# THE IMPACT OF EVOLUTIONARY THEORY ON COLLEGE STUDENTS' OUTLOOK-ON-LIFE

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THE IMPACT OF EVOLUTIONARY THEORY ON

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# CHAPTER I

## INTRODUCTION

A positive outlook-on-life and education can be complementary. On the one hand, students who have a positive outlook-on-life may experience a sense of hope, significance, and well-being, and it is the development of a positively oriented state of mind that many times enables students to succeed academically (Ainley, 2006; Chang, 1998; Huppert & Baylis, 2004; Snyder, Lopez, Shorey, Rand, & Feldman, 2003). A positive outlook-on-life can have this psychological carrying power because it is composed of more than just a personalized global explanation of life. The concept of outlook-on-life consists of three components: "(a) theoretical assumptions of the human and the world, (b) a central system of values, and (c) an emotional foundation" (Norlander, Gard, Lindholm, & Archer, 2003, p. 4). This study adopts this basic definition, plus the fourth implication that outlook-on-life places value on the future. To say that students have a positive outlook-on-life is to say that they not only maintain a coherent worldview by which spiritual and/or social values are derived, but that their deeply personal reflections upon their worldview provide them with the belief that a substantive level of continued well-being is attainable, for the structure and future of the world seem to permit this.

On the other hand, students who experience a quality education may have

learning experiences and expanded opportunities that contribute to the development of the various psychological elements constituting a positive outlook-on-life (Hammond, 2004; Pallas, 2000; Ross & Van Willigen, 1997). Of course, this does not imply that all students who are fortunate enough to access a good education will have a positive outlook-on-life, or that a good education is necessarily required to maintain some optimism, although it may infer that students who do not have access to a quality education have a more difficult time developing a positive outlook-on-life. For those students who do have access, education can often provide many of the conceptual connections that help students construct a coherent worldview and gain a sense of self-efficacy beyond that which they might gain at home. Knowledge and an emotionally positive perception of the world, therefore, can work together to enable students to succeed academically and to sustain some level of satisfaction and well-being in life. Many, if not most, educators likely wish for their students to experience positive outcomes from education and have fulfilling lives as a result. But what happens if, during the educational process, students perceive that the very subject matter they are studying threatens the sustainability of a positive outlook-on-life? And if there were such a subject in public schools of the United States, what does this mean for educators?

While it is true that students may struggle to grasp a wide range of topics in school, most students would probably not allege that the topics themselves have the general power to disrupt a positive outlook-on-life. However, there is one subject in school that does seem to have a tendency to challenge the optimism of at least some students. In fact, its presentation in a high school biology classroom might cause more than a few science teachers to agonize over whether or not they should temporarily adjust

their usual pedagogical practices; some of those same teachers might even be tempted to make a major curricular decision and go against educational standards by downplaying or skipping the topic altogether (Donnelly & Boone, 2007; Hermann, 2008; Moore, 2004). It is not a topic like cell growth, diversity of life, sexual reproduction or environmental ecology that proves to be a discouragement to students and teachers alike. It is not even a topic that typically drives practical fears, such as environmental pollution and global warming. No, it is the scientific theory of evolution that troubles the minds of many students and often foils the attempts of teachers to teach about it.

If evolutionary theory contributes to the formation of ambivalent feelings among students toward the biological sciences, then this can be a substantial educational problem, especially when secondary educational standards in many states require students to take biology classes or their equivalents, wherein evolutionary theory is usually, but not always, presented as a unifying principal of the entire science curriculum (Education Commission of the States, 2008; Zinth, 2006). In conjunction with meeting state standards, science educators, especially those who hold firmly to the factual nature of the Modern Synthesis of evolutionary theory, typically expect students to be well grounded in the basic ideas of biological science by the time graduation from high school takes place. On a very basic level, this means that students are expected to demonstrate knowledge of the Modern Synthesis by specifying how all of earth's life forms are biologically connected and have progressively changed and diversified through mutations and time, mostly by way of nature's seeming "selection" of genetic characteristics that make reproduction and survival possible (Gregory, 2009). But as it so happens, and against the hopes of many science educators, students often finish high school and enter

college science classes with not only an inadequate understanding of the theory of evolution, but also with varying degrees of reluctance in accepting it as a part of their own worldview (Alters & Nelson, 2002; Cavallo & McCall, 2008; Thagard & Findlay, 2009; Woods & Scharmann, 2001). For these students, the theory of evolution is not the unifying concept of science that many scientists and science educators perceive it to be; it is rather a disruption to the coherence of a positive outlook-on-life.

## Statement of the Problem

Evolution has been often misunderstood and rejected by numerous students, parents, politicians, educators and administrators, as well as by some science teachers and scientists. Its presence as a working concept in science classrooms is often less than what it could be, and usually less than what many scientists and science teachers believe it should be (Blackwell, Powell, & Dukes, 2003; Scott, 2004; Skoog & Bilica, 2002). Indeed, the teaching of evolution in the United States today is a complex and, at times, politically charged matter that influences instruction and curricula. Needless to say, the lack of comprehension and the negative response that evolution receives in biology and related science classes is a concern to science educators. They recognize that a persistently negative perception of evolution can prevent a student from learning and fully understanding the processes of biology (McKeachie, Lin, & Strayer, 2002; Woods & Scharmann, 2001).

Although the educational complexities involved with teaching the theory of evolution in its current Modern Synthesis have been addressed primarily by science educators, there are some good reasons why it should be a concern to social science educators as well, especially if there happen to be any clear and distinct impacts to

students' outlook-on-lfe. First, if students feel justified in ignoring evolution as a cogent, scientific explanation of biological life, they may be doing so at a moment when the opportunity to acquire a robust science education is present, and if students miss the opportunity to learn science well, especially while in college, their occupational options can be affected. This is a social problem and can be addressed by social science educators. Second, if the theory of evolution stimulates a negative outlook-on-life among students, the negativity may lead to other emotional and relational complications in students' lives outside of school and in the long term of life. This, too, is a social problem that is appropriate to the field of social science.

There is a third reason for the involvement of social science educators in researching how education about evolution plays in the perceptions of students. Research by science educators on this issue has been driven at times by the goal of actuating "conceptual change" in the minds of students—that is, to get them not only to learn evolutionary theory, but if possible, to accept it (Kampourakis & Zogza, 2008; Sinatra, Brem, & Evans, 2008; Sinatra, Southerland, McConaughy, & Demates, 2003). Although this seems to be a laudable pedagogical and academic goal, being that the economy in the United States is also driven by technological innovation, it should be pointed out that very few of the studies in this research area have strictly investigated the ways in which the concept of evolution may affect students' outlook-on-life just for the sake of the students' well-being. Perhaps this is because the work of many science educators is contextualized by the philosophical assumption of the universality of Western science (Coburn & Loving, 2000). In other words, since the phenomenon of evolution is scientifically qualified as a universal fact of nature and its theoretical construct seems to

present the best explanation of biological change from prehistory to the present, it is therefore professed to be something with which all people *must* at some level learn to live; other perceptions and explanations are considered to be deficient (Coburn & Loving, 2000; Nash, 2004). Therefore, if students have emotional misapprehensions about the theory of evolution, these are typically assessed as manifestations of cognitive confusion or misunderstanding. To 'fix' these perceptual incongruities, some science educators feel that they merely need to teach students, in essence, the necessary scientific facts (Alters & Nelson, 2002; Nelson, 2008).

Although the traditional pedagogical approach to teaching biological science may be applied with good intentions, and perhaps even masterfully executed, there is evidence that if students feel pressed to accept a worldview that is incongruous with their native thinking, any openness they may have toward learning may be complicated by feelings of alienation (Beyerlein, 2004; Sikkink, 1999; Woods & Scharmann, 2001). To help ameliorate these pedagogical complications and inefficiencies, some educational researchers in this field recommend a constructivist approach to science pedagogy as an antidote to teaching that is informed by hard-line realism (Alters & Nelson, 2002; Deniz, Donnelly, & Yilmaz, 2008; Matthews, 2001; Nelson, 2008; Thagard & Findley, 2009). Put another way, students' ideas, voices, and personal interactions in the classroom are not only to be taken into consideration in the teaching process, but are to be drawn upon as vehicles for the learning process itself. In line with the constructivist approach, Mengel (2008), while in support of a fully scientific understanding of evolution, criticized the broader science community and its affiliates for not addressing the affective

problems that can accompany human cognition when engaged with the modern rendering of what has developed from Charles Darwin's evolutionary ideas:

> Unfortunately, rather than trying to discover the real reasons that this resistance to evolution continues to strike a chord, the scientific community and the secular media typically circle the wagons and insist that evolution is simply beyond doubt. The Earth is round, the moon is not made of cheese, and Darwin was right. Period. What these cultural elites are missing, however, is that this is not primarily a disagreement about facts; it is at heart a disagreement about *meaning*. As evolutionists insist on the truth of the *facts*, many ordinary people continue to reject what Darwinism seems to *mean* about who and what we are. (p. 214)

With these considerations in mind, if the theory of evolution is causing undue psychological discomfort to students, this issue needs to be addressed and/or taken into account by science educators. All of the personal and social concerns that might plague students while they sit in high school and college science classes connect to personal meaning of the world and should be of concern to science educators and researchers. Educational researchers from other disciplines should also expend time researching in this neglected area of study, especially since the processes and meanings of evolution do not manifest in a philosophical vacuum, but in a living and socially dynamic world, which implies an interdisciplinary approach. Educators working within the context of the social sciences would do well to contribute to this quite public, pervasive, and ongoing educational discussion. Therefore, it was from within a social science context that this research project was conducted.

## Research Questions

In sum, the social science questions directing this study were:

1. Based on the theory of evolution, what are the positive and negative impacts to students' outlook-on-life?

2. What similarities or differences exist in the way that undergraduate biology majors reflect upon the theory of evolution in comparison to undergraduate non-biology majors?

# CHAPTER II

# REVIEW OF LITERATURE

Understanding the ways in which students' outlook-on-life is affected by evolutionary theory is important, especially since many factors, both cognitive and affective, go into students' perceptions of life. Moreover, since students who do not have a positive outlook-on-life may be less motivated to learn, as well as be susceptible to a lowered state of mental health in the long term, it seems feasible to suggest that social and science educators should be responsible for taking into account the positive and negative impacts that the theory of evolution may have on students' lives. To facilitate the theoretical understanding of how students may see and feel about the world in light of evolutionary theory, a review of several considerations that bear upon the cognitive and affective aspects of learning in relation to the theory of evolution is essential.

## Cognitive and Affective Factors

As literature on evolution and education was reviewed by this researcher while attempting to answer the first research question of this study, (i.e. Based on the theory of evolution, what are the positive and negative impacts to students' outlook on life?), one point of social interest continuously came up—many students at both the high school level and the college level are reluctant to engage or accept the theory of evolution (Alters & Nelson, 2002; Woods & Scharmann, 2001). One reason this may be the case

is that to accept the theory as it presently stands in its Modern Synthesis, students have to know enough content about it to even begin to build a sufficient understanding of its complexity. At the college level, it is often difficult for students to retain much of what they learn, not the least of which is content from biology classes (Alters & Nelson, 2002). A second reason some students are reluctant to engage or accept evolution is that even if they do retain the premises of evolution, they may still not be able to sufficiently develop an understanding that brings together its theoretical complexity. So, it is unfortunate for science educators that, even if students are taught in a masterful fashion, it does not follow that evolution will be readily comprehended. However, on the other side of this consideration are students who may actually understand the theory but still reject it. Interestingly enough, Sinatra, Southerland, McConaughy, & Demastes (2003) found no relationship between students' understanding of evolutionary theory and their acceptance of it. Similarly, Deniz et al. (2008) reported no direct relationship between acceptance of evolution and the number of years students spend in biology programs. These findings seem to address the second research question in this study (i.e. What similarities or differences exist in the way that undergraduate biology majors reflect upon the theory of evolution in comparison to undergraduate non-biology majors?), and they seem to demonstrate that students' acceptance or rejection of evolution may be more influenced by reasons other than those related merely to levels of content retention or understanding. However, research in this area is scant and it may perhaps be that even college students who major in the biological sciences can express negative effects upon outlook-on-life in relation to evolution.

If students feel disinclined to accept evolution even when they have a sufficient

understanding of it, some of this response may be due to the cognitive structure of their epistemological beliefs, which has to do with their view on what counts as knowledge. The way in which beliefs about knowledge are formed by students affects how they determine whether or not a general concept of any sort is coherent; it also affects their philosophical understanding of the nature of science (Dagher & BouJaoude, 1997; Sinatra et al., 2003). In other words, how students believe knowledge about the world is gained, structured, and applied seems to affect whether they see science as a static, unalterable knowledge construct, or instead, as a contingent and recursive process that changes as scientists find out new information. How students understand the nature of science may in turn temper the ways in which they construct ideas and beliefs about evolutionary theory.

Having a reasonable grasp of the nature of science may contribute to whether or not students are in fact willing to approach evolution as a scientific theory that reflects the processes of life in our world, but even then, a firm view of the nature of science may not be enough to ensure that students are able to perceive evolution as theoretically comprehensible. For some students, just the vocabulary of science gets in the way of fully understanding the theory of evolution. Moore, Mitchell, Bally, Inglis, Day, & Jacobs (2002) found that students can struggle with the figurative language often employed by scientists and science educators to describe evolutionary processes. The concept of natural selection, for example, is one such scientific term that utilizes figurative language. The term, natural selection, was originally employed by Charles Darwin as a kind of shorthand linguistic device to infer that evolution is a natural and undirected change within the biological world--that is evolutionary change is not directed

by any specific agents or supernatural forces. However, when some students first encounter natural selection as a concept, they may get confused by thinking that it denotes an actual act of selection by nature, as if nature acts as a thinking entity (Gregory, 2009). Science instructors, therefore, need to be careful in explaining abstract notions that are found in evolutionary science. If students do not come to the realization that some abstract concepts are being described figuratively because immediate demonstrations are often very difficult to produce, then they may never see any coherence in the theory of evolution. Rather, they will simply reject it without truly having engaged it.

Brem, Ranney, & Schindel, (2003) have asserted that in order for science educators to effectively teach students the theory of evolution, it is important to understand the mental framework that students use to engage the conceptual complexities of evolution. This framework, or "conceptual ecology," provides a way for educators, both social and science, to envision how students' perceptions may interact with self and society (Brem et al., 2003, p. 183). Deniz et al. (2008) laid out an extended taxonomy of the theorized components of "conceptual ecology": (1) prior learning; (2) scientific focus; (3) the nature of science; (4) biological views incorporating competition and cause; (5) religious views; (6) capacity for reasoning; (7) perceptions of evolutionary theory's impact; (8) beliefs about knowledge; (9) style of thinking; and (10) educational levels of students' parents (pp. 421-422). All ten of these factors interact in a synthesis that influences whether or not students understand or even accept the theory of evolution. The idea that students make assessments about evolutionary theory within the cognitive complexities of a conceptual ecology is important for all educators to realize when

teaching students, especially when the topic involves the modern complexities of evolution. In a study examining how secondary students approach learning about evolution, Cavallo & McCall (2008) affirmed the importance of taking students' cognitive processes into account when learning is taking place:

> Beliefs often begin to develop at a young age and can be very deeply ingrained by the time students reach high school. These beliefs are influenced by many factors such as family, peers, and religion. Students have a strong personal investment with these individuals, groups, and organizations who can influence their beliefs. These beliefs are likely resilient even in light of scientifically-based and logical evidence that may contradict such beliefs. (p. 527)

Matthews (2001) summed up related pedagogical considerations that science educators should be aware of at the college level:

> …our students do not come to us as 'blank slates.' They have preexisting ideas which are shaped by their intuitive understanding and their enculturation, although most of these ideas are nonscientific…if students are comfortable with their existing views, it may be more reasonable for them to reject scientific evidence as flawed, or simply preposterous, rather than undergo a cognitive shift and a rethinking of their own beliefs. This may especially be true when their own ideas are ignored within the instructional setting. (pp. 407-408)

This researcher, working from a social science perspective, has noted that conceptual ecology has been used by science educators and researchers to not only facilitate insight into the cognitive frameworks of students' minds, but also to promote conceptual change among students, i.e. teaching to change students' viewpoints on

biological origins. Since it has been used as a pedagogical tool in this capacity, conceptual ecology has been criticized by other cognitive researchers for not sufficiently taking into account the social and psychological aspects of students' lives (Deniz et al., 2008). In taking the critics' suggestions seriously, this researcher has incorporated two aspects of the interdisciplinary field of positive psychology, hope and well-being (Fishman & McCarthy, 2005; Huppert & Baylis, 2004), into the conceptual ecology theory that informs the basis of this study. Hope and well-being are important states of mind that augment human mental functioning, and as such, seem to be an appropriate part of the overall task in ascertaining how students' outlook-on-life may be influenced by the theory of evolution. Although hope and well-being are treated more generally in this study than they are elsewhere by positive psychologists such as Snyder, Lopez, Shorey, Rand, & Feldman (2002) or Seligman (2002), they are still incorporated in this study as important aspects of a positive outlook-on-life. This researcher has recognized that the way in which students look out upon the world, either as a hopeful place of personal and social existence, or as one that threatens their physical and mental well-being, interacts as a part of their conceptual ecology, which also influences the decisions students make and enact in the world. So, it matters if students believe that evolution positively or negatively affects their outlook-on-life, even though the perceptions of what evolution means to them may or may not accurately reflect what is actually going on in the world; the ongoing levels of hope and well-being that flow from their perceptions, along with their interactions with the world, can have material consequences, psychologically, physically, and socially.

## Philosophical Factors

Evolutionary theory was initially articulated quite powerfully by Charles Darwin during the middle of the nineteenth century, and its Modern Synthesis is typically represented today by two types of voices in the scientific community. One voice is somewhat conciliatory to students' concerns about how evolution affects philosophical aspects of outlook-on-life, such as the meaning and purpose of life, or spiritual beliefs. Kenneth Miller (2008), a prominent educator in the life sciences and a strong proponent of evolutionary theory, represents this first voice in science and has stated that:

> If this universe was indeed primed for human life, then it is only fair to say, from a theist's point of view, that each of us is "the result of a thought of God," despite the existence of the natural processes that gave rise to us. The skeptic will object to this viewpoint, of course, regarding it as nonscientific. And so it is. (pp. 161-162)

In a position that skirts the spiritual but still supports the existence of purpose in life, Brian Boyd (2009), an English professor who studies the connections between literature and Darwinism perhaps also represents this first voice, even if a bit more ambiguously, and he recently attempted to address the concern over life's purpose as it relates to evolution:

> Does evolution by natural selection rob life of purpose, as so many have feared? The answer is no. On the contrary, Charles Darwin has made it possible to understand how purpose, like life, builds from small beginnings, from the ground up. In a very real sense, evolution creates purpose. (pp. 24-25)

Although Boyd may be correct that evolutionary theory, in a sense, actually avails human beings of more opportunities to develop purpose(s) within their lives, this likely will not pacify some students who harbor fears about the personal, spiritual, or social impacts of evolution, especially when the second voice within the scientific community makes itself heard and is mostly antagonistic to the usual religious and social ideas that students use to construct a positive outlook-on-life. Scientific commentator and philosopher Daniel Dennett (1995) is one representative of this second voice in science, and he is known for having called the theory of evolution a "universal acid" (pp. 61-64), implying that it is a philosophically caustic agent that is able to break down all forms of wishful thinking, superstition and pseudo-science, leaving only what is naturally real and rational. If there is purpose and meaning in life, it is necessarily of a different nature than, and disconnected from, the traditional views that have slowly been displaced since Darwin's time. If this is the case, students who have listened to messages sent out by any of the various representatives of this second voice from within the scientific community will likely express an alarmist reaction against the possibility that their outlook-on-life is dissolvable. Thus, the polemics emanating from the second voice in science likely contribute to some students' mixed feelings, particularly when students go off to college.

To allay some students' philosophical fears of evolution, it could be pointed out that Dennett's evaluation that evolutionary theory has the power to "break down" philosophical errors or wishful thinking does not in fact represent the way in which much of the scientific establishment methodologically utilizes evolutionary theory. It could also be pointed out to disquieted students that there are positive technological effects of evolutionary theory, as can be seen in medicine (Mindell, 2006, 2009; Thagard &

Findlay, 2009). Unfortunately, those technological effects, valued and understood by many scientists and science educators, likely remain largely unconsidered by the lay public, which includes of course, many students.

In the effort to defend an outlook-on-life that engenders their own hope and well-being, some students resist learning about evolutionary theory; a few may even resort to a form of what Foucault cited as "*parrhesia*" (as cited in Zembylas & Fendler, 2007, p. 327), a kind of emotional speaking out against what is seen as error on behalf of what is seen as truth. From a liberal point of view, this may seem like a brave material act, but it does not take an overly astute educator to see what this implies for the materiality of a student's occupational future, especially if the student lives in a scientifically and technically savvy business culture like that of the United States. It also might not bode well for some students' long term emotional health. Thus, philosophical considerations based on evolution come to bear on the way students construct their outlook-on-life.

## Religious Factors

Even before Charles Darwin published his landmark book *On the Origin of Species* in 1859, giving evolutionary theory its first scientifically credible articulation, Darwin realized that his particular vision of evolution would likely raise debate and social apprehension, especially from persons with strong religious beliefs (Rachels, 1990). Indeed, his personal estimation has continually proven to be correct, and nowhere has this been truer than in the United States. Evidence of this is seen through the accumulated and long-range coverage of the creationist-evolutionist debate within the journal *Science* between the years 1880 to 2000 (Bleckmann, 2006). Apprehension about evolutionary theory on a public scale has been ongoing to various degrees since Darwin's

time, driven in part by the historical remembrance of social Darwinism, the eugenics movement, and the racial hatred that motivated the Nazis in Germany during the World War II era (Wiekart, 2005).

In countries where religious beliefs of Semitic orientation are prominent, that is, the related religions of Judaism, Christianity, and Islam, there are many students who hold their beliefs in a very literal way and support the ideology of creationism, the view that a divine power has instead directly influenced the origin of life on earth and delineated a special place for human beings within the total 'creation' process. Of course, when religious students in the United States encounter the theory of evolution in public schools, they may already know, or at least become quickly aware, that evolution challenges their outlook-on-life. Many of them learn at some point that a major premise of evolutionary theory is that *Homo sapiens* have become a highly advanced form of life through natural selection. This implies that no supernatural intervention(s) take place during ongoing evolutionary processes. Therefore, it is common for students who firmly adhere to literalized Semitic religious views to react negatively to the presentation of evolution in the classroom; this is, of course, a reflection of the larger, ongoing public controversy between creationists and evolutionists. More specifically, when science instructors teach in accordance with Darwin's dictum that human beings are, in essence, no more special than any of earth's other multitudinous organisms, some religious students, and those in their affiliated communities, may perceive this as an intended aspersion upon their religious beliefs, along with all of the spiritual, social, and ethical values that attend those beliefs (Pearcy, 2004).

Religious students often find it difficult to reconcile their beliefs with evolutionary thought. This is the case in countries that are influenced by the larger Semitic religious traditions, especially in the United States (Chinsamy & Plagany, 2008, Dagher & BouJaoude, 1997; Deniz et al., 2008, Verhey, 2005). Some of the tensions between religion and evolution were reflected in an opinion poll recently released by the Pew Research Center; the results of this opinion poll conducted in the United States showed that Jehovah's Witnesses, Mormons, Evangelical Protestants, Historically Black Protestants, and Muslims tended to disagree with the statement that "evolution is the best explanation for the origins of human life on earth" (Masci, 2009). An exception to this trend was seen, however, among those poll participants who affirmed a Jewish or Catholic affiliation. These later two groups showed up instead with persons on the more agreeable side of the same poll, such as those affiliated with the Eastern religions of Buddhism and Hinduism, as well as those who identified as being religiously un-affiliated.

From these data, it could be inferred that students belonging to Semitic religious traditions other than Catholicism and Judaism will probably have more difficulty in accommodating their outlook-on-life to evolution. However, even though persons in the later group seemed to accommodate evolutionary theory fairly well, this does not necessarily indicate that all of their beliefs are compatible with evolutionary theory. It may simply mean that the spiritual dynamics of these later religious views provide greater utility for constructing an outlook-on-life that competes less with the concepts of evolutionary theory. In other words, since conceptual ecologies are multifaceted, certain numbers or combinations of cognitive and/or affective factors within those ecologies may

have to be challenged in order for a conflicting shift to occur in students' thinking. And in regard to persons within the 'un-affiliated' construct, it might also be important to add that according to Crabtree & Pelham (2008), a Gallup poll covering 84 countries has suggested that "those who claim no religious affiliation are more than twice as likely as those who do claim one to say they do not feel their lives have an important purpose" (Takeaway section, para. 1).

In the context of this study, the data reported by the polls may primarily indicate that students committed to conservative Christian and Muslim religious beliefs, as many are in the United States, will be more likely to view evolution as being corrosive to their outlook-on-life. This could be assessed as a kind of social problem because some evidence suggests that religion plays a part, even if only a moderate one, in mental health (Silberman, 2005; Wuthnow, 2007); there is also the complementary premise that religious doubt does not seem to pose much, if any, benefit to well-being (Gauthier, Christopher, Walter, Mourad, & Marek, 2006).

Much of the religious resistance to the theory of evolution comes from students' perceptions that it directly implies atheism, and along with that, a mitigation of moral values and purpose in life. As mentioned already above, much of the concern and cognitive confusion among the lay public has been possibly fueled by philosophers and practitioners of science who represent the second voice in science and who articulate antagonistic arguments about the social and philosophical impact of Darwinian evolution, demonstrating through their arguments that a threat does indeed exist to traditional religion. For instance, James Rachels (1990) said that:

> Darwinism undermines both the idea that man is made in the image of God and the idea that man is a uniquely rational being. Furthermore, if Darwinism is correct, it is unlikely that any other support for the idea of human dignity will be found. The idea of human dignity therefore turns out to be the moral effluvium of a discredited metaphysics. (p. 5)

Although Rachels made this comment in order to clear the ground for alternative forms of morality and meaning rather than scrubbing out morality and meaning altogether, creationists often perceive that assertions such as this not only pose a threat to their beliefs, but also to the social structures in which they live, as well as to their hope of maintaining any personal meaning or purpose in life. They believe that their personal well-being is at stake, not just a lost argument.

Some scientific commentators who speak more in line with the first voice of the scientific community, such as Stephen Jay Gould (2003), have proposed that religion and science are two separate fields of inquiry that do not impinge upon one another. This view, therefore, relegates the theory of evolution to a separate domain that does not, supposedly, overlap with religious concerns. Gould is not alone in this approach to evolution and religion. Advocates of evolution in secondary education in the United States, such as Eugenie Scott (2004), support a view similar to this as well, although it should be noted that the view of separate domains does not necessarily provide an invitation for creationists to have entrance or even parity of time in the public school classroom.

A very brief summation of the apologetic principle typically used in the first voice view is that “The creator of nature would be beyond the constraints of our physics and the

realm of science to seek or explain" (Hardy, 2005, p. 29). This approach does two things for the biology curriculum. First, it affords a kind of philosophical space for students' religious beliefs to remain mostly intact by countering the reciprocal assertion that there really is no evidence for a divine hand in earth's biological life. The conclusion that may be drawn from this it that, if all measure of the divine lies outside of normal human cognitive powers, then it simply follows that there is no evidence to be had. Second, keeping religion separate from science legitimates the role of science educators as curricular gatekeepers, meaning that religion has its own domain and is not considered to be a proper feature of the science curriculum (Cobern & Loving, 2000). Unfortunately for more conservative religious students in the United States, all of this may further mystify their views on evolution. Moreover, some science teachers who are sympathetic to conservative religious views may be mystified as well.

Within the milieu of public education in the United States, religious students who pass through the educational system may develop the sense that they are indeed a part of a bureaucracy that eschews their religious beliefs, especially since the theory of evolution has academically and politically progressed to become a mostly standardized part of public schools' science curricula since the 1960's (Scott, 2004), unless of course specific science teachers decide that they will privately, and without authorization, alter the existing curriculum standard for their own classroom. Evidence that religious students feel threatened by evolution is seen in the fact that even though the theory has practically attained a permanent presence as a foundational doctrine of science in most secondary and university-level biology classes, its place in those classes continues to be challenged in the public realm. In high school classrooms, evolutionary theory has been specifically

targeted by activist religious groups, usually from conservative Christian affiliations, who seek to displace or diminish the theory's presence by introducing creationism (Forrest, 2005). Of course, this has motivated concerned science educators in those schools to defend the place of evolutionary theory in science curricula (Gunn, 2004; Scott, 2004), which, not surprisingly, may further antagonize some religious students who, with the support of their parents and communities, feel that they have to stand even more firmly for their beliefs (Gibson, 2004; Munro, 2006). Additionally, science educators have also had to wrestle the political influences of the Christian right since state science standards for some states do not clearly define the concept of evolution as an objective of learning (Skoog & Bilica, 2001). In fact, some state standards documents do not even use the word 'evolution' itself, such as in the science Priority Academic Student Skills (PASS) objectives of Oklahoma (Oklahoma State Department of Education, 2009).

At the university level, science educators usually deal less or not at all with the defense of the place of evolution in the science curriculum. Instead, they are most likely to address pedagogical challenges related to the complexities of students' conceptual ecology, as previously described in this study. Much of this is due to the fact that there is more freedom to teach evolution at this level. As such, one problem remaining at the college level is that some science instructors are at times remiss in using teaching methods that facilitate a non-threatening environment for students who are reluctant to understand and accept evolution (Alters & Nelson, 2002).

### Sociological and Multicultural Factors

But while students are most likely to express a reluctance to accept evolutionary theory in metaphysical or religious terms, there are other students who may retort against

the theory for more secular, social reasons. Richards (2008) pointed out that when he has presented the theory of evolution in various college philosophy courses that cover themes of evolution, students actually seemed to have "fewer worries about evolution based on a creationist, Biblical literalism and more based on other issues" (p. 158); and from other scholars, Richards has heard similar concerns expressed about what is perceived to be the negative social implications of evolution.

For college students majoring in sociology, or students who happen to be more sociologically conscious, a negative response to evolutionary theory is an expression of a backlash that has emanated from various sociologists in opposition to the developing field of sociobiology. Students who have taken sociology classes may have absorbed the view that although evolution is generally true and that it legitimately describes how bodies and brains have evolved, it does not have the theoretical power to effectively describe the complexities of human social behavior or social change (Machalek & Martin, 2004, Udry, 1995). Students with a sociologically informed view may be sensitive to how reductive principles in evolutionary sciences such as sociobiology moderate current understandings of altruism, autonomy, culture, equality, gender, race, and rights (Machalek & Martin, 2004, Richards, 2008; van den Berghe, 1990). In an expressive revolt that is similar in some ways to that of religious students, sociologically minded students may assert that evolution impinges too strongly upon some of their more valued beliefs about individual freedom and identity, and thus upon a positive outlook-on-life.

Along with the sociological concerns over evolutionary theory, multicultural educators have also had a complaint against the typical science curriculum as it is

structured in the United States. Usually, science educators, including those teaching the biological sciences, adhere to a universalistic concept of science, meaning that there is a standard definition of legitimate science that precludes the inclusion of native science in the classroom (Cobern & Loving, 2000; Gaskell, 2003; Irzik & Nola, 2009). This means, for example, that the cultural views Native Americans traditionally hold about natural ecology, herbal medicine, or the creation of humanity will not be given a place in a biology class, which in some capacity reflects the creation and evolution debate that affects public school science curricula. Multicultural educators contend that this approach does not consider the views of students or the value of knowledge embedded in other cultures, thus multicultural educators, like sociological educators, feel that when public school science curricula give primary place to the Western view of science, it is simply a form of cultural hegemony and scientism (El-Hani & Mortimer, 2007; Snively & Corsiglia, 2000).

## General Factors

Of course, there are numerous students attending biology classes who are from a broad spectrum of backgrounds, some of whom might have no prior specific religious or sociological commitments, who might be more open to learning about evolutionary science, and who might also have a more positive view about the theory of evolution. Nevertheless, Brem et al. (2003) have found evidence that even among these students, some entertain the notion that evolution can undermine various aspects of personal and social life. Moreover, Brem et al. found additional evidence in the same study that there seems to be a relation between how well students from all backgrounds understand the

theory of evolution and the likelihood that aspects of their outlook-on-life will be subject to some level of discouragement:

> It is often the case that, as individuals learn more about a subject, their perspectives become richer, more complex, and more balanced. In this case, however, even when controlling for belief, greater exposure to information about evolution, whether pro- or antievolution, is associated with greater negativity regarding the consequences of believing in evolution. Likewise, greater knowledge of the principles and mechanisms of evolution are associated with greater negativity. Even if you accept evolutionary theory, learning more is associated with a bleaker view. (p. 198)

## Conclusion

Blackwell, Powell, & Dukes (2003) said that "evolution unfortunately remains a topic that will often require deep penetration into an individual's belief system prior to acceptance" (p. 61). Perhaps some students come to realize this as they consider the scientific, sociological, religious, and philosophical implications of evolution. If students holding religious sentiments perceive that the theory of evolution primarily implies an atheistic outlook that permeates all of a person's thinking, or if students with more secular outlooks-on-life perceive that evolution may philosophically undermine social relations and egalitarian political policies, it is very likely they will close themselves off from learning about the theory of evolution, reflecting the central idea of this study that evolution can impact students' outlook-on-life. One can only hope that there are some positive impacts to be found from students' cognitive and affective engagement with the theory of evolution.

# CHAPTER III

# METHODOLOGY

## Purpose of Study

The purpose of this study was to address two research questions, one pertaining to the way in which evolutionary theory positively or negatively impacts students' outlook-on-life, and the second pertaining to the way that undergraduate biology students compare with non-biology students when they personally reflect upon the implications of evolution. This researcher thought these particular questions were important for this study because they may provide significant insights for the social sciences. For instance, in relation to the first research question, if the theory of evolution has a negative impact upon students, this might affect some of their deeply held views of the world, as well as some of their personal values. However, even though it might be plausible from a historical perspective to expect negative responses to evolutionary theory, positive responses should not be ruled out since it is also possible that evolutionary theory provides some students with cognitively creative approaches to life. If instead evolutionary theory impacts students in a positive way, then perhaps it could further encourage them to take on an expanded and more scientifically useful understanding of the world's biological structures; it might even lead some of them to shape a positive out-look-life. And in relation to the second research question, it may be beneficial for

social science educators to find out if the college major of biology correlates in any way with the kinds of responses college students express toward evolution as a social force. This second research question is also pertinent since the theory of evolution plays a central role in the science classes of the United States.

## Statement of Hypothesis

After reflecting upon the purpose of this study as it has been informed by the literature review, four hypotheses were considered for examination in this study:

1. Students who accept the theory of evolution will report a more positive outlook-on-life than students who do not accept the theory of evolution.
2. Students with Buddhist, Hindu, Jewish, or those with no religious affiliation, will report a more positive outlook-on-life than students with conservative Christian or Islamic religious affiliations.
3. Students who major in biology will report a more positive outlook-on-life than students who do not major in biology.
4. Students who are more oriented toward creationism will report a more negative outlook-on-life than students who are not oriented toward creationism.

## Concept of Method

The working concept of outlook-on-life was defined in this research by drawing upon the general theoretical implications of conceptual ecology. From this approach, six general aspects of life were delineated: meaning and ethics, spirituality, social issues, self-determination, altruism and selfishness, and hope and well-being. The first five of these aspects of outlook-on-life were based upon five similar concepts used by Brem et al. (2003). The sixth was developed by this researcher since it was considered to be a

necessary property of outlook-on-life. Each of these six aspects of outlook-on-life was expanded to provide a basis for the research methodology:

(1) Meaning and Ethics. Most people require a sense of meaning or purpose that imparts a reason to continue moving their lives in a constructive way into the future. An outlook-on-life without a purposeful meaning cannot be a positive one, but rather one reflecting a kind of normlessness. From a social science standpoint, normlessness typically refers to feelings of detachment from society due to what appears to be social breakdown (Sadovnik, 2007); in the case of outlook-on-life, a person experiencing normlessness may similarly have trouble engaging the world if they perceive that little meaningful direction exists in life. Some meaning in life is derived from ethics. Ethics is therefore coupled with meaning as an aspect of outlook-on-life, and it, like meaning, is conceptually directional; the philosophical framework of ethics to which a person subscribes also influences a person's thoughts on what and how social actions in life 'should' be done.

(2) Spirituality. Metaphysical beliefs centering around the transcendent and the divine very often give people a heightened sense of significant and identity. Human beings throughout known history have often attested to the significance of the religious impulse. For some people, the spirituality expressed in the idea of the divine, or in the possibility of an existence in a favorable afterlife, may be a very important part of their own outlook-on-life.

(3) Social issues. Some of the personal problems that people seek to resolve are often those dealing with the differences that exist between people groups and

cultures; concepts such as race, human rights, and competition have at times caused massive social conflicts. Many people, particularly those who are politically active and socially aware, are concerned about how human rights and equity play a part in a democratic society, such as that which has been prevalent for over two centuries in the United States.

(4) Self determination. The idea that a person can make his or her own decisions in life is an important aspect of outlook-on-life for many people. Probably most citizens of the United States value the idea that they are free to make their own responsible choices in life. And since freedom and autonomy at times come with a personal as well as a political price, self-determinism is a value that is typically highly prized

(5) Altruism and selfishness. Societal and individual well-being is many times dependent on the particular moral decisions people make as citizens living within a community or family. Providing for other people's needs through a sense of altruism, or freely given assistance, is usually a valued act. This is especially an act everyone needs at birth for survival, and it is something that people born with physical or mental challenges need all through life. It is not difficult to see that an act of selfishness on the part of one person could be detrimental to the outlook-on-life of another person.

(6) Hope and well-being. Part of the emotional base of a positive outlook-on-life is a sense of hope and well-being. This is important because each individual person has to face the concept of mortality head-on; in looking at the future,

many people need to feel that mortality can somehow be ameliorated or overcome. On a more practical level, the relational structures that a person has at his or her disposal, such as friends and family, can be instrumental in the formation of hope and well-being.

These six aspects provided a way for this researcher to shape the general thematic contours of outlook-on-life as the research method was being constructed. It should be noted that this working definition of outlook-on-life was not meant to be comprehensive in scope, since it was recognized that the psycho-social dynamics of a student's outlook-on-life permeate many important conceptual elements. Even though it was simplified in this manner, this researcher believes that it seems to sufficiently represent a composite of areas in students' thinking that have been noted by other researchers (Brem et al., 2003; Deniz et al., 2008; Thagard & Findlay, 2009), with the addition of the concepts of personal hope and well-being. Once these six aspects were recognized by the researcher, they were then used to thematically organize twenty-four questions used in the final research instrument.

## Study Design

The design of this study was descriptive in nature and utilized a survey to gather data from participants. The survey was used to elicit responses to questions that collected data on: 1) students' college major, gender, and religious affiliation, 2) an individual conceptual approach to the theory of evolution, and 3) individual perceptions about how the theory of evolution affects aspects of a personal outlook-on-life.

## Survey Instrument

The instrument designed for this study was composed of four parts, used to collect

data about students' outlook-on-life based on the theory of evolution (see Appendix C). Since this research was specifically for social science inquiry, a mixed methods format was used which allowed for an emergent analysis of the data. Thus, Parts I through III of the survey instrument were constructed as quantitative items, while Part IV offered one open question along with two multiple-choice questions. These last three questions were used to acquire data for interpretive analysis. After the data were collected from all four parts of the survey instrument, they were later analyzed to see what positive or negative responses students gave in relation to how they thought evolution affected their ideas about outlook-on-life. The data were also analyzed for any significant contrasts between groupings of students and for possible relationships among the twenty-four questions of Part III.

Part I of the survey was designed to collect quantitative data on students' college major, gender, and religious affiliation. For the first question of Part I, students' choice of college major was requested so that data related to the second research question of this study could be gained: What similarities or differences exist in the way that undergraduate biology majors reflect upon the theory of evolution in comparison to undergraduate non-biology majors? This data allowed for the testing of the third hypothesis--students who major in biology will report a more positive outlook-on-life than students who do not major in biology. The second question on Part I asked students to identify their gender. This was placed on the survey so that the researcher could gain insight into how men and women compared when they evaluated the effects of evolution on outlook-on-life. The final question on Part I asked students to indicate their religious affiliation. The responses to this last item enabled the researcher to address the second

hypothesis in this study--to see if students who identify themselves with Buddhism, Hinduism, Judaism, or with no religious affiliation, would indeed express a more favorable outlook-on-life in conjunction with evolutionary theory than students who identified themselves with conservative Christianity or Islam.

Part II of the survey was also quantitative. It was constituted of five questions adapted from Brem et al. (2003, p. 200). These five questions were used with the permission of Dr. Brem (S. Brem, personal communications, September 8, 2009). See Appendix F of the present research for these five questions. For the purpose of categorization, the responses to these questions were considered to be an inseparable unit and were very useful for indicating students' general disposition toward the conceptual overlap, or lack of overlap, of supernatural influence(s) on the theory of evolution. This aided the researcher in identifying nuances in students' general disposition toward evolutionary theory that students might not identify themselves.

On the survey, a 5-point Likert-scale was offered for response. As an independent variable, the choice of response on each question ranged from Strongly Agree (SA), Agree, (A), Undecided (U), to Disagree (D) and Strongly Disagree (SD). The data that were later analyzed from these five questions were used to place students into one of nine categories (see Table 1 below); these were also adapted from Brem et al. (2003, p. 189).

The responses to the five questions were processed for analysis through the adapted table from Brem et al. (2003), composed of five columns and nine rows. The five columns corresponded to the five questions, and the nine rows corresponded to one of nine positions a respondent could take on biological origins. The steps used by this

**Table 1**

*Nine Categories and Descriptions of Students' View on Origins*

| View of Origins | Description |
|---|---|
| Creationism | |
| Strong | All life recently created by a supreme being or beings. |
| Human-only | Only human life created by a supreme being or beings; all other life evolved. |
| Non-specific | All life created by supreme beings or beings without specification of time or process. |
| Evolution | |
| Non-theistic | All life evolved naturally; no supreme beings or beings involved. |
| Theistic | All life evolved naturally; a supreme being or beings somehow began the process. |
| Interventionist | All life evolved, but with intervention(s) by a supreme being or beings. |
| Non-specific | All life evolved, but with no claim to know whether or not a supreme being or beings played a part in the process. |
| Undecided | |
| Inconsistent | A position on origins marked by inconsistent responses (ex. agreement with strong creationism and theistic evolution) |
| Neutral | Undecided on all options |

researcher for categorization were simple but consistent. First, the 5 point-Likert response scale on each question was assigned a range of numerical values: 2 for strong agreement, 1 for agreement, 0 for undecided, -1 for disagreement, and -2 for strong disagreement. As the data were analyzed, values of 1 or 2 counted as a 'yes' response, and values of 0, -1, or -2 counted as a 'no' response. Using the adapted table, this

researcher took each set of data and looked for the horizontal row among the five vertical columns that provided a best match for the set of yes and no responses from each respondent. Column one corresponded to question one, column two corresponded to question two, and so on to column five. Responses were consistently assumed to match with one of three Creationism categories or one of four Evolution categories. Only responses that did not fit with one of these seven categories were defaulted to match with one of the two Undecided categories.

Part III and Part IV of the survey were the central focus of this research, addressing students' primary concerns as to how evolutionary theory may bear upon various aspects of outlook-on-life. Part III specifically addressed questions related to the six aspects of outlook-on-life delineated above: meaning and ethics, spirituality, social issues, self-determination, altruism and selfishness, and hope and well-being. This quantitative portion of the survey was constituted of twenty-four questions which also utilized a 5-point Likert-scale. As independent variables, the choice of response on each question ranged from Much Harder (MH), Harder, (H), Undecided (U), to Easier (E) and Much Easier (ME). Questions 1, 4, 7, 8, 10, 11, 13, 14, 17, and 18 were adapted from those created by Brem et al. (2003, pp. 201-202), with the permission of Dr. Brem (S. Brem, personal communications, September 8, 2009). See Appendix F in this study for the original questions. Questions 4, 10, 13, 17, and 18 were evaluated in reverse sequence so as to align with the response values of the other questions.

The general format of the twenty-four questions on Part III purposely followed that which was articulated by Brem et al, (2003); each question began with the same inquiry, "If everyone accepted the theory of evolution as true beyond doubt, do you think

that people would find it harder or easier to…?" This format was chosen for use in this study because of its semantic structure; the question itself requires cognitive thinking of a future oriented nature. We do not yet live in a world where all people view evolution as beyond doubt, so its emphasis is on one possible future, which easily aligns with the actual forward looking mental processes that are involved in the overall concept of outlook-on-life. Additionally, since the questions are phrased in a way that invokes the consideration of *all* people, this includes the student in the process of deliberation as well, making the answers projected but also personal at the same time.

Each of the twenty-four questions in Part III addressed a different element of the particular theme of which it was an inherent part:

Meaning and Ethics

*Question 1. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to know how life should be lived?* This question invited the student respondent to think about whether or not a general sense of purpose with ethical implications may be affected by evolutionary theory.

*Question 2. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to commit to following a code of ethics?* This question invited respondents to consider if evolution theory affects the extent to which people will appropriate a decisive ethical framework; the question did not name a specific code of ethics, for there are many.

*Question 3. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to find a personally*

*meaningful purpose in life?* Part of a positive outlook-on-life, as defined in this research, requires that a person have a sense of purpose. This question asked respondents to consider if evolution affects the extent to which a person can sustain a claim to purpose that is their own.

*Question 4. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to lose focus on what is important in life?* For meaning and/or purpose to be sustained in a positive outlook-on-life, substantial focus must be also be sustained upon a value or an entity that provides meaning. This question asked if evolution sways the extent to which people may feel that values or entities can hold their attention.

Spirituality

*Question 5. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to appreciate spiritual teachings?* On a general level, spiritual teachings can only be appreciated if a person finds some level of value or authority in those teachings. This question asked respondents to think about how evolution may affect the way in which people esteem spiritual teachings, for these are often a part of a positive outlook-on-life.

*Question 6. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to feel comforted or inspired by spiritual teachings?* Another way in which spiritual teachings may contribute to a positive outlook-on-life is in the way they may promote feelings of hope and well-being. Like the previous question, this one asked respondents to indicate the extent that

evolution influences the potential that spiritual teachings may have for catalyzing a positive affective response in people.

*Question 7. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that there is an afterlife?* One of the aspects of spirituality that is most promising to many people is the possibility of somehow surviving the death of the body. This transcendent notion, usually nuanced by a consideration of the future, has held deep meaning for many people. Question 7 therefore asked respondents to contemplate whether people could still believe that an afterlife is a realistic proposition after taking evolution into account as an implied context for this life.

*Question 8. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that there is a supreme being or beings?* This question was much like the seventh question, but centered on the idea that one or more entities with a transcendent nature could be involved with the welfare of human beings. This question asked respondents to identify the extent that they think evolution may imply or preclude the existence of these kinds of entities.

Social Issues

*Question 9. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to value cooperation as a means of social interaction?* For any society to grow and to sustain itself, individuals must cooperate. A person who lives in a society where cooperation is not valued may have an outlook-on-life that is less positive. This question asked respondents to evaluate

the likelihood that cooperation can be valued by people if evolution is a commonly shared view.

*Question 10. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to consider some races and ethnic groups "less advanced" than others?* Some of the most troubling social conflicts in history have centered on racial or ethnic differences. This question was important in that respondents were given the opportunity to indicate the extent to which they believe evolution may affect the way people categorize and/or value each other.

*Question 11. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that all races of human beings are related to one another?* Following the topic of the previous question, this one asked respondents to indicate if they think evolution demonstrates a biological link between all people groups and individuals. This question was highly relevant to outlook-on-life; if evolution can mediate in the way people look at the biological structure of the world, perhaps it can also affect how a person expects to be treated.

*Question 12. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that human rights should be respected?* Extending the social matters of the previous two questions a bit more, this question invoked what is considered to be a 'self-evident' idea, that human beings have rights as an expression of nature. This question invited respondents to think about how evolution affects the extent that respect and dignity should be extended to other people.

Self-determination

*Question 13. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that great athletes, artists, and thinkers were born with talents that the rest of us don't have?* Since a significant aspect of the Modern Synthesis of evolutionary theory involves genetics, this question was relevant to outlook-on-life. It asked respondents to indicate the extent that evolution may influence the view that some people have naturally superior abilities. This question reflected the tensions that exist between the notions of nature and nurture and could influence a person's estimation of their own potential for personal success in life.

*Question 14. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that with hard work one can overcome most physical and intellectual obstacles?* This question presented another angle of the thirteenth question. If a person faces obstacles, her outlook-on-life will probably be positively affected if she believes she can appropriate some level of self-determination. Evolutionary theory may influence a person's sense of self-determination and alter her outlook-on-life.

*Question 15. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that persons with violent tendencies can learn to become more peaceable?* This question put the idea of self-determination on a more social level. It was centered on the way respondents may estimate what choices a violent person could be capable of making. Since violence is a disruption to social cohesion, a person's outlook-on-life may be mediated by the belief

that other people may not be able to make choices other than those that were made. Therefore, this question asked respondents to indicate the extent they think evolution affects other people's ability to change.

*Question 16. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that persons with physical and mental challenges can live productive lives?* This question combined some of the aspects of the previous two questions. For some people, physical or mental challenges are a permanent part of life and affect the extent to which they can take care of themselves. Within the context of evolution as a natural fact, this may factor into how one person believes that another person's self-determination should be shaped; in this case two outlooks-on-life are affected. Respondents were asked to indicate the extent that evolution may influence the way they think a person with certain challenges can contribute in any productive capacity.

Altruism and Selfishness

*Question 17. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to rationalize becoming obsessed with getting ahead in life?* In the Unites States today, the pursuit of prosperity and position commands the focus of many people. Some people take this pursuit as their main goal of life. For this question, respondents were asked to evaluate the extent to which they think evolution plays a part in an extreme commitment to success.

*Question 18. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that human beings are always looking out for their own best interests?* It is natural for people to look

out for their own best interests. However, what may not be helpful to a person's outlook-on-life is the belief that other people will look out ONLY for their own best interests. This question sought respondents' views on how they think evolution would affect the way in which some people may be inclined toward selfishness.

*Question 19. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to feel a need to contribute their time and money to charity?* This question follows the previous one in an obverse fashion by focusing on charity, an act that contributes to the well-being of other people in a community. This question asked respondents to indicate the extent they think evolution may influence a person to give or not to give of their own time and resources.

*Question 20. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to consider another person's point of view?* One act that is often beneficial to social interaction is the willingness to listen to someone else's ideas, even if those ideas conflict with one's own views. For this question, respondents were asked to indicate the extent that evolution may influence a person to value another person's thoughts.

Hope and Well-being

*Question 21. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to cope with personal health problems?* Health problems are a common occurrence for most people; if not today, then perhaps tomorrow. Depending on the severity of the disorder or illness, a person's ability to cope through a sustained sense of hope and well-being can be accordingly affected. This question asked respondents to consider how the theory of

evolution may affect a person's coping mechanisms, an emotional aspect of a person's outlook-on-life.

*Question 22. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to deal with the issues of death and dying?* Beyond human illness is the universal phenomenon of death. The way in which people envision the reality of end-of-life circumstances and events can influence the quality of their outlook-on-life. Since the theory of evolution acknowledges death as a part of the cycle of biological life, this question asked participants to think about how the fact of evolution may influence the way a person handles the future implications of human mortality.

*Question 23. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to maintain a sense of hope and emotional well-being?* The hardships of life come in many different forms. To successfully move through hardship requires that a person have some level of positive outlook-on-life. If a person has a sense of hope and emotional well-being, they may be able to face the challenges life brings their way. This question asked respondents to indicate how evolution may affect the extent that people can sustain hope and well-being.

*Question 24. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to maintain personally meaningful relationships with friends or family?* For some people, hope and emotional well-being are influenced by the quality of relationships they have with peers and relatives. Since evolution posits some level of competition as a fact of life, this question

asked respondents to evaluate the way evolution may affect important personal relationships.

These twenty-four questions comprised Part III of the survey and together represented a kind of conceptual ecology like the one cited in the review of literature. Again, this conceptual form of outlook-on-life was not seen by this researcher as a comprehensive model, for the human mind is still a mysterious 'thing' that is continually being explored through scientific investigation.

Part IV, the final section of the survey instrument, utilized one open-ended response item and two multiple choice items designed to acquire data on: students' experiences with evolutionary theory in relation to various information sources they may have drawn upon, and their experiences with learning about evolution as a subject of the enterprise of education. The first question, the open-ended item, was designed to collect data on students' possible affinity for specific sources, those that might even be recommended to a friend. This question was considered beneficial in that some insight could be gained as to the possible scientific quality of students' engagement with evolutionary concepts. Likewise, the multiple choice items, questions 2 and 3, were offered so that some indication might be evidenced as to how these college students may evaluate recent educational experiences involving the study of evolution at the college level and the pre-college level.

## Procedures

After the Institutional Review Board (IRB) approved of the methodology and instrument of this research (see Appendix G), the following procedures were followed in accordance with the protocol. For student recruitment, a state university in

the Midwestern United States was utilized to access a sample population of students. In order to secure responses from the largest number of students who would likely be somewhat informed about the theory of evolution, introductory biology laboratories were approached to find volunteer participants. Biology students were focused upon because Introduction to Biology was one of the core curriculum classes that undergraduate students studying at this research site were required to take. It should also be noted that this research was conducted later in the Fall semester of 2009 to allow time for students to cover evolutionary theory in their classes and be familiar with the concept before being asked to participate in this study.

In assessing the number of students to survey, this researcher spoke to the head of the biological sciences department at the university. This department head indicated that 45 lab sessions were available which possibly represented up to 1000 students. Accessing all of the approximately 1000 students would have been ideal, but because this researcher had a limited number of working days and hours that were compatible with the curricular schedule by which the necessary biology labs could be made available, 16 of 45 biology lab sessions were specifically accessed on two consecutive Mondays and Tuesdays just before the Fall break in the later part of November 2009. The coordination of these lab times with the consent of the respective teachers in each lab allowed for 243 students to be invited for participation. This researcher perceived that the total potential sample population, about 24.3% of the possible whole, would better represent the undergraduate student population that semester than a smaller sample comprised of only 10% considered as an earlier option.

Each biology lab in which the survey was distributed was over two and a half hours in length. Being that the survey would only take 15 to 30 minutes of response time, students were able to fill out the survey between their normal lab projects, if they volunteered to do so. The surveys were distributed at the beginning of each lab session by the researcher, and a specific protocol authorized by the Institutional Review Board was followed for the survey distribution. As students finished, the surveys were collected by the researcher and secured in designated envelopes at the end of each lab session.

A participation information sheet was attached to the survey as a protocol to inform students of their rights of participation in the study (see Appendix B). At the time that the survey was administered by the researcher, the following protocol was followed: (1) distribute the participant information sheet and survey to students, (2) direct students to thoroughly read the participant information sheet, (3) collect survey responses from students who participate, and (4) secure the survey responses.

## Participants

Although the problems pertaining to students' outlook-on-life based on evolution apply to secondary students just as well as they do for college students, the data collection process in this study focused specifically on undergraduate college students. This procedural direction followed the pragmatic suggestions for methodology presented in the study by Brem et al. (2003). By doing so, this researcher was able to access applicable data without introducing undo conflict to secondary teachers, students or parents, and it allowed for the completion of this study within an allotted, and limited, period of time during the last two academic months of the Fall semester 2009.

When the distribution of the survey was commenced, no incentive was offered to the 243 students who were approached for participation, other than to inform them that the survey was voluntary and anonymous.

# CHAPTER IV

# FINDINGS

The raw data from the collected surveys was tabulated for Parts I, II, and III and placed onto a spreadsheet for correlational analysis. For these first three parts of the survey, the analysis performed was that in which the Pearson Correlation Co-efficient in perfect relation is +1 or -1 or (45 degree angle). The responses to the questions from Part IV of the survey were assessed separately for interpretive analysis.

## Categorizing Students

In this study, 243 undergraduate biology students were requested to participate with 145 respondents, or 59.6%* of the accessible student population. Of those undergraduate students who decided to participate, 70.3% were women, and 29.6% were men. Of these participants, both male and female, 87.5% chose to identify with the Christian religion, 12.5% with other forms of religious affiliation (see Table 2 below), which was unexpected but perhaps not surprising for the area of the Midwestern United States in which the study took place. No students identified with Buddhism, Confucianism, Islam, or Judaism. In addition to the items of gender and religion, participants also represented up to thirty-eight different majors at the university; the top three most reported: Animal Science, Bio-systems Engineering, and Nutritional Science.

***Data reported in this study may not add up to 100% since percentages given are exact.**

**Table 2**

*Religious Affiliation of Survey Participants*

| Religion | Percentages Represented | Actual Number of Students |
|---|---|---|
| Agnosticism | 4.8 % | 7 |
| Atheism | 3.4 % | 5 |
| Christianity | 87.5 % | 127 |
| Personalized | 0.6 % | 1 |
| Taoism | 1.3 % | 2 |
| Transcendentalism | 0.6 % | 1 |
| Unsure | 1.3 % | 2 |

In line with the methodology delineated for Part II above, each participant's responses to five questions on the view of origins were categorized (see Table 3 below). Most participants identified with Creationism of one kind or another; even in the evolution category, most identified with Theistic or Interventionist forms of evolution. None of the participants could be clearly identified as Undecided and Inconsistent; perhaps this reflects the fact that so many of the students that participated in this study affiliated with one particular religion, and this may have swayed the conceptual bias of the students when they deliberated their response to Part II.

**Table 3**

*Results of Students' Views on Origins*

| View on Origins | Percentages Represented | Actual Number of Students* |
|---|---|---|
| Creationism | | |
| Strong | 25.8% | 31 |
| Human-only | 15.8% | 19 |
| Non-specific | 38.3% | 46 |
| Evolution | | |
| Non-theistic | 3.3% | 4 |
| Theistic | 16.6% | 20 |
| Interventionist | 4.1% | 5 |
| Non-specific | 5% | 6 |
| Undecided | | |
| Inconsistent | 0 | 0 |
| Neutral | 10.8% | 13 |

*Actual numbers do not add to 145; one student declined to answer.

## Quantitative Analysis of Survey Data

The data from the completed surveys (see Appendices D and E) were subjected to an analysis where the Pearson Correlation Co-efficient in perfect relation is +1 or -1 or (45 degree angle). In order to calculate the analysis, each question from Parts I, II, and III of the survey was sequenced as a variable (ex. VAR00001, VAR00002, VAR00003, etc.), regardless of their original designation within the parts of the survey (see Table 4 below). For instance, Part I, question 1, which asked students to identify their college

major, was designated as VAR00001. The five questions of Part II that were considered to be a single unit of data were labeled as VAR00004. And Part III, question 1 was labeled as VAR0005, and so on. Once the variables were sequenced, they were

**Table 4**

*Cross-reference of Survey Questions and Variable Designations*

| Survey Question | Survey Section | Variable Designation |
|---|---|---|
| Q1 | Part I | VAR00001 |
| Q2 | Part I | VAR00002 |
| Q3 | Part I | VAR00003 |
| Q 1-5 | Part II | VAR00004 |
| Q1 | Part III | VAR00005 |
| Q2 | Part III | VAR00006 |
| Q3 | Part III | VAR00007 |
| Q4 | Part III | VAR00008 |
| Q5 | Part III | VAR00009 |
| Q6 | Part III | VAR00010 |
| Q7 | Part III | VAR00011 |
| Q8 | Part III | VAR00012 |
| Q9 | Part III | VAR00013 |
| Q10 | Part III | VAR00014 |
| Q11 | Part III | VAR00015 |

| | | |
|---|---|---|
| Q12 | Part III | VAR00016 |
| Q13 | Part III | VAR00017 |
| Q14 | Part III | VAR00018 |
| Q15 | Part III | VAR00019 |
| Q16 | Part III | VAR00020 |
| Q17 | Part III | VAR00021 |
| Q18 | Part III | VAR00022 |
| Q19 | Part III | VAR00023 |
| Q20 | Part III | VAR00024 |
| Q21 | Part III | VAR00025 |
| Q22 | Part III | VAR00026 |
| Q23 | Part III | VAR00027 |
| Q24 | Part III | VAR00028 |

analyzed for correlation. Any correlation with an R value less than .3 was evaluated as weak, .3 to .39 mild, .4 to .49 moderate and .5 or above as strong. For this study, only R values of .3 or higher were considered to be of reportable strength.

With the results of the analysis completed, the research questions of this study could be addressed: 1) Based on the theory of evolution, what are the positive and negative impacts to students' outlook-on-life?, and 2) What similarities or differences exist in the way that undergraduate biology majors reflect upon the theory of evolution in comparison to undergraduate non-biology majors? Taking the second of these research questions as a beginning point, analysis on students' college major as an independent

variable (VAR0001) indicated no significant relationship with any of the other variables in the survey. More specifically, the results seemed to indicate that the biology students who participated in this study were no more or less affected by their thoughts about evolutionary theory than students in other majors. The third hypothesis of this study was thus not validated by the data; whatever impact evolutionary theory might have for these students is likely connected to other variables.

The first of the research questions in this study was partially represented by the second hypothesis: Students with Buddhist, Hindu, Jewish, or no religious affiliation will report a more positive outlook-on-life than students with conservative Christian or Islamic religious affiliations. Analysis of religious affiliations (VAR00003) as an independent variable revealed only two relationships, one with students' views on origins (VAR00004), with correlation R= .228 @ .006 level of significance, and the other with human rights (VAR00016), with correlation R= -.285 @ .001 level of significance. Both of these relationships were weak and did merit enough significance to report on. Thus, the second hypothesis also was not validated by the data; religious affiliation among the students surveyed in this study apparently had very little to do with their responses to other variables. It seems plausible to say that for these students, religious affiliation does not seem to be an affected part of their outlook-on-life when considered from a context of evolutionary theory

As the data were analyzed for other positive or negative implications, the independent variable of view on origins (VAR0004) revealed some mildly noticeable relationships. In sum, the way in which participants identified as being either creationist or evolutionist, or even undecided, had a mild inverse relation to three other variables

(see Table 5 below), all located in Part III of the survey: (1) the attainment of a personally meaningful purpose in life, in reference to VAR00011, (2) the maintenance of a sense of hope and well-being, in reference to VAR00027, and (3) the maintenance of personally meaningful relationships with friends or family, in reference to VAR00028.

**Table 5**

*Variable Relationships with Students' Views on Origins (VAR00004)*

| Variable Designation | Variable Strength R= | Variable @ Level of Significance |
|---|---|---|
| VAR00011 | -.313 | .000 |
| VAR00027 | -.365 | .000 |
| VAR00028 | -.346 | .000 |

These findings could indicate that students who more firmly believe supernatural forces in some way play or have played a role in the world's biological existence may tend to feel that finding purpose, maintaining a sense hope and well-being, as well as close relationships, is slightly more difficult if contextualized by evolutionary theory. On the other hand, this may also mean that those students who are either not sure about the existence of the supernatural, or who already fully subscribe to the scientific concept of evolutionary development in the world, may experience less difficulty in maintaining these three areas of outlook-on-life. Even though these variables only demonstrated a mild relationship, this is indicative that hypotheses one and four have at least a mild level of validation.

One interesting detail that emerged from the analysis done in this study was seen in the frequency of strong relationships that certain variables had with any of the other variables. Two variables stood among the rest in revealing the most R values of .5 or higher @ .000 level of significance (see Table 6 below). The first of these was

**Table 6**

*Frequency of Strong Correlation with VAR00027 and VAR00028*

| Other Variables | VAR00027 R=___ @ ___ level of significance | VAR00028 R=___ @ ___ level of significance |
|---|---|---|
| VAR00005 | R= .511, @ .000 | |
| VAR00006 | R= .534, @ .000 | |
| VAR00007 | R= .524, @ .000 | |
| VAR00010 | R= .522, @ .000 | |
| VAR00016 | | R= .595, @ .000 |
| VAR00019 | | R= .500, @ .000 |
| VAR00020 | | R= .511, @ .000 |
| VAR00023 | R= .623, @ .000 | R= .634, @ .000 |
| VAR00024 | R= .529, @ .000 | R= .591, @ .000 |
| VAR00025 | R= .516, @ .000 | R= .506, @ .000 |
| VAR00027 | | R= .671, @ .000 |
| VAR00028 | R= .671, @ .000 | |

VAR00027, which pertained to the question of how evolution may affect the sustainment of hope and well-being. It had the highest frequency of significant relationships, with eight instances of strong correlation to other variables. The second of these was VAR00028, which pertained to the question about how evolution may affect the maintenance of important relationships with friends and family; it had seven instances of strong correlation. This finding may indicate some strength to this researcher's assertion that the aspect of outlook-on-life defined as Hope and Well-being should be considered as an integral part of the structure of this kind of conceptual ecology, especially when contextualized by evolutionary theory.

One additional area of note that was not a part of the hypotheses but of relevance to the first research question was seen in a comparison of the independent variable of gender (VAR00002). A mild, direct relationship existed between VAR00002 and VAR00017, the latter variable pertained to the question on whether evolution makes it "harder or easier to believe that great athletes, artists, and thinkers were born with talents that the rest of us don't have." These two variables had correlation R= .351 @ .000 level of significance. Being that VAR00017 was analyzed with a reversal of the Likert-scale values from the response choices, the correlation here may indicate that the males in this study had a mild tendency to think that evolution makes it easier to believe that some individuals have superior genetic endowments which enable them to outperform most other people. The females in this study seemed to express this evaluation a bit less.

In looking at the overall results of the quantitative sections of the survey, it is fair to state that the data did not firmly support the general expectation that most participants

would express more negative than positive reactions when asked how they thought evolutionary theory may impact outlook-on-life.

## Qualitative Analysis of Part IV Survey Data

Part IV of the survey was designed with the intention of gaining some further insight as to the ways in which participants may have recently interacted and/or reacted to evolutionary theory in relation to the learning process. With this in mind, the data analysis of this survey section was assessed interpretively. The first question, as an open-ended item, collected students' statements on specific media sources which they felt were useful and might even be recommended to a friend. It specifically asked students to, "Please indicate the title or name of one source of information (book, movie, video documentary, website; speaker/expert, teacher, religious leader) which addresses the theory of evolution and that you feel you could recommend to a close friend. Why?" The resulting responses to this question allowed for some limited insights into the scientific quality of students' engagement with evolutionary concepts as well as to what specific sources were viewed as relevant to students. The findings that emerged from this analysis were somewhat surprising to this researcher. One of the results from the first question was seen in that 44 (or 30.3%) of the participants in this study left the question blank with no response. An additional 28 (or 19.3%) simply marked the question with a response of "N/A" or "Unknown." Together, these two groups of non-respondents represented almost 50% of the 145 student participants. From this result, it may be of interest to note that students could have written something as simple as 'biology book' for a response. Does this mean these students did not like the question and declined to respond? Or does it possibly indicate that they did not really know of any source to cite?

Answers to these questions cannot of course be directly ascertained. However, after some additional analysis of the data, a finding related to the respondents who left the question blank seemed to emerge and indicated a difference between this group and the group that at least wrote a response of "N/A, Unknown." Of the 44 participants who left the question blank, 41 (or 93.1%) indicated an affiliation with the Christian religion. The other three in this group were: one atheist, one transcendentalist, and one that was undecided on religion. Perhaps some of these students were swayed by their religious affiliation to skip the question.

Of those participants who provided an articulate response to Part IV, question 1, the written answers were of diverse types. Twenty-four (or 16.5%) of the 145 participants cited the Bible as a main source for their personal engagement with the theory of evolution. Several of the responses from this particular group expressed or implied that the theory of evolution was being specifically rejected as an explanatory construct of the biological world. The remaining 49 (or 33.7%) participants gave a wide range of diverse responses, citing such media sources as movies, books, teachers, authors, comedians, television science programs, religious apologetic books and programs, parents, and websites on the internet. Some of the written responses from this diverse group are presented below:

- "My biology book and teacher; [name deleted here] told our class that there can still be a God and have evolution within species still."
- "The only place I've learned about evolution was in school. So, the only book I can recommend would be a biology book."

- “many different sources to get ideas from many dif. Angles”
- “A man named [name deleted here] because he taught me that it doesn't matter if other people believe in a higher power or not as long as I ask my questions and come to the conclusion that works for me.”
- “Discovery Channel. Its very interesting and a lot of knowledge on the subject of evolution is discussed.”
- “Thomas Jefferson collected fossils and was interested in geomorphology and often wrote & categorized (sic) his findings. I think TJ is an incredible man w/ an eye for science before it was popular or accepted. He was also famous for saying “Religion is a matter between man & his Creator” and deism.”
- “you could look up theory of evolution on google.com. I recommend google because it gives you options & different things about the theory of evolution.”
- “My father, because he taught me how science and religion can coexist. *My beliefs of the relationship between the two is built on the gray areas while this survey is very black & white”
- “Darwin – although I do not agree with him, it is a good source to learn about evolution.”
- “Dan Brown (the author of the DaVinci Code & Angels and Demons) because I like the idea that maybe we have gone through

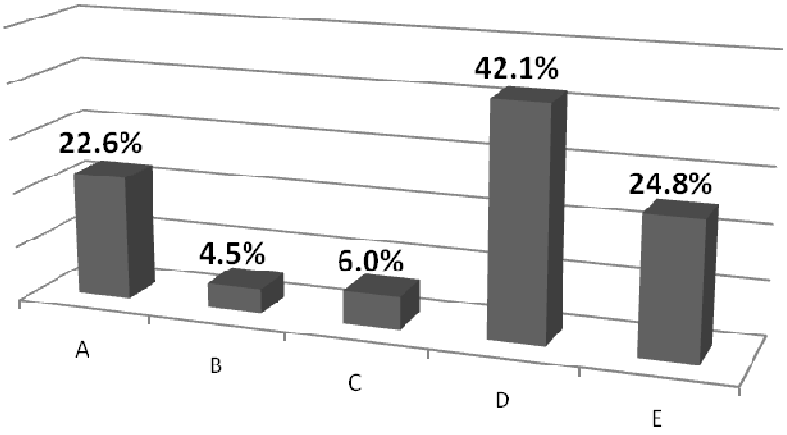
a little bit of evolution, but ultimately it was and is God who started it all."

- "Bill Maher addresses Christianity and the theory of evolution in his talk show. I would recommend it because he gives the perspective of an realist atheist."
- "Expelled: No Intelligence Allowed. This movie by Ben Stein shows that science is very hypocritical when it comes to intelligent design & evolution. I also illustrate that the theories of how life began without intelligent design are ridiculous" (sic).
- " I saw Dr. Miller speak on campus and would recommend him to anyone. Amazing ideas, well spoken, intelligent, funny. Really pulls in the audience and leaves an impact. I would also recommend the book "your inner fish", very interesting."
- " Dawkins, seems to be a reputable source."

It was noted by this researcher that of the sources cited by participants, very few could be considered as having originated from within mainstream science. And even though a few students did cite Darwin as a source, this does not demonstrate that they had apprehended evolutionary theory as it is presently articulated by the Modern Synthesis. Darwin is a historical source for evolutionary theory, but he did not know about genetics and the integral role it has in the processes of natural selection and mutation; the Modern Synthesis of evolution does include the field of genetics as a part of its theoretical structure.

The second question on Part IV of the survey gave participants five options to express what personal outcome they felt was personally obtained after they learned about evolutionary theory in their current college classes. Of the 145 students participating in this study, 12 declined to respond to this question, leaving 133 who did. The breakdown of responses for this question are shown in Figure 1.

**Figure 1. Responses to Question: What has learning about the Theory of Evolution in college done for you?**




A. It has allowed me to better understand the nature of biological life on earth.

B. It has introduced confusion to my understanding of the nature of biological life on earth.

C. It has not helped me to understand the nature of biological life on earth.

D. It has allowed me to learn about one of the many ways in which people view the nature of biological life on earth.

E. I have not yet learned about the Theory of Evolution in college.

The findings from question 2 of Part IV indicated that many of the participating students likely did not have negative experiences when learning about evolutionary theory in their college classes; most (42.1%) of the responding students defined evolutionary theory as just one of many options for understanding the biological world. Only 4.5% of these students felt that what they learned about evolution in college was disruptive to their understanding of the nature of biological life. This qualitative interpretation of the data from these responses seemed to reflect the findings from the quantitative sections of this study in that there was a low yield of negative impact to students' outlook-on-life. One of the interesting details of this analysis is that 24.8% of these students indicated that they did not learn about evolutionary theory in their respective college classes. This is surprising because this researcher was informed by the head of the biological sciences department prior to distributing the survey that these students had just finished a unit that included the topic of the theory of evolution. Does this mean that some of these students were absent while evolutionary theory was being taught? Or does it instead imply that these students were somehow not engaged with the learning process while in their biology classes?

Finally, the fourth question asked students if they had learned about the theory of evolution in school before they came to college. Of the 140 students who responded to this question, 121 (or 86.4%) indicated that they had learned about evolution in school before coming to college, while 19 (13.5%) indicated that they did not. Of course, this finding does not show the quality of students' knowledge about evolution, but it does imply that a majority of them were at least familiar with the concept at by a particular time.

# CHAPTER V

# CONCLUSION

In general, this study seemed to indicate that, for these particular students, evolution was not overly problematic, nor necessarily helpful, to the development of a positive outlook-on-life. Most of these students seemed to take evolution in stride, despite the fact that it may have posed some minor perceptual challenges for students who hold more Westernized religious views, such as is found in the many denominations of Christianity in the United States. From a social science perspective, this could be a bit problematic. Many of the students who participated in this study did not seem to value the theory of evolution as a way to coherently perceive the biological world. Although it is understandable that evolution can pose some level of concern to various students, it could be a concern to social scientists that these same students do not perhaps engage evolutionary theory for at least the sake of a fuller scientific knowledge base. The theory of evolution is a part of the scientific enterprise in the United States and is connected to many technological fields of employment, fields that are often fairly lucrative. Students who do not pursue an education in the foundational concepts of science are perhaps less likely to find and benefit from employment that offers more financial potential, which in turn may affect some aspects of their outlook-on-life in the long term. However, this is

not to say that that the financial advantages of a career in science outweigh the social benefits of other, perhaps less lucrative, careers.

This researcher suggests that evolutionary theory be one aspect of science that motivates a tendency among students to diminish a fuller engagement with science. This could be due to the fact that the theory of evolution sometimes runs up against other philosophical, cultural, or religious commitments students already have in place. It may be important for educational praxis in the sciences, for both curriculum and pedagogy, that science educators not ignore the multicultural issues that may be embedded in the teaching and learning of science in their classrooms. El-Hani & Mortimer (2007) address the handling of multicultural issues in science classrooms; their arguments lead to the proposition that students should be enabled and allowed to learn science, which includes evolutionary theory, in such a way that they can be challenged to cognitively absorb scientific concepts but without the affective disturbances that can accompany the pedagogical goal that some educators have of a full conceptual change, or, in the case of this study, the full acceptance of the theory of evolution.

## Limitations of Study

One of the limitations that existed in the methodology of this study was that there were no follow up interviews to help categorize students' various approaches to understanding the nature of the origin of biological life. This feature of research was something utilized in the study of Brem et al. (2003). For researchers who have the time, interviews may be a boon to categorizing the finer nuances of students' views on origins of biological life.

Another limitation of this study manifested itself in the lack of respondents who affiliated themselves with Buddhism, Confucianism, Hinduism, or Judaism. It is not enough to research the complexities of outlook-on-life while only taking into account the perceptions of students who gain their personal views of the world from what are mainly Western cultures, like the United States. Future research on how evolution may affect outlook-on-life should attempt to find study sites that allow for a larger, multicultural sampling.

A third limitation of this study was that it only addressed undergraduate students. These students may still have a somewhat undeveloped knowledge base in science, and this smaller knowledge base could affect their understanding of the theory of evolution. Additionally, from the findings of this study, undergraduate students might not be engaging the concepts of evolution in a robust manner, which may hinder research that is done with the intention of finding out if evolution truly has a positive or negative impact on students' outlook-on-life.

## Implications for Future Research

Although this researcher felt that the method used to categorize students' views on origins was for the most part efficient and accurate, it is likely still beneficial to ask students to clarify their positions on this area of outlook-on-life since their views on the nature and origins of the biological world may at times be quite complex. Future research in this area should probably use a more extensive qualitative methodology to bring out nuances in students' beliefs about origins that may go beyond straightforward categorizations.

Research on outlook-on-life that incorporates a significantly larger number of participants from what are often called the Eastern Religions would offer a much richer data source. Since the theory of evolution is a scientific concept that is steadily gaining acceptance and utilization in many countries of the world, it would be important to find out how the outlook-on-life of students living in other countries may be affected by the theory of evolution.

In following the findings of Brem et al. (2003), it is suggested that further studies involving students' outlook-on-life should be done by approaching potential participants who have more substantial academic understanding of evolutionary theory so as to see if there is a relationship between evolutionary knowledge and quality of outlook-on-life. This may mean eliciting responses and insights from more advanced undergraduate students, graduate students and/or their respective college faculties. Additionally, more qualitative data would likely be important in discerning the psycho-social complexities that are typically involved in any impact that evolutionary theory may have, positively or negatively, upon outlook-on-life.

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# APPENDICES

*Appendix A*

Reflections on Research Logistics

- In consideration of instrument design, a researcher should be aware that the setting in which the study will take place will have a bearing on how the instrument can be constructed. For instance, time limitations exist within many classrooms and laboratories, so it is wise to discuss with head faculty and/or officials working in that institution to determine what kind of instrument may be most appropriate.
- In consideration of potential participants, a researcher should keep in mind that maturity levels of participants may actually affect the level of motivation and cooperation received. Younger participants may not be as willing to follow through on an agreement to participate, and their attention span can more easily wane and possibly affect results.
- In consideration of costs, if the researcher is funding the research itself, then it is important to understand beforehand that even a small revision can quickly add up if the construction of the research instrument is large or complex. It is can also be expensive in time as well.

*Appendix B*

## Participant Information Sheet

**Project Title**: The Impact of Evolutionary Theory on College Students' Outlook on Life.

**Researcher**: David Chadwick (OSU student/Master's Degree Candidate/College of Education)

**Researcher's Advisor**: Dr. Jeffrey Hawkins

**Research Purpose**: The purpose of this study is to investigate the positive and negative perceptions of college students' "outlook on life" based on the theory of evolution. It will also seek to discern the similarities and differences that exist between students' "outlook on life" based on the theory of evolution. In this study, the concept of "outlook on life" is defined as the way in which a person perceives the following aspects of life: meaning and purpose, spirituality, social issues, self-determination, altruism, and psychological well-being.

Your voluntary participation in this study will help the researcher better understand how the theory of evolution may interact with students' thinking about life.

**Procedures:** A survey that should take approximately 15-30 minutes has been included with this letter. Please complete the survey and return it to the proctor. Survey questions will cover subject matter such as: 1) your personal understanding of the theory of evolution, and 2) your personal insights as to how the theory of evolution impacts your personal "outlook on life."

**Risks of Participation:** There are no known risks associated with this project which are greater than those ordinarily encountered in daily life.

**Benefits**: This study will allow some student concerns to be accounted for by educators and may contribute to the way in which instruction and curriculum are shaped in the future.

**Confidentiality:** All information will be anonymous as no names or identification numbers will be recorded on the survey. The surveys will be destroyed in May 2010 after the responses have been entered into a computer. No names or identification numbers will be recorded in the data file. All results will be reported as aggregated data and no individual responses will be reported. The OSU IRB has the authority to inspect consent records and data files to assure compliance with approved procedures.

**Contacts**: If you have questions about the nature of this study, please feel free to contact the researcher, David Chadwick, at 918-486-1739 or david.chadwick10@okstate.edu. The researcher's advisor, Dr. Jeffrey Hawkins, can be reached at 405-744-8023 or jeffrey.hawkins@okstate.edu. If you have questions about your rights as a research volunteer, you may contact Dr. Shelia Kennison, IRB Chair, 219 Cordell North, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu.

**Participant Rights:** Your participation in this project is appreciated and completely voluntary. You may choose not to participate at any time without any penalty or problem. Returning your completed survey in the envelope provided indicates your willingness to participate in this study.

*Appendix C*

**Project Title**: The Impact of Evolutionary Theory on College Students' Outlook on Life.

**Researcher**: David Chadwick (OSU student/Master's Degree Candidate/College of Education)

**PART I**

1. **Your Undergraduate Major**: Please circle one major from the two pages below

   ( If undecided on a major, please circle here ⇨ Undecided )
   ( If your major is not listed below, please circle here ⇨ Other )

| **COLLEGE OF AGRICULTURAL SCIENCES & NATURAL RESOURCES** | **COLLEGE OF ARTS AND SCIENCES** | |
|---|---|---|
| Agribusiness | American Studies | Mathematics |
| Agricultural Communications | Art | Microbiology/Cell and Molecular Biology |
| Agricultural Economics | Biochemistry | Music |
| Agricultural Education | Biological Science | Music Education |
| Agricultural Leadership | Botany | Philosophy |
| Animal Science | Chemistry | Physics |
| Biochemistry / Molecular Biology | Communication Sciences | Physiology |
| Entomology | Computer Science | Political Science |
| Environmental Science | Economics | Psychology |
| Food Science | English | Russian Language and Literature |
| Horticulture | French | Sociology |
| Landscape Contracting | Geography | Spanish |
| Landscape Architecture | Geology | Statistics |
| Natural Resource Ecology/Management | German | Theatre |
| Plant and Soil Sciences | History | Zoology |
| University Studies | Journalism / Broadcasting | University Studies |
| | Liberal Studies | |

**(MORE CHOICES ON NEXT PAGE)**

**COLLEGE OF EDUCATION TECHNOLOGY**

Aerospace Administration and Operations

Athletic Training

Career and Technical Education

Education

Elementary Education

Health Education and Promotion

Physical Education

Secondary Education

University Studies

**COLLEGE OF ENGINEERING, ARCHITECTURE &**

Aerospace Engineering

Architectural Engineering

Architecture

Biosystems Engineering

Chemical Engineering

Computer Engineering

Construction Management Technology

Electrical Engineering

Electrical Engineering Technology

Fire Protection / Safety Technology

Industrial Engineering / Management

Mechanical Engineering

University Studies

**COLLEGE OF HUMAN ENVIRONMENTAL SCIENCES**

Design, Housing and Merchandising

Hotel & Restaurant Administration

Human Development and Family Science

Nutritional Sciences

University Studies

**SCHOOL OF BUSINESS**

**WILLIAM S. SPEARS**

Accounting

Economics

Entrepreneurship

Finance

General Business

International Business

Management

Management Information Systems

Marketing

University Studies

**(Continue To Next Page)**

Demographic Information

For items 2 and 3, put an X beside the one choice that best describes you.

2 **Gender**: Female _____ Male _____

3 **Spiritual affiliation**: Atheism _____

Buddhism _____

Christianity _____

Confucianism _____

Hinduism _____

Islam _____

Judaism _____

Taoism _____

Other _____ (please specify: _____ )

**(Continue To Next Page)**

**PART II**

For the following items, please indicate the degree of your agreement or disagreement with the given statements by circling one of the choices on each five-point Likert-scale:

SA strongly agree  A agree  U undecided  D disagree  SD strongly disagree

---

1. All forms of life evolved from earlier forms, and no supreme being or beings has ever played any role in the evolution of life on earth.

SA  A  U  D  SD

2. All forms of life evolved from earlier forms, but evolution was first set in motion by a supreme being or beings and then left running without any additional intervention by the supreme being or beings.

SA  A  U  D  SD

3. All forms of life evolved from earlier forms, but a supreme being or beings intervenes from time to time to shape or override the evolutionary process.

SA  A  U  D  SD

4. Some forms of life evolved from earlier forms, but human beings were created in more or less their present form by a supreme being or beings.

SA  A  U  D  SD

5. All forms of life were first brought into being in more or less their present form by a supreme beings or beings.

SA  A  U  D  SD

**(Continue To Next Page)**

**PART III**

For the following items, please indicate your response to the given questions by circling one of the choices on each five-point Likert-scale:

MH much harder H harder U undecided E easier ME much easier

---

1. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to know how life should be lived?

MH H U E ME

2. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to commit to following a code of ethics?

MH H U E ME

3. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to find a personally meaningful purpose in life?

MH H U E ME

4. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to lose focus on what is important in life?

MH H U E ME

5. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to appreciate spiritual teachings?

MH H U E ME

6. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to feel comforted or inspired by spiritual teachings?

MH H U E ME

7. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that there is an afterlife?

MH H U E ME

**(Continue To Next Page)**

For the following items, please indicate your response to the given questions by circling one of the choices on each five-point Likert-scale:

MH much harder H harder U undecided E easier ME much easier

---

8. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that there is a supreme being or beings?

MH H U E ME

9. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to value cooperation as a means of social interaction?

MH H U E ME

10. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to consider some races and ethnic groups "less advanced" than others?

MH H U E ME

11. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that all races of human beings are related to one another?

MH H U E ME

12. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that human rights should be respected?

MH H U E ME

13. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that great athletes, artists, and thinkers were born with talents that the rest of us don't have?

MH H U E ME

**(Continue To Next Page)**

For the following items, please indicate your response to the given questions by circling one of the choices on each five-point Likert-scale:

MH much harder H harder U undecided E easier ME much easier

---

14. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that with hard work one can overcome most physical and intellectual obstacles?

MH H U E ME

15. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that persons with violent tendencies can learn to become more peaceable?

MH H U E ME

16. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that persons with physical and mental challenges can live productive lives?

MH H U E ME

17. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to rationalize becoming obsessed with getting ahead in life?

MH H U E ME

18. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that human beings are always looking out for their own best interests?

MH H U E ME

**(Continue To Next Page)**

For the following items, please indicate your response to the given questions by circling one of the choices on each five-point Likert-scale:

MH much harder  H harder  U undecided  E easier  ME much easier

---

19. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to feel a need to contribute their time and money to charity?

MH  H  U  E  ME

20. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to consider another person's point of view?

MH  H  U  E  ME

21. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to cope with personal health problems?

MH  H  U  E  ME

22. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to deal with the issues of death and dying?

MH  H  U  E  ME

23. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to maintain a sense of hope and emotional well-being?

MH  H  U  E  ME

24. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to maintain personally meaningful relationships with friends or family?

MH  H  U  E  ME

**(Continue To Next Page)**

**PART IV**

For the following question, please write your response in the space provided:

1. Please indicate the title or name of one source of information (book, movie, video documentary, website; speaker/expert, teacher, religious leader) which addresses the theory of evolution and that you feel you could recommend to a close friend? Why would you recommend this source?

_____
_____
_____
_____
_____

For the following questions, please put an X next to one choice that best describes your view:

2. What has learning about the Theory of Evolution in college done for you?

   _____ A. It has allowed me to better understand the nature of biological life on earth.
   _____ B. It has introduced confusion to my understanding of the nature of biological life on earth.
   _____ C. It has not helped me to understand the nature of biological life on earth.
   _____ D. It has allowed me to learn about one of the many ways in which people view the nature of biological life on earth.
   _____ E. I have not yet learned about the Theory of Evolution at college.

3. Did you learn about the Theory of Evolution in school before you came to college?

   _____ Yes
   _____ No

**End of Survey**
**Thank you for your participation!**

*Appendix D*

Summary of Quantitative Response Data

Researcher - David Chadwick

RESULTS OF SURVEY PARTICIPATION [The Impact of Evolutionary Theory on College Students' Outlook-on-Life]

| | Part I | | | | Part II | Part III | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Undergraduate Major | Gender | Spiritual Affiliation | Origin(s) Orientation | | Q 1 | Q 2 | Q 3 | Q4* | Q5 | Q6 | Q7 | Q8 | Q9 | Q10* | Q11 | Q12 | Q13* | Q14 | Q15 | Q16 | Q17* | Q18* | Q19 | Q20 | Q21 | Q22 | Q23 | Q24 |
| SRDC | Item 1 | Item 2 | Item 3 | * | | | | | | | | | | | | | | | | | | | | | | | | | |
| A-1 | 4 | 2 | 3 | 1 | | 1 | 1 | 1 | 3 | 5 | 5 | 5 | 5 | 3 | 2 | 2 | 2 | 4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 |
| A-2 | 19 | 2 | 3 | 9 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| A-3 | 7 | 2 | 3 | 1 | | 5 | 5 | 5 | 1 | 5 | 5 | 5 | 5 | 5 | 1 | 5 | 5 | 1 | 5 | 5 | 5 | 1 | 1 | 5 | 5 | 5 | 5 | 5 | 5 |
| A-4 | 3 | 2 | 9 | 9 | | 4 | 4 | 5 | 3 | 4 | 5 | 5 | 4 | 2 | 2 | 1 | 2 | 3 | 2 | 3 | 4 | 4 | 5 | 4 | 3 | 2 | 4 | 4 | 2 |
| A-5 | 0 | 2 | 3 | 1 | | 5 | 5 | 5 | 2 | 5 | 5 | 5 | 5 | 4 | 4 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 3 | 5 | 5 | 4 |
| B-1 | 6 | 1 | 3 | 2 | | 3 | 5 | 3 | 3 | 5 | 5 | 5 | 5 | 3 | 3 | 5 | 3 | 1 | 3 | 4 | 3 | 3 | 5 | 3 | 3 | 5 | 5 | 5 | 3 |
| B-2 | 3 | 1 | 3 | 1 | | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 3 | 4 | 4 | 2 | 4 | 4 | 4 | 2 | 4 | 5 | 4 | 5 | 5 | 5 | 4 |
| B-3 | 32 | 1 | 3 | 3 | | 5 | 5 | 5 | 2 | 5 | 5 | 5 | 4 | 3 | 5 | 5 | 4 | 2 | 2 | 4 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 2 | 4 |
| B-4 | 20 | 1 | 3 | 3 | | 4 | 4 | 4 | 3 | 4 | 4 | 5 | 4 | 3 | 4 | 2 | 3 | 4 | 4 | 5 | 5 | 3 | 4 | 4 | 4 | 5 | 4 | 4 | 4 |
| B-5 | 30 | 1 | 3 | 1 | | 3 | 4 | 4 | 2 | 5 | 5 | 5 | 5 | 3 | 4 | 1 | 2 | 2 | 3 | 2 | 2 | 3 | 4 | 3 | 2 | 3 | 4 | 2 | 3 |
| B-6 | 30 | 1 | 3 | 1 | | 5 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 4 | 5 | 2 | 4 | 5 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| B-7 | 3 | 1 | 3 | 3 | | 4 | 4 | 4 | 2 | 5 | 5 | 5 | 5 | 2 | 4 | 3 | 2 | 4 | 4 | 4 | 4 | 2 | 2 | 4 | 4 | 4 | 4 | 5 | 4 |
| C-1 | 0 | 1 | 3 | 1 | | 5 | 5 | 5 | 1 | 5 | 5 | 5 | 5 | 5 | 1 | 5 | 5 | 1 | 5 | 5 | 5 | 1 | 1 | 5 | 5 | 5 | 5 | 5 | 5 |
| C-2 | 34 | 1 | 3 | 5 | | 3 | 2 | 4 | 4 | 5 | 5 | 4 | 5 | 2 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| C-3 | 12 | 1 | 3 | 1 | | 3 | 2 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| C-4 | 31 | 1 | 3 | 9 | | 4 | 4 | 4 | 3 | 5 | 5 | 5 | 5 | 3 | 4 | 2 | 2 | 3 | 4 | 3 | 4 | 3 | 4 | 3 | 3 | 2 | 2 | 3 | 2 |
| D-1 | 2 | 1 | 3 | 3 | | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 4 | 3 | 2 | 3 | 2 | 4 | 2 | 3 | 3 | 2 | 2 | 2 | 4 | 4 | 2 |
| D-2 | 39 | 2 | 3 | 1 | | 3 | 4 | 5 | 4 | 4 | 5 | 4 | 5 | 3 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 2 | 4 | 4 | 4 | 3 | 4 | 4 | 3 |
| D-3 | 30 | 1 | 3 | 2 | | 4 | 4 | 5 | 3 | 5 | 5 | 5 | 5 | 3 | 5 | 5 | 5 | 1 | 5 | 5 | 5 | 1 | 2 | 5 | 5 | 5 | 5 | 5 | 5 |
| D-4 | 20 | 1 | 3 | 3 | | 5 | 5 | 5 | 4 | 5 | 5 | 4 | 5 | 4 | 2 | 3 | 4 | 2 | 4 | 5 | 5 | 1 | 2 | 5 | 5 | 4 | 5 | 5 | 4 |
| D-5 | 8 | 2 | 3 | 3 | | 5 | 5 | 5 | 2 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 3 | 2 | 5 | 5 | 5 | 5 | 5 | 4 | 3 | 3 | 5 | 4 | 4 |
| D-6 | 1 | 2 | 3 | 3 | | 5 | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 1 | 5 | 4 | 1 | 5 | 5 | 0 | 5 | 5 | 5 | 5 | 1 | 5 | 5 |
| D-7 | 30 | 1 | 3 | 6 | | 2 | 4 | 2 | 3 | 4 | 4 | 4 | 2 | 2 | 3 | 4 | 3 | 2 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 2 | 3 | 3 | 2 |
| D-8 | 30 | 1 | 3 | 1 | | 4 | 3 | 4 | 1 | 3 | 4 | 4 | 4 | 3 | 5 | 2 | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 2 | 3 | 3 | 3 | 3 | 3 |
| D-9 | 34 | 1 | 3 | 1 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 5 | 3 | 3 | 2 | 4 | 2 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 3 | 5 | 5 | 4 |
| D-10 | 7 | 1 | 3 | 3 | | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 3 | 3 | 4 | 2 | 3 | 4 | 4 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 |
| E-1 | 3 | 1 | 3 | 1 | | 5 | 5 | 5 | 1 | 5 | 5 | 5 | 5 | 3 | 2 | 5 | 3 | 3 | 3 | 3 | 5 | 3 | 3 | 4 | 5 | 3 | 5 | 4 | 3 |
| E-2 | 6 | 1 | 3 | 9 | | 3 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 4 | 5 | 4 | 4 | 4 | 4 | 4 |
| E-3 | 39 | 1 | 3 | 1 | | 5 | 5 | 5 | 1 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 2 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |

Researcher - David Chadwick

RESULTS OF SURVEY PARTICIPATION [The Impact of Evolutionary Theory on College Students' Outlook-on-Life]

| | Part I | | | | Part II | Part III | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Item 1 | Item 2 | Item 3 | * | Q 1 | Q 2 | Q 3 | Q4* | Q5 | Q6 | Q7 | Q8 | Q9 | Q10* | Q11 | Q12 | Q13* | Q14 | Q15 | Q16 | Q17* | Q18* | Q19 | Q20 | Q21 | Q22 | Q23 | Q24 |
| E-4 | 4 | 1 | 3 | 3 | 5 | 5 | 5 | 1 | 5 | 5 | 5 | 5 | 4 | 2 | 2 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 |
| E-5 | 30 | 1 | 3 | 3 | 2 | 3 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 4 | 2 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| E-6 | 3 | 1 | 3 | 2 | 5 | 4 | 4 | 2 | 5 | 5 | 5 | 5 | 3 | 1 | 1 | 1 | 1 | 1 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 5 | 5 | 5 |
| E-7 | 7 | 1 | 9 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 4 | 1 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 5 | 5 | 2 |
| E-8 | 11 | 1 | 3 | 7 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 4 | 3 | 2 | 3 | 3 | 4 | 3 | 2 | 2 | 3 | 3 | 2 |
| E-9 | 10 | 2 | 3 | 2 | 5 | 4 | 4 | 3 | 5 | 5 | 4 | 3 | 3 | 4 | 3 | 3 | 4 | 5 | 4 | 4 | 3 | 3 | 4 | 4 | 5 | 5 | 5 | 3 |
| E-10 | 39 | 1 | 3 | 3 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 2 | 4 | 2 | 4 | 5 | 4 | 3 | 3 | 5 | 4 | 5 | 5 | 5 | 4 |
| E-11 | 38 | 1 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 4 | 3 | 5 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 4 | 2 | 4 | 4 | 4 | 3 | 2 | 3 | 4 |
| E-12 | 24 | 1 | 3 | 3 | 3 | 4 | 4 | 3 | 2 | 3 | 4 | 3 | 4 | 5 | 2 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 4 | 4 | 3 |
| E-13 | 9 | 1 | 3 | 3 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 3 | 5 | 5 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 3 |
| E-14 | 3 | 2 | 3 | 3 | 4 | 4 | 4 | 2 | 1 | 4 | 5 | 5 | 4 | 4 | 3 | 4 | 4 | 2 | 5 | 5 | 3 | 4 | 5 | 5 | 5 | 5 | 5 | 4 |
| E-15 | 18 | 2 | 3 | 1 | 5 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 3 | 5 | 3 | 5 | 5 | 4 | 5 | 5 | 2 | 5 | 4 | 3 | 2 | 5 | 3 | 4 |
| E-16 | 13 | 2 | 1 | 4 | 1 | 1 | 1 | 5 | 4 | 4 | 4 | 4 | 1 | 4 | 1 | 1 | 5 | 2 | 1 | 1 | 4 | 4 | 1 | 1 | 2 | 4 | 4 | 2 |
| E-17 | 26 | 1 | 3 | 1 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 3 | 2 | 3 | 3 | 2 | 3 | 4 | 3 | 2 | 4 | 4 | 4 | 5 | 4 | 4 |
| E-18 | 16 | 2 | 3 | 5 | 4 | 4 | 3 | 4 | 3 | 4 | 4 | 4 | 2 | 4 | 2 | 3 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| F-1 | 25 | 2 | 3 | 5 | 3 | 3 | 4 | 3 | 5 | 4 | 3 | 5 | 2 | 4 | 2 | 4 | 5 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 2 | 3 | 4 | 3 |
| F-2 | 30 | 1 | 3 | 1 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 2 | 5 | 2 | 4 | 3 | 4 | 0 | 2 | 5 | 5 | 5 | 5 | 5 | 5 |
| F-3 | 25 | 2 | 3 | 3 | 3 | 2 | 5 | 3 | 5 | 3 | 5 | 5 | 3 | 4 | 2 | 4 | 1 | 3 | 5 | 4 | 3 | 4 | 5 | 4 | 5 | 5 | 5 | 5 |
| F-4 | 30 | 1 | 3 | 1 | 3 | 4 | 4 | 3 | 5 | 5 | 4 | 5 | 2 | 2 | 4 | 4 | 2 | 4 | 4 | 4 | 2 | 1 | 5 | 4 | 3 | 5 | 5 | 4 |
| F-5 | 17 | 1 | 3 | 3 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 5 | 3 | 5 | 2 | 4 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 4 | 3 |
| F-6 | 30 | 1 | 3 | 1 | 5 | 5 | 4 | 1 | 5 | 5 | 5 | 5 | 4 | 1 | 2 | 2 | 2 | 4 | 4 | 4 | 2 | 3 | 5 | 4 | 4 | 1 | 2 | 2 |
| F-7 | 30 | 1 | 3 | 1 | 5 | 4 | 5 | 1 | 5 | 5 | 4 | 4 | 4 | 4 | 5 | 4 | 1 | 4 | 5 | 4 | 5 | 3 | 5 | 4 | 4 | 3 | 5 | 5 |
| F-8 | 24 | 1 | 3 | 2 | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| F-9 | 30 | 1 | 3 | 1 | 5 | 4 | 5 | 1 | 5 | 5 | 5 | 5 | 4 | 2 | 5 | 4 | 3 | 4 | 4 | 5 | 3 | 1 | 5 | 4 | 4 | 5 | 5 | 4 |
| F-10 | 30 | 1 | 1 | 4 | 2 | 2 | 2 | 1 | 5 | 5 | 5 | 5 | 1 | 1 | 1 | 2 | 4 | 1 | 3 | 2 | 4 | 4 | 1 | 1 | 4 | 2 | 2 | 1 |
| F-11 | 3 | 1 | 3 | 1 | 4 | 4 | 4 | 2 | 5 | 5 | 5 | 5 | 3 | 2 | 3 | 3 | 2 | 4 | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 4 | 4 |
| F-12 | 23 | 1 | 3 | 3 | 5 | 5 | 5 | 2 | 5 | 5 | 5 | 5 | 3 | 3 | 4 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 5 | 3 | 2 | 5 | 5 | 4 |
| F-13 | 30 | 1 | 3 | 5 | 2 | 4 | 3 | 4 | 4 | 5 | 5 | 5 | 3 | 2 | 2 | 2 | 4 | 3 | 2 | 2 | 3 | 3 | 4 | 3 | 4 | 2 | 4 | 4 |
| F-14 | 30 | 1 | 3 | 1 | 5 | 5 | 5 | 1 | 5 | 5 | 5 | 5 | 3 | 3 | 4 | 5 | 1 | 5 | 5 | 5 | 1 | 1 | 5 | 3 | 5 | 5 | 5 | 5 |
| F-15 | 38 | 2 | 3 | 6 | 5 | 5 | 5 | 1 | 5 | 5 | 5 | 5 | 4 | 5 | 1 | 3 | 3 | 5 | 5 | 5 | 3 | 5 | 5 | 4 | 5 | 5 | 5 | 4 |

Researcher - David Chadwick

RESULTS OF SURVEY PARTICIPATION [The Impact of Evolutionary Theory on College Students' Outlook-on-Life]

| | Part I | | | Part II | Part III | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Undergraduate Major / Gender | | Spiritual Affiliation | Origin(s) Orientation | | | | | | | | | | | | | | | | | | | | | | | | |
| | Item 1 | Item 2 | Item 3 | * | Q 1 | Q 2 | Q 3 | Q4* | Q5 | Q6 | Q7 | Q8 | Q9 | Q10* | Q11 | Q12 | Q13* | Q14 | Q15 | Q16 | Q17* | Q18* | Q19 | Q20 | Q21 | Q22 | Q23 | Q24 |
| F-16 | 39 | 1 | 3 | 2 | 2 | 4 | 4 | 4 | 3 | 2 | 3 | 4 | 2 | 4 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 5 | 3 | 3 | 2 |
| G-1 | 3 | 1 | 11 | 7 | 3 | 3 | 3 | 3 | 5 | 3 | 3 | 4 | 2 | 1 | 1 | 1 | 2 | 1 | 5 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 3 | 2 |
| G-2 | 18 | 1 | 3 | 5 | 1 | 1 | 1 | 5 | 1 | 1 | 1 | 4 | 1 | 5 | 1 | 1 | 5 | 1 | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 1 | 3 | 1 |
| G-3 | 21 | 1 | 3 | 3 | 5 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 3 | 3 | 2 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 4 |
| G-4 | 7 | 2 | 3 | 3 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 3 | 5 | 1 | 4 | 5 | 4 | 4 | 4 | 3 | 5 | 5 | 3 | 5 | 5 | 5 | 4 |
| G-5 | 39 | 1 | 3 | 1 | 4 | 5 | 5 | 1 | 5 | 5 | 4 | 3 | 3 | 4 | 2 | 3 | 4 | 3 | 4 | 3 | 3 | 4 | 4 | 3 | 3 | 5 | 5 | 5 |
| G-6 | 39 | 2 | 3 | 1 | 5 | 5 | 5 | 1 | 5 | 5 | 5 | 5 | 4 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 5 | 5 | 3 |
| G-7 | 28 | 2 | 3 | 5 | 4 | 5 | 2 | 4 | 5 | 4 | 4 | 3 | 1 | 2 | 1 | 2 | 5 | 4 | 4 | 4 | 3 | 4 | 4 | 1 | 4 | 2 | 4 | 3 |
| G-8 | 0 | 2 | 8 | 7 | 3 | 3 | 4 | 2 | 4 | 3 | 4 | 5 | 3 | 4 | 2 | 2 | 4 | 5 | 4 | 4 | 2 | 4 | 3 | 3 | 2 | 2 | 3 | 3 |
| G-9 | 22 | 1 | 3 | 3 | 5 | 5 | 5 | 1 | 5 | 5 | 5 | 5 | 4 | 2 | 4 | 4 | 3 | 5 | 4 | 4 | 3 | 4 | 3 | 3 | 5 | 5 | 5 | 3 |
| G-10 | 35 | 2 | 3 | 2 | 4 | 4 | 3 | 3 | 4 | 4 | 5 | 2 | 2 | 0 | 2 | 4 | 4 | 2 | 4 | 5 | 4 | 4 | 1 | 2 | 2 | 5 | 4 | 2 |
| G-11 | 3 | 2 | 3 | 7 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 2 | 2 | 3 | 4 | 2 | 4 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| G-12 | 7 | 1 | 3 | 2 | 4 | 4 | 4 | 2 | 5 | 5 | 5 | 5 | 4 | 4 | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 |
| G-13 | 7 | 1 | 3 | 3 | 5 | 4 | 5 | 1 | 3 | 4 | 5 | 3 | 3 | 2 | 1 | 4 | 3 | 5 | 5 | 5 | 1 | 1 | 4 | 4 | 5 | 5 | 5 | 5 |
| H-1 | 34 | 1 | 9 | 9 | 4 | 4 | 3 | 2 | 4 | 4 | 3 | 3 | 2 | 3 | 1 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 2 | 3 | 2 | 3 | 3 |
| H-2 | 34 | 1 | 1 | 9 | 2 | 3 | 4 | 3 | 5 | 4 | 4 | 4 | 2 | 1 | 2 | 3 | 4 | 1 | 4 | 4 | 3 | 4 | 3 | 2 | 1 | 4 | 2 | 2 |
| H-3 | 22 | 1 | 3 | 3 | 4 | 4 | 4 | 2 | 5 | 5 | 5 | 5 | 3 | 2 | 2 | 2 | 4 | 3 | 5 | 3 | 5 | 5 | 5 | 4 | 3 | 4 | 4 | 4 |
| H-4 | 15 | 1 | 10 | 3 | 4 | 4 | 5 | 4 | 5 | 5 | 5 | 5 | 4 | 1 | 1 | 3 | 4 | 3 | 3 | 2 | 4 | 4 | 5 | 4 | 3 | 4 | 4 | 3 |
| I-1 | 18 | 1 | 1 | 4 | 4 | 4 | 2 | 4 | 5 | 4 | 5 | 4 | 2 | 3 | 2 | 2 | 4 | 2 | 3 | 2 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | 2 |
| I-2 | 11 | 1 | 3 | 5 | 2 | 1 | 4 | 2 | 4 | 5 | 5 | 4 | 3 | 5 | 2 | 1 | 1 | 1 | 2 | 1 | 3 | 4 | 2 | 4 | 3 | 2 | 3 | 3 |
| I-3 | 32 | 2 | 3 | 5 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 2 | 2 | 4 | 3 | 3 | 4 | 3 | 4 | 3 | 2 | 2 | 4 | 2 | 2 |
| I-4 | 32 | 1 | 3 | 1 | 2 | 2 | 3 | 2 | 5 | 5 | 5 | 5 | 4 | 3 | 2 | 4 | 1 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 4 | 5 | 4 | 5 |
| I-5 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| I-6 | 20 | 1 | 3 | 0 | 3 | 2 | 4 | 4 | 5 | 4 | 5 | 5 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 2 | 4 | 4 |
| J-1 | 33 | 2 | 9 | 9 | 3 | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| J-2 | 1 | 2 | 3 | 2 | 4 | 4 | 5 | 4 | 4 | 5 | 5 | 5 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 5 | 2 | 4 | 4 | 4 | 4 | 5 | 4 | 3 |
| J-3 | 7 | 2 | 3 | 6 | 4 | 3 | 5 | 4 | 4 | 4 | 4 | 4 | 2 | 4 | 2 | 5 | 5 | 4 | 5 | 4 | 2 | 5 | 4 | 3 | 2 | 5 | 4 | 4 |
| J-4 | 13 | 2 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 3 | 3 | 2 | 2 | 4 | 2 | 2 | 2 | 3 | 4 | 4 | 3 | 3 | 4 | 4 | 4 |
| J-5 | 3 | 1 | 3 | 7 | 4 | 4 | 3 | 4 | 4 | 5 | 4 | 4 | 3 | 4 | 2 | 4 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 3 | 4 | 5 | 4 | 4 |
| J-6 | 14 | 1 | 3 | 3 | 5 | 5 | 5 | 1 | 5 | 5 | 5 | 5 | 2 | 5 | 2 | 5 | 4 | 5 | 5 | 5 | 2 | 5 | 5 | 5 | 5 | 1 | 5 | 5 |

Researcher - David Chadwick

RESULTS OF SURVEY PARTICIPATION [The Impact of Evolutionary Theory on College Students' Outlook-on-Life]

| | Part I | | | | Part II | Part III | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Undergraduate Major | Gender | Spiritual Affiliation | Origin(s) Orientation | | | | | | | | | | | | | | | | | | | | | |
| | Item 1 | Item 2 | Item 3 | * | Q 1 | Q 2 | Q 3 | Q4* | Q5 | Q6 | Q7 | Q8 | Q9 | Q10* | Q11 | Q12 | Q13* | Q14 | Q15 | Q16 | Q17* | Q18* | Q19 | Q20 | Q21 | Q22 | Q23 | Q24 |
| J-7 | 30 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| J-8 | 30 | 1 | 3 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| K-1 | 30 | 1 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 | 1 | 4 | 3 | 1 | 3 | 2 | 2 | 2 | 3 | 1 | 1 | 1 | 2 |
| K-2 | 27 | 2 | 3 | 1 | 3 | 3 | 5 | 3 | 4 | 3 | 5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| K-3 | 30 | 1 | 3 | 3 | 1 | 2 | 3 | 0 | 0 | 5 | 2 | 1 | 2 | 3 | 1 | 5 | 0 | 1 | 2 | 4 | 4 | 5 | 5 | 4 | 3 | 1 | 3 | 5 |
| K-4 | 30 | 2 | 3 | 3 | 3 | 2 | 2 | 4 | 5 | 3 | 5 | 5 | 2 | 4 | 2 | 2 | 4 | 1 | 4 | 4 | 3 | 5 | 5 | 3 | 4 | 2 | 5 | 4 |
| K-5 | 30 | 1 | 3 | 3 | 1 | 5 | 5 | 1 | 5 | 5 | 5 | 5 | 3 | 5 | 4 | 5 | 5 | 3 | 1 | 5 | 3 | 5 | 5 | 4 | 5 | 5 | 5 | 3 |
| K-6 | 12 | 1 | 3 | 9 | 5 | 5 | 5 | 1 | 5 | 5 | 5 | 5 | 5 | 1 | 5 | 5 | 1 | 5 | 5 | 5 | 1 | 1 | 5 | 5 | 5 | 5 | 5 | 5 |
| K-7 | 30 | 1 | 3 | 2 | 4 | 4 | 3 | 3 | 5 | 5 | 4 | 4 | 3 | 3 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 4 | 4 | 4 |
| L-1 | 36 | 1 | 9 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 5 | 2 | 1 | 1 | 1 | 3 | 1 | 3 | 3 | 3 | 2 | 2 | 1 | 3 | 3 | 3 | 3 |
| L-2 | 30 | 1 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 3 | 2 | 4 | 2 | 3 | 4 | 4 | 3 | 4 | 3 | 3 | 4 | 5 | 4 | 3 |
| L-3 | 39 | 1 | 3 | 9 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 3 |
| L-4 | 5 | 1 | 8 | 5 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| L-5 | 16 | 1 | 3 | 3 | 4 | 3 | 5 | 4 | 5 | 5 | 5 | 5 | 2 | 5 | 1 | 3 | 3 | 4 | 3 | 4 | 1 | 3 | 3 | 2 | 3 | 4 | 5 | 4 |
| L-6 | 7 | 1 | 3 | 3 | 4 | 4 | 5 | 3 | 5 | 4 | 5 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 2 | 2 | 3 | 4 | 3 | 3 | 4 | 4 | 3 | 3 |
| L-7 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | 3 | 3 | 1 | 3 | 4 | 1 | 2 | 2 | 3 | 4 | 3 | 3 | 3 | 3 | 2 | 2 |
| L-8 | 29 | 2 | 3 | 6 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 1 | 1 | 5 | 2 | 4 | 5 | 5 | 5 | 5 | 1 | 2 | 2 | 4 | 3 | 1 | 3 | 4 |
| L-9 | 12 | 1 | 3 | 2 | 2 | 3 | 5 | 2 | 5 | 5 | 5 | 5 | 3 | 4 | 2 | 3 | 2 | 5 | 4 | 2 | 4 | 5 | 2 | 2 | 4 | 4 | 4 | 4 |
| L-10 | 3 | 1 | 9 | 6 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | 4 | 4 | 2 | 2 | 2 | 1 | 2 | 2 |
| L-11 | 30 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 |
| L-12 | 3 | 1 | 3 | 1 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 4 | 2 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 4 | 4 |
| M-1 | 0 | 1 | 3 | 3 | 5 | 5 | 5 | 2 | 5 | 5 | 5 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 4 | 5 | 4 | 4 | 4 |
| M-2 | 24 | 1 | 3 | 5 | 4 | 4 | 5 | 4 | 5 | 4 | 5 | 5 | 3 | 2 | 2 | 4 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 2 | 4 | 3 |
| M-3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 5 | 5 | 5 | 5 | 3 | 5 | 4 | 3 | 4 | 5 | 4 | 4 | 3 | 3 | 5 | 3 | 4 | 5 | 3 | 4 |
| M-4 | 30 | 1 | 3 | 2 | 3 | 4 | 4 | 2 | 5 | 5 | 5 | 5 | 3 | 3 | 3 | 4 | 3 | 4 | 4 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 3 |
| M-5 | 5 | 2 | 3 | 1 | 2 | 5 | 5 | 1 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 3 | 4 | 5 | 5 | 5 |
| M-6 | 5 | 1 | 3 | 2 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 4 | 3 | 2 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 5 | 5 | 4 | 4 | 5 | 5 | 3 |
| M-7 | 12 | 2 | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 2 | 4 | 2 | 2 | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| M-8 | 22 | 1 | 3 | 3 | 4 | 4 | 5 | 1 | 5 | 5 | 5 | 5 | 4 | 1 | 5 | 5 | 1 | 5 | 4 | 5 | 2 | 4 | 4 | 4 | 4 | 2 | 5 | 5 |
| M-9 | 3 | 1 | 3 | 7 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 2 | 5 | 4 | 4 |

Researcher - David Chadwick

RESULTS OF SURVEY PARTICIPATION [The Impact of Evolutionary Theory on College Students' Outlook-on-Life]

| | Part I | | | Part II | Part III | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Undergraduate Major / Gender | | Spiritual Affiliation | Origin(s) Orientation | | | | | | | | | | | | | | | | | | | | | | | | |
| | Item 1 | Item 2 | Item 3 | * | Q 1 | Q 2 | Q 3 | Q4* | Q5 | Q6 | Q7 | Q8 | Q9 | Q10* | Q11 | Q12 | Q13* | Q14 | Q15 | Q16 | Q17* | Q18* | Q19 | Q20 | Q21 | Q22 | Q23 | Q24 |
| M-10 | 21 | 2 | 1 | 4 | 1 | 1 | 1 | 1 | 2 | 2 | 5 | 5 | 1 | 2 | 1 | 1 | 5 | 3 | 2 | 3 | 4 | 2 | 2 | 2 | 4 | 4 | 1 | 1 |
| M-11 | 27 | 1 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 5 | 3 | 5 | 3 | 3 | 4 | 5 | 5 | 3 | 5 | 5 | 5 | 5 | 5 | 5 |
| N-1 | 31 | 1 | 3 | 3 | 3 | 3 | 5 | 2 | 0 | 5 | 5 | 5 | 3 | 3 | 3 | 5 | 2 | 3 | 3 | 4 | 4 | 3 | 3 | 4 | 5 | 1 | 4 | 2 |
| N-2 | 4 | 1 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| N-3 | 5 | 2 | 3 | 5 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 1 | 1 | 1 | 3 | 2 | 2 | 3 | 2 | 4 | 2 | 2 | 4 | 4 | 4 | 2 |
| N-4 | 38 | 1 | 3 | 5 | 4 | 4 | 4 | 2 | 4 | 4 | 4 | 4 | 3 | 4 | 2 | 3 | 2 | 3 | 4 | 4 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 |
| N-5 | 34 | 1 | 3 | 3 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 2 | 2 | 5 | 4 | 2 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| N-6 | 0 | 1 | 3 | 3 | 3 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 1 | 1 | 1 | 1 | 5 | 3 | 3 | 1 | 4 | 4 | 3 | 2 | 2 | 4 | 4 |
| O-1 | 39 | 2 | 12 | 4 | 2 | 4 | 1 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 2 | 1 | 2 | 1 | 2 | 3 | 5 | 4 | 4 | 2 | 4 | 4 | 2 | 2 |
| O-2 | 37 | 1 | 3 | 5 | 3 | 3 | 4 | 3 | 4 | 4 | 4 | 5 | 3 | 4 | 2 | 4 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 3 | 4 | 3 | 5 | 3 |
| O-3 | 6 | 1 | 3 | 2 | 5 | 2 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 0 | 1 | 2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 2 | 0 | 5 | 2 |
| O-4 | 0 | 2 | 3 | 3 | 3 | 3 | 4 | 2 | 5 | 4 | 4 | 5 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 4 | 2 | 4 | 2 | 4 | 3 | 5 | 4 | 4 |
| O-5 | 3 | 1 | 3 | 5 | 4 | 5 | 5 | 4 | 4 | 5 | 5 | 5 | 2 | 2 | 1 | 1 | 5 | 4 | 4 | 5 | 1 | 4 | 5 | 3 | 2 | 2 | 5 | 3 |
| O-6 | 32 | 1 | 3 | 5 | 3 | 3 | 2 | 4 | 4 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 4 | 4 | 2 | 4 | 3 | 2 |
| O-7 | 3 | 1 | 3 | 9 | 3 | 3 | 4 | 2 | 4 | 4 | 4 | 5 | 5 | 1 | 5 | 5 | 1 | 5 | 4 | 3 | 4 | 5 | 3 | 3 | 3 | 3 | 3 | 3 |
| O-8 | 7 | 1 | 3 | 2 | 2 | 3 | 4 | 3 | 5 | 5 | 5 | 5 | 4 | 5 | 4 | 4 | 1 | 4 | 3 | 4 | 4 | 3 | 3 | 4 | 4 | 5 | 3 | 3 |
| O-9 | 34 | 1 | 3 | 9 | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 1 | 1 | 5 | 2 | 1 | 5 | 1 | 2 | 1 | 4 | 5 | 1 | 1 | 3 | 2 | 1 | 2 |
| O-10 | 38 | 2 | 9 | 5 | 4 | 4 | 5 | 2 | 1 | 4 | 4 | 5 | 1 | 4 | 2 | 1 | 5 | 2 | 4 | 3 | 4 | 5 | 4 | 2 | 5 | 5 | 4 | 2 |
| O-11 | 0 | 1 | 3 | 9 | 4 | 4 | 4 | 2 | 2 | 2 | 2 | 4 | 3 | 2 | 2 | 2 | 1 | 4 | 2 | 3 | 3 | 2 | 2 | 4 | 2 | 2 | 2 | 2 |
| P-1 | 39 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 5 | 2 | 2 | 5 | 3 | 4 | 4 | 3 | 3 | 3 | 2 | 3 | 3 | 4 | 4 |
| P-2 | 29 | 2 | 3 | 5 | 5 | 4 | 4 | 3 | 5 | 5 | 5 | 5 | 3 | 4 | 2 | 2 | 3 | 2 | 4 | 3 | 4 | 4 | 4 | 4 | 2 | 4 | 4 | 3 |
| P-3 | 3 | 1 | 3 | 3 | 4 | 4 | 4 | 2 | 4 | 4 | 5 | 5 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 |
| P-4 | 3 | 1 | 3 | 2 | 2 | 2 | 2 | 4 | 2 | 2 | 2 | 2 | 2 | 4 | 3 | 2 | 4 | 3 | 3 | 2 | 4 | 4 | 2 | 2 | 2 | 2 | 2 | 2 |
| P-5 | 9 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| P-6 | 19 | 1 | 3 | 9 | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| P-7 | 30 | 2 | 12 | 2 | 5 | 5 | 4 | 3 | 5 | 2 | 4 | 5 | 3 | 2 | 2 | 1 | 3 | 2 | 3 | 4 | 4 | 5 | 4 | 3 | 4 | 4 | 4 | 3 |

*Appendix E*

## Descriptive Key for Quantitative Response Data

**SRDC** - [Student Response Designator Code] This column designates the alpha-numeric code assigned to each participant's survey responses (ex. A-1, A-2, etc.)

**Part I, Item 1 notation**:

0 = Blank / Multiple Response
1 = Agribusiness
2 = Agricultural Education
3 = Animal Science
4 = Athletic Training
5 = Biochemistry / Molecular Biology
6 = Biological Science
7 = Biosystems Engineering
8 = Chemical Engineering
9 = Communication Sciences
10 = Computer Sciences
11 = Education
12 = Elementary Education
13 = English
14 = Entomology
15 = Environmental Science
16 = General Business
17 = Geography
18 = Geology
19 = Health Education and Promotion
20 = History
21 = Hotel and Restaraunt Management
22 = Human Development / Family Services
23 = International Business
24 = Journalism / Broadcasting
25 = Management
26 = Marketing
27 = Mechanical Engineering
28 = Microbiology / Molecular Biology
29 = Natural Resource Ecology / Management
30 = Nutritional Science
31 = Physical Education
32 = Physiology
33 = Political Science
34 = Psychology
35 = Secondary Education
36 = Sociology
37 = Zoology
38 = Other
39 = Undecided

**Part I, Item 2 notation**:

0 = Blank / Multiple Response
1 = Female
2 = Male

Continued

**Part I, Item 3 notation**:

0 = Blank / Multiple Response
1 = Atheism
2 = Buddhism
3 = Christianity
4 = Confucianism
5 = Hinduism
6 = Islam
7 = Judaism
8 = Taoism
9 = Agnosticism
10 = Transcendentalism
11 = Personalized Religion
12 = Unsure

**Part II notation**:

0 = Blank / Insufficient Response
1 = Creationism / Special
2 = Creationism / Human Only
3 = Creationism / Non-Specific
4 = Evolution / Non-Theistic
5 = Evolution / Theistic
6 = Evolution / Interventionist
7 = Evolution / Non-Specific
8 = Uncertain / Inconsistent
9 = Uncertain / Neutral

**Notation for Part III, Questions 1-3,5-9,11-12,14-16,19-24**

5 = Much Harder (Negative Attitude)
4 = Harder
3 = Undecided
2 = Easier
1 = Much Easier (Positive Attitude)
0 = Blank / Multiple Response

**Notation for Part III, Questions 4,10,13,17,18**

5 = Much Harder (Positive Attitude)
4 = Harder
3 = Undecided
2 = Easier
1 = Much Easier (Negative Attitude)
0 = Blank / Multiple Response

*Appendix F*

**Survey Questions Adapted from "Perceived Consequences of Evolution: College Students Perceive Negative Personal and Social Impact in Evolutionary Theory" Brem, Ranney, & Schindel (2003)**

**Questions on Origins (Brem et al., p. 200)**

1. All forms of life evolved from earlier forms, and no supreme being or beings has ever played any role in the evolution of life on Earth.

2. All forms of life evolved from earlier forms, but evolution was first set in motion by a supreme being or beings and then left running without any additional intervention by the supreme being or beings.

3. All forms of life evolved from earlier forms, but a supreme being or beings intervenes from time to time to shape or override the evolutionary process.

4. Some forms of life evolved from earlier forms, but human beings were created in more or less their present form by a supreme being or beings.

5. All forms of life were first brought into being in more or less their present form by a supreme being or beings.

**Questions on Impact of Evolution (Brem et al., pp. 201-202)**

1. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to know how they should live their lives?

2. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to lose their focus on what is important in life?

3. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that there is an afterlife?

4. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that there is a supreme being or beings?

5. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to consider some races and ethnic groups "less advanced" than others?

6. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that all races of human beings are related to one another?

7. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that great athletes, artists and thinkers were born with talents that the rest of us don't have?

8. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that with hard work one can overcome most physical and intellectual obstacles?

9. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to rationalize becoming obsessed with getting ahead?

10. If everyone accepted the theory of evolution as true beyond any doubt, do you think that people would find it harder or easier to believe that human beings are always looking out for their own best interests?

*Appendix G*

IRB Approval Sheet

**Oklahoma State University Institutional Review Board**

| | |
|---|---|
| Date: | Friday, October 09, 2009 |
| IRB Application No | ED09130 |
| Proposal Title: | The Impact of Evolutionary Theory on College Students' Outlook on Life |
| Reviewed and Processed as: | Exempt |

**Status Recommended by Reviewer(s): Approved Protocol Expires: 10/8/2010**

Principal Investigator(s):

David W. Chadwick
27434 E. 113th St.
Coweta, OK 74429

Jeffrey Hawkins
268 Willard
Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

X The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTeman in 219 Cordell North (phone: 405-744-5700, beth.mcteman@okstate.edu).

Sincerely,

Sheila Kennison, Chair
Institutional Review Board

VITA

David W. Chadwick

Candidate for the Degree of

Master of Science

Thesis: THE IMPACT OF EVOLUTIONARY THEORY ON COLLEGE STUDENTS' OUTLOOK-ON-LIFE

Major Field: Education

Biographical: My undergraduate work at OSU was in Philosophy. I am preparing to become an instructor of social studies/humanities.

Personal Data:
27434 E. 113th St.
Coweta, OK 74429

Education:

Bachelor of Arts in Philosophy, Oklahoma State University 2005.

Completed the requirements for the Master of Science in Education at Oklahoma State University, Stillwater, Oklahoma in May, 2010.

Experience:

Dollar Thrifty Automotive Group, Inc., Tulsa, OK February 1992 to Current

Name: David Chadwick Date of Degree: May, 2010

Institution: Oklahoma State University Location: Tulsa, Oklahoma

Title of Study: THE IMPACT OF EVOLUTIONARY THEORY ON COLLEGE STUDENTS' OUTLOOK-ON-LIFE

Pages in Study: 96 Candidate for the Degree of Master of Science

Major Field: Education / Teaching, Learning, and Leadership

Scope and Method of Study:

The purpose of this study was to investigate from a social science perspective the extent to which students held a positive or negative outlook-on-life through the lens of the theory of evolution. The working concept of outlook-on-life was defined as the way in which students individually perceived the following six general aspects of life: meaning and ethics, spirituality, social issues, self-determination, altruism and selfishness, and hope and well-being. Using a descriptive studies approach, data from 145 undergraduate college students from a wide variety of majors were collected. Quantitative data were subjected to a correlational analysis, and qualitative data were subjected to an interpretive analysis.

Findings and Conclusions:

The findings of this study revealed a mild relationship between students' outlook-on-life and the way in which they viewed the theory of evolution. Those students who viewed the origin of biological life as supernatural expressed that they would have slightly more difficulty in finding purpose or maintaining hope, well-being, and close relationships if they accepted the theory of evolution. Students who held a natural view of the origins of biological life indicated that they would have less difficulty. Additionally, while students seemed to be mostly unconcerned with evolution's impact on outlook-on-life, they demonstrated what may be interpreted as a somewhat superficial level of personal engagement with evolutionary theory.

ADVISER'S APPROVAL: Jeffrey M. Hawkins, Ed.D