to have some biological basis yet influenced by the environment.^{xviii} This nature/nurture dynamic is further refined by Matt Ridley’s (2003) suggestion that it is not nature *versus* nurture, but it is instead nature *via* nurture. As rational beings we may find comfort in what appears to be some opportunity for control over our biological destinies, but we complicate this discussion for our students by injecting theological perspectives regarding free will.

VI. Conclusion

Negotiating touchy ethical issues, such as arise in genetics, can be very tricky in communities of faith, and yet the fact that one is teaching within a community of faith affords many benefits as well. With regard to the Catholic nature of our institution, we were able to draw upon resources deeply rooted in the Catholic tradition that certainly supported our exploration of these issues. In addition, being rooted in a Catholic community of faith allowed us to explore issues from a uniquely Catholic perspective at times, a perspective of which many of our students are unaware. Balancing academic freedom and commitment to our institutional mission provided a challenging yet extremely satisfying experience. It forced us to be creative in our pedagogy, and encouraged us to challenge students to consider an alternative religious approach to ethical issues in genetics. However, as we pointed out earlier, the issue of religious identity and even academic freedom are not issues relevant only to Catholic institutions, but have implications for all religious institutions, and for all who teach within these communities of faith. We wanted, then, to provide some recommendations for teaching the ethical, social, and legal implications of HGP that might apply to anyone teaching within a faith-based institution.

First, it is extremely important that one be intimately acquainted with not only the ethos of one's particular institution, but with that of the larger denomination with which it is affiliated. This includes having more than a passing acquaintance with the significant documents of the denomination that are related to issues in higher education, as well as a grasp of the spirit behind and actual words of one's own institutional mission statement. Second, with regard to genetics in particular, one should understand how one's community of faith views the relationship between religion and science, and how they view emerging genetic technologies. One should be acquainted with any specific positions that one's community of faith has on issues in genetics, understand the basis for them, and be willing to present them "authentically." Third, one should know the limits for discussion and engage in it in such a way that one respects one's institution while simultaneously upholding academic freedom, at least for students, so that they feel that they can engage in open discussion. This requires a conceptual framework which then is expressed in specific pedagogical techniques. Fourth, when teaching interdisciplinary courses, it may be easier at times for the non-theologian to raise some of the more troubling questions and present the arguments/reasons for the more controversial side of issues, rather than the theologian. This is especially important in communities of faith that view "Truth" as having a capital "T." Fifth, it is important that one teaches students to think in a way that they are not provided simply with "the answer," for example, as to whether or not we should clone humans. Rather, it is crucial that students can appreciate the complexity of the issue and learn strategies for addressing dilemmas that will be created by future genetic technologies. Thus, it is important that in addressing ethical issues in genetics, which is a continually developing field, that students learn to think critically so that they can apply established modes of reasoning to new issues.

In *Consilience: The Unity of Knowledge*, the famous biologist E. O. Wilson (1998) calls for academic disciplines to seek ways to better understand each other's ways of knowing in order to deal with the many challenges facing humans today.^{xix} There is certainly no doubt that emerging genetic technologies will raise many unique challenges. Wilson in his book *The Creation* (2006), extends an olive branch to religious leaders in an appeal to save life on earth, and this certainly has relevance with regard to teaching ethical issues in genetics within a community of faith. In Wilson's words:

I already know much of the religious argument on behalf of the Creation, and would like to learn more. I will now lay before you and other who may wish to hear it the scientific argument. You will not agree with all that I say about the origins of life--science and religion do not easily mix in such matters--but I like to think that in this one life-and-death issue we have a common purpose. (p. 8)

This reminder that we all have a common purpose in seeking truth should help us navigate the tough situations in which our developed and developing technologies will often put us in. To venture beyond what we know via the traditional epistemology of our respective disciplines may be unsettling for those seeking only Truth, whether a biologist or theologian, but reasoned reflection on the issues facing our world as a result of emerging genetic technologies is an essential interdisciplinary venture. Faculty and student reflection on how we taught "God, Science, and Designer Genes" might be a start.

References

Alvernia College. Mission Statement. Retrieved 22 June 2007, from Alvernia College: <http://www.alvernia.edu/about/mission.htm>.

Alvernia College Office of Mission and Ministry. Retrieved 22 June 2007, from <http://www.alvernia.edu/ministry/index.html>.

AAUP. (2006). *"Redbook": Policy documents and reports* (10th ed.). Washington, D.C.: American Association of University Professors (AAUP).

Birnbaum, R. (1991). Value of different kinds of colleges. In J. L. Bess (Ed.), *Foundations of American higher education* (11-129). Needham Heights, MA: Ginn Press).

Bok, D. (1990). *Universities and the future of America*. Durham, NC: Duke University Press.

Catechism of the Catholic Church (2nd ed., 1994).

Commission on Higher Education. (1991). *Designs for excellence: handbook for institutional self-study*. Philadelphia, PA: Middle States Association of Colleges and Schools

Curran, C. E. (1990). *Catholic higher education, theology, and academic freedom*. Notre Dame, IN: University of Notre Dame Press.

Curran, C. E. (2006). *Loyal dissent: memoir of a catholic theologian*. Washington, D.C.: Georgetown University Press.

Haskell, T. L. (1996). Justifying the rights of academic freedom in the era of "power/knowledge." In L. Menand (Ed.), *The future of academic freedom* (pp. 43-90). Chicago, IL: The University of Chicago Press.

Hesburgh, T. M. (1994). *The challenge and pursuit of a catholic university*. Notre Dame and London: University of Notre Dame Press.

Keller, E. F. (1996). Science and its critics. In L. Menand (Ed.), *The future of academic freedom* (pp. 199-213). Chicago, IL: The University of Chicago Press.

Kennedy, D. (1997). *Academic duty*. Cambridge, MA: Harvard University Press.

Lewis, R. (2007). *Human genetics: concepts and applications* (7thed.). New York: McGraw Hill Education.

Morehy, M. M. & Piderit, J .J. (2006). *Catholic higher education: a culture in crisis*. New York, NY: Oxford University Press.

Newsom, W. & Hayes, C. R. (1990, Winter). Are mission statements worthwhile? *Planning for Higher Education*, 9, 28-30.

O'Brien, R. P. (2001, January/February). Theologians at risk? *Ex Corde* and Catholic Colleges. *Academe*, 87(1), 13-18.

O'Brien, R. P. (1994) What is a catholic university? In T. Hesburgh (Ed.), *The challenge and pursuit of a catholic university*. Notre Dame and London: University of Notre Dame Press.

Palmer, P. J. (1987, September/October). Community, conflict, and ways of knowing: Ways to deepen our educational agenda. *Change*, 19(5), 20-25.

Peters. T. (2003) *Playing god? genetic determinism and human freedom*. Second Edition. Routledge.

Pontifical Council for Pastoral Assistance. *Charter for Health Care Workers* (reprint, 1999). Boston: St. Paul Books & Media.

Ridley, M. (2003). *Nature via nurture*. New York: Harper Collens.

Steinfels, P. (2003). *A people adrift: the crisis of the roman catholic church in america*. New York, NY: Simon Schuster.

Stober, S. S. (1997). A content analysis of college and university mission statements. [Diss]. Ann Arbor, MI: UMI Dissertation Services.

United States Conference of Bishops (2006). *Catholic identity in our colleges and universities: a collection of defining documents*. Committee on Education, Bishops' and Presidents' Subcommittee. Washington, D.C.

Gravissimum Educationis [Declaration on Christian Education, 1965]

Code of Canon Law, 1998

Sapientia Christiana [On Ecclesiastical Universities and Faculties, 1979]

Ex Corde Ecclesiae (On Catholic Colleges and Universities, 1990)

The Application of Ex Corde Ecclesiae for the United States [1990]

Guidelines Concerning the Academic Mandatum in Catholic Universities [2001]

Instruction on the Ecclesial Vocation of the Theologian [1990]

Wilson, E. O. (1998). *Consilience: The unity of knowledge*. New York: Alfred A. Knopf, Inc.

Wilson, E. O. (2006). *The Creation: An appeal to save life on earth*. New York: W. W. Norton and Company.

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ⁱ This text provides an excellent overview of the crisis in the Church, particularly with regard to Catholic institutions, as well as the hierarchy (Peter Steinfels, *A People Adrift: The Crisis of the Roman Catholic Church in America*, New York and London: Simon Schuster, 2003).

ⁱⁱ In these documents, the term “university” is used to refer to both colleges and universities. For the purposes of this paper, unless otherwise indicated, the term “university” will refer to both universities and colleges.

ⁱⁱⁱ There is no shortage of books on the subject of Catholic identity. A more recent one is *Catholic Higher Education: A Culture in Crisis* (Melanie M. Morehy and John J. Piderit, Oxford University Press, 2006). In their volume, they conduct studies of numerous Catholic universities and very nicely conceptualize paradigms for the sake of comparison. Another excellent volume, containing a number of essays by professors mostly associated with Notre Dame, was edited by Theodore M. Hesburgh (*The Challenge and Pursuit of a Catholic University*, Notre Dame and London: University of Notre Dame Press, 1994).

^{iv} The issue of mission will be addressed in more detail below.

^v While acknowledging the tension that will always exist between faith and science, Richard P. O'Brien paraphrases Father Theodore Hesburgh: “...ultimately there can be no conflict between science and theology because they have a common source of truth. If there is an apparent conflict, it is because there is either bad theology or bad science” (“What is a Catholic University?” in Hesburgh volume).

^{vi} The concept of academic freedom is discussed more fully below.

^{vii} An entire document was developed to provide procedural guidelines for the *mandatum* (*Guidelines Concerning the Academic Mandatum in Catholic Universities*, 2001).

^{viii} A survey of 48 students in our *God, Science and Designer Genes* classes revealed, when asked if human cloning should be banned: 40 supported a ban, 3 were not sure, and 5 would not support a ban.

^{ix} Commonly called the “Red Book,” *Policy Documents and Reports* is published regularly by the American Association of University Professors, Washington, D.C., and distributed by the Johns Hopkins University Press, Baltimore and London. The most recent publication is the tenth edition. For additional information, see <http://www.aaup.org/aaup>.

^x Donald Kennedy’s book, *Academic Duty*, published in 1997 by Harvard University Press, provides an excellent discussion of duty to scholarship, teaching and service. He reminds us that “by nature, universities are controversial places” (p.22) and that “academic freedom has a counterpart, academic duty” (p.2).

^{xi} In her essay, “Science and Its Critics,” in *The Future of Academic Freedom*, edited by Louis Menand (1996), Evelyn Fox Keller defines “science studies” as a discipline “which takes the study of science rather than the study of nature as its central mission” (p. 199). Keller states: “Virtually all scholars in *science studies* take as their starting point the need to attend to the historical and social contingency of the particular kinds of human practices that, at any given time or place, are said to constitute *doing science*” (p. 202).

^{xii} For a detailed account, read Charles E. Curran’s (1990) “Personal Involvement” in *Catholic Higher Education, Theology, and Academic Freedom* and his recent book, *Loyal Dissent*. Curran’s liberal interpretations of Catholic theology got him in trouble and the CUA Board did not renew his contract, but he was not alone. Curran had the support of the school of Theology at CUA in the form of a resolution stating that the Board’s action jeopardized academic. The university faculty met and voted 400 to 16 in support of the Theology Department’s resolution and more than two thousand faculty and students rallied outside the rector’s quarters in his support.

^{xiii} The Catholic document, *Sapientia Christiana* (1979), lays down guidelines specifically for these types of institutions.

^{xiv} Even in our choice of textbooks, we had one devoted to genetic science (Ricki Lewis, *Human Genetics: Concepts and Applications*, 7th edition, Boston: McGraw Hill Higher Education, 2007) and the other devoted to a theological approach (Ted Peters, *Playing God?*). We also utilized a collection of readings addressing primarily the ethical questions of certain technologies.

^{xv} This technique was developed by one of our former colleagues at Alvernia College, Dr. Nan Hamberger.

^{xvi} The five choices (definitely yes, probably yes, not sure, probably no, and definitely no) were collapsed into three choices (no, not sure, and yes) for purposes of discussion here. Copies of the survey are available upon request (Spencer.Stober@alvernia.edu).

^{xvii} Students were required to read, *Playing God? Genetic Determinism and Human Freedom*, 2nd edition, by Ted Peters, published by Routledge, 2003.

^{xviii} The National Center for Biotechnology Information (NCBI) at [OMIM Home](#) is an excellent resource that allows you to search on-line for genes associated with traits (e.g., novelty seeking behavior, obsessive compulsive disorder, hair and eye color, cystic fibrosis, etc.).

^{xix} Wilson builds on the William Whewell’s use of the terms *coherence* and *consilience* in *The Philosophy of the Inductive Sciences* in 1840. Units of knowledge can be linked when there is a *consilience of inductions*, that is, when the inductions of two distinct classes of data coincide.