Encouraging Spiritual Vitality through Multidisciplinary Discussions on the Role of Engineering in Reconciling Science and Faith Issues

Dominic Halsmer, PhD, PE, Dean of Science and Engineering, Oral Roberts University
Joshua Beck, Honors Student, Undergraduate Theology, Oral Roberts University

Spirituality and Honors Education Symposium, May 29-31, 2012

Abstract

Why is the universe the way it is? Do human beings have a purpose? Is there value in being a person of integrity, or "whole person?" What does it mean for someone to be spiritually alive? These are just a few of the "big questions" with which everyone wrestles at some point in their lives. Every person finds their own answers to these questions and it affects every part of their existence, including the kind of person they become. A university setting provides an excellent venue for applying knowledge from multiple fields in an effort to address these questions. This is a challenging endeavor for students, many of whom find the tensions between science and faith at the forefront of these uncertainties. Students in science and engineering are particularly challenged to integrate their major field studies with their faith traditions. Regarding questions of purpose, an engineering mindset has been found to be helpful in reconciling perceived problems in science and faith. Through multidisciplinary research and discussion, undergraduate honors students are discovering that the field of engineering plays a key role in the consilience of knowledge from a variety of disciplines that leads them on a path to personal integrity and spiritual vitality.

A research study involving undergraduate honors students and faculty from a diversity of academic fields, including engineering, theology, psychology, engineering physics, music, biology, chemistry and biomedical engineering is currently underway at Oral Roberts University. The students engage in weekly extra-curricular research and discussions centered on the hypothesis of "God as Engineer." This hypothesis is continuously evaluated in light of a serious engagement with mainstream scientific understandings as well as a respect for traditional religious truth claims. Students assess research in the sciences, mathematics, humanities, theology, and reverse engineering methodologies for applicability to the hypothesis in question. Weekly meetings are held to discuss findings and develop journal articles, conference papers and presentations. The diversity of academic fields represented provides rich and fertile ground for discussion and conflict resolution. Survey data from current and previous group participants suggest that these studies help students to solidify personal integrity, knowledge of purpose, and spiritual vitality, and enhance their ability to effectively communicate such convictions.

Motivating Students by Exploring the Implications of Science and Engineering

A few years back, Columbia University Physics Professor and author, Brian Greene, published an article in *The New York Times* entitled "Put a Little Science in your Life."[1] It offered a scathing indictment of the dry and uninspiring ways that science is often presented to today's young people. He found this appalling, since he sees science as "a language of hope and inspiration, providing discoveries that fire the imagination and instill a sense of connection to our lives and our world." From his extensive experience at the frontiers of physics and cosmology, he recognizes that, "Science is the greatest of all adventure stories, one that's been unfolding for thousands of years as we have sought to understand ourselves and our surroundings. Science needs to be taught to the young and communicated to the mature in a manner that captures this drama. We must embark on a cultural shift that places science in its rightful place alongside music, art and literature as an indispensible part of what makes life worth living."

He expounds on these ideas in a more recent *Newsweek* article entitled, "Brian Greene: Welcome to the Multiverse."[2] In this article, he presents the astounding discoveries of modern cosmology, and reasons why people should care about these theories. The point he makes is a good one, and it's time for teachers to adjust their curricula and pedagogy accordingly. It is the metaphysical and spiritual implications of science that make it such an interesting field. Obviously, the practical applications of science are also important, but its implications have the potential to enthuse and motivate students to discover their place in the world and their purpose in life. Too often in schools, science is quarantined from its implications and restricted from interaction with other bodies of knowledge. This can lead to a disjointed understanding of reality and a misunderstanding or lack of purpose, an idea that was illustrated recently in an award-winning major motion picture. In reflecting on a broken down robot, an orphaned boy, who is the title character in the movie, *Hugo*, puts it this way, "Maybe that's why a broken machine always makes me a little sad, because it isn't able to do what it was meant to do... Maybe it's the same with people. If you lose your purpose... it's like you're broken."[3] This also reveals the importance of the field of engineering in this discussion. Engineers combine their creativity with knowledge of science and mathematics to solve a problem, or devise a system to accomplish some purpose. This expertise also allows them to reverse engineer systems to address questions of purpose. But this is best accomplished when epistemological resources are not limited to the field of science.[4]

Fortunately, a few courageous pathfinders are calling attention to this persistent problem in science education, and are making a clarion call for change. Adrian Bejan, J.A. Jones Distinguished Professor of Mechanical Engineering at Duke University and discoverer of the constructal law, which governs the evolving configurations of all flowing systems, writes in his recent book, *Design in Nature*, "In my professional capacity I see the constructal law as a powerful scientific tool. As a human being, I also appreciate its metaphysical implications…When we raise our eyes and look around, we encounter a wondrous world of living drawings: birds and airplanes painted against an azure sky, pine trees and skyscrapers

reaching for the heavens, rivers and roads snaking across the earth's surface. If we take a closer and wider look at the same time, we also see how much these images have in common: similarities in shape and structure so numerous that they can't be the result of accident."[5] Although Bejan hesitates to attribute purpose in nature to the intentionality of a divine designer, he recognizes that the discovery of such purpose inspires hope and enthusiasm for a significant and meaningful life committed to the betterment of species and our world..

In a more measured assessment, Alexander Astin (Founding Director of the Higher Education Research Institute at UCLA) et al. discuss the situation in higher education in their book, *Cultivating the Spirit: How College Can Enhance Student's Inner lives*.[6] They investigates how students wrestle with seemingly contradictory beliefs regarding life's big questions, how they make meaning of their education and their lives, and how they develop a sense of purpose. Astin's group discovered that spiritual growth enhances students' academic performance, leadership development, and satisfaction with their education. But they also found that colleges could be doing more to address students' needs in these areas. Their studies show that two-thirds of the students surveyed express a strong interest in spiritual matters, while well over half report that their professors never encourage discussions of religious/spiritual matters. Furthermore, about the same percentage report that professors never provide opportunities to discuss the meaning and purpose of life. As a result, the authors encourage institutions to give greater priority to the spiritual aspects of students' lives and assist them in reconciling their spirituality with their academic pursuits.

Another perspective on spirituality in higher education was recently advanced by Anthony Kronman, former Dean of the Law School and Sterling Professor of Law at Yale University. In his book, *Education's End; Why our Colleges and Universities Have Given up on the Meaning of Life*,[7] he proposes that when professors emphasize the secular, they offer no recognition of the spirit, and no encouragement for the pursuit of spiritual values. In particular, he claims that teachers of the humanities, who once felt a special responsibility to guide students in exploring the question of what living is for, have lost confidence in their authority to do so, and have even lost sight of the question itself. But the humanities are not solely responsible for addressing this question. Recent scientific discoveries bear on the issue, and it is helpful for students to engage in discussions of the implications of science, even in the science classroom. This helps to motivate their study of science. Kronman suggests that the time is ripe for change. He observes a desire among both students and teachers to engage questions of ultimate meaning. He urges the humanities to regain their lost tradition through careful but critical reading of classic works in literature and philosophy. But does this go far enough? Questions of ultimate meaning and purpose are multifaceted, and need to be addressed with all the pertinent evidence in hand. Current scientific understandings and their philosophical implications are a key part of this evidence. Ultimately, a multidisciplinary approach to life's big questions is needed. A university provides an excellent setting, but as many voices as possible should be invited to engage in the discussion.

The Need for Whole Person Graduates

During the summer of 2009, Samuel Schuman, Chancellor Emeritus at the University of North Carolina, delivered a powerful lecture entitled, "Seeing the Light: Reflections on Honors at Faith-based Colleges from a 'Sympathetic Outsider'" at the Council on Christian Colleges and Universities Honors Workshop. During this lecture, he made a radical suggestion: that we "reopen the doors of higher learning to the human spirit." He reiterates this point in a his latest book, *Seeing the Light: Religious Colleges in Twenty-First-Century America*[8] where he argues that there is much to be learned by the secular academy from such institutions. Many in higher education are echoing this sentiment.

In a recent article, Astin, argues that spirituality deserves a central place in higher education. In describing what he means by "spirituality," he writes that, "…spirituality has to do with the values that we hold most dear, our sense of who we are and where we come from, our beliefs about why we are here – the meaning and purpose that we see in our work and our life – and our sense of connectedness to each other and to the world around us." Based on this definition of spirituality, it is hard to imagine anyone who would not be interested in this pursuit, or who would not benefit from discussions of how their chosen discipline interfaces with spirituality. In a new book entitled *Educating Engineers: Designing for the Future of the Field*,[9] the authors call for a broadening of engineering education by asserting "…that an approach that integrates knowledge, skill, and *purpose* [emphasis mine] through a consistent focus on preparation for professional practice is better aligned with the demands of more complex, interactive, and environmentally and socially responsible forms of practice." Human spirituality is intimately related to a sense of purpose, which governs human concerns and motivations. Proper motivations are critically important for the responsible practice of science and engineering, as well as the successful completion of these challenging degrees, and even the choice to pursue the fields of science or engineering as a career.

Suggestions for making the college experience more "spirit-friendly" are offered in a recent book entitled *Encouraging Authenticity and Spirituality in Higher Education*. In this book, Chickering et al. note that, "American undergraduate education is largely focused on the transmission of theories, empirically derived facts, and the disciplinary frameworks and methods used to create and interpret empirically derived information. Unfortunately, examining the ways in which students can use the information and analytic processes about which they are learning to create meaningful individual lives and positive social structures has largely been excluded. Such characteristics as wisdom, compassion, and integrity, and such concepts as justice, ethics, values, morality, virtue and character are ones that most undergraduates fail to consider because the curriculum does not encourage them to do so."[10] In science and engineering, students are taught to be objective and analytical, and rightly so. But if their education consists solely of this approach, then is it possible that something of critical importance is being left out? Courses in

ethics typically provide students with positive understandings of moral duty and professional obligation, but does this go far enough in making connections with spirituality?

Recent studies are recognizing the importance of encouraging students to make connections between scientific knowledge and other ways of knowing such as direct experience, self-evident truths, and wisdom. For example, Michael Reiss at the University of London, in a recent article entitled "The Relationship between Evolutionary Biology and Religion," writes that effective teaching in this area can help students appreciate the procedures and limitations of science, "and the ways in which scientific knowledge differs from other forms of knowledge."[11] Other ways of knowing are also being discussed by educators such as P. J. Palmer, who writes, "The mode of knowing that dominates higher education I call objectivism. It has three traits with which we are all familiar. The first of these traits is that the academy will be objective… Secondly, objectivism is analytic…Third, this mode of knowing is experimental…Very quickly this seemingly bloodless epistemology becomes an ethic. It is an ethic of competitive individualism, in the midst of a world fragmented and made exploitable by that very mode of knowing. The mode of knowing itself breeds intellectual habits, indeed spiritual instincts, that destroy community. We make objects of each other and the world to be manipulated for our own private ends."[12]

Chickering et al. make it clear that their "problem is not with scientific methods and research or with rational inquiries concerning human nature. Instead the problem is that we tend to assume that objective methods require us to eliminate questions of purpose, value, and meaning, and to assume that we humans are only machines, or collections of molecules or interacting subatomic particles."[13] What kind of identity do students develop under such a system? It is widely recognized that students should not be indoctrinated into a particular world view. Rather, they should receive the pertinent knowledge that will allow them to form their own view of things, and integrate the meaning and purpose of their lives into this view. Although higher education strives for this ideal, is it possible that current curricula are guilty of the following stinging accusation? "A great irony is that while spiritual indoctrination, in particular, has been banned from our classroom, indoctrination and imposition continue unimpeded. Students aren't indoctrinated into religious liturgy but instead into dualism, scientism, and most especially consumerism. We have been indoctrinated into a severely limited, materialistically based world view. Rather than learning to nurture and preserve spirit, we learn to manipulate the world: to earn, store, and protect wealth. Rather than learning to be sensitive – understand and attend to the needs of others – we learn to want, rationalize, and do for ourselves. With the rise of a kind of "economic individualism" as our basic sense of identity has come the centralization of wealth and power, the loss of the "commons", and the ravishing of the planet. The fact is, within our schools and culture, identity is being imposed: not spiritual identity but material identity."[14]

Due to this worldview with its embedded philosophy of science, which permeates the classroom experience, students are shaped into efficient scientists and engineers who tend to focus on making discoveries and producing effective products in the absence of spiritual

considerations. This is due largely to the current "academic" worldview under which they labor. While this worldview of efficiency is not necessarily bad, and is certainly the means to an often progressive end, it can lead to a dysfunctional society. This perpetuates a fragmented form of community in which members fight over resources in what Palmer calls "competitive individualism," rather than working together, using all of the talents offered, to reach a more complete and harmonious solution.

So what kind of graduates *are* needed to solve today's societal problems? Chickering et al. suggest that our colleges and universities are well poised to 'educate a citizenry able to function at the levels of cognitive and affective complexity the problems require. They are the only social institutions that can help create the…"servant leaders" our distressed globe requires. Ten capacities of servant leaders include listening, empathy, healing, awareness, persuasion, conceptualization, foresight, stewardship, commitment to the growth of people and building community. No other educational institutions can do as much to enhance these human competencies and personal qualities. But higher education is not succeeding in these tasks.'[15] Why is higher education failing in this regard? Are not all of the tools to develop servant leaders readily available to them? What do faith-based schools offer that can succeed where secular schools have not? A focus on spirituality, as opposed to religion, is suggested. It may be helpful at this point to further clarify the distinction between religion and spirituality. Teasdale offers some insightful comments in this regard, "Being religious connotes belonging to and practicing a religious tradition. Being spiritual suggests a personal commitment to a process of inner development that engages us in our totality. Religion, of course, is one way that many people are spiritual. Often, when authentic faith embodies an individual's spirituality, the religious and the spiritual will coincide. Still, not every religious person is spiritual (although they ought to be) and not every spiritual person is religious. Spirituality is a way of life that affects and includes every moment of existence. It is at once a contemplative attitude, a disposition to a life of depth, and the search for ultimate meaning, direction, and belonging. The spiritual person is committed to growth as an essential ongoing life goal. To be spiritual requires us to stand on our own two feet while being nurtured and supported by our tradition, if we are fortunate enough to have one."[16]

Every engineering program strives to produce graduates who are ethical. Engineering ethics is an area that potentially benefits from making connections between science/engineering and spirituality. In fact, Robert Niewoehner of the U.S. Naval Academy, in his paper for the 2008 ASEE Conference, "Must Engineering Ethics Presume a Secular Foundation,"[17] argues persuasively that a secular foundation for engineering ethics lacks the necessary robustness of a faith-based approach. Motivation is a key consideration in this regard. Is it possible for engineers, or any human beings for that matter, to simply learn a set of ethical standards, and henceforth do what is right by shear act of the will, or does ethical behavior flow from having effectively addressed critical spiritual issues? This is the crux of the matter for many faith-based

institutions that would hold the latter view, instead of the former. The next section describes how faculty-directed, interdisciplinary student communities facilitate the investigation of these issues.

A Call for a Humble Spirit in Science/Engineering and Spirituality

Randy L. Maddox wrote an article entitled "John Wesley's Precedent for Theological Engagement with the Natural Sciences."[18] In this article, Maddox highlighted five characteristics of Wesley's theological engagement with science. The second characteristic is the one that is most pertinent to the current study. This characteristic is a call "*for Epistemic Humility in* BOTH *Theology and Science*." Maddox mentioned seventeenth-century theologians like William Chillingsworth, John Tillotson, and Edward Stillingfleet who, in response to a "growing awareness of the lack of absolute certainty in most human knowing," advocated a "common sense" approach. This approach would only ask for conviction beyond a reasonable doubt. Wesley eventually embraced this stance. Wesley became aware that all of human knowing consists of opinions. "They are *interpretations* of their subject matter. While that subject matter may exist as objective fact, our interpretations of it remain *fallible*, and should remain open to the possibility of further confirmation or modification" wrote Maddox.

In Wesley's time, with the Enlightenment rising, the recognition of the fallibility of theological claims was mostly welcomed. Maddox claimed that "Where Wesley ran into opposition was when he suggested that scientific claims were in the same epistemological camp." There were two parts to the call for epistemic humility. The first side of the call is for the theologian. It's an understanding that we will never know all there is to know about God and the natural world. The second part of the call is a challenge to the belief that science is the answer to all knowledge, including religion and ethics. In regard to the second part, Maddox wrote that "Most critiques of scientism focus on admonishing science to "stick to its field," but say less about the importance of epistemic humility even within its proper field." This concept of epistemic humility will go a long way in the dialogue between science and theology, and will probably solve many of our problems. And the key to this dialogue is not to "stick to your own field," but as Maddox said, and Wesley would surely advocate, have epistemic humility even within your own field.

An Extra-curricular Honors Research Program

Oral Roberts University was founded because a healing evangelist from the 1950s named Oral Roberts believed that God said to him, "Build me a university; build it on my authority, and on the Holy Spirit. Raise up your students to hear my voice, to go where my light is dim, where my voice is heard small, and my healing power is not known." Thus, ORU's most compelling benefit is realized by actively engaging students to hear God's voice, excel in academics, and go impact their world in a positive way. Developing Spirit-empowered leaders who know how to hear from God is the unique calling of this Christ-centered university.

From a historical perspective, the Pentecostal movement of the twentieth century consisted largely of those lacking formal education,[19] and often maintaining an anti-intellectual bias.[20] This perspective limited their influence in more educated circles. Hence, it is significant

that God's mandate to Oral Roberts concerning the spiritual receptivity of students was given in the context of a university education. While "engaging students to hear God's voice" certainly involves experiences where students are encouraged to listen intently during times of prayer, praise and worship, and Scripture reading, students should also be engaged in a way that facilitates hearing God's voice in the midst of their scholarly pursuits. In other words, how is God speaking to them through what they are learning in their academic disciplines? It is this idea that sets ORU apart from most educational institutions, and likely lies at the very core of why God called Oral Roberts to build a university.

Curricular and extra-curricular elements within the Honors Program at Oral Roberts University facilitate the students' quest to integrate faith and learning in their disciplines. Interdisciplinary honors courses such as Philosophy of Science, History of Quantitative Thought, and Science and the Imagination specifically address integration issues that arise when the fields of science, engineering and mathematics touch on spiritual concerns. However, additional opportunities are made available to honors students through the Honors Research Program, in which students are compensated for assisting faculty on research projects outside of the classroom. This research often presents students with opportunities to integrate faith and learning. This can be especially important in the sciences where many view integration to be particularly difficult or even impossible.

Multidisciplinary Team Explorations into Science/Engineering and Spirituality

If campus leaders are calling for an exploration of ways to better integrate students' spiritual quest with their academic preparation, as Chickering et al. suggest, then what might this look like for a science or engineering curriculum? They argue that instructors play a key role, noting that, "Most important, both the curricula and teaching practices need to be accompanied by teachers who are themselves authentic, who are open and candid, [and] who share their own searching, their own concerns, and their own struggles, past and present."[21] A recent article in *Christianity Today* echoes this sentiment, emphasizing the role of teachers as mentors. Perry Glanzer writes, "[Christian] university faculty can mentor students and help them understand what loving God looks like when engaged in a particular discipline."[22]

However, not much is available in terms of how a science or engineering curriculum might be specifically upgraded in this regard. Chickering et al. assert that a unit on the confluence of science and spirituality is particularly significant for students, since we seem to be accelerating into an ever more technological age. Classroom discussions around questions such as: "How do we make meaning of transcendent spirituality in a technological age?" and "How do individuals reconcile traditional systems of belief with an increasingly complex and comprehensive knowledge of science?" are suggested.[23]

Fortunately, much has been written in an effort to bring understanding, even reconciliation, to the fields of science/engineering and spirituality. A book that has been used with some success is Guy Consolmagno's book entitled *God's Mechanics: How Scientists and Engineers Make Sense of Religion*.[24] Another valuable set of resources are the proceedings of the Christian Engineering Education Conference[25] which has been meeting periodically to discuss these issues from a Christian perspective since 1992. International conferences can be a valuable arena for learning what others are doing around the world. At the 2006 International Conference on Engineering Education (ICEE) in Puerto Rico, the author discovered a paper entitled "Confucian Influence in American Classrooms"[26] by Jainping Yue, which provided a better understanding of the world view and motivations of Asian students with a background in Confucianism. At that same conference, the author presented a paper describing an early attempt at assisting science and engineering students from a faith-based university to integrate their academics with their spirituality. This effort has continued and become more focused over the last six years. The remainder of this paper will describe that effort, and attempt to assess the value and level of success of a multidisciplinary honors research group for this purpose.

The ICEE paper referred to above, "Multidisciplinary Cross-cultural University Outreach to Secular Scientists and Engineers (Why Engineers Make Good Apologists),"[27] contains ideas that sprang from interactions between undergraduate engineering students at a faith-based university and technically-oriented foreign nationals (temporarily in the United State for training) who were typically skeptical of a faith-based world view. The students were challenged to learn from (and about) our guests, and also to articulate their own world-view in an understandable and coherent fashion. These interactions were found to be very successful at motivating the students to want to learn more about the connections between science/engineering and spirituality. One of the learning objectives of their engineering program is the practice of faith-based principles of stewardship, which was introduced in a paper on assessment using electronic portfolios presented at the 2004 ASEE Conference.[28] The development of these connections in the lives of students is seen as an important part of accomplishing this learning objective since proper stewardship of both public and personal resources depends on motivations and purpose.

One insight that was realized from the very beginning is that (just like with traditional engineering topics) students benefit from working in multidisciplinary teams. This was also necessary due to the multidisciplinary nature of the issue. Thus, opportunities were grasped to allow multidisciplinary teams of students to research and write on the connections between science/engineering and spirituality. A special topics course for upper division engineering students was introduced, regular seminars were delivered to pique their interest, new material was introduced into honors courses such as Philosophy of Science and The History of Quantitative Thought, and an ongoing research group for honors students was initiated. There has been no lack of interest from the students. This idea of multidisciplinary community-based research with purpose, contrary to the "competitive individualistic" approach, allows for a

unique opportunity for multiple talents, as well as multiple points of view, to shed light on puzzling questions. As a result of this approach, not only are solutions discovered, which are not bounded by a single worldview, but a passion for servant leadership is formed, as students work together and serve each other to achieve a goal that is higher than any of them could achieve individually. It is recognized that the research group at this time is somewhat limited, in that all of its members approach these questions from a faith-based perspective. However, one goal for future work is to deepen our connections with others who hold different points of view. We believe that this dialogue would enrich the students' experience and benefit society as a whole.

The current honors research group consists of a biomedical engineering student, an engineering student in the mechanical concentration, an engineering student in the electrical concentration, and a student majoring in theology. This group meets with their faculty director weekly during the academic year to present and discuss research findings, and to develop publications based on such findings. Other students from various disciplines who are also interested in these issues sometimes join the weekly discussions. Group members review books and articles in an ongoing evaluation of the hypothesis of "God as engineer," or the idea that the universe is in the process of being engineered by some kind of intelligence. This is thought to be one of the oldest and most important of life's big questions, and it profoundly affects meaning-making and purpose-finding in human beings. Virtually every academic discipline provides data that bears on this question. Some data, such as the apparent "fine-tuning" of physical constants, seem to argue in favor of the hypothesis, while other data, such as the extensive amount of evil and suffering in the world, seem to argue against it. Part of the challenge in assessing this hypothesis is in attempting to determine how all of the various data fit together. Does it tend to dovetail into a coherent worldview, or does a hodgepodge of disjointed ideas result?

Recent Presentations and Publications

One of the first attempts to address this question came out of an ORU special topics course called Spiritual Engineering, which had a similar format to the honors research group. This paper, entitled, "The Applicability of Engineering Design Principles in Formulating a Coherent Cosmology and Worldview,"[29] was presented at the Annual Meeting of the American Society for Engineering Education (ASEE) in Pittsburg in 2008. Another early effort produced through this course focused on the enhancement of higher education curriculum to incorporate these ideas. This paper, "Enhancing Science and Engineering Programs to Equip and Inspire Missionaries to Technical Communities,"[30] was presented at the Christian Engineering Education (CEE) Conference at Geneva College in 2008.

The first major publication produced by the honors research group, entitled "The Coherence of an Engineered World," was originally presented by Jon Marc Asper, an honors engineering student, at the Design and Nature Conference at The Algarve in Portugal. An extended version was later published in the *International Journal of Design & Nature and Ecodynamics*.[31] Another team of honors research students, consisting of two engineering majors,

a psychology major and a theology major, began researching the idea of applying reverse engineering methodologies to natural systems. Their work was presented at the 2009 ASEE conference and also at the 2009 Annual Meeting of the American Scientific Affiliation (ASA). The ASA paper, "A Reversible Universe: Worldview by Affordance-based Reverse Engineering of Complex Natural Systems,"[32] was submitted for publication to the journal of the ASA, *Perspectives on Science and Christian Faith*.

The application of a reverse engineering mindset has proven to be a fruitful approach to these issues. In response to recent claims of dis-teleology in the human genome appearing in major science journals, the honors research group responded with a reverse engineering analysis, which incorporates the possibility of corruption. This work was presented at the 2011 CEE Conference at Trinity Western University. The work associated with this paper, "Affordance-based Reverse Engineering of Natural Systems with Possible Corruption,"[33] is ongoing. A follow-on paper, "Introducing the Possibility of Corruption to Facilitate Reverse Engineering of Natural Systems,"[34] will be presented at the July 2012 ASA Meeting. Two additional papers written by group members will be presented at the Engineering and Metaphysics Conference in June of 2012. Their titles are, "Constructal Theory in Relation to Metaphysics and a Christian Worldview,"[35] and "The Problem of Evil and Suffering from an Engineering Perspective."[36]

Assessment of the Honors Research Group

In an effort to assess the value and success of the honors research group, a brief survey was conducted via email. Responses were received from both former and current group members. The small number of participants makes it difficult to draw any statistically significant conclusions, but the responses were helpful in evaluating the effects of the group activity, and in thinking about the implementation of changes for improvement.

The survey consisted of six short statements with which respondents could indicate either strong disagreement (1), disagreement (2), neutrality (3), agreement (4), or strong agreement (5), followed by an invitation to provide further details, and an opportunity to offer suggestions for improving the research experience. Individual responses to each of the six statements were associated with a numerical score as indicated above. The six statements asserted that participation in the honors research group…

1. assisted in reconciling problems in science and faith – [4.2]

2. assisted in solidifying personal integrity (wholeness) – [4.0]

3. assisted in becoming more spiritually alive (closer to God) – [3.2]

4. resulted in a greater sense and understanding of personal purpose – [4.6]

5. assisted in the ability to communicate with others on issues of science and faith – [5.0]

6. actively engaged the student in hearing God's voice in nature – [4.0].

The numbers in brackets after each statement are the average scores from all respondents. It is encouraging to see that all the scores are higher than the neutral level (3.0), with the statement regarding spiritual vitality being the lowest at 3.2, and the statement regarding communications being the highest at 5.0. Thus, all the respondents strongly agreed that participation in the honors research group assisted in their ability to communicate with others on issues of science and faith. In regard to whether participation in the group assisted in spiritual vitality, all the respondents agreed or were neutral except one, who disagreed. Perhaps these responses were influenced by a persistent belief among evangelical Christians that one is either spiritually alive or not, with no possibility of improvement in this category. An attempt was made to circumvent this kind of thinking by adding the parenthetical phrase "closer to God." All respondents either agreed or strongly agreed that participation in the group resulted in a greater sense and understanding of personal purpose, with the majority strongly agreeing. All respondents agreed that participation assisted in solidifying personal integrity (wholeness).

In providing further details, respondents were appreciative of opportunities to be involved in the stimulating conversations, to participate in the research and publication processes, and to prepare and deliver conference presentations. One respondent even equated the value of his/her experience in the research group with the value of his/her engineering degree. In offering suggestions for improvement, respondents asked for a clearer focus, with a set of goals and expectations, and a more structured timetable with deadlines. Changes are already being implemented to incorporate these suggestions. Another respondent greatly appreciated his/her experience in presenting at a conference, and suggested that all participants be given the opportunity to participate in an academic conference. This is a current goal of the research group. Another respondent suggested that Oral Roberts University offer more courses in philosophy, since they would be very helpful in the continuing work of the research group. There is currently an effort underway to implement this suggestion. Another respondent suggested that the research group meet more often than just one hour per week. This is one of the major challenges of this work. The research is effectively extra-curricular, with students only putting in somewhere between one and five hours per week on this effort. They are typically extremely busy with their coursework, which tends to shove their work for the research group to the "back burner." Any opportunities to synergize the work of the group with their coursework are quickly grasped and utilized. Another respondent suggested that we conduct more interviews with people whose ideas of spirituality may be different from our own. This is a good idea that will bring better understanding of the pertinent issues. A format for incorporating this suggestion is currently being studied.

Conclusion: Taking a Research Experience from Good to Great

Both students and faculty have enjoyed and benefited from participation in a multidisciplinary honors research group investigating the role that engineering concepts might

play in the current dialogue in science and theology. The involvement of participants from multiple disciplines provides a rich environment for discovery, discussion, and conflict resolution. Survey respondents felt strongly that their abilities to communicate with others on issues of science and faith were assisted by their participation in the research group. They felt almost as strongly that the group had helped them achieve a greater sense and understanding of personal purpose. All respondents agreed that the group helped them in solidifying personal integrity. All but one of the respondents agreed that the group assisted them in reconciling problems in science and faith. Respondents were less certain that the group has assisted them in becoming more spiritually alive. Valuable feedback was obtained and will be incorporated to improve the research experience for future honors student participants. With the help of this feedback, it is anticipated that the honors research experience at Oral Roberts University will improve from good to great.

Bibliography

1. Greene, B., *The New York Times*, "Put a Little Science in your Life," June 1, 2008.

2. Greene, B., *Newsweek*, "Brian Greene: Welcome to the Multiverse," May 21, 2012.

3. Selznick, B., *The Invention of Hugo Cabret*, Scholastic Press, New York, p. 374, 2007.

4. Halsmer, D. & Fitzgerald, J., "Metaphysical Considerations Enhance Reverse Engineering Studies," presented at the Annual Meeting of the American Scientific Affiliation, Naperville, IL, July 29-31, 2011.

5. Bejan, A. & Zane, J.P., *Design in Nature: How the Constructal Law Governs Evolution in Biology, Physics, Technology, and Social Organization*, Doubleday, New York, p. 26, 55, 2012.

6. Astin, A. et al, *Cultivating the Spirit: How College Can Enhance Student's Inner lives*, Jossey-Bass, San Francisco, 2010.

7. Kronman, A., *Education's End: Why Our Colleges and Universities Have Given Up on the Meaning of Life*, Yale University Press, New Haven, CT, 2008.

8. Schuman, S., *Seeing the Light: Religious Colleges in Twenty-First-Century America*, Johns Hopkins University Press, Baltimore, MD, 2010.

9. Sheppard, S.D., Macatangay, K., Colby, A., & Sullivan, W.M., *Educating Engineers: Designing for the Future of the Field*, Jossey-Bass, San Francisco, 2008.

10. Chickering, A. W., Dalton, J. C., & Stamm, L., *Encouraging Authenticity and Spirituality in Higher Education*, Jossey-Bass, San Francisco, p. 1-2, 2006.

11. Reiss, M. J., "The Relationship between Evolutionary Biology and Religion," *Evolution*, 63(7), 1934-41, July 2009.

12. Palmer, P. J., "Community, Conflict, and Ways of Knowing: Ways to Deepen our Educational Agenda," *Change*, 26(3), 41-42, May-June 1994.

13. Chickering, A. W., Dalton, J. C., & Stamm, L., *Encouraging Authenticity and Spirituality in Higher Education*, Jossey-Bass, San Francisco, p. 29, 2006.

14. Glazer, S. (Ed.) *The Heart of Learning: Spirituality in Education*, Tarcher, New York, p. 79-80, 1999.

15. Chickering, A. W., Dalton, J. C., & Stamm, L., *Encouraging Authenticity and Spirituality in Higher Education*, Jossey-Bass, San Francisco, p. 27-28, 2006.

16. Teasdale, W., *The Mystic Heart*, New World Library, Novato, CA, p. 17-18, 1999.

17. Niewoehner, R., "Must Engineering Ethics Presume a Secular Foundation?" presented at the ASEE Annual Conference in Pittsburgh, PA, June 22-25, 2008.

18. Maddox, R., "John Wesley's Precedent for Theological Engagement with the Natural Sciences," *Wesleyan Theological Journal*, 44(1), p. 23-54, Spring 2009.

19. Marsden, G., *Fundamentalism and American Culture*, Oxford University Press, New York, p. 95, 191, 2006.

20. Yong, A., *The Spirit of Creation: Modern Science and Divine Action in the Pentecostal-Charismatic Imagination*, Eerdmans, Grand Rapids, MI, p. 2-3, 2011.

21. Chickering, A. W., Dalton, J. C., & Stamm, L., *Encouraging Authenticity and Spirituality in Higher Education*, Jossey-Bass, San Francisco, p. 94, 2006.

22. Glanzer, P., "The Missing Factor in Higher Education: How Christian Universities Are Unique, and How They Can Stay That Way," *Christianity Today*, March 2012.

23. Chickering, A. W., Dalton, J. C., & Stamm, L., *Encouraging Authenticity and Spirituality in Higher Education*, Jossey-Bass, San Francisco, p. 125, 2006.

24. Consolmagno, G., *God's Mechanics: How Scientists and Engineers Make Sense of Religion*, Jossey-Bass, San Francisco, 2007.

25. http://www.calvin.edu/academic/engineering/ces/ceec/

26. Yue, J., "Confucian Influence in American Classrooms," International Conference on Engineering Education, San Juan, Puerto Rico, July 23-28, 2006.

27. Halsmer, D., "Multidisciplinary Cross-cultural University Outreach to Secular Scientists and Engineers (Why Engineers Make Good Apologists)," International Conference on Engineering Education, San Juan, Puerto Rico, July 23-28, 2006.

28. Halsmer, D., "Electronic Portfolio for Assessment of Engineering," presented at the ASEE Annual Conference, Salt Lake City, Utah, June 20-23, 2004.

29. Halsmer, D., Halsmer, N., Johnson, R., and Wanjiku, J., "The Applicability of Engineering Design Principles in Formulating a Coherent Cosmology and Worldview," presented at the ASEE Annual Conference in Pittsburgh, PA, June 22-25, 2008.

30. Halsmer, D., Asper, J.M. and Zigrang, B., "Enhancing Science and Engineering Programs to Equip and Inspire Missionaries to Technical Communities," presented at the Christian Engineering Education Conference, Geneva College, Beaver Falls, PA, June 26, 2008.

31. Halsmer, D., Asper, J.M., Roman, N. and Todd, T, "The Coherence of an Engineered World," *International Journal of Design & Nature and Ecodynamics*, 4(1) p. 47–65, 2009.

32. Halsmer, D., Gewecke, M., Gewecke, R., Roman, N., and Todd, T., "A Reversible Universe: Worldview by Affordance-based Reverse Engineering of Complex Natural Systems," presented at the ASA Annual Meeting, Baylor University, August 1-3, 2009.

33. Halsmer, D., Weed, K., & McDonough, S., "Affordance-based Reverse Engineering of Natural Systems with Possible Corruption," presented at the Christian Engineering Education Conference, Vancouver, BC, June 30-July 1, 2011.

34. Halsmer, D., Weed, K., & Tryon, T., "Introducing the Possibility of Corruption to Facilitate Reverse Engineering of Natural Systems, accepted for presentation at the Annual Meeting of the ASA, Point Loma Nazarene University, July 20-23, 2012.

35. Odom, P., Halsmer, D. & McDonough, S., "Constructal Theory in Relation to Metaphysics and a Christian Worldview," accepted for presentation at the Engineering and Metaphysics Conference, Oral Roberts University, June 15-16, 2012.

36. Fitzgerald, J., & Halsmer, D. "The Problem of Evil and Suffering from an Engineering Perspective," accepted for presentation at the Engineering and Metaphysics Conference, Oral Roberts University, June 15-16, 2012.