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Attitudes Toward Science and Stem Cell Research Based on Religious Worldview: Comparing the Views of Theists, Naturalists, Skeptics, and Dualists Toward Science as an Institution, Method, and Application of Knowledge

Jon Van Wieren
Western Michigan University

ATTITUDES TOWARD SCIENCE AND STEM CELL RESEARCH BASED ON RELIGIOUS WORLDVIEW: COMPARING THE VIEWS OF THEISTS, NATURALISTS, SKEPTICS, AND DUALISTS TOWARD SCIENCE AS AN INSTITUTION, METHOD, AND APPLICATION OF KNOWLEDGE

by

Jon Van Wieren

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Advisor: Vyacheslav Karpov

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Jon Van Wieren, Ph.D.

Western Michigan University, 2012

This dissertation is a study of attitudes toward science and stem cell research based on religious worldview. This study examines the relationship through General Social Survey data (2006).

Religious worldview is measured here through some of the most common measures of religiosity. This study differs from many other sociological studies of religiosity in that it includes the view of naturalism alongside other religious worldviews, including theism, dualism, and skepticism. Science is understood and measured here as multidimensional. Comparisons are made between attitudes toward science as a social institution, a research method, and as an application of knowledge – where attitudes toward stem cell research are compared.

This study begins by considering some of the present day issues within the study of religion and society. A few of the most pressing concerns within this literature are given emphasis, including secularization and desecularization. Some of the controversies surrounding the secularization debate are considered with special attention given to writings that address the compatibility of religion and science, past and present.

TABLE OF CONTENTS

Table of Contents—continued

CHAPTER

Table of Contents—continued

CHAPTER

Table of Contents—continued

CHAPTER

APPENDICES

LIST OF TABLES

CHAPTER I

INTRODUCTION TO THE STUDY

This study examines attitudes toward science based on religious worldview. The study examines this relationship through General Social Survey data (2006). The GSS regularly measures the religiosity of respondents. The 2006 GSS also includes a module dedicated to important issues surrounding the benefits and harms of science and technology. This module measures attitudes toward science in general, as well as attitudes toward specific issues of science and technology facing the public, including stem cell research.

This study measures attitudes toward *science* based on *religious worldview*. A religious worldview is perhaps one of most important ways, if not the most important way in which a person orientates himself or herself to the world. As a sociological variable within this study, religious worldview is thought of in terms of some of the most common measures of religiosity. An emphasis is placed within this study on clear and unambiguous indicators of a person's world picture. This study differs from many other sociological studies of religiosity in that it includes within the concept of "religious worldview" the view of naturalism[1]. Few, if any, studies within the sociology of religion have considered naturalism alongside other religious worldviews. From these measures, four patterns of religious worldview are identified. The attitudes and demographic

[1] The view that the natural world is best described through natural laws as described by science.

backgrounds of these four worldviews are compared. The construction of the variable for religious worldview is described in depth within Chapter VI.

Within this study, "science" is understood, and operationalized, as multidimensional. Three forms of science are identified within this study, they are: 1) science as a social institution; 2) science as a method (or process); and 3) science as an application of knowledge. The indicators used in the construction of these three aspects of science are described in Chapter VI.

This study begins by considering some of the present day issues within the study of religion in society. These issues are covered through a review of recent literature within the sociology of religion and related fields (Chapter II). A few of the most pressing concerns within this literature are given emphasis, including secularization and desecularization. Some of the controversies surrounding the "secularization debate" are considered within this chapter, with special attention given to writings that address the compatibility of religion and science, past and present.

Chapter III of this study reviews recent empirical studies on the relationship between religion and science within the social sciences. A critical analysis of recent empirical studies within sociology and related fields is presented within this chapter.

Chapter IV considers science as a social institution. A rationale is provided within this chapter for understanding science as *multidimensional*. The three forms of science proposed within this study are described within this chapter. Analysis of science as a social institution, a method, and an application of knowledge is provided within this chapter.

In Chapter V of this study, the controversial issue of stem cell research is examined as a cultural phenomenon within the United States. Some of the recent history and policy decisions surrounding the issue are detailed, along with some of the new ways in which stem cell treatments have been being applied as a form of scientific knowledge within the health and life sciences.

Within Chapter VI, the research question is clearly stated. The data and method of this study are described, along with a description of variable construction. The variable construction of both *religious worldview* and *science* are explained within this chapter. This chapter examines the attitudes of four religious worldviews toward science (Theism, Naturalism, Skepticism and Dualism). Empirical findings are presented within this chapter. Following the presentation of data and findings, Chapters VII and VIII continue to describe the empirical findings of this study. These chapters help to provide some of the demographic and attitudinal backgrounds of the respondents within this study.

The final chapter, Chapter IX, considers what the findings of the empirical tests may have to suggest about the relationship between religion and science- in so far as it is measured through this study. The implications of the research findings are thought through within this chapter.

CHAPTER II

SOCIOLOGICAL PERSPECTIVES ON RELIGION, SCIENCE, AND THE SCECULARIZATION DEBATE

This chapter reviews the study of the "secularization debate" within the social sciences. The secularization debate regards the state of religious vitality across the world. The secularization debate has centered on the question of whether or not broad social and cultural changes associated with modernization[2] might be correlated with a decline of religious belief and behavior. The purpose of this chapter is to identify some of the key issues and controversies within this debate. The research question of the present study is a response to some of the themes within this literature. The research question extends inquiry into the relationship between religion, science, and secularization.

Modernity, Pluralism and Religious Certainty

Many of the early theorists of society believed that modernization had a direct impact on religion. There is controversy, however, as to whether or not early theorists and empiricists presented an accurate picture of the relationship between modernization and secularization. Even today, it is not exactly clear or agreed upon what the ramifications and even definitions of "modernization" and "secularization" are, or will be in the future. What seems clear though, is that the simple idea that *modernization directly*

[2] The change from "traditional" to "modern" ways of life, social institutions, and governance.

leads to religious decline is being reconsidered today. Some of the best-known proponents of the original secularization thesis today argue that modernity does not necessarily lead to secularization. Peter Berger, for example, is no longer committed to the thesis of direct causation between modernization and secularization. He has stated otherwise that: "modernity very likely, but not inevitably, leads to pluralism, to a pluralism of worldviews, values, etc." (interview with Mathews, 2006:151-152). Berger defines "pluralism" as the coexistence of different worldviews and value systems within a society under the conditions of civic peace. Pluralism, then, does not necessarily involve an absolute decline of religion. Within pluralistic societies, the coexistence of different worldviews may lead to less certain boundaries between belief systems, Berger suggests:

> What pluralism and its social and psychological dynamics bring about is that certainty becomes more difficult to attain. That's what I mean by the how of belief. It's more vulnerable. The what can be inherently unchanged, but the how is different, and I think the difference is that certainty becomes more difficult to attain or can only be attained through a very wrenching process, of which fundamentalism is the main expression (Berger, 2006 interview).

On the issue of certainty, Hervieu-Leger (2006) has written that "the 'rational disenchantment' characteristic of modern societies does not mark the end of religion." (59). On Hervieu-Leger's view, religious belief thrives when and where there is *un*certainty. In pluralistic societies, individuals come into contact with different worldviews on a daily basis. In societies where individuals have freedom of belief, there is more flexibility to assimilate a diverse range of beliefs and worldviews into a single map of reality.

> In societies that have adopted the autonomy of individuals as a principle, individuals create, in an increasingly independent manner, the small systems of belief that fit their own aspirations and experiences (2006: 59).

Habermas (2008) has characterized "modernity" as a time marked by two countervailing trends: "the spread of naturalistic worldviews and the growing political influence of religious orthodoxies" (1). Habermas contends that both of these trends, religious revival through desecularization and the spread of naturalistic worldviews, are a response to "Western modernity." Habermas writes of the religious reaction directed toward the "postmetaphysical and nonreligious self-understanding of Western modernity" (2).

> These conflicting intellectual trends are rooted in opposed traditions. "Hard" forms of naturalism can be understood as an implication of the Enlightenment's uncritical faith in science, whereas the political reawakening of religious consciousness breaks with the liberal assumptions of the Enlightenment. However, these intellectual and spiritual outlooks do not merely clash at the level of academic controversies. They also develop into powerful political forces both within the civil society of the leading Western nation and at the international level in the encounter between the major world religions and the dominant global cultures (2008: 2).

Within pluralist societies there may be patterns of secularization, desecularization, and the never-been-secular all interacting within civil society. Where might these countervailing trends be headed? In thinking about secularization, desecularization, and counter-secularization, definitions of these terms are important. Accurate empirical measures of proposed trends will rely first on clear conceptualizations of these terms. There may be different implications associated with each. Karpov (2010) provides a conceptual framework for better understanding desecularization, and has written that there may be multiple, overlapping, and clashing desecularizations:

> Upon globalization's entrance, the picture of overlapping and clashing counter-secularizations becomes even more complicated. Globalization leads to a global spread of transnational communities, real and imagined. Drawn to the communities are people and groups from variably

> modernized and individualized national settings. Previously unthinkable patterns emerge as a result (269).

Karpov's (2010) model of desecularization is especially relevant in explaining religious revival across Russia after the fall of the Soviet Union- a state that sought to abolish all forms of institutionalized religion.

In the United States, there are opposing viewpoints about whether or not secularization is positive or a negative. The conflict over secularization is one of the main issues within the "culture wars"- a term used to describe the apparent clash of cultural traditions within the United States (see Edgell and Tranby 2010). One of the primary dividing lines within the culture wars is that of the role of religion in public life. Amidst the clash of cultures, there is the related question of whether or not the opposing cultural traditions will ever be able to reach a consensus on social and policy issues facing the public such as prayer in public schools, the abortion debate, the creation-evolution debate, stem cell research, and so on. Some contend that it is this clash of default cultural-based worldviews that has contributed to political deadlock in U.S. government, and an entrenchment of political sides. With the sides so clearly laid out, and so clearly opposed on so many big issues, what are the prospects for conversation between the sides, or what Habermas (2008) has called the "postsecular society." The postsecular society is a society where religious and nonreligious communities are open to dialogue, take the other side seriously, and respect the views and contributes of the other side to social order and solidarity. Taken within the broader framework of Habermas' notion of "communicative action," the postsecular society is a necessary requirement of an open, plural, and democratic society. Only under these circumstances will a society that is both

secular *and* religious be open to reconciling its internal antagonisms, and be open to an alternative, more inclusive, future (Siebert 2012).

Models of Religious Change: Religious Decline or Resurgence?

> The seminal social thinkers of the nineteenth century- Auguste Comte, Herbert Spencer, Emile Durkheim, Max Weber, Karl Marx, and Sigmund Freud- all believed that religion would gradually fade in importance and cease to be significant with the advent of industrial society (Norris and Inglehart 2004: 3).

Recent work within the sociology of religion has questioned some of the assumptions surrounding the secularization debate (Berger, ed. 1999; Bruce 2002; Norris and Inglehart 2004; Finke and Stark 2005). The assumption of the classical view has been that modernization and industrialization have had a direct causal effect on religious belief. While some have worked to make it a clear point that secularization is not universal and inevitable (Bruce 2002), theories of social change from the past have often posited universal and law-based explanations of these phenomena. Bruce (2002) defines secularization as:

> ...a social condition manifest in (a) the declining importance of religion for the operation of non-religious roles and institutions such as those of the state and the economy; (b) a decline in the social standing of religious roles and institutions; and (c) a decline in the extent to which people engage in religious practices, display beliefs of a religious kind, and conduct other aspects of their lives in a manner informed by such beliefs (2002: 3)

As defined, it would seem that secularization, of some kind, has taken place at certain times within certain places. Western Europe is identified across the literature as one such place. Bruce's "secularization paradigm" (2002: 4) is an attempt to provide an

explanatory model for social phenomena connected with secularization. Bruce's secularization paradigm attempts to provide a model for understanding secularization.

> Like Weber's Protestant Ethic thesis, the secularization story is an attempt to explain a historically and geographically specific cluster of changes. It is an account of what has happened to religion in Western Europe (and its North American and Australasian offshoots) since the Reformation. Whether any parts of the explanation have implications for other societies is an empirical matter and must rest on the extent to which the causal variables found in the original setting are repeated elsewhere (2002: 37).

Bruce argues that the secularization paradigm does not rest on a "systematic theory." He believes that such a theory would be responsible for accounting for too much, to the point of being so abstract as to be useless (39). Bruce's secularization paradigm instead is said to consist of a cluster of testable explanations of religious change. The idea of testability is important. The present study tests an explanation of the relationship between religion and science offered by Bruce; detailed in the final chapter.

One of the problems with clear understandings of secularization has been the mysterious nature of religious belief itself. Kniss (2003) writes:

> One of the persistent difficulties in the literature has been the slippery nature of the "stuff" of religious conflict. It is not easy to speak of things like ideas, symbols, or meanings with the same clarity and precision that one might use in analyzing demographic characteristics, for example (Kniss 2003: 331).

Religious identity can also be a less than certain source of personal identity. Even for those with clear religious affiliations, appropriate responses to novel and unforeseen social events (such as the availability of new applied sciences and technologies) may be a source of uncertainty. Doctrinal or ideological commitments may be one thing, and behavioral responses another.

The writings of classical theorists of social change such as Comte and Spencer implied a teleological direction of change in the mass belief and knowledge structures of societies. Comte presented a model of evolutionary change within societies- the idea was that as societies evolved, theological and metaphysical belief systems would increasingly be replaced by belief systems based on positive, and/or scientific knowledge. Definitions of "modernization" and "secularization" have often implied one another. Definitions of these terms are often coupled: "secularization is an aspect of modernization; modernization is an aspect of secularization."

Bruce (2002) has argued that certain early writers on secularization (such as Weber, Troeltsch, Niebuhr, Wilson, Berger and Martin) did not claim that secularization was a universal law or that it was inevitable (37). Even still, secularization has typically been treated as a universalizing social pattern. Western Europe is often characterized as a set of secular nations (Berger, Davie, and Fokas; 2008). While Europe has been the model of modernization and secularization for the rest of the world, the original thesis is being rethought:

> Since 1970, however, it has been increasingly questioned. In the last quarter of the twentieth century, the markedly different situation in the United States, the growth of Christianity in the southern hemisphere, the presence of Pentecostalism all over the developing world, the affirmation of Islam in global affairs, increasingly heated debates for and against proselytism, and so on have prompted scholars of many disciplines to rethink the secularization paradigm as it was inspired by the European case and to question the assumptions on which it was built (2008: 2).

A range of new explanations of religious change have been developed across the sociology of religion. Three general trends might be identified here. One response has been a restatement of the basic tenets of the secularization thesis- along with certain qualifications made in response to its critics. Bruce's (2002) *God is Dead* might be

viewed as an example of this position; while he does not believe that science has directly contributed to secularization. Another trend and position within the literature has been the focus on religious markets. The religious economies perspective has been advanced by Stark and Finke's *The Churching of America* (1992, 2005). A third trend centers on explaining the development of "multiple modernities"; here the work of Eisenstadt and Cassonova (2003) is important. Explaining this line of work, Berger, Davie, and Fokas' (2008) write:

> Advocates of multiple modernities recognize two very simple things: first that there is more than one way of being modern, and second that not all modernities are necessarily secular – indeed on present showing relatively few are (2008: 44).

Berger et al. argue that "Eurosecularity" may in fact be unique; not the model case for explaining what is going on with religion across the rest of the world. Across the world there are trends that might be raised in support of both secularization as well as religious revival. As the authors note, each instance comes with its own seemingly plausible theoretical explanations:

> Each situation- Europe and the United States – has produced a body of theory applicable to its own case. In Europe, the emphasis has been on secularization, an idea inextricably linked to the development of sociology as a discipline. In the United States, the stress has been on the market and the forms of theory that support a model of choice (2008: 31).

The question of how to explain both of the cases, Europe and United States, poses a problem for the sociology of religion, and a problem more generally for the prospects of a unified sociological theory of secularization. No single theory seems to apply to all of the cases. There are seemingly plausible theories for the divergent religious patterns we see across the world.

To take just the case of the United States, patterns of secularization within the U.S. seem to be divided between two trends. Some see the U.S. as engaged in a "culture war." Berger describes the situation as a divide between "Swedes" and "Indians." One trend within American culture has more closely resembled the trends within Sweden- one of the most secular nations of the world. Another trend of religious belief more closely resembles the nation of India –where religious belief remains very strong. Proponents of this view contend that there are real divisions within American culture, divisions that reflect opposing cultural traditions as well as opposing patterns of religious belief:

> America is often observed as being at once the most religious and the most secular nation on earth. Whether or not this is precisely so, it is clear that the religious concerns of the majority of Americans are at best dimly reflected in the public spheres of education, business, law, government, mass media, and so on, which constitute the largely unavoidable institutional contexts in which much of their lives are lived. (Smith 2003: 7-8)

Religion and Science in Conflict

The original secularization thesis involved the idea that science plays a role in religious decline. Today, some have questioned this relationship, including: Bruce (2002); Norris and Inglehart (2004); Stark and Finke (2005); and Evans and Evans (2008).

Bruce suggests that it was the "Enlightenment zero-sum view" that contributed to a simple acceptance of the notion that religion and science are in direct competition over claims. In contrast to the zero-sum view, Bruce has taken on Wilson's position that "...religion and science can co-exist as alternative orientations to the world" (Wilson, 1966: 43; 2002: 26). Bruce considers the relationship between secularization, religion and

science to be less determined by a direct competition over factual claims, and more the result of the development of a "technological consciousness." A "technological consciousness" is thought to be difficult to reconcile with notions of the sacred (28). Through this idea, Bruce draws upon Weber's notion of the disenchantment of the world, and the loss of the mysterious (1948: 139; 2002: 29). On Bruce's account, it is a rationalistic orientation to the world in general, not science in particular, that has the greater influence on trends associated with secularization.

> In my *Religion in the Modern World* I leave science to the end of my explanation and introduce the topic by saying: 'I do not actually think that science has directly contributed much to secularization' (Bruce 1996a: 48: 2002: 107).

Further connections to Weber's theorized types of action might be drawn out here; based on the presumed split between "instrumental" behavioral orientations and "expressive" or "value-rational" behavioral orientations (Turner 1995).

In support of his argument Bruce presents Stark and Finke's (2000: 53) data showing religion by academic discipline, where natural scientists are considerably more likely than social scientists to be regular churchgoers. These data, Bruce believes, support his thesis that it has not been science in particular that has the greatest impact on religious belief, but instead "by the general relativism that supposes that all ideologies are equally true (and hence equally false)" (2002: 117). Similar conclusions might be drawn from Wuthnow's (2005) study of religious diversity, where "spiritual shoppers" showed the highest degrees of acceptance of diverse views and a general relativism toward ultimate claims on beliefs, knowledge and "truth."

In discussing these matters, Norris and Inglehart (2004) also raise the question of Weber's theory of rationalistic action. A "Rational Weltanschaung" involves a presumed

loss of faith; instrumental rationality is expected to trump expressive/value rationality. But, Norris and Inglehart also question this presumption- that scientific and religious ideas are in direct competition. Norris and Inglehart scrutinize Weber's thesis, and write:

> But if a rational worldview generates widespread skepticism about the existence of God and belief in the metaphysical, then those societies that express most confidence in science might be expected to prove least religious; in fact, as documented in Chapter 3, we find the reverse (2004: 9).

Norris and Inglehart's graphic data of this reverse trend is shown through the measure of "Faith in Science and Religion" figure 3.3 (68). These data are organized by nation-state. What is interesting is that some of the nations showing the highest reports of religious belief and also the highest reports of confidence in science are nations that one does not usually associate with strong scientific programs or agendas: Egypt, Turkey, Nigeria, Iran, Jordan, Bangladesh, Zimbabwe, Indonesia, Uganda, Philippines (and the exception, the United States, along with perhaps Indonesia) are not nations we typically think of as having national cultures centered on instrumental rationality. What is interesting too is that some of the nations showing the lowest confidence in science are those with the most developed science programs. Other than the United States, some of the nations we may think of as having the most robust science agendas and public dollars spent on scientific research and development are found toward the bottom of the scale of scientific confidence.

> Indeed, the more secular postindustrial societies, exemplified by the Netherlands, Norway and Denmark, prove most skeptical toward the impact of science and technology, and this is in accordance with the countries where the strongest public disquiet has been expressed about certain contemporary scientific developments such as the use of genetically modified food, biotechnological cloning, and nuclear power. Interestingly, again the United States displays distinctive attitudes

> compared with similar European nations, showing greater faith in both God and scientific progress (2004: 67).

The last sentence above is an interesting one, and pertinent to the present study. Based on a number of empirical studies (as reviewed within an NSF report on Science and Technology, 2008), the United States shows both a great deal of faith in religion and a great deal of faith in scientific progress. Sociologically, the United States is a nation that shows both high rates of faith in religion and science. This situation would seem to present a problem for the argument that religion and science are in direct conflict. However, this conclusion may also be premature. A review of empirical studies on the matter may complicate an already confusing picture. One purpose of the present study is to suggest that while treating the United States as single entity may be methodologically expedient, the seeming paradox of the United States as one of the most religious and most accepting of science may be made better sense of when we are able to identify different trends in attitudes and belief across separate religious worldviews.

Science and the Christian Worldview: A Brief History

Rodney Stark elaborates on a thesis covered in his books *For the Glory of God: How Monotheism led to Reformations, Science, Witch-Hunts, and the End of Slavery* (2003), and *The Victory of Reason* (2005) in the following passage:

> During the past century, Western intellectuals have been more than willing to trace European imperialism to Christian origins, but they have been entirely unwilling to recognize that Christianity made any contribution (other than intolerance) to the Western capacity to dominate. Rather, the West is said to have surged ahead precisely as it *overcame* religious

> barriers to progress, especially those impeding science. Nonsense. The success of the West, including the rise of science, rested entirely on religious foundations, and the people who brought it about were devout Christians (Stark 2005: xi).

Bruce (2002) recounts Merton's (1970) work on Puritan scientists. As Bruce recounts:

> Merton argues that many seventeenth-century Protestant scientists were inspired to natural science by a desire to demonstrate the glory of God's creation, by the rationalizing attitude of the Protestant ethic and by an interest in controlling a corrupt world (2002: 27).

Stark (2003) argues that the foundation of science was not anti-Christian, but Christian-inspired. Early on, Stark argues, religion was not an oppressive force that worked to constrain science. The argument is that monotheistic religion was the major impetus in the development of science. Scientific reason depends on a metaphysical picture of a world created by an: "omnipotent," "dependable," and "responsive" deity. The creator is said to have made the world in accordance with discernable laws, centered on a "rational" and "stable structure" (2003: 147). Stark cites Alfred North Whitehead's view, that "Christian theology was essential for the rise of science in the West, just as surely as non-Christian theologies had stifled the scientific quest everywhere else" (147).

This is a brief commentary on the history of religion and science in the West, as presented by Stark. Bruce (2002) suggests that while early Christianity promoted science, this gave rise to a paradox:

> Because the Puritan scientists were able to demonstrate the fundamental rule governed nature of the material world, they made it possible for subsequent generations to do science without topping and tailing their work with the assertion that 'This shows God's glory'. At any state in the growth of knowledge, God could be summoned to fill a gap… Science became autonomous and generated explanatory models of the world that did not require the divine (2002: 27).

Some historians may question the statement that the origins of science are exclusively Christian, as Stark seems to be arguing. Even still, the broader issue of interest is the back-and-forth between accounts and the conflicting reports. Were, or are, religion and science in conflict? Taking another approach toward the whole issue is Christian Smith (2003); who seems to argue that in a sense, yes, religion and science were and are in a type of conflict.

Secularization as Political Struggle

Christian Smith (2003) reframes secularization as an "...intentional political struggle by secularizing agents to overthrow a religious establishment's control over socially legitimate knowledge" (1). On this view, secularization is not thought to be a causal outcome of modernization forces, but instead a product of motivated actors who have sought to overthrow religious authority within American life. Describing the situation, Smith calls this a "rebel insurgency" on the part of "activists":

> The rebel insurgency consisted of waves of networks of activists who were largely skeptical, freethinking, agnostic, atheist, or theologically liberal; who were well educated and socially located mainly in knowledge-production occupations; and who generally espoused materialism, naturalism, positivism, and the privatization or extinction of religion (2003: 1-3)

Smith describes secularization as a form of revolution, one that would undermine the "institutional privilege and dominance" of religious authority. The revolution would ultimately lead to a transfer of power and control from one regime to another. A profound cultural impact would follow:

> Thus, for example, the secular revolution transformed the social construction of science and its production of new knowledge from an

> enterprise thought compatible with, and to some extent, at the service of theism into one which considered religion to be irrelevant and often an obscuring impediment to true knowledge (2).

The transformation is said to have impacted institutions of higher education, removing the Protestant worldview and replacing it with secular one:

> The secular revolution transformed the basic cultural understanding of the human self and its care, displacing the established spiritually and morally framed Protestant conception of the "care of souls" (over which the church and its agencies held jurisdiction), and establishing instead a naturalistic, psychologized model of human personhood (over which therapists and psychologists are the authorities) (3).

As Smith sees it, the primary issue is one of the role of religion as an institutional, and cultural, regulator within American public life. Smith's argument is that secularization has been encouraged more so by activists than by macrosocial causal forces; such as those connected to modernization. Smith sees secularization then as a "powerful cultural movement," one broadly following in line along with the Enlightenment movement. Smith describes a world before secularization where theists were the keepers of knowledge, and the framers of culture and social reality. After secularization, naturalists became the keepers of reality:

> Religion's historical marginalization in science, the universities, mass education, reform politics, and the media was a historical accomplishment, an achievement of specific groups of people, many of whom intended to marginalize religion. The people at the core of these secularizing movements, at least, knew what they were doing, and they wanted to do it. They were activists, secularizing activists- actors who operated with the same kind of and level of agency as people who go shopping, get married, and vote (2003: 32-33).

Secularization and Science

By linking secularization and science, Christian Smith seems to be implying that science is just an arm of the "rebel insurgency," not an independent method and process of gaining knowledge of the world. The idea that America is both the most religious and most secular nation on earth would seem to be a paradox. The present study looks further into the suggestion that the religious concerns of Americans are "dimly reflected" within the public sphere, as Smith has suggested. The question of whether or not Americans' religious convictions are dimly reflected in their attitudes toward science is asked over the following.

CHAPTER III

THE RELATIONSHIP BETWEEN RELIGION AND SCIENCE: A REVIEW OF EMPIRICAL STUDIES

This chapter reviews empirical studies on the relationship between religion and science. It is not the case that there has been a shortage of thought or writing on the relationship between religion and science. Across religious traditions and/or theological and philosophical positions, there is any number of accounts, commentaries, and sides to choose from when it comes to describing how religion and science either complement one another, are neutral toward one another, or are in conflict. Much of this thought and writing, however, has been more ideological than empirical. Ideological statements, whether argued for convincingly or not, do not constitute sociological empiricism. The ideological brand of literature rarely reflects what is actually going on within human groups and societies when it comes to patterns of mass belief and behavior. While the role of ideologues in influencing mass belief is an important factor (and considered in a later chapter), ideological positions are not the main focus within this chapter. The main focus of this chapter is on empirical studies of the relationship between religion and science. Some of the trends across the literature will be reviewed followed by a more narrow focus on studies that have a particular relevance to the present study.

Lack of Sociological Empiricism within the Historical, Theological, and Philosophical Writings on Religion and Science

Much of the writing on the religion-science relationship has been dedicated to position-based argumentation either for or against the compatibility of religion and science[3]. In terms of influence, Max Planck (1968) and Bertrand Russell (1961) have provided important contributions to this literature. Planck and Russell present different answers to the question of compatibility. Planck argued for compatibility, while Russell argued against. More recently, Stephen Jay Gould's (1997) model of "nonoverlapping magisteria" (NOMA) has often been cited as a resolution to the compatibility question. Gould's model bears a similarity with Planck's position, because it rests on the idea of consilience; that religion and science do not overlap on knowledge or value claims. From the NOMA position, religion is typically framed to cover the domains of morality and meaning; and science the empirical world- without the two bleeding over into one another. An aspect of the NOMA position that doesn't seem to receive as much attention is that there is difference between: 1) logical relationships between the claims or premises of religion and science, and 2) the sociological relationships between religion and science. The difference is akin to the difference between the logical study of knowledge through epistemology, and the sociological study of knowledge through the sociology of knowledge- based on the study of whatever passes as "knowledge" within a society. If religion and science cover separate domains, then not only can neither domain refute or comment on the logical relations of the truth claims of the other, but neither domain is granted a warrant to refute or comment on the social practices of the other.

[3] The theological and/or logical compatibility of religion and science are not same thing as the sociological compatibility.

Sociologically, we know of many cases past and present where social groups have not honored the idea of NOMA, where religious groups have taken issue with certain practices of science, and vice versa. When the Heaven's Gate religious group committed mass suicide so that they might fly away on an alien space craft following the Hale-Bopp comet, there were people (probably including some scientists) who questioned the truth claims, and practices, of this religious group. Likewise, when scientists began harvesting embryos in order to conduct research on embryonic stem cells, there were people (including religious figures) who questioned the ethical aspects of this practice. There are many cases of consilience between religion and science to mention also. Simply stated, sociologically, empirical cases may vary. Gould's "NOMA" is not a sociological law.

Along with the theological and logical arguments on the compatibility of religion and science, the historical relationship has received attention as well. Rodney Stark (2003; 2005) has argued against the received view that Western history has been shaped by a direct conflict between religion and science. On Stark's account, the received view of an inherent conflict between religion and science is inaccurate. Many early scientists were Christian scholastics. On the other side of the argument, the conflict thesis places an emphasis on historical events connected with Copernicus, Galileo, and later the Darwin debate. These events are taken as examples of a long-standing tension between religion and science as social institutions.

Recent Writings on Religion and Science in Popular Press: Still Not Sociologically Empirical

Recently, the question of the compatibility between religion and science has made its way into the popular press. Once again, the topic has been approached from a diversity of viewpoints. Here too, argument-based writings are the norm within this brand of literature. Theologians, philosophers, and natural scientists have renewed the debate. One example of a noted natural scientist who has contributed to the debate is Michael Behe (2007). Behe is a biochemist and an advocate of intelligent design. Behe takes a position similar to the Christian scholastics: that science is in the service of theism. Behe employs the language and methods of science to argue that life is too complex to have evolved without a designer (in line with the "teleological argument"; William Paley).

Those who take the side of incompatibility between religion and science have also contributed to this literature. Richard Dawkins (2006) and Daniel Dennet (2006) have taken a strong position against compatibility. Both argue that the truth-claims of religion and science come into direct contact and conflict. Dennett argues that religious phenomena should be studied scientifically. Both reject the view that religion and science can co-exist logically as separate domains of fact and truth. Kaye (2008) and Audi (2009) offer an overview of related writings.

Whether theological, philosophical or historical, what is missing from these brands of literature is empiricism. Sociological studies place a focus on what real individuals, groups, and societies believe and behave in relation to religious and scientific convictions. Empiricists who study the relationship between religion and science typically present a more complex picture than do ideologues.

Different Approaches to Study the Relationship Between Religion and Science

Evans and Evans (2008) provide a comprehensive review of studies on the relationship between religion and science. They categorize studies of religion and science into three groups. First, are studies that place emphasis on what they term as the "symbolic epistemological conflict studies" (that religion and science conflict on knowledge claims). Second, are the "symbolic directional influence studies"; and third, the "social-institutional studies." The authors argue that many studies simply assume that there is an epistemological conflict between religion and science and proceed from there. They argue that this approach has limited understandings of the religion-science relationship. They suggest that research into the relationship should leave the question of conflict as an open empirical question. They argue that neither religion nor science are static enterprises, and that they are best treated as social institutions. They write that science should be viewed as a "complex, plural, and multifaceted object of study" (101). The social-institutional studies do not presume that conflicts between religion and science are strictly epistemological. Therefore, the authors contend that the social-institutional approach is best suited for examining public conflicts between religion and science.

Narrowing the Literature: Themes Important to the Present Study

The literature reviewed below will explore some similar themes as described above; some of the following studies are based on epistemological conflict, some

examine directional influence, and others focus on the institutional level. The following review works to highlight themes relevant to the present study.

What complicates the picture of the empirical studies is that the relationship between religion and science might be understood at two levels of analysis: 1) the attitudinal level (or ideational level); 2) the behavioral level. Sociologically, both levels might be studied empirically.

In thinking about the religion-science relationship at the level of mass public *attitudes*, widespread cultural representations and the role of idea leaders are important factors. At the level of *behavior*, what matters more are real events, actions, and behavioral patterns of people doing things. Without empirical studies, it's easy to fall into thinking that mass behavior follows directly from mass attitudes. This is a persistent concern of survey-based research. Attitudinal reports may not be behavioral reports. Still, such reports reflect something important. Social surveys of attitudes and behaviors involve both a social interaction between interviewer and interviewee, as well as a test of cognition on the part of the interviewee. For these reasons, attitudinal reports might also be thought of as a form of social behavior (Sudman, Bradburn, and Schwarz 1996). The idea that respondents may report what they believe is expected of them (in deference to the "social desirability" of certain responses over others), is a concern within any form of survey research. Revealed through such interactions are normative expectations respondents are willing to commit themselves to (whether a respondent leans more toward religious or secular normative avowals, for example).

Review of Empirical Studies on the Relationship between Religion and Science

Granger and Price (2007) employ General Social Survey data to explore whether or not Christian religious beliefs constrain the supply of scientists. A direct relationship between belief and behavior is examined through this study. Evans and Evans (2008) would likely classify this study as one of "directional influence"- in that it explores how the religious symbol system influences the symbol system of science. The authors explore the effects of holding certain religious beliefs on a person's decision to pursue (and obtain) a graduate degree in a quantitative science. For the category of "quantitative science," Granger and Price include mathematics, physical and natural sciences, engineering, and economics. The authors reason that these disciplines are centered on mathematical abstractions, and for reasons they explain, these branches of science come at the highest cost for those who interpret the Bible as the literal word of God. The authors contend that the book of Genesis includes themes of anti-intellectualism, and that there are costs (to one's religious belief) associated with the pursuit of knowledge within the quantitative sciences. The authors cite Kass (2003) on this point, and describe his exegesis of the book of Genesis. Man's exit from the Garden of Eden and the Tower of Babel episode are well-known cases of such costs associated with the pursuit of knowledge. These themes from the bible are believe to be meaningful and an influence on the behavior of those who interpret the bible as the literal word of God. In defense of their case, Granger and Price cite Noll's (1994) study of Christian evangelicals and fundamentalists which found that holding a belief in biblical literalism did negatively influence the capacity and willingness of students and faculty at fundamentalist and evangelical colleges and universities to explain nature, human society, and culture.

In Granger and Price's study, the effect of religious belief on the decision to pursue a graduate degree was tested through two measures of religiosity. The first was biblical literalism; whether or not an individual believes that the Bible is the literal word of God. The second is whether or not an individual believes in an afterlife. The authors' control variables included: science being a favorite subject in high school, being male, race/black, having a father with a graduate degree, being raised as a Christian fundamentalist, and living in the south. This study found that the biblical literalism and afterlife variables together have a negative causal effect on the decision to earn a graduate degree in science. This is compared to not earning one; as well as compared to earning a graduate degree in other disciplines. Therefore, the authors found that "the individual labor supply decision can be a function of religiosity"; and, "As such, it is plausible that religious beliefs about the truth content of the Bible, and the afterlife consequences of being a scientist in the temporal world could constrain the aggregate supply of scientists" (2007: 158).

Granger and Price's study is important within this literature in that it makes a direct link between a set of beliefs (biblical literalism and believe in the afterlife) and a particular behavior (pursuing a graduate degree in science). The study found both of these to have a significant negative causal effect on the decision to earn a graduate degree in a quantitative science. This study is important in relation to the present study because it suggests that commitment to a religious worldview may impact not only attitudes toward science, but behavior as well. However, with its focus on the supply of scientists (a very small proportion of the actual population), this study does not address broader questions of how the general public receives science- including attitudes toward science as a social

institution, and/or issues regarding public acceptance of an applied science such as stem cell research- both relevant to the present study. Therefore, holding beliefs in biblical literalism and an afterlife may not significantly impact an individual's attitudes toward science as an institution, or attitudes toward real world science and applications such as stem cell science.

When "science" is viewed, and operationalized, as a multidimensional social institution then it may very well be the case that religious beliefs interact with science in different ways.

For example, Ellison and Musick (1995) analyzed 1988 General Social Survey data and found that "Conservative Protestantism" was associated with moral criticisms of science. The indicators the authors chose to analyze, however, reflect a very narrow view of science. At worst, a choice of narrow or limited indicators could lead to potentially misleading results or conclusions regarding the variables under study. The authors write that they gauge attitudes toward science based on responses to the following four statements: 1) "Scientists always seem to be prying into things that they really ought to stay out of"; 2) "One of the bad effects of science is that it breaks down people's ideas of right and wrong"; 3) "One trouble with science is that it makes our way of life change too fast"; 4) "Science will solve our social problems like crime and mental illness" (1995: 249). While there is nothing wrong with such measures, and while responses to statements may in fact reveal a good deal about moral feelings toward science, together these statements reflect a very narrow range of moral attitudes toward "science." When science is more narrowly conceived, or when specific aspects of science are measured, researchers may find different results. A case in point is Scheitle's (2005) study on

religion and optimism toward biotechnology. The results of this study may not follow expectations. Whereas Ellison and Musick found that Conservative Protestantism (measured through biblical literalism, theological orthodoxy, and the perceived ubiquity of sin) was associated with moral criticism of science, Scheitle's study found that holding certain religious beliefs may actually *increase* optimism and favorable attitudes toward biotechnology, a brand of science. This study found that belief in a personal and powerful God makes a person *more optimistic* toward a future world with biotechnology. In summary, this study found that holding an image of a personal God increases optimism toward biotechnology, but that church attendance and other measures of personal religiosity did not.

When it comes to specific and controversial areas of applied science- such as reproductive genetic technologies, there may in fact still be opposition from religious groups. Evans and Hudson (2007) find this to be the case is their study of attitudes toward reproductive genetic technologies. They find that opposition to reproductive technologies is strongest amongst evangelicals, fundamentalists, and traditional Catholics- which mirrors opposition to the issue of abortion. They also found that attendance in any religious tradition, other than liberal Protestantism and liberal Catholicism, makes a person more likely do disapprove of reproductive genetic technologies.

> Like the abortion debate, most of the organizations that oppose reproductive genetic technologies are religious. For example, the Catholic Church, which is opposed to the destruction of embryos, produces educational materials to argue that reproductive genetic technologies should be integrated as one of the life issues that Catholic activists should oppose. Similarly, most evangelical denominations and social movement organizations are opposed to abortion on the grounds that the embryo and fetus are human life worth of protection (Moen 1992), and they are

> therefore opposed to the reproductive genetic technologies on the same grounds (Evans and Hudson, 2007: 567).

As the authors note, the opposition to such technologies does not seem to be determined by views toward embryonic life (or demographics). Additionally, while attitude formation reflects that of the abortion issue, the two issues raise novel concerns. Reproductive technologies do not always involve the destruction of embryos; plus, they posses the potential to alleviate suffering. They might be used simply for enhancement or improvement. Evans and Hudson find that religious conservatives are opposed to these technologies because they hold a different view toward suffering[4] in comparison to non-religious groups. These issues raise further questions regarding whether or not the source of opposition is ultimately a matter of the sanctity of embryonic life, or a more general opposition to the science and applied technologies based on what they promise in terms of the alleviation of suffering, as well as human enhancement.

In thinking about the findings from these studies together, the first point is that a researcher's choice of measures matters. Second, it would seem that while certain religious beliefs may in fact limit the supply of scientists, holding certain other religious beliefs may not necessarily constrain attitudes toward other aspects or domains of science: such as what scientists do and how they do it; or attitudes toward the applications, outcomes, and products of science.

Another line of research at the macro-level is from Howard-Ecklund, Park and Veliz (2008). This study places focus on religiosity and scientists, and explores relationships between science and secularization. The authors study the religiosity of elite academic scientists across natural and social sciences. The authors contend that the

[4] Hudson and Evans (2007) suggest that religious conservatives view suffering as having a religious function and importance.

research focus on elite scientists is important because elites generally hold more influence as institutional leaders (Collins 1998; Rado 1987; Howard Ecklund et al. 2008). The emphasis on the religiosity of scientists is based on the standing presumption that science is a central aspect within secularization theories, and that the academy was one of the first institutions to break from church authority (Smith 2003b; Howard Ecklund et al 2008); "…religion is a key knowledge arena for creating boundaries around what is and is not science (Gieryn 1983), the university is a key societal institution and elites are seen as key knowledge producers (Collins 1998; Rado 1987)" (2008: 1808).

> Earlier scholarship viewed scientists as prime advocates of secularization because of their intimate connection with modernist worldviews (Leuba 1916). Little recent scholarship, however, has examine the religious views of scientists themselves (2008: 1806).

This study replicates the well documented 1969 Carnegie Commission National Survey of Higher Education Faculty Study. The original Carnegie Commission study found higher rates of religiosity among natural scientists as compared to social scientists. The 2005 study gathered data from 2,198 professors in the natural and social sciences from seven fields, at 21 different elite U.S. research universities. In the 2005 study, the researchers found that religious affiliation rates among elite scientists were lower in 2005 than in 1969. By 2005, a higher proportion of natural scientists were not affiliated with any religious tradition as compared with social scientists. This study suggests a changing picture from previous studies where the religiosity of scientists was explored, and further suggests a distancing between the beliefs of "scientists" and the "mass public."

A study with special relevance for the current study is Gauchet's (2008), "A Test of Three Theories of Anti-Science Attitudes." Using 1993 General Social Survey data, Gauchet tested three theories of anti-science worldviews. In an effort to identify the most

influential source of anti-science attitudes, explored are possible explanations that cover "scientific literacy," "evangelical faith," and "social embeddedness." The author found empirical support for all three explanations of anti-science attitudes. This study is an important one, and helps to inform the present study. Still, within this study "science" (or "anti-science" as defined by the author) is understood and measured through three indicators of scientific attitudes. The GSS used by the author are: "1. We believe too much in science, and not enough in feelings and faith. 2. Any change humans cause in nature – no matter how scientific – is likely to make things worse. 3. Overall, science does more harm than good." (2008: 355).

While this study does explore attitudes toward science as a social institution, considerations of scientific process and application are not included. To reiterate the same criticism of the Granger and Price (2007) study, Gauchet's operationalization of "science" is too narrow; there is more involved with science than this. Broad conclusions based a narrowly operationalized view of science may be misleading. This criticism is an important one in so far as previous studies of religion and science go. Few envision science as multidimensional. In summary, findings and conclusions about the relationship between religion and science may be too particular in such cases and not reflect science as a whole.

Noteworthy also with this review of literature are highlights from the National Science Board/National Science Foundation report: *Science and Engineering Indicators 2008; Chapter 7, Science and Technology: Public Attitudes and Understanding*.

The report reveals important trends in Americans' thoughts on issues pertaining to science and technology. The report compiles a number of survey data sources examining

the attitudes, knowledge, sources of information, interest and involvement of Americans in response to current scientific issues. One of the data sources from the report is the 2006 General Social Survey, which includes a module dedicated to scientific issues. The present study utilizes the 2006 GSS data, as described below.

The present study builds from some of the observations of the NSF report. A first highlight from the NSF report is the observation that Americans, across demographic boundaries, tend to express generally positive attitudes toward science and technology. The report states:

> Americans of all kinds – men and women, college graduates and high school dropouts, blacks and whites- consistently endorse the past achievements and future promise of S&T. In practically any major American social grouping, individuals who express serious doubt about the promise of science are a rare breed (2008: 7-24).

Among social institutions within the U.S., science receives some of the highest confidence:

> In 2006, more than half of Americans said that the benefits of scientific research have strongly outweighed the harmful results, and only 6% said the harms slightly or strongly outweighed the benefits. Other indicators yield similar results (S & E Indicators 2008: 7-3).

The report demonstrates a persistent trend in the United States, that as a social institution, science consistently receives considerable public support. When it comes to public attitudes toward specific science and technology issues such as embryonic stem cell research, a technique that has generated ethics debate, one might expect to find more divergence in attitudes- with a considerable number of people expressing negative attitudes. It may be a surprise to some then that the NSF report finds a majority of Americans to be in support of medical research that uses stem cells from human embryos.

On this point, however, there are other factors and considerations to be aware of, as the report notes:

> Although a majority of the public supports such research a significant minority is opposed. When surveys ask about medical technologies to be derived from stem cell research in the contexts of expected health benefits, public response is relatively positive. But technologies that involve cloning human embryos evoke consistently strong and negative responses (S & E Indicators 2008: 7-38).

The purpose of the present study is to examine potential social factors that may encourage or discourage the acceptance of "science" as a generalized social institution; as well as specific applied techniques- in this case, stem cell science. Of primary interest here is how social factors such as an individual's religious-ontological worldview may interact with attitudes toward science.

A highlight from the NSF report is the interesting relationship between Americans' attitudes toward science in general, and their attitudes toward specific areas of research- particularly evolution and the big bang theory of the origins of the universe. The report is revealing when it comes to the overall American landscape of belief and received knowledge. The report highlights that U.S. scores on the knowledge questions dealing with the theory of evolution and big bang cosmology are much lower as compared to those of select other countries. Americans' responses to questions about evolution have changed very little over the past 25 years. For the question: "human beings, as we know them today, developed from earlier species of animals," 43% of GSS respondents answered "true." For the question, "the universe began with a huge explosion," less than 40% answered "true." Compared to select other countries the comparable indicators of knowledge showed substantially higher "true" answers to these questions (see the S & E Indicators report 2008). The report notes that "Many Americans appear skeptical of

established scientific ideas in these areas, even when they have some basic familiarity with them" (7-3). And; "Americans' responses to questions about evolution and the big bang appear to reflect factors beyond unfamiliarity with basic elements of science" (7-19). Also revealing is that: "Respondents were much more likely to answer correctly if the question was framed as being about scientific theories or ideas rather than as about the natural world" (7-19, 20).

The report speculates that these differences in knowledge are likely influenced by religious belief. The present study seeks to explore some of these relationships and utilizes these findings from the NSF report in the construction of group categories based on religious-ontological worldview; where knowledge of evolution and the big bang theories are considered to be key indicators of "naturalism" as a worldview.

Answers to such questions as whether or not evolution is "true" are illustrative of the American landscape of knowledge, as well as belief. They reveal something of the broader world pictures from which Americans self identify. This study explores this often hazy relationship between religious and scientific belief and knowledge. From the NSF report, there has often been a presumed connection between scientific knowledge and attitudes toward science. The report notes, (summarizing Allum et al.'s (2008) study of how knowledge of science related to attitudes toward science and technology in society);

> There is "a small positive correlation between [favorable] general attitudes toward science and general knowledge of scientific facts and processes." Though small, this relationship appears consistent across countries (7-25).

However, the report is quick to point out that the Allum et al. study does not establish a causal link between knowledge and attitudes, and calls on researchers to address "the social and psychological mechanisms that generate the associations we observe" (7-25).

Summary of Empirical Studies

In summary, the present study works to address issues raised by recent empirical studies. The first issue regards the persistent failure to envision "science" as multidimensional. Understanding science as a multidimensional will lead to better formulations and studies on the relationship between religion and science, and perhaps better ideas about broader connections between religion, science and secularization. Following Evans and Evans (2008), viewing science first as a social institution may also help prevent assumptions regarding a presumed sociological conflict between religion and science. This is an empirical question, one advanced through the present study. Second, the empirical studies reviewed here inform the present study in important ways. Granger and Price (2007) found that religious beliefs may impact choices related to the pursuit of science. Scheitle (2005) found that religion may operate perhaps unexpectedly and influence optimism toward potentially risky applied sciences such as biotechnology. Howard-Eucland et. al. (2008) emphasized the role of scientists as idea leaders and differences of belief between elite scientists and the mass public. This study also questions earlier views about religion within the lives of elite scientists. Gauchet's (2008) study offers a set of hypotheses as to why certain religious beliefs may lead to anti-science attitudes. The NSF report (2008) informs the present study both in the construction of variables, and by providing a general guide to the landscape of American attitudes in response to a range of ethical dilemmas brought on through advances in science and technology.

CHAPTER IV

SCIENCE AS A SOCIAL INSTITUION, METHOD, AND APPLICATION OF KNOWLEDGE

When we think about the *where* of science and scientific research, we probably think first of colleges and universities. Colleges and universities have been the primary location of science for some time and have played a lead role in the production of knowledge. These institutions, and places, exhibit a distinctive cultural form and ethos. Today, when thinking of science as a social institution, in addition to academic science, we need to consider another form and brand of science. Ziman (1996) has argued that academic science has changed so rapidly that we must now ask: "what is taking place?" (70). Ziman names this new brand of science: "postacademic science." As a form of knowledge production, postacademic science exhibits distinctive characteristics in comparison to traditional academic science. Ziman writes about the societal forces that have been "pressing on academic science from society at large" (70).

> In effect, the whole enterprise, having grown steady for centuries, has now become too large and expensive to be allowed to go its own way. The governments that mainly fund academic research are putting strict financial ceilings on their patronage, and are trying to get better value for their money. They are insisting that researchers should become more accountable, more responsive to societal needs, more directly concerned about the quality and impact of their products, and so on. The transition to a "steady state" regime is thus imposing on academic science a number of requirements that are quite foreign to its ethos, and thereby transforming it as a cultural form (1996: 70).

Postacademic science has laid the groundwork for a range of new applied sciences. If academic science might be viewed as one mode of knowledge production ("Mode 1"), postacademic science clearly represents another mode of producing knowledge ("Mode 2"; Gibbons et. al. 1994).

> Applied science has expanded so rapidly and diffused so widely that it now greatly exceeds academic science in scope and scale. But it never developed a homogeneous culture. It is distributed in pockets throughout society, and in each pocket it is shaped to fit local practices. Clinical medicine, for example, is a very different profession from engineering, and organizes its research activities very differently (Ziman, 1996: 75).

Describing further, Ziman writes:

> The differences between Mode 1 and Mode 2 are not just signs of a recent change from an old to a new method of knowledge production. They have their roots in the historical distinction between pure and applied research – a distinction that has embodied science carried out in universities and industrial science carried out in industrial laboratories. This gap corresponded to a real cultural difference between two social systems. But these systems were always closely connected and dependent on one another (76).

Ziman argues that the emergence of postindustrial and postacademic science is changing this historical relationship between pure and applied science. As a social institution, science includes both its academic and postacademic forms.

Social Institutions: A Brief Primer

Social institutions guide human interaction and reduce uncertainty (North 1990). The lines between institutions and culture are sometimes clearly, and other times not so clearly demarcated.

> How well do we understand reality? How do beliefs get formed? Whose beliefs matter and how do individual beliefs aggregate into belief systems?

> How do they change? What is the relationship between beliefs and institutions? How do institutions change? How do institutions affect performance? What accounts for the widely varied patterns of performance of economies and polities? And perhaps most fundamental of all, what is the essential nature of the process itself? (North, 2005: 4).

Social institutions are understood here in the more fundamental sense of underlying patterns of social behavior. The demarcation between institutions and organizations is clearer: organizations are real collections of individuals joined together in the pursuit of some organizational goal. Organizations include political bodies, economic bodies, social-cultural bodies (churches, clubs, associations), and educational bodies (North 1990). Organizations are often organized around, or through, underlying patterns of thought and behavior, or "social institutions." While it may be possible to think of social institutions as distinct from "culture," the demarcation between institutions and culture is not always clear. In many ways the demarcation depends on what parts of human life we are going to call "culture," and what parts an "institution." Both North and Mokyr (2002) make this point. Social institutions can be either formal or informal. There may be written rules that state explicitly how behavior is to be structured. Or, unwritten and unstated norms may be the source of influence on behavior. Searle (2010) offers the example of a tribe who clearly recognizes a certain person as their leader, while there are no formal or written documents to prove it. Such informal norms depend on group recognition and "collective intentionality" (Searle 2010).

Social institutions guide social behavior. In making connections between social institutions and human behavior North presents an argument against the traditional rational choice approach (as popularized by economists). There are two aspects of human behavior that North believes are overlooked through the rational choice approach: "1)

motivation; and 2) deciphering the environment" (20). On "motivation," the rational choice approach has dealt with the decision making on the parts of individuals as driven by the maximization of self-interest and rewards. On "deciphering the environment," the issue is one of *knowledge*; and the relation back to the guiding patterns of social institutions. Institutions guide actors through environments, making decisions in response to a range of choices much easier: "...it is the existence of an imbedded set of institutions that has made it possible for us not to have to think about problems or to make such choices. We take them for granted, because the structure of exchange has been institutionalized in such a way as to reduce uncertainty" (1990: 22). Citing Herbert Simon, North brings to light the relationship between the *perceptions* and the computational power of decision makers in relation to the actual/real world. An actor's perceptions and subjective representation of the real world clearly matter, North argues.

> Simon's statement captures the essence of why, in my view, the subjective and incomplete processing of information plays a critical role in decision making. It accounts for ideology, based upon subjective perceptions of reality, playing a major part in human beings' choices (1990: 23).

Questions regarding perceptions and views of reality are tied to questions of belief and knowledge. The next section explores the idea of "useful knowledge."

Moykr on "Useful Knowledge"

Mokyr's theory of "useful knowledge" is helpful in expanding on the relationship between social institutions and the application of knowledge through science. This relationship is an important one when it comes to the matter of *which knowledge* is applied and *made real* through applications and products put out into the social world.

The theory of useful knowledge starts with the separation between knowledge "what" and knowledge "how" (what = propositional knowledge; how = prescriptive, instructive/applied knowledge). With influences from evolutionary epistemology and general selectionist models of culture and technology, Mokyr presents a "selectionist" model of technological choice:

> The rules by which society decides whether to select or reject a given invention are part of its institutional structure. Any change in technology leads almost inevitably to an improvement in the welfare of some and to a deterioration in that of others. …Unless all individuals accept the "verdict" of the market outcome, the decision whether to adopt an innovation is likely to be resisted by losers through non-market mechanism and political activism (2002: 232).

Continuing;

> Historically, a technological choice is made whenever a new technique is proffered, and selectors (firms and households) have to decide whether to adopt it. It might seem that in the vast majority of cases this decision is trivial: if the new technique increases efficiency and profits it will be adopted, otherwise it will not. But few economies have ever left these decisions entirely to the decentralized decision-making process of competitive firms. There is usually a non-market institution that has to approve, license, or provide some other imprimatur without which firms cannot change their production method. The market test by itself is not always enough. In the past, it almost never was (2002: 219).

The selection of new knowledge is subject to resistance from/by more than competitive market forces or individual choices. Opposition to new knowledge and techniques may come from many sources and groups, depending on what's at stake for the invested parties. For example, Glezos (2010) describes the patent system as actually being a highly restrictive practice that limits and channels technological innovation in ways that are deemed acceptable. There may be other, non-social, non-political sources of resistance or opposition to new knowledge as well. Mokyr describes such blockages to new knowledge as having to do more with "system equilibrium." Described here is the

tendency of self-regulating systems to lean toward stability. Technological innovation, no doubt, can be a serious shock to a social system. "Cardwell's Law" refers to the idea that most societies have only been able to withstand rapid technological innovation for relatively short periods of time (2002: 276). On the whole, resistance then may come either through markets, or political/policy decisions. Rostow's (1960) description of the historical resistance to modernization on the part traditional cultures presents a similar theme. Important aspects of the decision to adopt or reject a new innovation is often far beyond the competency of the general public. "Precisely for that reason, there is more reliance on the opinion of 'experts' but also, paradoxically, a frequent appeal to emotions, fears, and religious and nationalist sentiments" (2002: 236).

If social institutions *reduce* uncertainty, it is clear that technical innovation poses a serious threat to *increase* uncertainty. Institutions then can either encourage or discourage the acceptance of new knowledge and technology. Mokyr describes four channels though which institutions shape the development of knowledge in his book, *The Gifts of Athena: Historical Origins of the Knowledge Economy*. The four channels are summarized through the following passages from this text.

1) *The ability of society to generate new propositional knowledge.*

> Quoting:
> What is the research agenda regarding natural regularities, what is motivating it, and which areas is a society most interested in? Many societies in antiquity spent a great deal of time studying the movements of heavenly bodies, which did little to butter the turnips (though it helped work out the calendar). For many generations Jewish sages spent their lives on the exegesis of the scriptures, add much to wisdom and legal scholarship but little to useful knowledge as defined here. Beyond the question of agenda, there is the question of allocation: How many and what kinds of resources are spent on generating this new knowledge? (2002: 290).

2) *The diffusion and tightness of the propositional knowledge generated.*

Quoting:
Who shares in the knowledge, and how many do? What is the culture of access: is knowledge kept secret or inaccessible through impenetrable codes and jargon, or is it publicized as fast and as widely as possible and further disseminated to wider audiences through popularizing books, magazines, and TV programs? How is knowledge tested and "selected"- that is, accepted by the consensus of the people who matter? What criteria exist to determine that a proposition is "true," and what kinds of languages and symbols exist for practitioners to communicate with one another? (290).

3. *The application or "mapping" of propositional knowledge onto the set of prescriptive knowledge or "techniques."*

Quoting:
Institutions set up the payoffs and penalties of innovation, and the likelihood of successful resistance to the innovation to suppress it and discourage others. How will the person who makes the invention be compensated and what other incentives are there to carry out the often dreary and frustrating work of actually making techniques work? Beyond that, the people who are engaged in production need to communicate with those who study nature (290).

4. *The diffusion of the innovation:*

Quoting:
...even assuming that a "mapping" from (propositional knowledge) to (prescriptive knowledge) occurs and an invention is made, will it be adopted? Here the institution on which I focused in chapter 6 is the widely observed social and political resistance of groups within society who might end up being the losers from the new technique or who dislike it for some other reason. Institutions determine whether these groups will be successful, and whether society will put up with the risks and turmoil of creative destruction (291).

How then do social institutions guide behavior and reduce uncertainty? By establishing a body of beliefs that exists "out there" in the world of social-institutional facts; as well as "in here" -in the minds and world pictures of individuals. Each institution functions by guiding social interaction based on established norms of belief and behavior.

Science as Social Institution, Social Process, and Application of Knowledge

Within the empirical sections of this study construction of the variables measuring "science" are based on the presumption that science takes, at least, three forms within society. Science is first a social institution. Within societies, science stands next to other social institutions and vies for public attention and support. The choice to become a scientist, or direct ones career towards fields dependent on science, may also be reflective of its place within a society as an institution. Within mass beliefs, scientists play a key role in informing the general public- as educators, contributors to academic and popular culture media sources, etc. The public can take or leave scientific beliefs and knowledge. As far as it exists as a social institution, science can be viewed positively or negatively. The measures of science as a social institution measure these attitudes. Science is also a social process. It has a set of recognized methods and procedures, discussed below. Finally, science involves applications of knowledge. It is important to consider the different forms science may take within society as to better observe how science as an institution may be held in high esteem, while some of its findings and applications may not be, and vice versa.

Science as a Social Institution

Most people are not scientists. Most people do not make scientific discoveries or contribute to the production of scientific knowledge. Most people do not have direct interaction with science as a social institution. There are really only a few ways then for most people to interact within science as a social institution. The majority of people within a society are limited to a narrow interaction with science. First, people can: 1)

have beliefs, attitudes, and desires about scientific discoveries and products. Second, people can: 2) accept or reject scientific propositions, and/or the real physical products of science. Thinking about the second of these, people do not necessarily have to accept the claims of science. There is nothing forcing people to believe even well-established scientific facts. The same seems to go for the real applications and/or physical products of new knowledge. Even if and when such applications work, people do not necessarily have to use these applications or adopt them into their lives (there may be arguments here though in so far as choices, influence, and even force, goes when it comes to accepting system-wide applications, such as nuclear power for example).

In many ways, people interact with science through their acceptance or rejection of the outputs of science; whether these outputs are propositions or products. People interact with science by way of their beliefs and attitudes toward the institution, and their acceptance or rejection of scientific output. Do these beliefs and attitudes matter when it comes to what science as an institution does or does not do? Do they impact social change and the paths societies take? They would seem to. People's behavior within economies/markets, or the buying and selling of the products of science, and now especially the highly marketed products of "postacademic" applied science, would seem to matter as well.

Today, there remain questions about the place of science as a social institution with broader society; particularly its place in relation to other social institutions: religion, government, law, the university system, and economy- including the increasing role of corporate financing of science- bringing us back to Ziman notion of "postacademic science" (1996; 2000). While religion and science have often been viewed as standing

against one another in the historical record (Jacob 1988), the case has been made that the two weren't always entirely separate social institutions. Stark (2003; 2005) has made this case, focusing on the role of medieval Scholastics in the early formation of Western science. Smith (2003) also writes on the history of the popular view of "warfare" between religion and science. Smith cites works by Stephen Shapin (1996) and, Lindberg and Numbers (1986), as questioning the warfare view between these social institutions. "They show, for instance, that most of the early leaders of the Scientific Revolution were theists, if not Christians, who viewed science and religious faith as mutually reinforcing" (Smith 2003: 10).

Science, as Ziman (2000) describes, is a social institution, but a "peculiar" one. Science involves large numbers of people performing coordinated tasks, but is peculiar according to Ziman because unlike other social institutions; "The peculiarity of science is that knowledge as such is deemed to be its principal product and purpose" (4). On many accounts, science has made the modern world and has shaped modern culture. Yet, Shapin (2007) asks, "Do we live in a scientific world?" And answers; "Assuming that we could agree on what such a statement might mean, there is quite a lot of evidence that we do not now and never have" (436). Shapin suggests that most Americans are unchanged in their general beliefs by the presumed triumph of science over religion that was to have happened over a century past.

> And so one thing we cannot sensibly mean when we say that we live in a Scientific Age or that Science Made the Modern World is that scientific beliefs have got much grip on the modern mind writ large. That just isn't true. Maybe, if we mean anything legitimate at all by saying such things, we mean that the *Idea of Science* is widely held in respect (2007: 439).

It is this "idea of science" that Shapin identifies that is important in understanding public perceptions of science as a social institution. The public perception of science, of course, does not necessarily correspond with the actual practices of science in its different modes, whether academic (mode 1) or postacademic (mode 2). The identification of the "idea of science," though, helps to explain how science might be held in high esteem at the same time as some of its findings and applications are ridiculed and rejected, or vice versa. Shapin describes debates over certain knowledge and belief questions as not being about "antiscience," but instead a contest over what ideas are winners of the designation of science. Shapin writes, "That's a sign that the label "science" is a prize very much worth having" (2007: 439). The marker of science carries great authority.

Ziman's work gives a special importance to trying to define and understand "real science." In the past, he writes, defenders of science could name the ways in which science differed from other knowledge producing social institutions based on its epistemic norms and high standards admissible truth. Is sum, this is the academic ethos of "pure science." This image, however, simply does not hold in actual practice. Ziman does not present a wholly "constructivist," or anti-realist picture of science, as many sociologists of science have. His project, instead, traces the real processes of science as an institution, showing how real science deviates from the idealized image of pure science and the academic ethos.

> The fact is, however, that real science –even the sort of science carried out in universities – is deviating more and more from the long-established academic mode. This must be very obvious to any reader familiar with the present-day research scene. For some of them, the 'academic science' described in the previous chapter must have seemed worlds away. What about intellectual property rights, project proposals and grants, directed programmes, contact researcher, global networks, interdisciplinary centres and teams, research performance evaluation, and so on? Where do these

> new social practices and conventions fit into the academic ethos? (2000: 59).

Science as a Method and Social Process

Science is a social practice. It would be more alarming if it weren't; if it were driven by some foreign force beyond the control or foresight of human beings. Constructivist sociologists of science have glamorized the idea of science as a "social construction." The effort has been to undermine science as a distinctive and superior way of knowing. Some equate the suggestion that science is a superior way of knowing to cultural imperialism and even sexism and racism (see Sismond 2003 and Stehr and Meja 2005 for an overview of this literature). For some constructivists, science is nothing more than an execution of power politics. The constructivist vision of science as being nothing more than powerful interests and politics ignores, however, the reality of discovery. Seen pragmatically, special interests may in fact be even more driven by real and actual discoveries. Scientific practice, like any other social institution, is full of error. "Scientific life would not be human if it were not permeated with folly, incompetence, self-interest, moral myopia, bureaucracy, anarchy and so on" (Ziman 2000: 5). Ziman maintains that while these are concerns that shape the practice, the epistemic norms of science distinguish it from other forms of knowledge production. Ziman emphasizes that scientific knowledge is the result of a systematic process:

> Epistemological naturalism also emphasizes the *dynamism* of science. Even the knowledge it generates is continually changing. The noun 'science' is closely identified with the verb 'to research', indicating that it is an active *process* (2000: 7).

Understood this way, science is an ongoing process. It is provisional, and ideally dynamic and adaptive to changes in evidence and information. Science a social process depends on accepted methods. It is interesting that the methods of science are often widely agreed upon across diverse interest groups. Shapin (2007) quotes Dworkin, who notes: "Almost all religious conservatives accept that the methods of empirical science are in general well designed for the discovery of truth..." (Dworkin, 2006: 24; 2007: 438). In generating knowledge, science depends on shared norms and epistemic practices. Between research communities (or Kuhn's "paradigms") differences definitely do arise when it comes to the details of these norms and practices. Shapin argues that there has never been a consensus on the details of the scientific method. As an ideal, the epistemic norms that would seem universal to scientific knowledge include a commitment to evidence over speculation, repeatable results, and the connection of facts to explanatory theories. Still, while complete agreement of the details of the method vary and are a real concern, and may vary in respect to different research communities, the point here is that the generation of scientific knowledge requires *some form* of shared and agreed upon method for it to be recognized and carried out as a social process.

Science as an Application of Knowledge

Science is in the service of knowledge. Since Plato, "knowledge" has been understood as justified true belief (Goldman 2002). Ziman writes, "And beliefs are, of course, the very stuff of scientific knowledge" (2000: 306). Knowledge requires belief- but belief of a special sort: justified belief. For a belief to count as knowledge it must be justified through a reliable process of testing (Goldman 2002). Science tests belief.

Through a reliable process of testing, some beliefs may be deemed justified, while others not. Scientific knowledge, as justified true belief, may make its way to mass publics, and influence the beliefs of large groups at the aggregate level, but not necessarily. While scientific knowledge possesses the potential to influence and shape widespread belief, it is an open question as to whether or not larger groups will accept the beliefs of science as their own. The beliefs of science, even when convincing by reliable methods, do not always convince mass publics. Steven Shapin quotes Alfred North Whitehead below, where a standard picture of direct influence is presented;

> Science "has altered the metaphysical presuppositions and the imaginative contents of our minds…" Born in Europe in the sixteenth and seventeenth centuries, its home is now "the whole world." Science, that is to say, travels with unique efficiency: it is "transferable from country to country, and from race to race, wherever there is a rational society" (Whitehead, [1925] 1946: 2; Shapin 2007: 434).

Scientific knowledge has the potential to shape widespread belief and belief systems; but only where such knowledge is accepted, and adopted.

The same is case for applied knowledge, it must be adopted if it is to be useful and have an impact on large groups, or societies. Applied knowledge usually yields more direct benefits as compared to non-applied or propositional knowledge. Applied knowledge in the form of real world techniques, machines, and computer networks posses the ability to shape whole economies. When science is in the service of not just knowledge, but applied knowledge, the emphasis is on utility; "what can this knowledge do for us?" Ziman sees the utility aspect of scientific knowledge as increasingly shaping the nature of science, both as a social institution and social process. Ziman has written extensively on the notion of "post-academic science." Post-academic science is believed

to be the emergent model of science, shaping how science gets done. Post-academic science is shaped foremost by the prospects for the science to yield direct applications:

> In effect, post-academic science is under pressure to give more obvious value for money. Many features of the new mode of knowledge production have arisen 'in the context of application' – that is, in the course of research on technological, environmental, medical or societal problems. More generally, science is being pressed into the service of the nation as the driving force in a national R&D system, a wealth-creating techno-scientific motor for the whole economy (2000: 73).

The idea of "useful knowledge" (Mokyr 2002) captures these thoughts well. Direct applications of knowledge build products and whole economies. The economic dimension of this brand of science is as clear now as it was in the past; as Mokyr writes, useful knowledge is what we use in our game against nature. Returning to some of the thoughts at the start of this section on economy and ontology, the role, or question, of ethics in all of this is also difficult to avoid. On utility, Ziman writes:

> Utility is a moral concept. It cannot be determined without reference to more general human goals and values. Scientists cannot be expect to be more on the alter for potential applications of their research whilst closing their minds to ethical considerations. (74).

When it comes to direct applications of knowledge such as stem cell research, or the ambitious discoveries of Craig Venter in creating synthetic biofuels, for markets the question is still one of adoption or rejection. Will market or non-market forces influence their adoption? As applications of knowledge, these new techniques may shape entire research fields, and possibly economies. The economic incentives would seem to be clear for both. Potentially, both could lead to tremendous economic growth, not to mention medical therapies for a range of ailments in the case of stem cell science. Will such technologies be widely adopted or rejected? Will religious belief influence the adoption of such techniques within the public sphere and market economy?

CHAPTER V

THE CULTURAL SIGNIFICANCE OF STEM CELL RESEARCH: A CASE STUDY OF RESPONSES TO NEW SCIENCE ACROSS WORLDVIEWS

This chapter considers some of the different reactions within the United States to new science. Specifically, the stem cell debate is explored within this chapter. Americans seem conflicted over the permissibility of this new brand of science. Stem cell research is one of the so-called "culture war" issues within the United States. Some of the recent events surrounding stem cell research are highlighted within this chapter along with key policy decisions on the part of the U.S. government. Some of the ways in which stem cell science has been applied through treatments are also considered within this chapter. These cases depict how far, and perhaps how widely accepted, certain stem cell treatments have already become over a relatively short period of time.

The second section of this chapter is dedicated to a case study of some of the ideological responses to advances across the life sciences. The positions covered in this section reflect different cultural orientations toward some of the new developments within the life sciences. There are different visions of the future in so far as the permissibility of the application of certain of these new sciences. There are different views regarding which advances should be embraced and which should be rejected, banned, and/or prohibited. A case study of emergent ideologies in response to new science illustrates that there are diverse and conflicting ideas about which applications

should be embraced, and which rejected. The case study that follows reviews some of the positions of well-known idea leaders and ideologues.

The sociological question of this study is whether or not there are different groupings of attitudes- based on religious worldview, when it comes to feelings about science: as a social institution, a method, and an application of knowledge. An aspect of this question regards the interesting relationship between idea leaders, a small group of influential elites, and the attitudes of the mass public. Converse (1964) was instrumental in identifying the differences in the consistency of belief between "ideologues" and "mass publics." Mass publics rarely seem to show a consistency of belief in the way that an ideologue does. Influential idea leaders and ideologues are much more likely to hold to a well-defined belief system and a consistent set of attitudes. The question here is: what are some of the different worldviews available to ideologues and mass publics?

Stem Cell Research: Current Events and Recent Cases

As one of the most publicized of the life sciences, stem cell research has generated considerable cultural, as well as legal, controversy. Stem cell science has been one of the key issues within the "culture wars" of the United States (Segerstrale, 2000). Reactions to stem cell research have been mixed. Within the United States, stem cell science has taken on a cultural as well as religious significance.

Stem Cell Science in the News, Popular Culture and Legal System

Some very high profile cases of stem cell treatments have made the news recently. The funding and legality of stem cell research has been up in the air over the past few years. A recent timeline of stem cell policy in the U.S. illustrates a clash of political interests. During the Bush era, 2001-2009, stem cell research was restricted to existing embryos; embryos created for reproductive purposes, and embryos given informed consent, and not induced by financial incentives. In 2009, President Obama issued the executive order: "Removing Barriers to Responsible Scientific Research Involving Human Stem Cells." In August 2010 President Obama's executive order was placed under injunction by Judge Royce C. Lamberth of the U.S. District Court for the District of Columbia. The reason for the injunction was the ban on federal money spent for the destruction of human embryos. In September 2010 the United States Court of Appeals lifted the injunction. A recent ruling by U.S District Court Judge Royce Lamberth, July28 2011, allows the National Institutes of Health to continue funding human embryonic stem cell research (AAMC.org, 2011).

Recent Stem Cell Treatments

News stories of new stem cell research and treatments have been widespread in recent times. For example, the BBC reports that trials at Glasgow's Southern General Hospital involving the use of stem cells in the treatment of stroke patients were a success; leading to scheduled plans to move on to the next phase of research on new patients

(BBC, 2011). Stroke is one of many ailments that stem cell science and treatments might be applied to.

One of the most dramatic examples of a recent stem cell treatment was the successful transplant of the first synthetic windpipe performed on a patient suffering from tracheal cancer (which took place on June 9, 2011). The synthetic windpipe was created in a lab using the patient's own adult stem cells. A similar procedure was performed in 2008 on a female patient, also using the patient's adult stem cells. The latest procedure marks an advance in technique in that it involved the creation of an entirely new organ from a patient's adult stem cells (Reported by Madison Park, 2011).

Stem cell treatments may also see a dramatic rise within the sports world, if the case of Batolo Colon is any indication. The news outlet Slate reports that in April 2010 the baseball pitcher Bartolo Colon underwent a stem cell procedure in order to repair tissue in his shoulder and elbow. Using his own adult stem cells, doctors took fat and bone stem cells from other parts of Colon's body and implanted them within his shoulder and elbow. Before the procedure, the pitcher's career was said to be over. While some question whether his revived health was the product of the stem cell procedure or the suspected use of human growth hormone, if procedures such as this are viewed as beneficial they are likely to gain in popularity over the coming years. The well-known American football player Peyton Manning has reportedly also undergone a non-embryonic stem cell procedure that has not been approved within the United States, reports Brian Palmer of the Los Angeles Times, 2011.

Finally, perhaps one of the most interesting cases of a recent stem cell procedure as far as this study goes involves the current Governor of Texas, Rick Perry. Rick Perry's

case plays out as exemplary of some of the themes from this study. Rick Perry is a political conservative whose strong religious convictions are well documented. He has made his attitudes toward prayer, the inerrancy of the Bible, and intelligent design well-known through his political speeches. Rick Perry is pro-life, and opposes government funding of abortions. In 2003 he signed the Prenatal Protection Act, which includes fetuses in the definition of human life. All of the aforementioned information is publicly available.

What makes this case so interesting is that Rick Perry recently underwent a stem cell treatment to treat a back condition. Amanda Chan reports:

> For the procedure, doctors took Perry's own fat cells to grow stem cells in a lab. Then, those cells were injected back into Perry via a spinal fusion, with hopes that the cells would speed up the recovery of Perry's back problems, according to news reports (from the Huffington Post, 2011).

While Rick Perry's procedure did not involve the use of embryos, given his religious convictions, it raises some questions nonetheless. Is there a conflict (ethical or logical) between Rick Perry's religious convictions and his decision to undergo a stem cell procedure? Would his religious convictions have prevented him from undergoing a stem cell treatment if human embryos had been involved? Maybe, but even in cases where no human embryos are harvested ethical questions persist from the vantage point of some religious worldviews. This matter is considered next.

Stem Cell Science: Embryonic, Adult, and Pluripotent Stem Cells

The last three of these examples of stem cell procedures involve the use of adult stem cells, not embryonic stem cells from human embryos. Adult stem cells may prove to

be less controversial than embryonic stem cells- simply for the reason that human embryos are not involved, but this is yet to be played out within the public and cultural debate. Another way in which some of the controversy surrounding the source of stem cells might also potentially be thwarted is through the use of stem cells from skin cells. New techniques involving the use of "induced pluripotent stem cells" (iPSCs) from skin cells have been developed recently, which are also non-threatening to human embryos. The use of stem cells from other sources than embryos may alter the ethical and legal debate, but again, this is still unknown, as Hochedlinger (2010) suggests. As for now, researchers do not yet have a full understanding of the workings of iPSCs, and embryonic stem cells are still at the center of the stem cell research policy debate.

In the broader picture, even if new techniques involving skin cells were to be successfully developed, the ethical debate may not simply go away, as Hochedlinger explains:

> Injecting iPSCs into a developing mouse embryo yields a chimeric animal that displays the presence of foreign cells in its mixed coat colors. The same technique could, in theory, create a chimeric human embryo; iPSCs could also theoretically generate sperm and eggs to produce a human embryo through traditional in vitro fertilization. The pluripotency of iPSCs thus could raise some of the same ethical issues as human embryo research (2010: 52).

Hochedlinger's article includes pictures of a mouse with a patchwork of coats- revealing multiple cellular origins (i.e. multiple progenitor mice). This particular mouse is the product of a splicing together of cells from a number of different mice to create a single new mouse. It would seem that the creation of such a mouse raises a set of ethical, as well as ontological, questions not easily answered- especially from theistic worldviews.

The Ascendance of Stem Cell Research as an Issue of Cultural Significance: Promises and Risk

When former chairman of G.W. Bush's Council on Bioethics Leon Kass was asked in an interview with Francis Wilkinson; "Why did stem cells become the dominant bioethical issue?" his response was:

> Stem cell research was everybody's Public Issue Number One- God knows, really, why. Partly as a legacy of the way the abortion decisions came about in this country and the degree to which abortion is important in American politics, killing and destruction-of-life questions have come to be regarded as *the* bioethical questions, whether it's euthanasia at the end of life or abortion and embryo destruction at the beginning (2008: 65).

Today, stem cell research remains a source of cultural debate. There remains question however, if the cultural and ideological positions within the debate will stand and hold ground when it comes to the mass public, or if these are debates for ideologues alone.

In the bigger picture, stem cell research is one of many advances within the life sciences, offering promises as well as risk. The issue of risk is particularly interesting in the case of stem cell science. Opposition to stem cell science, presumably, starts with definitions of life. In the case of embryonic techniques, the opposition would seem to come from the taking of embryonic life- which opponents believe to be a human life- given by God. The risk to the individual life then is clear from this position. The risk inherent in stem cell research seems of a different kind in comparison to say, nuclear power (see Allhoff 2009 for a discussion of risks inherent in emerging technologies).

Case Study: Responses to New Science from Different Worldviews

In this section some of the responses to new sciences including stem cell research are considered. The following is a brief case study of some of the emerging ideological positions that are developing in response to advances across the life sciences.

Scientism and Transhumanism

Ray Kurzweil is one of the best known and most outspoken proponents of accelerating the rate of technological advance. Kurzweil presents an ideological commitment to speeding up technological change through his advocacy of the rapid adoption of life-altering applications, machines, and devices. In *The Singularity is Near: When Humans Transcend Biology* (2005) Kurzweil defines a future period in which the pace of technological change will be so rapid and profound that human life will be irreversibly changed. Looking back over the history of technology and human life, Kurzweil's vision is one of exponential and limitless transformation. The epoch of "Singularity" will be one in which humans transcend biology and redefine the basis of life. Kurzweil writes that he is aware of the criticisms his vision provokes. He also writes of the potential risks. Kurzweil's ethical position rests on the principle that the most important aspects of humanity are not lost through new genetic, nanotechnology, and robotics technologies. Instead, he believes that these and future technologies will refine the best of human traits. Taken as a whole, Kurzweil's vision is not really as radical as his hyperbole may suggest. His stance on scientific progress is widely shared by the

scientific research community. A case in point is the recent discovery/invention of a synthetic organism by Craig Ventor's research company Synthetic Genomics. Ventor's research team is responsible for the first man-made and self-replicating species "whose parent is a computer" (McAuliffe, 2011: 19). While the general public may be shocked and largely unaware of such developments, there were no ethical or religious-based holds or blocks on this brand of life-altering science. Exxon Mobil, in fact, is quite interested in seeing this discovery realized and applied through the production of biofuels.

Sources of Opposition: Humanist and Theist

In contrast to Kurzweil's predictions of an accelerating rate of technological change, Francis Fukuyama presents a different vision for the future in his book, *Our Posthuman Future: Consequences of the Biotechnology Revolution* (2002). For Fukuyama and like minded critics the biotechnology revolution has brought with it an unprecedented moral dilemma. The Catholic Church and conservative Protestant groups have taken a strong stance against many biomedical technologies; such as birth control, in vitro fertilization, abortion, stem cell research, cloning, and prospective forms of genetic engineering. Fukuyama's straightforward solution to the moral dilemma brought on by the benefits and threats of biotechnology is regulation through powers of state-governments. Based on the track record of state-governments in regulating other aspects of the global free-market, one wonders how successful this plan might be.

Economist and activist Jeremy Rifkin (2004) is also critical of unregulated technological change. He predicts that human life will undergo more change in the next

several decades than in the previous thousand years. One of Rifkin's major concerns is with patenting life through the mapping of genetic blueprints. He speculates that genes will be the raw material resource of the new economic epoch. The merger of molecular biology and international commerce possess the possibility of transforming genetic knowledge into what Rifkin has called "green gold."

Jürgen Habermas has also raised a number of issues in the debate over the future of biotechnology. In his *The Future of Human Nature* (2003), a primary problem raised is that of a secular or non-religious ("postmetaphysical") response to the question of biotechnology. For Habermas, "what is the good life?" is the question hovering over the discussion about the biotech revolution. His concern is the ethical and moral foundation upon which secular communities come to consensus on controversial issues such as genetic screening and gene therapy. While such techniques offer the possibility of treating hereditary diseases, they also offer the possibility of "liberal eugenics," with choices over gene-modification being made based on individual preferences and market forces.

Habermas extends scrutiny of biotechnology through the perspective of "self-instrumentalization." From this view, human life is "instrumentalized" through practices such as cloning, the harvesting of replacement body parts, and the creation of designer babies. Arthur Kroker has characterized these trends as representative of a "culture of nihilism," and draws upon Nietzsche and Heidegger in exploring the seemingly innate drive toward the "will to technology" (2004).

Theistic Responses

Considering the potential upheaval surrounding advances across the sciences, we might expect stronger public opposition behalf of interest groups, particularly those representing theistic worldviews. One theist's response to some of these issues comes from philosopher and Easter Orthodox theologian David Bentley Hart. These ideas exemplify one cultural response to new developments across the life sciences. It is difficult to say, however, whether or not theists from other faiths and backgrounds share all of Bently Hart's positions. Statements from some conservative evangelical Protestants, such as U.S. politician and Texas Governor Rick Perry would suggest a similarity of positions, however. Arguing through John Paul II's *Theology of the Body*, Hart has written:

> Not only is every abortion performed an act of murder, but so is the destruction of every "superfluous" embryo created in fertility clinics or every embryo produced for the purposes of embryonic stem cell research. The fabrication of clones, the invention of "chimeras" through the miscegenation of human and animal DNA, and of course the termination of supernumerary, dispensable, or defective specimens that such experimentation inevitably entails are in every case irredeemably evil. Even if, say, research on embryonic stem cells could produce therapies that would heal the lame, or reverse senility, or repair a damaged brain, or prolong life, this would in no measure alter the moral calculus of the situation: human life is an infinite good, never an instrumental resource; human life is possessed of an absolute sanctity, and no benefit (real or supposed) can justify its destruction (2005: 65-66).

Further along, on the broader issue:

> The far antipodes of John Paul's vision of the human, I suppose, are to be found at the lunatic fringe of bioethics, in that fanatically "neo-Darwinist" movement that has crystallized around the name of "transhumanism." A satirist with a genius for the morbid could scarcely have invented a faction more depressingly sickly, and yet- in certain reaches of the scientific community- it is a movement that enjoys some real degree of

> respectability. Its principle tenet is that it is now incumbent upon humanity to take control of its own evolution, which on account of the modern world's technological advances and social policies has tragically stalled at the level of the merely anthropine; as we come to master the mysteries of the genome, we must choose what we are to be, so as to progress beyond Homo sapiens, perhaps one day to become beings – in the words of the Princeton biologist Lee Silver – "as different from humans are from… primitive worms" (which are, I suppose, to be distinguished from sophisticated worms). (2005: 67).

Hart contends that:

> Transhumanism, as a moral philosophy, is so risibly fabulous in its prognostications, and so unrelated to anything that genomic research yet promises, that it can scarcely be regarded as anything more than a pathetic dream; but the *metaphysical* principles it presumes regarding the nature of the human are anything but eccentric (69).

> Obviously none of this would interest or impress the doctrinaire materialist. The vision of the human that John Paul articulates and the vision of the "transhuman" to which the still nascent technology of genetic manipulation has given rise are divided not by a difference in practical or ethical philosophy, but by an irreconcilable hostility between two religions, two metaphysics, two worlds- at the last, two gods. And less than the moral nature of society is at stake. If, as I have said, the metaphysics of transhumanism is inevitably implied within such things as embryonic stem cell research and human cloning, then to embark upon them is already to invoke and invite the advent of a god who will, I think, be a god of boundless horror, one with a limitless appetite for sacrifice. And it is by their gods that human beings are shaped and known (2005: 71-72).

David Bently Hart's views are stated clearly above. It would seem difficult to reconcile his position with an open acceptance of certain brands of stem cell science; specifically those that involve the harvesting of human embryos.

Another theistic view is presented by Christian and critic of technology Paul Virilio. Virilio warns of the threat of the "genetic bomb" in his book *Crepuscular Dawn* (2002; with Sylvere Lotringer). Virilio has coined an entire vocabulary of terms to describe the history and trajectory of technology. He thinks the history of technology

through three revolutions: the revolutions in *transportation*, *transmissions*, and now *transplants*. His critique bears some similarity with Fukuyama's, at least in the regard of upholding the sanctity of the human body. He does not believe that human beings are capable of existing outside of their *territorial*, *social*, or *animal* bodies. Virilio's dire predictions are directed toward the "extreme sciences." He sees this brand of science as promoting the practices of "absolute eugenics," "artificial selection," and the creation of super-human "genetic robots"—all of which he considers to be endemic of the "militarization of science," leading us toward the potential of a "Total Accident."

New Science: Understood through Religious or Secular Metaphysics? Identifying Worldview Types

Theism and naturalism present different worldviews. Theism rests on view that a God exists, who governs the universe and gives meaning to human life. Naturalism rests on the view that the universe is governed by natural laws and forces apart from the control of a hands-on deity. Some believe the two worldviews might be reconciled. Strong leanings toward one worldview over the other, though, reflect different visions, and potentially attitudes, toward the world and how one should live within it. Advances across the life sciences offer new applications never seen before in human history. How will such advances be understood by mass publics: through religious or secular metaphysics? The answer to this question may help to answer some of the questions surrounding the debate over secularization. New science raises questions not only how to make sense of natural reality, but also questions about which sciences should/will be applied, and how they will be given meaning with social reality.

In response to these question areas, it is speculated that the attitudes and beliefs of individuals will gravitate toward certain worldviews. Theism is a philosophical position. It is also presumed to be a real sociological category and worldview in answering life's big questions. Theism represents one response toward making sense of potential new worlds and forms of life brought on by new knowledge. Naturalism is also a philosophical position. It represents another response toward makings sense of scientific change. Individuals who combine theist and naturalist worldviews might be thought of as representing a form of dualism[5]. Skepticism is another philosophical position that is also presumed to reflect a certain approach to the knowledge-claims of both religion and science. Skeptics seem reluctant to openly accept any doctrinal belief. Many critics of science are presumed to take a negative position toward the claims of even well-received scientific knowledge. They are equally unlikely to have strong religious affiliations.

From here, the empirical research questions of this study are: will these presumed worldviews be reflected as sociologically real categories based on measures of attitudes and beliefs? And, will attitudes toward science differ by religious worldview?

[5] While the term as used here may not reflect all of its philosophical uses.

CHAPTER VI

DATA AND METHOD

The empirical sections this study work with 2006 General Social Survey data. The first step in this study was to examine patterns within the GSS data. A recent report compiled by the National Science Foundation which also worked with 2006 GSS data, (*Science and Engineering Indicators 2008; Chapter 7, Science and Technology: Public Attitudes and Understanding*); was very helpful in identifying which topics and measures to focus on within the GSS data. During a preliminary examination of 2006 GSS data certain patterns emerged in response to certain research questions. Interestingly, some of the starkest contrasts were found in responses to questions that probed some very basic, or fundamental, aspects of a person's worldview. There were some very clear differences in the groupings of responses to certain questions from the survey. Strong differences in responses were found in particular with specific measures of religious belief and scientific knowledge. These differences are presumed to reflect distinct religious worldviews and ideological positions found across American society and culture. The four worldviews identified are: "Theism," "Naturalism," "Skepticism," and "Dualism." These worldviews were constructed based on the patterns found within responses to certain GSS questions probing religious belief and scientific knowledge. The construction of these worldviews through GSS data is described in detail below. Following this description, empirical results are discussed. This study measures *attitudes toward science* across four *religious worldviews*. This study measures attitudes toward science in three

forms: 1) science as a social institution; 2) science as a method and social process; and 3) science as applied knowledge.

Data Source

This study examines religious worldviews and attitudes toward science through 2006 General Social Survey data. The GSS regularly measures religiosity. In addition, the 2006 GSS also includes a module dedicated to science. The 2006 science module probes important issues surrounding science and technology. It measures attitudes toward potential benefits and harms of science and technology, including attitudes toward specific issues facing the public: covering global warming, embryonic stem cell research, and genetically modified foods. A number of demographic indicators are also regularly measured through the GSS survey.

Variables

This study examines relationships between religious worldview and attitudes toward science. This study treats "religious worldview" as the independent variable. The dependent variable is "attitudes toward science." Direct causation between the independent and dependent variables is not assumed. The purpose of the study is to examine the question of whether or not people with different worldviews might express different attitudes toward "science" – where is understood as taking three forms. The research question is: *do attitudes toward science (as an institution, process, and application) vary by religious worldview*?

Religious worldview includes broad notions related to an individual's ultimate world picture. When an individual's worldview does not have a specifically "religious" basis, a better label and fit might be "metaphysical," "cosmological" or "ontological" worldview.

Regarding the dependent variable "science," whereas science is often thought of and measured as a single/unified variable, science is understood here as taking three forms. Accordingly, it is measured through three distinct sets of variables. The dependent variables were constructed with this in mind and to reflect the three forms that science is proposed to take; as described below.

Independent Variables

Religious worldview is treated here as the independent variable. The construction of the variable measuring religious worldview follows from a review of the literature on religion and secularization. A case might made that the construction of the variable for "religious worldview" is specific to the cultural environment of the United States. Let the reader be the judge. The construction of the variable for religious worldview is based on the following assumptions. A person's religious world picture is presumed to lean toward either God-first explanations of the world; and/or nature-first explanations of the world. People who see the world through God-first explanations share a theistic worldview. People who see the world through nature-first explanations share a naturalistic worldview. Of course, there may include cross-over, or dualistic explanations. The two primary variables then within the construction of the variable for "religious worldview" are: "theism" and "naturalism." Theism and naturalism reflect fundamentally

different perspectives on the nature of the universe and life on earth. The first task of this study was to identify indicators from GSS data that would adequately reflect theism and naturalism as worldviews. These two variables were then constructed to form a single measure of "religious worldview." From this measure, four groups were constructed based on respondents' attitudinal commitments to theism and/or naturalism as a worldview. Variables were recoded to reflect high and low commitment to the respective world pictures.

On the construction of the four worldviews, respondents with a high commitment to theism and low commitment to naturalism were identified as "Theists." Respondents with low commitment to theism and high commitment to naturalism were identified as "Naturalists." Respondents who reported low commitment to both theism and naturalism were identified as "Skeptics." Respondents with high commitment to both theism and naturalism were identified as "Dualists."

The design of the independent variables is summarized below. This study attempts to overcome some of the problems associated with quality measures of religiosity. The focus here is on simple, yet meaningful measures of religious-ontological worldview. For example, with the GSS variable "GOD," a range of response options are provided, each with a clear and distinct meaning. The difference between the answers, "I don't believe in God"; and "I know God really exists and I have no doubts about it" are two very different answers. Within the middle of the response range, however, are options available to respondents which may reflect the "graded" rather than "binary" nature of belief- even in the existence of God. While answers to questions of religiosity such as: "do you believe in God" would seem to have a clear cut binary answer ("yes" or "no"), there are

arguments that within human cognition belief is not always so clear cut or binary. There are strong arguments that many beliefs come in "graded" and/or "fragmented" packages (Egan 2008).

These considerations further substantiate the use of simple and unambiguous questions- which include a range of responses reflective of a person's relative commitment and/or certainty of belief. Even when and if beliefs are graded, they are still presumed to reflect different worldviews and commitments. These kinds of general, yet meaningful, measures are believed to be clear markers of individual attitudes and belief. Responses to meaningful questions, such as a person's beliefs on the existence of God, or questions probing naturalism such as the truth of the Big Bang and human evolution, are presumed to be highly reflective of existing worldviews within the United States. With variable construction then, emphasis is on simple, yet revealing, indicators that reflect clear boundaries of belief and worldview.

Independent Variable Construction: Theism and Naturalism

Many of the GSS measures take gradation of belief into consideration. The measure of belief in God allows for gradations of certainty. The GSS question reads:

> 369. Please look at this card and tell me which statement comes closest to expressing what you believe about God.

Possible answers: "I don't believe in God" [1]; "I don't know whether there is a god and I don't believe there is any way to find out" [2]; "I don't believe in a personal God, but I do believe in a higher power of some kind" [3]; "I find myself believing in God some of the time, but not at others" [4]; "While I have doubts, I feel that I do believe in God" [5];

"I know God really exists and I have no doubts about it" [6]. The last of these statements expresses complete certainty in the existence of God, while the first of these expresses a lack of belief in God, with some gradation across the middle of this spectrum. This measure, "GOD," was one of the measures used in the construction of the variable, "Religious Certainty." The next measure of religious worldview is a measure of religious affiliation ("RELITEN" from the GSS data). The question asks respondents:

> 107. Would you call yourself a strong (PREFERENCE NAMED IN Q.104 OR 104 – A) or a not very strong (PREFERENCE NAMED IN Q.104 OR 104 – A)

This question is asked after the religious preference of the respondents identified through question 104 regarding religious preference. Answers to this question: "Strong" [1]; "Not very strong" [2]; "Somewhat strong" [3]; "No religion" [4]; responses "Don't know" [8] and "No answer" [9] were not included with this measure. The next measure of religious certainty deals with the question of God's role as judge of human behavior. Those with a theistic worldview are understood here to view God as an active agent in the world and an active arbiter of human behavior. To measure this quality of belief in God as active in the world and as a judge of human behavior, a measure of attitudes toward the role of God as a judge of sin was selected. The GSS variable name is "PUNSIN." The 2006 GSS question reads:

> 374. Please consider the following statements and tell me whether you agree strongly, agree somewhat, disagree somewhat or disagree strongly with each statement – Those who violate God's rules must be punished.

Responses: "Agree strongly" [1]; Agree somewhat" [2]; "Disagree somewhat" [3]; "Disagree strongly" [4]. Responses "Don't know" [8] and "No answer" [9] were not included with this measure.

These measures (the existence of God, strength of affiliation, and the punishment of sin) were recorded so that they followed the same order from low to high degrees of certainty. Higher scores on each of these indicate greater religious certainty, or "Theism." Through factor analysis [see appendix with factor scores], responses were divided into low and high categories based on factor scores. Theism is understood here, and designed as such, to as an inclusive measure of a basic belief in the existence of God, as well as a basic measure of respondents' commitment to their particular religion or denomination. Lastly, another important aspect of theism is the view that God takes an active role in this world. Punishment of sin is a measure of this notion. The theism variable is designed as a basic measure of certain core beliefs that all theists are assumed to share: the belief in God, his active role in the world, and a personal commitment to a religion. Theists are thought, at minimum, to believe in the existence of God, have strong affiliations in accordance with their religious preference, and believe in an active God as a judge of human behavior. The Theist group is designed not just through high scores on these indicators, but also through low scores on indicators of naturalism. Theists are understood here as opposed to purely natural, or creator-free, explanations of the origins of the universe and life on earth (consistent with the recent statement made by Pope Benedict XVI that God was behind the big bang).

For the second constructed variable, "Naturalism," two measures are believed to be especially important as indicators of a worldview centered on naturalism. Naturalism, as understood here, is characterized foremost by the view that the universe and life on earth have emerged as the result of natural processes and causes. While there are arguments on the compatibility of theism and naturalism, naturalism is understood here

as a worldview that does not rely on a causal agent or creator God in explanations of life on earth and the workings of the universe (while the existence of God may not be excluded; i.e. Deism). The measures that are especially important in this understanding of naturalism are attitudes toward the big bang theory of the universe and evolution. In the 2006 GSS, the big bang and evolution are measured as scientific knowledge questions. As mentioned in the summary of the NSF report, the number of Americans who answered knowledge questions about the big bang and evolution correctly was comparatively low in relation to certain/select other countries [as cited within the chapter on empirical studies]. Here however, there is presumed to be more involved in the answering of these questions than just respondents "knowledge" of these areas. Even in cases where respondents are unaware of these scientific theories, revealed is something important about these respondents' worldviews. Commitment to the truth of evolution and the big bang are believed to be indicative of a worldview based on scientific naturalism. As belief systems, however, theism and naturalism are not necessarily mutually exclusive. The philosophical question of their compatibility is not the sociological question. As Converse (1964) writes, mass beliefs are not always ideologically consistent. For example, the worldview category of "Dualists" is a case in point. With this group, strong commitments to both theism and naturalism are found.

In the group category constructions, "Naturalists," show a commitment to both the big bang theory of the universe and evolution as scientific knowledge questions. In addition, they show a low commitment to theism. The questions from the 2006 GSS for the evolution variables "BIGBANG" and "EVOLVED" read:

> 1044. Now, I would like to ask you a few short questions like those you might see on a television game show. For each statement that I read,

> please tell me if it is true or false. If you don't know or aren't sure, just tell me so, and we will skip to the next question. Remember true, false, or don't know.
>
> G. The universe began with a huge explosion. (Is that true or false?)
>
> I. Human beings, as we know them today, developed from earlier species of animals. (Is that true or false?).

Available responses for both are: true, false, don't know, refused. For the evolution question answers from the 2006 GSS were: [True = 779; False = 791; Don't Know = 290; Refused = 4]. For the big bang, answers were: [True = 590; False= 633; Don't Know = 639, Refused = 2].

As reflected through factor analysis, respondents typically answered these two questions in the same way – if "yes" on big bang, typically "yes" on evolution as well [see appendix for factor scores]. This relationship supports the conceptualization of these two variables as reflective of a world picture centered on naturalism. For these measures, answers are either "True" or "False." Respondents' scores on the naturalism variable are based on their answers to these questions. While people who answered true to these questions may also have religious commitments (in the case of Dualists); the combination of a strong commitment to naturalism and low commitment to theism is believed to be indicative of a particular worldview centered on scientific naturalism.

The conceptual, and importantly sociological, difference between the "Naturalist" and "Dualist" categories needs to be emphasized. As understood here, naturalists hold commitments to the big bang and evolution theories, without strong religious commitments. While this is very a simplistic categorizing of ideologically based groups, this category is thought to reflect sociologically real groupings of attitudes and worldviews. In the case of "Naturalists," this group is thought to be unified by a commitment to natural explanations in addition to a low commitment to theism. The

"Dualists" category is also thought to reflect a sociologically real category of people. This group is distinct from both Naturalists and Theists in their attitudes and beliefs. This group has high scores on both measures of theism and naturalism. This group holds both a strong religious commitments and a commitment to the scientific truth of the theories of the big bang and evolution. The exact theology and philosophy behind how these worldviews are made compatible is not addressed within this chapter.

For the "Skeptics" group, this category is also thought to reflect a sociologically real set of attitudes and beliefs, and real collection of individuals. As Robert Merton characterized science, skepticism is in part an aspect of science. The brand of skepticism measured here, however, is more reflective of the rejection of any received or doctrinal belief- whether it comes from organized science or religion. This brand of skepticism rejects the big bang theory of the universe and biological evolution; two widely accepted theories of modern day science. This group shows a low commitment to both naturalism and theism.

Dependent Variable Construction: Science in Three Forms

The dependent variables measure attitudes toward science. The variables were constructed to be reflective of three aspects or forms of science. The three forms of science measured are: 1) *science as a social institution*; 2) *science as a method or social process*; and 3) *science as applied knowledge*. The 2006 GSS has clear measures for each of these aspects of science. These variables are designed to gauge attitudes toward science in three forms and are described below.

Science as a Social Institution

The variable "Confidence in Science" was constructed through three measures from 2006 GSS data. This variable corresponds with the first aspect of science as a social institution. The measures for this variable from 2006 GSS data are: confidence in science, benefits of science, and advances to the frontiers of knowledge brought about through science [the GSS variable names are: "CONSCI"; "SCIBNFTS" -{including "BALPOS," "BALNEG"}; and "ADVFRONT"].

For the first variable, the question measuring confidence in science as a social institution ("CONSCI") reads:

> 165. I am going to name some institutions in this country. As far as the people running these institutions are concerned, would you say you have a great deal of confidence, only some confidence, or hardly any confidence at all in them?

Available answers are: "A great deal" [1]; "Only some [2]; "Hardly any" [3]; "Don't know" [8]; "No answer" [9].

The question measuring the benefits of science ("SCIBNFTS") reads:

> 1038. Now for another type of question. People have frequently noted that scientific research has produced benefits and harmful results. Would you say that, on balance, the benefits of scientific research have outweighed the harmful results, or have the harmful results of scientific research been greater than its benefits?

Answers: "Benefits greater" [1]; "About equal" [2]; "Harmful results greater." "Don't know" [DK]. Along with the benefits of science question, are the connected questions:

(BALPOS)

A. Would you say that the balance has been strongly in favor of the benefits, or only slightly?

(BALNEG)

B. Would you say that the balance has been strongly in favor of the harmful results, or only slightly?

Answers for both: "Strongly in favor" [1]; "Slightly in favor"[2]; "Don't know"[DK].

Finally, for the measure of science as advancing the frontiers of knowledge: ("ADVFRONT"):

1035. I'm going to read to you some statements like those you might find in a newspaper or magazine article.
For each statement, please tell me if you strongly agree, agree, disagree, or strongly disagree.

C. Even if it brings no immediate benefits, scientific research that advances the frontiers of knowledge is necessary and should be supported by the federal government.

Answers: "Strongly agree" [1]; "Agree" [2]; "Disagree" [3]; "Strongly disagree" [4]; "Don't know" [DK].

The variables were all recoded in the same direction of lower numbers for less support and higher numbers for more support. For the benefits of science variable, the three variables were transformed into a single variable, and then recoded from low to high support. The measures that make up this variable were first recoded in ranked order from less to more support. The response categories were then simplified to reveal lower and higher levels of support. [For example, the GSS question for ADVFRONT: "…scientific research that advances the frontiers of knowledge is necessary and should be supported by the federal government," offers the answers: "Strongly Agree," "Agree," "Disagree," "Strongly Disagree." The answers for CONSCI are: "a great deal," "only some," "hardly any"; these were simplified into "lower" and "higher" to reveal blocks of support, or the lack of].

Taken together, this measure is broader than the GSS measure of "confidence in science." It measures a wider range of factors indicative of a person's attitudes toward science as an institution.

Science as a Method and Process

In thinking about science as a method and social process, the question is one of what it takes to make something "scientific." While the philosophy of science still struggles with some of the details of this matter, a few of the most basic requirements of science as an ideal are widely agreed upon. The 2006 GSS science module asks questions that probe this question. Three of the most basic features of scientific method/process were selected to comprise the variable "Scientific Method." Three of the most basic requirements of scientific thought and practice are: sold *evidence* for results, *replication* of results, and *explanation* of results- involving the examination of multiple interpretations of, or theories of, results. More generally, this question probes the importance of a link between evidence and theory. The question(s) from the science module are:

> 1072. Now I'm going to read you some statements about science and scientists. Please look at Card B19. How important are each of the following in making something scientific?
>
> C. The conclusions are based on solid evidence. (Would you say this is very important, pretty important, not too important, or not important at all in making something scientific?
>
> D. The researchers carefully examine different interpretations of the results, even ones they disagree with. (Would you say this is very important, pretty important, not too important, or not important at all in making something scientific?

G. Other scientists repeat the experiment, and find similar results. (Would you say this is very important, pretty important, not too important, or not important at all in making something scientific?

Responses: "Very important" [1]; "Pretty important" [2]; "Not too important" [4]; Not important at all" [4]; "Don't know" [DK].

These indicators of scientific method (evidence, repeatability, and careful analysis) factor well together, and were combined to create the variable "Scientific Method." This variable was recoded and scaled to "low" and "high" based on factor scores. This split works well for the measure of scientific method because the GSS survey questioned was asked as a knowledge question, where respondents either answered correctly or incorrectly. A "low" or "high" understanding of the aspects of the scientific method reflects the respondents' understanding of the importance of evidence, repeatability, and carefully analysis in the process of science.

Science as Applied Knowledge (Stem Cell Research)

Stem cell research is a form of applied science. The 2006 GSS asks respondents about their support for government funding of stem cell research. The question is listed below. While there are two questions here- support for such research, as well as support for government funding of such research, this question is thought to reflect general support for this area of research.

1063. Recently, there has been controversy over whether the government should provide funds at all for scientific research that uses "stem cells" taken from human embryos. Would you say the government…

Answers: "Definitely should fund such research" [1]; "Probably should fund such research" [2]; "Probably should not fund such research [3]; "Definitely should not fund such research" [4]; "Don't know" [DK]; "Refused" [REF]. Variable name [SCRESRCH].

The variable was then recoded to reflect either support ("definitely should fund" and "probably should fund") or a lack of support ("definitely should not fund" and "probably should not fund").

Control Variables

Control variables were included during the test of correlations. These variables included: age, sex, race and education. The chapter on demographics makes more connections between the four worldview groups and demographic measures in order to further identify the backgrounds of the four worldview groups.

Analysis

Cross tabulations were conducted analyzing attitudes toward science by religious worldview. Religious worldview categories include Theists, Naturalists, Skeptics and Dualists. The measure of science includes: confidence in science as a social institution, scientific method, and applied knowledge (stem cell research). The tables below depict the attitudes across the four worldview categories in response to each of these sets of questions.

Table 1. Confidence in Science as a Social Institution

	Religious Worldview				
Confidence in Science:	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
Lower	**61.4%** (97)	**69.4%** (270)	**40.2%** (80)	**46.3%** (37)	58.6% (484)
Higher	**38.6%** (61)	**30.6%** (119)	**59.8%** (119)	**53.8%** (43)	41.4% (342)
Total	(158)	(389)	(199)	(80)	(826)

The first cross tabulation was between the group categories (in arbitrary order), "Skeptics," "Theists," "Naturalists," and "Dualists" and the science variable "Confidence in Science."

It should be noted again, while looking at this first table, that the constructed variable, "Confidence in Science," is a combination of the GSS variables that measure: confidence in science [CONSCI], attitudes toward benefits of science [SCIBNFTS + BALPOS & BALNEG], and the advancement of knowledge through science [ADVFRONT]. This variable then is not just the GSS variable (by the same name) that measures confidence in science, but a combined measure of confidence in science- in addition to respondents attitudes about the benefits and advances brought on by science. Whereas confidence in science is traditionally high in the U.S., this combined measure reveals variance between groups in regards to overall confidence and perceived benefits and advances of science as a social institution.

61.4% of respondents identified as Skeptics reported lower confidence in science, with 38.6% of this group reporting higher confidence in science. This measure is not a direct measure of "low" and "high" support, but a breakdown of group attitudes into

"lower" and "higher." Of the groups, the Skeptics reported the second lowest ratio of low confidence to high confidence in science as a social institution. The group reporting the lowest amount of confidence in science was the Theists. 69% of Theists had lower confidence in science, with 30.6% of this group reporting higher confidence in science. It should be noted again that this measure should not be taken to mean that 69% of Theists report the *lowest* amount of confidence in science. Some of the respondents on the lower end of the spectrum may have had "some" confidence in science, and agreed that there are benefits with science. "Lower" support may still include responses that indicated some support on the original scale. Still, and importantly, what these measures show are group tendencies. It is clear from these data that the majority of both the Skeptics and Theists report lower confidence in science. Compared to the Dualists, the majority of this group reports higher confidence in science, with 53.8% responding with higher confidence in science; 46.3% report lower confidence. The Naturalists report the highest ratio of higher confidence to lower confidence, but not by much in comparison with the Dualists; 59.8% of Naturalists report higher confidence in science, and 40.2% report lower.

Table 2. Understanding of Scientific Method

	Religious Worldview				
Understanding of Scientific Method:	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
Lower (lack understanding)	**42.5%** (82)	**46.6%** (213)	**36.8%** (106)	**41.2%** (42)	42.6% (443)
Higher (possess understanding)	**57.5%** (111)	**53.4%** (244)	**63.2%** (182)	**58.8%** (60)	57.4% (597)
Total	(193)	(457)	(288)	(102)	(1040)

The cross tabulations between the groups and the science variable "Scientific Method" were much more even across groups.

It is important to note that a majority of all of these groups possess an understanding of the scientific process. In order, 53.4% of Theists responded with an understanding of scientific method, whereas 46.6% showing a lack of understanding of basic requirements of the scientific process. 57.5% of Skeptics possessed an understanding of scientific method, with 42.5% lacking this understanding. The Dualists show 58.8% understanding the basics of scientific method, with 41.2% not sharing this understanding. 63.2% of Naturalists understand scientific method, with 36.8% not showing this understanding. The order of the groups is the same for both the Confidence in Science and Scientific Method variables, with Theists reporting the lowest confidence in science and the least understanding of scientific method, followed by the Skeptics, Dualists, and Naturalists.

Table 3. Government Funding of Stem Cell Research

	Religious Worldview				
Government Should fund Stem Cell Research:	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
Should fund	**76.6%** (72)	**56.6%** (124)	**88.8%** (119)	**73.2%** (30)	70.7% (345)
Should not fund	**23.4%** (22)	**43.4%** (95)	**11.2%** (15)	**26.8%** (11)	29.3% (143)
Total	(94)	(219)	(134)	(41)	(488)

Table 4. Government Funding of Stem Cell Research #2

	Religious Worldview				
Government Should fund Stem Cell Research:	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
Definitely should fund	**22.3%** (21)	**15.5%** (34)	**52.2%** (70)	**24.4%** (10)	27.7% (135)
Probably should fund	**54.3%** (51)	**41.1%** (90)	**36.6%** (49)	**48.8%** (20)	43.0% (210)
Probably should not fund	**12.8%** (12)	**23.3%** (51)	**8.2%** (11)	**12.2%** (5)	16.2% (79)
Definitely should not fund	**10.6%** (10)	**20.1%** (44)	**3.0%** (4)	**14.6%** (6)	13.1% (64)
Total	(94)	(219)	(134)	(41)	(488)

With the Stem Cell variable the original categories from the GSS survey were retained with the first analysis of crosstabs. They were then recoded to show general support or a lack of support. Original response categories from the GSS question included the responses: "Definitely should fund such research," "Probably should fund such

research," "Probably should not fund such research," and "Definitely should not fund such research." After recoding these categories into general support or lack of support (as the table shows), group tendencies are further revealed.

Patterns in response to the question of stem cell research proved to be very interesting. Especially interesting are the differences between groups when it comes to variations in responses within the categories "Definitely should fund such research" and "Probably should fund such research." For example, of the Skeptics, just 22.3% believe that such research should *definitely* be funded, whereas 54.3% of this group feels that such research *probably* should be funded. As the table shows, when combined, the group total in favor of government funding of stem cell research jumps to 76.6%. This is a clear majority compared to the 23.4% who make up the "Probably should not fund..." (12.8%) and "Definitely should not fund..." (10.6%) categories. With the Dualists, there is a similar pattern. Only 24.4% of this group is *definitely* in favor of government funding for this research, whereas 48.8% feels that this research should *probably* be funded and take place. The percentage of the Dualists who is in favor of stem cell research is 73.2%; which is actually lower than the Skeptics, but not by that large of a margin. 14.6% of the Dualists feel that such research *definitely should not* be funded. 12.2% of this group feels that it *probably* should not be funded. 26.8% of the Dualists are against such research. The largest amount of opposition, for both definitely should not fund (20.1%) and probably should not fund (23.3%) comes from Theists. A total of 43.4% of Theists are against the government funding of stem cell research. Still with this group, 56.6% of Theists overall are in favor of the funding of this research; 41.1% feel that it probably should be funded, but only 15.5% feel that it definitely should be funded. The group with

the highest support for the funding of stem cell research are the Naturalists. With a total that dwarfs all of the others in its category, 52.2% of Naturalists feel that the government should definitely fund such research. 36.6% feel that such research should probably be funded. Significantly, here we see a reverse of the patterns for the other groups, with a majority expressing definite support. When these two are combined, Naturalists report an incredibly high 88.8% support for government funding of stem cell research. Only 3% feel that such research should definitely not be funded, and 8.2% feel that such research should probably not be funded; with a total of 11.2% of this group against government funding of stem cell research.

The last attitudinal measure provided here in comparing the four groups deals with science. This question asks a different question from the questions of science that went into the variable construction of "confidence in science," and "scientific method." It is a general question, but one that also proves to be revealing of the character of the four groups in regards to "science" as a generic idea. When we look at Skeptics, Theists, and Dualists on this question of whether or not science makes our way of life change too fast, when the categories are split into "agree" and "disagree," these three groups seem rather closely split between agree and disagree. Skeptics disagree with this question slightly more than do both Theists and Dualists, where most disagree that science changes our way of life too fast, 55%. Dualists disagree also, but the group seems rather evenly divided, with 47.6% agreeing. Theists too, are closely divided, but this time slightly in favor with agreeing that science changes our way of life too fast, 51.4% (agree) to 48.6% (disagree). Naturalists show the largest split, where 67.2% disagree that science changes our way of life too fast. 32.8% agree, however. On this question, it is difficult to discern

the near even split between Skeptics, Theists, and Dualists; whereas Naturalists seem to by and large disagree with the suggestion that science moves too fast.

Table 5. Science and the Pace of Change

	Religious Worldview				
Science Makes Our Way of Life Change too Fast	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
Agree	**45.0%** (90)	**51.4%** (242)	**32.8%** (96)	**47.6%** (50)	44.7% (478)
Disagree	**55.0%** (110)	**48.6%** (229)	**67.2%** (197)	**52.4%** (55)	55.3% (591)
Total	(200)	(471)	(293)	(105)	(1069)

Summary of Tables

There are similarities and differences in the attitudes toward science across worldviews. Relationships between religious worldview and attitudes toward science as an institution and stem cell research are statistically significant (see appendix, table 2). Attitudes differ based on which aspect of science we are talking about. For example, in a reversal of expectations, there appears to be more support for stem cell research amongst Theists than presupposed. There is support for stem cell research found across all of the worldviews. As compared with general confidence in science as a social institution, there seems to be much more support for the applied science of stem cell research; despite its controversial status in popular culture, and its status amongst ideologues. When percentages are added within the stem cell responses, a majority of all groups are in favor

of government funded stem cell research. The difference between general confidence and science and support for stem cell research is the greatest with the Skeptics. This group, surprisingly based on confidence in science, has the second highest amount of support for stem cell research. When the stem cell response categories are combined into for (definitely and probably should fund) and against (definitely should not and probably should not fund), Theists too show greater support for stem cell research than general confidence in science. For Naturalists and Dualists, the overall support for stem cell research is also very high. These trends reverse expectations that most groups would have generally high confidence in science as a social institution, but show less support for the applied science of stem cell research with its ethical controversies. What is clear also is that the understanding of scientific method and process is generally understood across all of the groups, while Theists boarder on 50/50, a majority of this group possesses an understanding of scientific method and process.

Overall, it is surprising that there would be greater support for stem cell research than general confidence in science, especially for the Skeptics and Theists groups. Even for Naturalists and Dualists, the support for stem cell research seems to exceed general confidence in science- when benefits and advances to knowledge are taken into consideration. Opposition to stem cell science is highest amongst theists. Opposition to stem cell research is lowest amongst naturalists, followed by skeptics, and then dualists. There are clear differences between the four worldviews when it comes to both general confidence in science as a social institution, and attitudes toward the development of stem cell science. That 88% of naturalists support stem cell research compared to 56% amongst theists, indicates differences between these worldviews. That support for stem

cell science amongst skeptics and dualists is over 70%, is also telling. While the majority of theists are in favor of advancing stem cell research, 43% of theists are opposed to stem cell research, the largest percentage amongst the four worldviews.

Finally, on science and the rate of change, the groups were rather evenly split on whether or not science makes our way of life change too fast. There was less much less support for this question amongst Theists and Dualists than expected. Naturalists disagreed in the majority that science makes our way of life change too fast, as did Skeptics and Dualists. Only Theists show more respondents who agree that science changes our way of life too fast, but the difference between the percentages is minimal, 51.4% who agree, compared to 48.6% who disagree.

CHAPTER VII

DEMOGRAPHIC PROFILES OF THEISTS, NATURALISTS, SKEPTICS AND DUALISTS

Who are the *Theists*, *Naturalists*, *Skeptics,* and *Dualists* of this study? This chapter looks into this question by comparing demographic backgrounds and further attitudinal measures toward religion and science from 2006 GSS survey data.

Identifying Theists, Naturalists, Skeptics, and Dualists through Demographic and Attitudinal Measures

Based on demographic measures, the following comparisons help to describe who the Theists, Naturalists, Skeptics and Dualists within this study are. The demographic measures covered here include: sex, age, education, region, and place of residence as either urban or rural. Further measures of religious attitudes are included within the next chapter.

Skeptics, Naturalists, Theists, and Dualists are compared first by sex; shown in the table below.

Table 6. Respondents' Sex

	Religious Worldview				
Respondents Sex:	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
Male	**40.5%** (83)	**34.8%** (167)	**57.5%** (169)	**46.7%** (49)	43.2% (468)
Female	**59.5%** (122)	**65.2%** (313)	**42.5%** (125)	**53.3%** (56)	56.8% (616)
Total	(205)	(480)	(294)	(105)	(1084)

As the table shows, there are some differences of note in regards to the composition of males and females between the four groups. The largest percentage of men is found within the group of Naturalists. Naturalists are the only group that shows a male majority; 57.5% are male compared to 42.5% female. The smallest percentage of men is found within the Theists group. 34.8% of this group is male, while 65.2% is female- the largest split between male and female is clearly with Theists. This finding is consistent with the trend of women usually ranking higher on overall measures of religiosity. The next largest split between males and females is with the group of Skeptics. A majority of Skeptics, 59.5%, are female; 40.5% are male. Skeptics are male. The smallest divide between the percentage of males and females id found with Dualists; where 46.7% are male and 53.3% female.

The next table compares the groups by age. The age variable was simplified to represent three stages of life: young life (0-35), middle life (36-55), later adult life (56-99).

Table 7. Respondents' Age

	Religious Worldview				
Age (Years):	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
0-35	**39.0%** (80)	**25.2%** (121)	**29.9%** (88)	**21.9%** (23)	28.8% (312)
36-55	**41.0%** (84)	**42.3%** (203)	**45.2%** (133)	**44.8%** (47)	43.1% (467)
56-99	**20.0%** (41)	**32.5%** (156)	**24.8%** (73)	**33.3%** (35)	28.1% (305)
Total	(205)	(480)	(294)	(105)	(1084)

Age proves to be somewhat evenly distributed between the groups, except for Skeptics. Skeptics appear to be the youngest category. The oldest groups are Theists and Dualists. The differences between Theists, Dualists, and Naturalists are not extreme, but Naturalists are slightly younger than Theists and Dualists, and a bit older than Skeptics.

Means for age were also compared, below. Again, Theists and Dualists are clearly the oldest groups, and Skeptics the youngest, with Naturalists in the middle.

Table 8. Respondents' Age #2

	Religious Worldview				
Age (Years):	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
Mean	**43.09** (203)	**48.64** (478)	**45.25** (293)	**48.58** (105)	46.67 (1079)
Std. Deviation	16.937	17.277	15.433	16.731	16.805

Education is compared next. The education variable was simplified based on the number of years of education a respondent has had. The variable was broken down into three categories of education. These three categories roughly reflect the number of years

for a person to attend high school, college, and graduate or extended years beyond four years of college.

Skeptics show the least number of years of education. They are the least likely to have completed 13-16 years of education (college), or 17-20 years (post-college). Close to half have between 0-12 years of education. Theists show the second lowest number of years of education. Theists have a low percentage within the bracket of 17-20 years of education. In contrast with Skeptics, more Theists have completed 13-16 years of education as compared to 0-12. The most salient difference between the groups appears to be that Naturalists and Dualists show a much higher percentage of people who have complete 17-20 years of college. Naturalists and Dualists are the two groups who show positive knowledge/attitudes toward the big bang and evolutionary theories of the world, which seems important to note. Naturalists have the highest mean score of years of education.

Table 9. Respondents' Education

	Religious Worldview				
Education (Years)	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
0-12	**49.3%** (101)	**40.8%** (196)	**22.4%** (66)	**32.7%** (34)	36.7% (397)
13-16	**42.0%** (86)	**49.4%** (237)	**49.0%** (144)	**46.2%** (48)	47.6% (515)
17-20	**8.8%** (18)	**9.8%** (47)	**28.6%** (84)	**21.2%** (22)	15.8% (171)
Total	(205)	(480)	(294)	(104)	(1083)

Table 10. Respondents' Education #2

	Religious Worldview				
Education (Years)	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
Mean	**13.21** (205)	**13.38** (480)	**15.07** (294)	**14.27** (104)	13.89 (1083)
Std. Deviation	2.624	2.722	2.752	2.900	2.833

When comparing the four groups by region, a concerning trend is revealed. Looking at where most of the respondents are from across all four groups, it is clear that the majority are from either the South and West. When looking at the more detailed breakdown of regions into nine categories [New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific] a large proportion of the respondents appear to come from the South Atlantic. This is a concern if generalization to the entire United States is a goal of this study. When analyzing the four groups by region, the between-group differences seem less significant than the between-region differences. The bulk of respondents across all four categories are from either the South or the West. The fact that most of the respondents are drawn from these regions, the South (42-56%) and the West (28-33%), is a major concern for the integrity of this data set, and extrapolations from this data to the entire U.S.

Table 11. Respondents' Region

Region	Religious Worldview				
	Skeptics	**Theists**	**Naturalists**	**Dualists**	Total
Northeast	**8.3%** (17)	**7.3%** (35)	**4.4%** (13)	**7.6%** (8)	6.7% (73)
Midwest	**18.5%** (38)	**16.5%** (79)	**10.5%** (31)	**12.4%** (13)	14.9% (161)
South	**42.4%** (87)	**47.9%** (230)	**56.8%** (167)	**46.7%** (49)	49.2% (533)
West	**30.7%** (63)	**28.3%** (136)	**28.2%** (83)	**33.3%** (35)	29.2% (317)
Total	(205)	(480)	(294)	(105)	(1084)

The next table compares the four groups by where they live, either metropolitan or not metropolitan- (or urban and rural). This measure is based on whether or not respondents live within a standard metropolitan statistical area (SMSA). This variable [GSS variable XNORCSIZ] was recoded so that all of the metropolitan statistical areas were grouped together into: "Metropolitan"; and all of the non-metropolitan statistical areas were grouped together as "Not Metropolitan." Given the fact most of bulk of the respondents for each group comes from either the South or the West, there are questions about this indicator as well- in so far as generalizing to the entire United States goes. Given that the East and Midwest have some of the largest urban areas in the nation, the identification of the four groups by urban/rural may not be as meaningful, or reflective of the U.S. as a whole.

Still, this indicator does provide an interesting comparison. Theists are much more likely to live in areas that are rural or non-metropolitan. 65.4% of Theists live in non-metropolitan areas. For the other three groups, the differences between urban and rural are small, with roughly five percentage points or less dividing each of the three

groups. Skeptics are slightly more likely to live in metropolitan areas. Naturalists are slightly more likely to live in non-metropolitan areas. Dualists are slightly more likely to live in metropolitan areas.

Table 12. Metropolitan Area

	Religious Worldview				
Metropolitan Area	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
Not Metro (Rural)	**47.4%** (64)	**65.4%** (212)	**51.6%** (98)	**47.1%** (33)	56.6% (407)
Metro (Urban)	**52.6%** (71)	**34.6%** (112)	**48.4%** (92)	**52.9%** (37)	43.4% (312)
Total	(135)	(324)	(190)	(70)	(719)

Summary of Demographic Backgrounds

In summary, the preceding tables help to further identify the backgrounds and attitudes of individuals within these four worldview categories. What these measures show is that there are some clear differences between the worldviews. Many of the existing expectations for the worldview categories are supported, with some notable surprises.

On the demographics of the four groups, it was not a surprise that more Theists were female. The majority of Skeptics are also female. Dualists were also mostly female. Only Naturalists show a majority of males. In regards to age, Skeptics are clearly the youngest group. Nothing all that dramatic was shown in regards to age otherwise; Theists and Dualists are the oldest groups. The differences in education were revealing.

Naturalists and Dualists report a significantly higher number of years of education. The region variable shows that a larger proportion of the sample are from the South and West; in comparison to the East and Midwest. The variable measuring residence illustrated that a majority of Theists live in non-metropolitan areas. Other groups showed a more even distribution between those who live in metropolitan and non-metropolitan areas.

CHAPTER VIII

RELIGION AND ATTITUDINAL CORRELATES: THEISTS, NATURALISTS, SKEPTICS AND DUALISTS

As one might expect, the differences between the four groups and worldviews are perhaps most pronounced when it comes to attitudes toward religion. The next set of data and tables compare the attitudes of Skeptics, Theists, Naturalists and Dualists on topics of religion; including measures of religious self-identification and participation. Measures of religiosity compared below include: feelings about the bible; how often respondents pray; attitudes about bible prayer in public schools; how often respondents attend religious services; and whether or not respondents have tried to convince others to accept Jesus.

The first comparison is between group worldviews and religious preference.

Table 13. Religious Preference

	Religious Worldview				
Religious Preference	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
Protestant	**42.0%** (86)	**81.9%** (393)	**33.3%** (98)	**42.9%** (45)	57.4% (622)
Catholic	**26.3%** (54)	**13.3%** (64)	**19.7%** (58)	**42.9%** (45)	20.4% (221)
Jewish	**2.0%** (4)	**.6%** (3)	**3.7%** (11)	**2.9%** (3)	1.9% (21)
None	**24.4%** (50)	**.6%** (3)	**36.1%** (106)	**3.8%** (4)	15.0% (163)
Other	**5.4%** (11)	**3.5%** (17)	**7.1%** (21)	**7.6%** (8)	5.3% (57)
Total	(205)	(480)	(294)	(105)	(1084)

This table depicts some very clear contrasts between the worldviews. Theists, for example, identify overwhelmingly as Protestants, at 81.9%. A smaller proportion of this group identify as Catholics, 13.3%. Only .6% identify as Jewish, and fewer for other categories of religious preference. Dualists are interesting here as well. Based on these data their proportions are evenly split between Protestant and Catholic, both at 42.9%. 2.9% of Dualists identify as Jewish. A sizable proportion of Skeptics identify as Protestants, 42%, and Catholics, 26.3%. While this group shows a weaker identification with the other measures of religiosity (belief in God, belief in God's role in the punishment of sin, and strength of affiliation), it is interesting that so many of the Skeptics still identify with a religious tradition. A sizable proportion of this group identify with "none" as a religious preference; 24.4%. Naturalists show the highest proportion of identification with the religious preference of "none," 36.1%. Still, 33.3% of the Naturalists identify as Protestants, and 19.7% percent as Catholics. Over 50% of this group retain their self-identification as either Protestant or Catholic. This group has the largest percentage of Jewish members, at 3.7%. None of the four groups shows a large number of members from the "other" category, which includes: Muslim, Buddhism, Hinduism, Orthodox-Christian, or Native American. Naturalists and Dualists show the largest percent who identify as one of these other religious preferences.

The next table deals with feelings about the bible. This table seems to accurately depict a common theme in the sociology of religion, that attitudes toward the bible vary based on "conservative" and "liberal" affiliations. Conservative Christians tend to view the bible as the direct word of God, shown often by related data (Bruce, 2002).

Table 14. Feelings about the Bible

Feelings about the Bible	Religious Worldview: Skeptics	Theists	Naturalists	Dualists	Total
Word of God	**24.5%** (50)	**66.3%** (318)	**4.8%** (14)	**21.9%** (23)	37.4% (405)
Inspired Word	**60.3%** (123)	**31.5%** (151)	**50.2%** (147)	**69.5%** (73)	45.7% (494)
Book of Fables	**13.7** (28)	**1.3%** (6)	**41.0%** (120)	**7.6%** (8)	15.0% (162)
Other	**1.5%** (3)	**1.0%** (5)	**4.1%** (12)	**1.0%** (1)	1.9% (21)
Total	(204)	(480)	(293)	(105)	(1082)

Theists show the highest percentage who believe that the bible is the literal word of God, at 66.3%. 31.5% of Theists believe the bible is the inspired word, which is the next highest category for Theists. Perhaps, unsurprisingly, only 1.3% of Theists believe the bible to be a book of fables. Interestingly, it is not Dualists, but instead Skeptics, who show the next highest percentage who believe the bible to be the literal word of God; but by a small margin. 24% of Skeptics believe that the bible is the word of God, while 60.3% believe it is the inspired word of God. A clear majority of Skeptics still believe that the bible is either the literal or inspired word of God. Only 13.7% of Skeptics believe the bible is a book of fables. This is unexpected, that Skeptics would not be more "skeptical" of the bible as the word of God. Dualists are the next highest group to believe that the bible is the word of God, at 21.9%. 69.5% believe that the bible is the inspired word, the largest percentage of the groups for the inspired word category. A small percentage of Dualists believe the bible to be a book of fables, 7.6%. One of the most interesting contrasts between the groups comes about when looking at the Naturalists on

this question. A very small percentage of Naturalists believe that the bible is the word of God, just 4.8%. The largest percentage of Naturalists believe the bible to be the inspired word, at 50.2%; but a rather large proportion of Naturalists believe the bible to be a book of fables, at 41%. Naturalists are also the only group to show higher than 1-2% who believes the bible to be "other" than the literal word, inspired word, or book of fables, at 4.1%. These data would seem to suggest that the construction of the group categories is meaningful and reflects something real about the character of these four worldview types.

Major differences between groups are found with the question of prayer; as the table below illustrates.

Table 15. Prayer

	Religious Worldview				
How often does R Pray	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
Several times a day	**19.6%** (40)	**58.3%** (280)	**10.3%** (30)	**33.3%** (35)	35.6% (385)
Once a day	**32.8%** (67)	**30.4%** (146)	**17.1%** (50)	**43.8%** (46)	28.6% (309)
Several times a week	**13.7%** (28)	**7.3%** (35)	**13.4%** (39)	**8.6%** (9)	10.3% (111)
Once a week	**8.3%** (17)	**2.1%** (10)	**8.2%** (24)	**6.7%** (7)	5.4% (58)
Less than once a week	**18.1%** (37)	**1.7%** (8)	**20.9%** (61)	**5.7%** (6)	10.4% (112)
Never	**7.4%** (15)	**.2%** (1)	**30.1%** (88)	**1.9%** (2)	9.8% (106)
Total	(204)	(480)	(292)	(105)	(1081)

Theists and Dualists report praying considerably more often than Skeptics and Naturalists. In looking at the table, we see that Skeptics aren't too far behind with their reports of payer, but Naturalists show a much different picture. The largest percentages

for Naturalists are less than once a week and never. Prayer seems to be a clear marker of difference between the four groups. Skeptics still show their highest percentage within a regular prayer pattern, at once a day, 32.8%. 58.3% of Theists report praying several times a day, and Dualists report the highest percentages as either praying several times a day, 33.3% or once a day 43.8%. In comparison, 30.1% of Naturalists report never praying, and the next highest category is at 20.9%, less than once a week. 10.3%, 17.1%, and 13.4% of Naturalists report praying either several times a day, once a day, or several times a week, so there is a still a sizable proportion overall of this group that reports praying, but the majority are in the least frequent categories for prayer.

Another telling attitudinal measure between the groups regards approval or disapproval of prayer in public schools. This particular table reflects the GSS question that reads, "The United States Supreme Court has ruled that no state or local government may require the reading of the Lord's Prayer or Bible verses in public schools. What are your views on this… do you approve or disapprove of the court ruling?"

Table 16. Bible Prayer in Public Schools

	Religious Worldview				
Bible Prayer in Public Schools	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
Approve	**40.4%** (40)	**25.6%** (60)	**75.5%** (108)	**46.3%** (25)	44.0% (233)
Disapprove	**59.6%** (59)	**74.4%** (174)	**24.5%** (35)	**53.7%** (29)	56.0% (297)
Total	(99)	(143)	(234)	(54)	(530)

The table shows a flip-flop contrast of attitudes between Theists and Naturalists; with the vast majority of Theists against the ruling, 74.4%, and the vast majority of

Naturalists against the ruling, 75.5%. For Skeptics the contrasts are not as strong, but perhaps surprisingly a majority of Skeptics disapprove of the ban on prayer and bible verses in public schools, at close to 60%. A majority of Dualists are also against the ruling, 53.7%. Dualists approving of the ruling are not that far behind, at 46.3%.

Attendance at religious services also splits the groups. The first table is followed by a table depicting the means for each of the groups.

Table 17. Attendance at Religious Services

	Religious Worldview				
Number of times R Attends Religious Services per year	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
0 times	**29.3%** (60)	**5.8%** (28)	**40.5%** (119)	**12.4%** (13)	20.3% (220)
.5 times (less than once a year)	**8.3%** (17)	**3.1%** (15)	**10.2%** (30)	**4.8%** (5)	6.2% (67)
1 time	**18.5%** (38)	**5.4%** (26)	**19.4%** (57)	**10.5%** (11)	12.2% (132)
6 times	**16.1%** (33)	**7.3%** (35)	**13.3%** (39)	**12.4%** (13)	11.1% (120)
12 times	**5.9%** (12)	**6.5%** (31)	**7.1%** (21)	**10.5%** (11)	6.9% (75)
30 times	**5.4%** (11)	**10%** (48)	**2.4%** (7)	**7.6%** (8)	6.8% (74)
36 times	**3.4%** (7)	**7.7%** (37)	**1.7%** (5)	**9.5%** (10)	5.4% (59)
52 times	**11.2%** (23)	**35.4%** (170)	**4.8%** (14)	**27.6%** (29)	21.8% (236)
78 times	**2.0%** (4)	**18.8%** (90)	**.7%** (2)	**4.8%** (5)	9.3% (101)
Total	(205)	(480)	(294)	(105)	(1084)

It is clear that Theists and Dualists report attending religious services at a much higher rate. 40.5% of Naturalists report never attending religious services, clearly the highest amongst the groups. The next highest percentage is found with Skeptics, with 29.3% reporting that they never attend religious services. 5.8% of Theists, and 12.4% of Dualists report never attending religious services. The two largest brackets for Theists are every week, 35.4%, and more than once a week, 18.8%. For Dualists, the highest bracket is also every week, 27.6%. In comparison to Theists, Dualists report less attendance at religious services. For Skeptics and Naturalists, apart from the category of never, there are some sizable percentages for categories such as once a year, with 18.5% of Skeptics reporting this; and 19.4% of Naturalists also reporting once a year.

Table 18. Attendance at Religious Services #2

	Religious Worldview				
Number of times R Attends Religious Services per year	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
Mean	**12.0902** (205)	**40.0990** (480)	**6.2313** (294)	**25.9190** (105)	24.2431 (1084)
Std. Deviation	19.61549	26.34051	13.81012	24.12339	26.73119

Maybe one of the most interesting tables concerns evangelism, and the question of whether or not respondents have tried to convince other to accept Jesus Christ (the GSS variable SAVESOUL).

Table 19. Tried to Convince Others to Accept Jesus

	Religious Worldview				
Tried to Convince others to Accept Jesus	**Skeptics**	**Theists**	**Naturalists**	**Dualists**	Total
Yes	**38.2%** (78)	**78.5%** (375)	**10.5%** (31)	**44.2%** (46)	49.1% (530)
No	**61.8%** (126)	**21.5%** (103)	**89.5%** (263)	**55.8%** (58)	50.9% (550)
Total	(204)	(478)	(294)	(104)	(1080)

The contrasts between Theists and Naturalists are plain. The worldview groups were constructed based on their responses to three core variables of religiosity (GSS: GOD, PUNSIN, and RELITEN); and based responses to measures of "naturalized" answers on the origins of the universe and life on earth (GSS: BIGBANG and EVOLVED). It is telling that the other variables of religious attitudes displayed here have by and large consistently met expectations. This consistency of attitudes amongst the groups might be interpreted as a positive as far as the reliability of these core measures of religiosity and of theism and naturalism. On evangelism, there are stark differences between Theists, Dualists, Skeptics, and Naturalists. Theists have overwhelmingly tried to convince others to accept Jesus; where 78.5% report having done so. Dualists, consistent with a more liberal versions of Protestantism and Catholicism, have not. Less than a majority of Dualists, 44.2%, report having done so. 55.8% report not having done so. There are also links that might be made here between the conservative and liberal braches of Christianity, which these data seem to reflect. Dualists do not report proselytizing to the extent of Theists, based on these data. Skeptics do not proselytize as much as either group, but perhaps surprisingly, 38.3% report having

done so. These additional measures of religiosity show Skeptics to be more religious than first expected. These additional measures of religiosity reveal Naturalists to be quite irreligious. 89.5% report having never tried to convince others to accept Jesus.

Summary of Attitudinal Measures of Religiosity

On the further measures of religiosity, starting with religious preference, Theists were overwhelmingly Protestant. Dualists were split evenly between Protestant and Catholic. One of the interesting surprises here was that Skeptics appear as more religious than their name would suggest. A majority of Skeptics report being either Protestant or Catholic, and smaller proportion report having no religious preference. A majority of Skeptics are also against the ruling to keep bible prayer out of public schools; even more so than Dualists. Naturalists show the highest percentage among the groups of those who have no religious affiliation. Still, moderate numbers of Naturalists still identify as Protestant or Catholic. Naturalists appear to be the least religious across all of the measures. As a follow up on this point and on the logic of the construction of the worldview categories, it is interesting that so many expectations can be supported based on how people answer two very simple, but very important, questions regarding the origins of the universe and the evolution of life on earth. While 50% of Naturalists report that the bible is the inspired word of God, 40% report that it is a book of fables. As expected, the clear majority of Theists believe that the bible is the literal word of God or the inspired word. Surprisingly here, a larger percentage of Skeptics report that the bible is the inspired word, not a book of fables. 24% of this group believes that it is the word of God. Only 13% of Skeptics believe that it is a book of fables, which again draws into

question the irreligious character of Skeptics, who based on these measures appear to be more religious than not. Dualists, interestingly, side in a majority with the bible as the inspired word, whereas Theists see it as the direct word. Here again the liberal-conservative split between these sets of theistic groups seems to be accurately drawn out. On prayer, and bible prayer in public schools, expectations for the four worldviews were largely drawn out as well. Here too, Skeptics appeared as more religious than expected. On attendance of religious services, Skeptics again appear as "skeptics," and less religious, but still with pockets of higher attendance. Naturalists attend religious services the least. Theists and Dualists have the highest rates of reported attendance. Proselytism was another revealing measure. Dualists were more likely to have *not* tried to convince others to accept Jesus. Naturalists were very unlikely to have attempted this. Dualists were closer to Skeptics here than to Theists. A vast majority of Theists have tried to convince others to accept Jesus.

CHAPTER IX

CONCLUSION: ANALYSIS OF EMPIRICAL FINDINGS

What do the empirical findings of this study suggest? Do attitudes toward science vary based on a person's worldview? Moreover, do the empirical findings suggest anything about the relationship between religion, science, and secularization?

Restating the Research Question

Do attitudes toward science -as an institution, method, and application of knowledge, vary by religious worldview? Are people more or less "open" to science- its discoveries and applications, depending on their religious worldview? The answer to this question may depend on *which* discoveries and applications we are asking about.

With the first measure of science as a social institution, emphasis is on the *ideal* of science. Is science an institution that brings benefits or harms to our lives? With the second measure of science, emphasis is on the *methods* of science. With the third measure of science, the emphasis is on a real *application.* By most accounts, stem cell science is a controversial application of knowledge. Stem cell science, whether embryos are used or not, raises a number of ethical questions regarding the control and manipulation of otherwise "natural" processes taking place within the human body. While the ethical questions have taken front stage, questions regarding the nature of life

itself have been pushed more to the backstage. There are ontological questions fewer people are asking regarding the nature of what exists- or can exist when it comes to the manipulation of human/animal cells. What forms of altered-life can be brought into existence?

Differences in Attitudes Toward Applied and Non-applied Scientific Knowledge

One of the important findings of this study is that people seem to respond to science differently based on whether or not the science in question is, or can be, applied. For example, it may be the case that the science behind the big bang theory of the universe may not be readily applied- at least not toward consumer products or medical procedures. The truth or falsity of such items of scientific knowledge may then seem removed from a person's day-to-day life. This kind of knowledge may be easier to reject – by individuals and/or mass publics. Non-applied pure scientific research, or "propositional" knowledge (Mokyr 2002), may seem like just another type of belief; a belief that we may choose to believe or not believe. When such items of knowledge come into conflict with pre-existing beliefs, individuals may feel motivated to reject the offensive belief as being untrue. The U.S. public is divided over the acceptance of evolutionary theory as true; survey data consistently shows. Acceptance or rejection of these theories is a matter of worldview, and perceived ontology- ideas about what exists. Attitudes toward such things may seem to be just that, *attitudes*- open to the individual to decide on.

Attitudes toward applied knowledge, or "prescriptive" knowledge (Mokyr), on the other hand, may be very different in basis from attitudes toward propositional knowledge.

In many cases, the applied knowledge in question already exists. Its ontology is not in question.

Ethical and Ontological Opposition to Science

At any point, people have the ability to accept or reject applied and/or non-applied science for *ethical* reasons. People can oppose the use of the atomic bomb for ethical reasons, but they cannot undo the atomic bomb as a discovery or event in world history. The same is true now with stem cell research. People may believe stem cell science is unethical and reject its applications, once they've become widely available. There are differences to note between the acceptance and rejection of applied and non-applied sciences. For a non-applied science like evolutionary biology, people may reject the theory of evolution by natural selection because they believe it conflicts with a literal interpretation of creation as told in the bible. A person may reject the knowledge of evolution as an *ontological* reality because they do not believe that the evidence adds up. It is more difficult to reject the ontological reality of an applied science like stem cell science- because it already exists, and is rapidly advancing.

Summary of Findings: Religion, Science, and Secularization

There are similarities and difference between religious worldviews when it comes to science as an institution. Institutional conflicts between religion and science may be real for certain worldviews. Based on the empirical results, there are reasons to believe that Theists and Skeptics have more reservations about science as an institution (and as

an ideal), in comparison to Naturalists and Dualists. All groups show a roughly similar understanding of scientific method. In regards to stem cell science, Theists are the only group to show a considerably lower amount of support for stem cell research in comparison to the other groups.

On these measures, Theists show the least amount of support for science as an institution (69.4% lower confidence in science; 30.6% higher). Skeptics are similar to Theists here (61.4% lower confidence in science; 38.6% higher). Starting with Skeptics, this group is based on the default position of rejection; this group seems to want first to reject any doctrinal or established claim- whether religious or scientific. Based on pure speculation about Skeptics as a group, the general attitude of this group might be typified by the title of the documentary film: "*What the Bleep do we Know*?" (2004). This film advocates a combination of pseudoscience and new age spirituality. Skeptics are presumed to be committed to a range of "alternative" knowledge claims and "new age" spirituality (Bruce 2002 describes elements of the "new age"). Yet while this group has comparably lower confidence in science as an institution (61.4% lower; 38.6% higher), this group still shows considerable support for stem cell research (76.6% say should fund; 23.4% say should not fund).

Returning to Theists, this group is clearly the most religiously conservative. A presumption here is that, at least in the U.S., the views of this religiously conservative "mass public" more closely reflect those of the "ideologues" who are influential in shaping this general worldview (Converse 1964). The majority of Theists, 69.4%, have a lower confidence in science as an institution. This finding may be interpreted to suggest that there is an "institutional conflict" between certain religious worldviews and science

as an institution – where science is characterized by brining benefits to society, whether scientific knowledge is applied or not. Evans and Evans (2008) argue that if there is a conflict between religion and science, it is a conflict over values, not knowledge itself. Therefore, the authors argue that if there is a conflict between religion and science it is institutional, not one of knowledge claims. These results would seem to support the first part of this claim; that there is institutional conflict amongst conservative Theists toward the role of science as an institution. Theists also show the least amount of support toward stem cell science (56.6% in favor of funding; 43.4% against). There may be some conflict here as well, toward this brand of applied science. Theists are the only group to show a considerable amount of disapproval toward stem cell research. Still, a majority of Theists are in favor of government funding of stem cell research. Both Naturalists and Dualists show majority support for science as an institution, with some reservation (Naturalists: 59.8% higher confidence in science; 40.2% lower; Dualists: 53.8% higher confidence in science, 46.3% lower). In response to stem cell research though, the differences between Theists and the rest of the groups is more pronounced. 88.8% of Naturalists support government funding of stem cell research; 73.2% of Dualists do; and 76.6% of Skeptics do also. In thinking about the influences on Naturalists and Dualists, it is clear that these groups are by far the most "pro-science" as an institution, and as application through stem cell research, even with its controversy. It may be the case that Naturalists are influenced by the "pro-science" sentiments of influential ideologues (Converse (1964). Innovation, new technologies, and new products are often framed as a necessary "good" within market-economies. The role of "post-academic" science (Ziman 1996) should be raised here also once again. Post-academic science is motivated by results and profits, not

necessarily or just "pure" research. The role of private research institutes should also be considered here. There are larger questions left regarding the role of governments in deciding which of the new sciences will be permissible, and/or funded. Post-academic science is in the business of applied knowledge.

Implications for Secularization Theory: *Religious* Toward Science as an Institution; *Secular* Toward Stem Cells

Amongst Theists- the most conservative religious worldview, there appears to be both disapproval of science as an institution, and *some* disapproval of stem cell research. A majority Theists still support stem cell research, however. Amongst Skeptics, Naturalists, and Dualists there is overwhelming majority support for stem cell research. While there is a portion of all groups that show *some* disapproval toward stem cell research, an overwhelming majority seems to hold *secular*, *not religious* views toward stem cell science.

Cultural traditions seem to matter here. The views of Theists seem more closely aligned with religious theologians who have spoken out against stem cell science. Dualists show a small proportion of disapproval, but much less in comparison to Theists. The same is the case when it comes to the measure of science as an institution. Theists, who are predominantly Protestant, show the most disproval toward the institution of science. Dualists, who are Catholic and Protestant, show some opposition here also, but much less in comparison to Theists. Even still, in regards to the measure of science as an institution, the response is *less secular*, and might be interpreted as being *religious* in motivation. Thinking of Converse (1964) the views of Theists may be more closely

aligned with the ideologues within their religious tradition. While some Catholic theologians have taken a strong stance against stem cell research, the Dualists category seems more secular than Theists in response to both science as an institution and more secular in response to the applied science of stem cell research.

Thinking Through the Results

This study found similarities and differences in the attitudes of Theists, Naturalists, Skeptics, and Dualists in response to these questions. This research question involves three related areas of investigation. First: (1) the identification of religious-ontological worldviews. Second: (2) the empirical study of attitudes toward science. Third: (3) the sociological relationship between religion, science, and secularization.

A larger proportion of both Skeptics and Theists report more favorable attitudes toward the government funding of stem cell science than they do toward science as an institution. Skeptics and Theists reject two of the most widely accepted items of scientific knowledge amongst the scientific community: the big bang theory of the universe and human evolution (two items of basic, non-applied, science).

Part of the problem with trying to understand the relationship between religion and science has been that "science" has often been treated as a single thing and/or variable within sociological research studies. Rarely has science been operationalized as multidimensional within research studies. When people ask about the relationship between religion and science, what, or which, parts of religion and science are they asking about? The review of literature showed that there are different ways to

operationalize both religion and science, and that when it comes to findings, operationalization matters. Another general point is that conceptualization matters. The following sections further illustrate these points. Two existing explanations of the relationship between religion and science are critically reviewed below.

Beyond the Epistemological Conflict between Religion and Science

Evans and Evans (2008) argue that it is time to move beyond the presumption that there is an "epistemological conflict" between religion and science. The authors contend that the relationship should be treated as an open question to be answered by empirical evidence, not a given.

The authors argue that the "epistemological warfare narrative" has dominated studies of religion and science within sociology and related fields. They write that the "vision of incompatibility" has shaped the field and limited the scope of research. The authors contend that religion is about more than scientifically conceived truth, and that conflicts over specific items of knowledge are small matters in comparison to the points of consensus.

> On most issues, there is actually very little conflict between religion and science. Religion makes no claims about the speed of hummingbird wings, and there are no university departments of anti-resurrection studies – scientists generally are unconcerned with the vast majority of religious claims and vice versa (Evans, 2011: 1; in an op-ed to the Los Angeles Times).

Further;

> There are, of course, a few fact claims in which conservative Protestant theology and science differ, such as the origins of humans and the universe. Here we find that typically conservative Protestants are likely to

> believe the teaching of their religion on the issue not the scientific claim (2011: 1).

Evans writes:

> The greatest conflict between fundamentalists, evangelicals and science is not over facts but over values. While scientists like to say that their work is value-free, that is not how the public views it, and conservative Protestants especially have homed in on the moral message of science (2011: 1).

Is there a conflict between religion and science over *values* more so than over *facts*? What kind of evidence would be necessary to support or refute this kind of theoretical claim? What would it mean for secularization theory for there to be conflict between religion and science over values and/or facts?

Support for Institutional Conflict between Religion and Science

Evans and Evans (2008) argue that religion and science must be understood first as social institutions. Where there is conflict, the authors argue, it is a conflict over values. Evans and Evans believe that the conflict over values is more important than conflict over facts or epistemological claims. Empirical evidence from the present study suggests that there may be support for Evans and Evans argument that the conflict between religion and science is institutional. Many of the GSS questions measure attitudes toward science in terms of value positions. Examples of the value-based nature of such questions include: "science makes our way of life change too fast"; "the benefits of science outweigh the harms"; and "scientific research advances the frontiers of knowledge" (paraphrasing GSS questions). If the conflict between religion and science is

in fact one over values, as Evans and Evans argue, we should expect to find differences between theistic and naturalistic worldviews in response to science as a social institution.

The present study found the least amount of support for science as an institution among Theists. This would seem to support the idea that there are considerable differences between religious worldviews over the value dimension of science as a social institution. Dualists are an interesting case because despite being a theistic worldview, they share more similarities with Naturalists in their attitudes toward science than they do with either Theists or Skeptics.

Empirical findings seem to support Evans and Evans (2008) thesis that there is a conflict of values in response to science as an institution; at least amongst Theists and Skeptics. In response to stem cell research, Theists also report the least amount of support. This would suggest a conflict of values for a segment of Theists here too, but not a majority. A minority of Dualists report low support toward science as an institution and toward stem cell research. Why is it then that Theists and Skeptics (a theistic worldview and a non-theistic worldview) are more alike in their values than Theists and Dualists (two theistic worldviews)? And, why are the attitudes, and values, of Skeptics, Dualists, and Naturalists so similar toward stem cell research? Only Theists report a considerable, but non-majority, amount of opposition to stem cell science.

A Conflict over Values, Facts, or Something Else

The title of Evans et al. (2008) article is "Religion and Science: Beyond the Epistemological Conflict Narrative." If by "epistemological" the authors mean a method

of knowing, findings from the present study also seem to support the claim that there is more of a value conflict than a epistemological conflict. There was very little difference between worldviews when it comes to the question of what it means to study something scientifically. Evans (2011) found this also to be the case, that across religious belief, people tend to have similar understandings of scientific method. If by "epistemological conflict" the authors mean a conflict over specific points of fact or knowledge (which they do, as they describe), then their conclusions about the absence of a broader epistemological conflict between worldviews does not follow. Sociologically, there is clearly a conflict between worldviews over not only specific points of fact, but also over something more basic.

Ontological Conflict

There are important differences between individuals in how they respond to certain knowledge questions. Survey data repeatedly shows it to be the case that in the United States there are different answers in response to two very important questions as far as a person's world picture goes. The Science and Engineering Indicators report (NSF, 2008) highlighted this data. To repeat a review of this report from an earlier chapter: Americans' responses to questions about evolution have changed very little over the past 25 years. 43% of GSS respondents answered "true" to the question: "human beings, as we know them today, developed from earlier species of animals." For the question, "the universe began with a huge explosion," less than 40% answered "true." In the report it is stated that: "Many Americans appear skeptical of established scientific

ideas in these areas, even when they have some basic familiarity with them" (7-3). Further: "Americans' responses to questions about evolution and the big bang appear to reflect factors beyond unfamiliarity with basic elements of science" (7-19).

Differences in answers to questions about the universe and evolution reflect deep differences between worldviews on matters of belief. Questions about the origins of the universe and humans evolution are not side issues or small matters of fact. The two beliefs: "evolution is true" compared to "evolution is false" are two very different beliefs. Such disputes are described as "epistemological conflicts" by Evans and Evans; which they are. Unlike the speed of hummingbird wings, however, answers to these kinds of questions are basic in piecing together a map of reality. These differences in belief represent differences in fundamental ontology: different ideas about what exists. For such questions what is interesting is that it does not seem to be the methods of science that are in question. The question is more one of how to interpret the facts. It is true that there may be a real conflict of "values," but that is not all. Evans writes that the big bang and human evolution receive more skepticism because they are "unobservable abstractions" (2011). Many people may believe that such knowledge claims are "unobservable abstractions" because they are not easily viewed or seen directly. Importantly, this brand of knowledge is not always directly applied. Such knowledge claims are "propositional" (Mokyr 2002). Other items of knowledge can be directly applied, such as stem cell science. This brand of knowledge is described by Mokyr as "prescriptive."

What is it that separates Theists from Dualists within this study? It is there answers to these two questions. For Theists and Dualists there is a clear difference in ontology. For Theists, presumably, this conflict begins as a conflict over ontology, leads

to a conflict over epistemology (specific knowledge claims), and manifests itself as a conflict over values (feelings toward both propositional and prescriptive knowledge claims). For Theists there is clearly more of a conflict reported in their attitudes toward all three forms of science (but much less so toward science as a method). For Dualists there is less of a conflict. Dualists accept the big bang and evolution as the ontological reality. Their attitudes toward all three forms of science are much more supportive. Skeptics, who like Theists, do not accept the big bang or evolution as an ontological picture, are just about as critical of science as a social institution as are Theists. Perhaps surprisingly, their skepticism does not translate to negative attitudes toward stem cell research. Skeptics are nearly as enthusiastic about stem cell research as are Naturalists. The fact that Skeptics, Dualists, and Naturalists are so supportive of stem cell research may have to do with the applied nature of stem cell science as a "prescriptive" brand of knowledge. Theists seem to be the only group with less than complete enthusiasm for expanding the government funding of stem cell research. Theists may more closely resemble idea leaders and ideologues on these issues. Even though Skeptics report similarly low support for science as an institution, this group reports dramatic differences in other measures of religiosity as compared to both Theists and Dualists. Skeptics, Naturalists, and Dualists all favor extending research into stem cell science.

In summary, there is evidence found within this study to support Evans and Evans' thesis of value conflict between those who are more and less religious. This study found that there is a conflict of values between religious worldviews in response to science as a social institution. There does not seem to be a conflict between worldviews over the method of science. What Evans and Evans' explanation fails to account for,

however, is the *meaning* of the differences in belief over fundamental issues of knowledge like the origins of the universe and human evolution. These differences in belief represent deep seated ontological differences between religious worldviews over what exists, has existed, and may exist. The authors make a case for not assuming there to be an epistemological conflict between religion and science. Empirical evidence from this study suggests that there is conflict over values between worldviews and conflicting attitudes about the role of science as a social institution. Theists and Skeptics are the most critical of science as a social institution. Theists are also critical of stem cell science, but not by a majority. It would appear then that even amongst Theists there is a majority support for stem cell science and a break amongst this segment of Theists from the ideologues. It is only the smaller segment of Theists who stand opposed to stem cell science whose attitudes more closely resemble the ideologues. On the other side, Skeptics, Naturalists, and Dualist all seem to be very much in support of stem cell science. Their attitudes reflect what would appear to be a majority support across all worldviews for government funding of stem cell science within the United States.

Implications for Secularization Theory

If there are differences between worldviews in response to value questions about science, what are the implications for existing theories of secularization? Steve Bruce (2002) argues a solution to what he sees as a paradox of secularization: how is it that religious individuals are able to enter into science-based careers and retain their

religious faith? It will be shown why Bruce's explanation for this paradox does not fit the findings of this study.

Bruce on Science and Secularization

Secularization is usually defined as a combination of a decline of religious belief, participation, and/or institutions. Within the secularization debate, there are differing accounts on the relationship between science and secularization. While Bruce (2002) is a proponent of secularization theory, he does not believe that science itself has directly influenced a decline of religion. Instead, he places emphasis on the spread of a "rationalistic orientation to the world." "General relativism" is believed to be another source of secularization. The relationship between general relativism and secularization is described, indirectly, by historian Gustavson (1955). Describing the Roman Catholic Church's role in upholding its claims on truth, Gustavson writes:

> The Church became the official custodian of Truth. In this way a fairly uniform body of beliefs was imposed upon the diverse language groups and cultures, and a very valuable contribution to the molding of European civilization it was. In the ignorance of the times, the medley of pagan residues, the sheer irreligious passions of a warrior society, only this approach could have saved the Church. Even in the Reformation, the chief churches, Lutheran, Calvinist, and Anglican, felt called upon to stamp out the smaller groups of the so-called lunatic fringe in order to preserve the unity of society (84).

When claims compete, the thought goes, there will be a negative influence on unified systems of belief. General relativism avoids granting any one set of claims the status of absolute truth. It would seem to stand to reason, then, that general relativism might negatively impact the Roman Catholic Church's authority over truth. General relativism

bears a similarity to the notion of "pluralism." Berger has suggested that pluralism, not modernization itself, is a likely contributor to secularization (interview with Mathewes, 2006).

Bruce does not believe then that science has directly contributed to secularization. Bruce explains that if it were correct that science and religion were in direct competition, then we should expect to find scientists to be less religious. By contrast, Bruce cites Stark and Finke (2000: 53) and the 1969 Carnegie Commission survey which found natural scientists to be more likely than social scientists to be regular churchgoers and to describe themselves as religiously conservative. While recent data (Howard Ecklund, Park and Veliz; 2008) question the present day accuracy of the 1969 Carnegie Commission survey, there does seem to be a paradox in the cases where otherwise "secular" scientists retain their religious faith. Bruce is particularly interested in how it is that evangelicals within the medical sciences are able to keep their faith. This topic is covered in depth in a chapter titled "Science and Secularization." The question is: *How is it possible for religious scientists to retain their faith*? The solution Bruce arrives at, I argue, is lacking.

A Criticism of Bruce's Resolution to the Paradox of the Co-Existence of Religion and Science

Bruce begins his account with the observation that conservative and liberal Protestants do not typically view the bible in the same way. Conservative Protestants tend to view the bible as the *literal* word of God; and as the most authoritative source of knowledge. Liberal Protestants, by contrast, place a greater emphasis on *interpretation* of the Bible. There is support for this observation through the present study. Theists were

more likely to view the bible as the "word of God" compared to Dualists (a more liberal worldview based on their reports). Dualists more typically viewed the bible as the "inspired word" of God.

Why do conservative and liberal Protestants differ in the way they view the Bible? Bruce contends that if we are looking for answers as to how it is that conservative Protestants are able to enter science-based careers and still hold onto their faith, we need to look away from specific points of conflict between religion and science and focus on something else. This is the same position held by Evans and Evans (2008; 2011). Both hold the theoretical position that points of conflict over specific knowledge claims should not be taken as evidence of a more widespread "epistemological conflict" between religion and science. Bruce believes we need to look away from these points of conflict, and instead consider the "cognitive styles" of conservative and liberal Protestants. His argument is that while religion and science may clash over specific facts, the "cognitive styles" of conservative and liberal Protestants matter more:

> The explanation of the paradox can be found if we move from the apparent clash between certain scientific findings (such as the age of the earth, the origins of species and so on) and the traditional teachings of the Christian tradition and concentrate instead on more abstract assumptions about the nature of knowledge or what we might call cognitive styles (2002: 111-112).

The argument Bruce makes from here is that conservative Christian groups possess an "empiricist" perspective toward the Bible (specifically the King James Version); whereas liberal Protestant groups posses more of an "interpretive" perspective toward the Bible.

> The conservative view of the Bible and how it is to be read is classically empiricist. Conservatives do not see themselves as adding anything by way of interpretation (2002: 113).

Bruce then connects what he sees as a conservative empirical epistemology with a particular brand of science:

> The conservative Protestant inhabits a world of hard empirical reality – a world where facts are separate from interpretations. There is thus a basic resonance between the cognitive styles or operating assumptions of evangelicalism and Baconian mundane science (115).

And:

> The account of the cognitive style of conservative Protestantism suggests a reconciliation with a certain sort of science: the inductionism pioneered by Francis Bacon and described by Karl Popper in his Logic of Scientific Discovery (1978) as the 'bucket' theory of science. Facts are collected up and when you have enough of them you have an explanation. Historians, philosophers and sociologists of science have done much to weaken faith in inductionism, but, I suspect, it is still at the heart of most views of science held by science undergraduates, lay people and those working in the 'applied' sciences (2002: 115).

Bruce contends that there is a shared cognitive style between conservative Protestants and empiricists. This point is based on a presumed likeness between the cognitive styles of conservative Protestants and the ideal, interpretation-less, brand of objective scientific empiricism. Bruce's argument is that religion and science can coexist, and often do, because conservative Protestants share a cognitive style that places an emphasis on direct empiricism. The bible and natural facts alike are said to be received by conservative Protestants as directly observed facts, bypassing interpretation. As Bruce's resolution to the paradox goes, this shared empiricist approach lends itself to the applied sciences- explaining why conservative Protestants can be natural scientists and retain their faith in the literal truth of the bible as God's word.

This explanation fails to explain the findings of this study. Sociologically, if all conservative Protestants share an empiricist outlook, we should expect to find more scientists who are conservative Protestants. We should also expect to find fewer scientists

who are liberal Protestants- because their "interpretive cognitive style" would hinder them from possessing the "cognitive style" of scientific empiricism. We might also expect to find more positive attitudes toward science on the part of conservative Protestants, in relation to more liberal worldviews. Sociologically, these claims are speculation. They sound more like folk psychology than sociological empiricism. These claims would need to be tested.

The present study found Theists to be the only group to report in a majority that the bible was the literal "word of God" (66.3%). Theists most closely resemble the label of conservative Protestant. Based on Bruce's theoretical account, Theists should have an empiricist cognitive style, along with attitudes favorable to science. In fact, against Bruce's explanation, this group expressed the least amount of support for science as an institution, possessed the least amount of understanding of science as a method, and reported the least amount of support for the applied science of stem cell research. Liberal Protestants were most closely typified by the Dualists category. In comparison to Theists, the attitudes of Dualists were much more supportive of science as an institution, method, and application of knowledge. Dualists were much *less* likely to view the bible as the literal word of God (21.9% report the bible to be "the word of God"; 69.5% of Dualists report the bible to be the "inspired word").

Logically, Bruce equates "conservative Protestant" with "empiricist." If being a conservative Protestant is in fact conducive to being an empiricist, we should expect to find an empiricist outlook toward all types of scientific investigation. Theists report the lowest number of respondents to report that the big band theory of the universe and evolution are "true." By choosing to ignore specific points of conflict between theist,

naturalist, and dualist worldviews on knowledge claims, Bruce is left to invent an ad hoc explanation of how it is that people who hold religious worldviews are also able to be practicing scientists. This explanation fails to explain why it is that conservative Protestants believe that the bible is the literal word of God in the first place; and why this worldview has chosen the Bible (specifically the King James Version) above other sources of empirical evidence as the first source of authoritative knowledge (and why Dualists have not). The biblical literalism of conservative Protestants might be concocted as a form of empiricism, but it is nothing like scientific empiricism.

Bruce's explanation and resolution to the paradox of religious scientists cannot be the best one. It attempts to explain why it is that religion and science can, and often do, co-exist within the thoughts and behaviors of some individuals, but it ultimately fails. Therefore, it cannot be the best explanation of the relationship between religion, science, and secularization.

Conclusion: Existing Theory Fails to Explain the Findings of the Present Study

For these reasons, these two explanations (Evans and Evans 2008; and Bruce 2002) of the relationship between religion, science, and secularization fail to explain the questions and findings of this study. Future research into this relationship may better address these questions if within the measure of "religious worldview" the worldviews of naturalists, skeptics and dualists are considered alongside those of theists. Also, sociological studies of science in society will be more accurate when they measure science as multidimensional.

REFERENCES

Association of American Medical Colleges. 2011. Embryonic Stem Cell Research. Retrieved April 3, 2012 from https://www.aamc.org/.

Audi, Robert. 2009. Religion and the Politics of Science: Can Evolutionary Biology be Religiously Neutral? *Philosophy & Social Criticism*, vol. 35, no. 1-2, pp. 23-50, Jan-Feb.

Behe, Micheal. 2007. *The Edge of Evolution: The Search for the limits of Darwinism.* Free Press, New York.

Berger, Peter , ed. 1999. *The Desecularization of the World: Resurgent Religion and World Politics*. Grand Rapids, MI. William B. Eerdmans Publishing Company.

Berger, Peter, Grace Davies, and Effie Fokas. 2008. *Religious America, Secular Europe?* Hampshire, UK: Ashgate Publishing Limited.

Bruce, Steve. 2002. *God is Dead: Secularization in the West*. Malden, MA.: Blackwell Publishing.

Cassonova, Jose. 1994. *Public Religions in the Modern World.* The University of Chicago Press, Chicago, IL.

CBS News. 2011. Pope: God Behind Big Bang. CBS NEWS. Retrieved January 7, 2011 from http://www.cbsnews.com/8301-501465_162-20027781-501465.html.

Chan, Amanda. 2011. Adult Stem Cells: Doctors Question Rick Perry's Experimental Procedure. *Huffington Post*. Retrieved 08/22/11 from http://www.huffingtonpost.com/2011/08/22/adult-stem-cells-back-pain_n_933082.html.

Converse, Philip E. 1964. The Nature of Belief Systems in Mass Publics. In: Apter, David, E. ed. *Ideology and Discontent*. London, Free Press of Glencoe.

Dawkins, Richard. 2006. *The God Delusion*. Boston: Houghton Mifflin.

Dennett, Daniel. 2006. *Breaking the Spell: Religion as a Natural Phenomenon.* New York: Viking Penguin.

Edgell, Penny and Eric Tranby. 2010. Shared Visions? Diversity and Cultural Membership in American Life. *Social Problems*. Vol. 57, No. 2. pp. 175-204.

Eisenstadt, Shmuel N. 1966. *Modernization, Protest, and Change*. Prentice Hall: New Jersey.

Ellison, Christopher and Marc Musick. 1995. Conservative Protestantism and Public Opinion toward Science. *Review of Religious Research*, vol. 36, no. 3, pp. 245-262, Mar.

Evans, John and Kathy Hudson. 2007. Religion and Reproductive Genetics: Beyond Views of Embryonic Life? *Journal for the Scientific Study of Religion*, vol. 46, no. 4, pp. 565-581, Dec.

Evans, John and Michael Evans. 2008. Religion and Science: Beyond the Epistemological Conflict Narrative. *Annual Review of Sociology*, vol. 34, pp. 87-105.

Evans, John. 2011. Science and religion: A false divide. (Op-Ed). *Los Angeles Times*. Los Angeles, CA.

Fukuyama, Francis. 2002. *Our Posthuman Future: Consequences of the Biotechnology Revolution*. New York: Farrar, Straus and Giroux, 2002.

Gauchat, Gordon W. 2008. A Test of Three Theories of Anti-Science Attitudes. *Sociological Focus*. Vol. 41: 4.

Glezos, Simon. 2010. Creative Destruction versus Restrictive Practices: Deleuze, Schumpeter and Capitalism's uneasy relationship with technical innovation. Ctheory. Retrieved 1/13/2011 from www.ctheory.net/articles.aspx?id=648.

Ghosh, Pallab. 2011. UK Stem Cell Stroke Trial Passes First Safety Test. *BBC*. Retrieved September 1, 2011, from http://www.bbc.co.uk/news/health-14731682.

Goldman, Alvin. 2002. *Pathways to Knowledge: Private and Public* (collected papers), New York: Oxford University Press. 224 pp.

Gould, Steven J. 1997. Nonoverlapping Magisteria. *Natural History*, 106, 16-22.

Granger, Maury D and Gregory N Price. 2007. The Tree Of Science And Original Sin: Do Christian Religious Beliefs Constrain The Supply Of Scientists? *The Journal of Socio-Economics*, vol. 36, no. 1, pp. 144-160, Feb.

Finke, R.; Stark, R. 2005. *The Churching of America, 1776-2005: Winners and Losers in our Religious Economy*. New Brunswick, NJ.: Rutgers University Press.

Habermas, Jürgen. 2003. *The Future of Human Nature*. Cambridge, MA: Polity Press,

Habermas, Jürgen 2008. *Between Naturalism and Religion: Philosophical Essays*. Polity Press: Malden, MA.

Hart, David B. 2005. John Paul II and the Ethics of the Body. *The New Atlantis*. Summer 2005. pp. 65-73.

Hervieu-Leger, Daniele. 2006. In Search of Certainties: The Paradoxes of Religiosity in Societies of High Modernity. *Hedgehog Review*, vol. 8, no. 1-2, pp. 59-68, spring-summer.

Hochedlinger, Konrad. 2010. Your Inner Healers. *Scientific American*. Vol. 302, Number 5, pp. 46-53.

Howard-Euckland, Elaine, Jerry Z. Park and Phil T. Veliz. 2008. Secularization and Religious Change among Elite Scientists. *Social Forces*, vol. 86, no. 4, pp. 1805-1839, June.

Jacob, Margaret C. 1988. *The Cultural Meaning of the Scientific Revolution*. Philadelphia: Temple University Press.

Karpov, Vyacheslav. 2010. Desecularization: A Conceptual Framework. *Journal of Church and State* vol. 52 no. 2, pages 232–270.

Kaye, Howard L. 2008. Are Science and Religion Complementary Perspectives? *Springer. Soc*: 45: 152-154.

Khan, Amina. 2011. Peyton Manning: Can Stem Cell Therapy get Colts QB back in game? Los Angeles Times. Retrieved September 19, 2011 from http://articles.latimes.com /2011/sep/19/news/la-heb-peyton-manning-stem-cell-treatment-colts-quarterback-20110919.

Kniss, Fred. 2003. Mapping the Moral Order: Depicting the Terrain of Religious Conflict and Change. In Dillon, M. ed. 2003. *Handbook of the Sociology of Religion*. Cambridge, UK: Cambridge University Press.

Kroker, Arthur. 2004. *The Will to Technology and the Culture of Nihilism*: Heidegger, Marx, Nietzsche. Toronto: University of Toronto Press.

Kurzweil, Ray. 2005. *The Singularity is Near: When Human Beings Transcend Biology*. New York: Viking.

Mathews, Charles T. 2006. An Interview with Peter Berger. *The Hedgehog Review*, 8: 1 & 2 Spring & Summer, pp. 152-161

McAuliffe, Kathleen. 2011. Top 100 Stories of 2010 #2: First Synthetic Organism Created. *Discover Magazine*. January-February Special Issue published online, April 28, 2011, http://discovermagazine.com/2011/jan-feb.

Mokyr, Joel. 2002. *The Gifts of Athena: Historical Origins of the Knowledge Economy.* Princeton: Princeton University Press.

North, Douglas C. 1990. *Institutions, Institutional Change and Economic Performance.* Cambridge: Cambridge University Press.

North, Douglas C. 2005. *Understanding the Process of Economic Change.* Princeton University Press, 2005.

Norris, Pippa and Ronald Inglehart. 2004. *Sacred and Secular: Religion and Politics Worldwide.* Cambridge, UK.: Cambridge University Press. .

Park, Madison. 2011. Lab-Made Organ Implanted for First Time. *CNN.* July 8, 2011 9:32 a.m. EDT. Retrieved 3/3/2012 from http://www.cnn.com/ 2011/HEALTH/07/07/ trachea.transplant/index.html

Palmer, Brian. (2011). Colon-oscopy: Doctors Injected Stem Cells into Pitcher Bartolo Colon's Injured Arm. Does that Really Work? *Slate.* Retreived May 13, 2011, from http://www.slate.com/articles/news_and_politics/explainer/2011/05/colonoscopy.html

Rifkin, Jeremy. 2004. "What Biotechnology Means for the Future of Humanity." In Biotechnology and the Future of Society: Challenges and Opportunities, edited by Al-Suwaidi, J.S., 41-70. South Court: Ithaca Press.

Science & Engineering Indicators. 2008. Prepared by National Science Foundation Division of Science Resource Statistics. Science and Technology: Public Attitudes and Understandings. www.nsf.gov/statistics/seind061

Searle, John R. 2011. *Making the Social World: The Structure of Human Civilization.* New York: Oxford University Press.

Segerstråle, Ullica. 2000. *Defenders of the Truth: The Battle for Science in the Sociobiology Debate and Beyond.* Oxford: Oxford University Press.

Shapin, Steven. 1996. *The scientific revolution.* Chicago, IL : University of Chicago Press, 1996.

Shapin, Steven. 2007. Science and the Modern World; in Hacket, E.J. (editor) *The Handbook of Science and Technologies Studies.* MIT Press.

Sheittle, Christopher P. (2005). In God We Trust: Religion and Optimism Toward Biotechnology. *Social Science Quarterly,* Vol. 86, Number 4, pp. 846-856.

Siebert, Rudolf J. 2012. *The Evolution of the Religious Consciousness toward alternative Futures.* New Deli, India: San Bun Publishers

Smith, Christopher. 2003. *The Secular Revolution: Power, Interests, and Conflict in the Secularization of American Public Life*. Berkely, CA.: University of California Press.

Solovey, Matthew. 2011. Stem Cells Morph into Cancer Busters. *Futurity*. Retrieved September 23, 2011 from http://www.futurity.org/health-medicine/stem-cells-morph-into-cancer-busters/.

Stark, Rodney. 2003. *For the Glory of God: How Monotheism led to Reformations, Science, Witch-Hunts, and the End of Slavery*. Princeton, New Jersey: Princeton University Press.

Stark, Rodney. 2005. *The Victory of Reason: How Christianity led to freedom, capitalism, and Western success*. New York: Random House.

Sudman, Seymor, Norman M. Bradburn and Norbert Schwarz, N. 1996. *Thinking about answers: The application of cognitive processes to survey methodology*. San Francisco, CA: Jossey-Bass.

Turner, Jonathan H.; Leonard Beeghley, and Charles H. Powers. 1995. *The Emergence of Sociological Theory*. New York: Wadsworth Publishing Company.

Turner, Jonathan H. 1997. *The institutional order*. New York: Longman.

Virilio, Paul. 2002. *Crepuscular Dawn*. Los Angeles: Semiotext(e).

Weber, Max. 1964. *The Sociology of Religion*. Boston, MA.: Beacon Press.

Wilkinson, Francis. 2008. The Discover Interview: Leon Kass: Stem Cells, bastard children, right to die- a former chairman of G.W. Bush's Council on Bioethics is dogged by controversy. *Discover*. February 2008.

Wuthnow, Robert. 2005. *America and the Challenges of Religious Diversity*. Princeton, NJ.: Princeton University Press.

Ziman, John. 2000. *Real Science: What is it, and what it means*. Cambridge, UK.: Cambridge University Press. .

Ziman, John. 1996. "Postacademic Science": Constructing Knowledge with Networks and Norms. *Science Studies*, vol. 9, no. 1, pp. 67-80.

APPENDIX A

Factor Analysis of Variables

Factor Analysis

Descriptive Statistics

	Mean	Std. Deviation	Analysis N
God recode	5.1709	1.33904	2932
strength of affiliation	2.6555	1.12811	2932
Punishment for sin recode	2.8250	1.42924	2932

Communalities

	Initial	Extraction
God recode	1.000	.639
strenght of affiliation	1.000	.604
Punishment for sin recode	1.000	.480

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.723	57.436	57.436	1.723	57.436	57.436
2	.724	24.138	81.574			
3	.553	18.426	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
God recode	.799
strenght of affiliation	.777
Punishment for sin recode	.693

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	2932	65.0
	Excluded[a]	1578	35.0
	Total	4510	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.619	3

Factor Analysis

Descriptive Statistics

	Mean	Std. Deviation	Analysis N
sci evidence	3.7744	.53127	1769
sci carefully examine	3.7032	.56640	1769
sci repeat	3.6331	.59831	1769

Communalities

	Initial	Extraction
sci evidence	1.000	.667
sci carefully examine	1.000	.685
sci repeat	1.000	.554

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.907	63.555	63.555	1.907	63.555	63.555
2	.629	20.977	84.533			
3	.464	15.467	100.000			

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.907	63.555	63.555	1.907	63.555	63.555
2	.629	20.977	84.533			
3	.464	15.467	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
sci evidence	.817
sci carefully examine	.828
sci repeat	.745

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	1769	39.2
	Excluded[a]	2741	60.8
	Total	4510	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.709	3

Factor Analysis

Descriptive Statistics

	Mean	Std. Deviation	Analysis N
confidence in sci	2.3807	.60140	1639

BENEFIT	1.1647	1.03996	1639
science advances frontiers of knowledge and should be supported by govt funding	3.2386	.62884	1639

Communalities

	Initial	Extraction
confidence in sci	1.000	.501
BENEFIT	1.000	.505
science advances frontiers of knowledge and should be supported by govt funding	1.000	.519

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.525	50.834	50.834	1.525	50.834	50.834
2	.746	24.875	75.708			
3	.729	24.292	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
confidence in sci	.708
BENEFIT	.711
science advances frontiers of knowledge and should be supported by govt funding	.721

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	1639	36.3
	Excluded[a]	2871	63.7
	Total	4510	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.482	3

APPENDIX B

Correlations of Variables

Control Variables			Theism	Naturalism	Confidence in Science	Scientific Method	Stem Cell Research
AGE OF RESPONDENT & HIGHEST YEAR OF SCHOOL COMPLETED & RACE OF RESPONDENT & REGION OF INTERVIEW & RESPONDENTS SEX a. Cells contain zero-order (Pearson) correlations.	Theism	Correlation	1.000	-.432	-.109	-.013	-.224
		Significance (2-tailed)	.	.000	.037	.805	.000
		df	0	361	361	361	361
	Naturalism	Correlation	-.432	1.000	.188	-.009	.193
		Significance (2-tailed)	.000	.	.000	.870	.000
		df	361	0	361	361	361
	Confidence in Science	Correlation	-.109	.188	1.000	.036	.195
		Significance (2-tailed)	.037	.000	.	.494	.000
		df	361	361	0	361	361
	Scientific Method	Correlation	-.013	-.009	.036	1.000	.048
		Significance (2-tailed)	.805	.870	.494	.	.362
		df	361	361	361	0	361
	Stem Cell Research	Correlation	-.224	.193	.195	.048	1.000
		Significance (2-tailed)	.000	.000	.000	.362	.
		df	361	361	361	361	0