Faithful Science

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Religious Education is delighted to cosponsor the symposium, "The Gospel: The Foundation for a Professional Career." Along with our colleagues in the Ira A. Fulton College of Engineering and Technology, we are anxious to do our part to help make the principles taught by our faith find practical application in the lives of our graduates. We support what President George Albert Smith taught concerning Brigham Young University: "Thus the university has a dual function, a dual aim and purpose—secular learning, the lesser value, and spiritual development, the greater. These two values must be always together, neither would be perfect without the other."[1]

We believe there is much need for attention to the topic of this symposium. Throughout history there have been individuals whose

1. George Albert Smith, in *Messages of the First Presidency of The Church of Jesus Christ of Latter-day Saints* (Salt Lake City: Bookcraft, 1975), 6:234.

quest for wealth, power, or fame has led them to set aside principles of virtue, integrity, and compassion. Much of the suffering humankind has endured and much of the harm inflicted on the earth's environment have been perpetrated by such calloused individuals, especially when they have manipulated themselves into positions of power or influence over businesses, industries, armies, religions, or governments. From the biblical Cain to some executives in the modern corporate world, such powermongers pursuing their selfish agendas have left destruction, suffering, and pain in their wake. Historically they have been found in every walk of life: in palaces and fortresses, in businesses and industries, in media and entertainment, in sanctuaries and at pulpits, in classrooms and laboratories.

While individuals with little regard for decency, integrity, and the welfare of others have always been found among humankind, there are some who suggest they are becoming even more prevalent in today's increasingly materialistic society. I do not know if such assessments are correct. I hope not. I am certain there is no shortage of people today who will readily compromise decency and goodness in order to promote or enrich themselves.

Fortunately, today there are also many who are deeply committed to principles of virtue and integrity and who truly care for the welfare of others and our environment. Such individuals would readily sacrifice their personal comfort, wealth, fame, or power to stay true to their values or to help another. As they pursue the betterment of humankind, these remarkable people leave hope, healing, and happiness in their wake. They too can be found in every walk of life—in palaces and fortresses, in businesses and industries, in media and entertainment, in sanctuaries and at pulpits, in classrooms and laboratories. They have lifted and blessed us all. How wonderful it is to know such people! Even better, how wonderful it is to try to be such a person!

I believe that religion can play a significant role in leading one to become a person of integrity and virtue. Typically religions encourage their adherents to be moral, ethical, and kind. For example, the Torah admonishes faithful Jews to be honest and to love their neighbors as themselves (see Exodus 29:16; Leviticus 19:13–18). Likewise the

Christians' New Testament encourages them to develop charity for others (see 1 Corinthians 13:1–13) and to "walk honestly" (Romans 13:13). The Koran assures Muslims that "Allah loves the doers of good" and counsels them not to "cover Truth with falsehood nor conceal the Truth when ye know" (see Koran 2.42, 195).[2] The Hindu faith teaches that all are to practice "truthfulness, restraint, purity, liberality" and "self-control" (see Institutes of Vishnu 2–1.17).[3] Similarly, Buddhists are instructed to "avoid all sorts of untruth," to "make distributions" to others according to their ability, and to practice temperance and fidelity (see Cullavagga, Dhammikasutta 18–29).[4]

Some would argue that while religion may indeed motivate some to live moral lives, it cannot be a source of motivation for the scientist because science and religion are mutually exclusive disciplines. They assert that one simply cannot be a person of both faith and science. A Cambridge professor of physics, the Reverend John Polkinghorne, described the dilemma such a position creates: "There is a popular caricature which sees the scientist as ever open to the correcting power of new discovery and, in consequence, achieving the reward of real knowledge, whilst the religious believer condemns himself to intellectual imprisonment within the limits of an opinion held on a priori grounds, to which he will cling to whatever facts there might be to the contrary. The one [the scientist] is the man of reason; the other [the believer] blocks the road of honest inquiry with a barrier labeled 'incontestable revelation.'" This world-class scientist goes on to reason, "If that were really so, those of us who are both scientists and religious believers . . . would be living

2. *The Holy Quran: English Translation of the Meanings and Commentary* (Al-Madinah Al-Munawarah, Saudi Arabia: The Custodian of the Two Holy Mosques King Fahd Complex for the Printing of the Holy Quran, 1413 H) 19, 82.
3. See Robert E. Van Voorst, *Anthology of World Scriptures* (Belmont, CA: Thomson Wadsworth, 2006), 38. Taken with editing from Julius Jolly, trans., *The Institutes of Vishnu, Sacred Books of the East*, vol. 7 (Oxford: Oxford University Press, 1880).
4. See Van Voorst, *Anthology of World Scripture*, 88–89.

schizophrenically, believing the impossible on Sundays and only opening our minds again on Monday mornings."[5]

Polkinghorne's logic indicates there are indeed scientists who have religious convictions—individuals who practice faithful science. History certainly supports such a claim. We can readily think of faithful scientists like Isaac Newton, who indicated his faith in a supreme being as he surmised that the "most beautiful system of the sun, planets, and comets, could only proceed from the counsel and dominion of an intelligent and powerful Being."[6] Likewise, Gregor Mendel, the father of genetics, who spent his life as a natural scientist and researcher while fulfilling the duties of a monk,[7] maintained faith in a Creator. One can feel the depth of his devotion in his poetry:

> Wherefore was man created?
> Wherefore did, into a pinch of dust,
> An unfathomably exalted Being
> Breathe the breath of life? Assuredly
> The Most High, who so wisely
> Shaped the round world, and who
> For his own sage purposes fashioned the worm out of dust
> Created man also
> For some definite reason. Assuredly
> The capacities of the mind
> Prove that for it a lofty aim
> Is reserved.[8]

I am especially fond of the way Nobel prize–winning physicist Max Born responded to the notion that scientists cannot have faith in

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5. J. C. Polkinghorne, *Reason and Reality: The Relationship Between Science and Theology* (Philadelphia: Trinity Press International, 1991), 49.
6. Isaac Newton, *The Mathematical Principles of Natural Philosophy* (New York: Citadel Press, 1964), 444.
7. Vitezslav Orel, *Gregor Mendel, The First Geneticist* (Oxford: Oxford University Press, 1996), 269.
8. Hugo Iltis, *Life of Mendel*, trans. Eden and Cedar Paul (New York: Hafner Publishing, 1966), 36.

God. He declared, "Those who say that the study of science makes a man an atheist must be rather silly people."[9]

Among Latter-day Saints there are practitioners of faithful science as well. Some, for example, though trained as scientists, have provided inspired ecclesiastical leadership in the Church, like Elder John A. Widtsoe. After being trained as a chemist and agronomist at Brigham Young College and Harvard, where he graduated with high honors, he taught chemistry at Utah State Agricultural College. Later he went to the University of Goettingen to obtain a PhD. Eventually he returned to teach at BYU and then became the president of Utah State Agricultural College, followed by an appointment to serve as the president of the University of Utah, all before being called to be an Apostle in 1921. Speaking of the relationship between science and religion, Elder Widtsoe explained: "Science contributes help in numerous corners of religion. The fields of prayer, eternity of man, the resurrection, life hereafter have been made clearer to the human understanding by the facts of science. Indeed the progress of knowledge by the scientific method has been a handmaid to faith."[10]

Another Apostle, James E. Talmage, was likewise schooled in the sciences. He studied geology and chemistry at Brigham Young Academy, Lehigh University, and Johns Hopkins University. He became a professor of geology and chemistry at BYU before becoming the president of the University of Utah. He was a fellow of the Royal Microscopical Society of London, as well as a fellow of the Royal Society of Edinburgh, the Geological Society of London, and the Geological Society of America. He became a member of the Quorum of the Twelve in 1911. Commenting on the alleged conflict between science and religion, Elder Talmage confessed, "I have been unable *to see* the point of

9. Frederick E. Trinklein, *The God of Science* (Grand Rapids, MI: Eerdmans, 1971), 64.
10. John A. Widtsoe, *Gospel Interpretations* (Salt Lake City: Bookcraft, 1947), 56.

conflict myself:—my belief in a loving God perfectly accords with my reverence for science."[11]

Joseph F. Merrill, a chemical engineer, likewise served in the Quorum of the Twelve. Elder Merrill studied at the University of Michigan, the University of Chicago, Cornell University, and Johns Hopkins University. He taught chemistry and physics at the University of Utah from 1893 to 1895. While serving as an Apostle, he gave a series of Sunday evening radio lectures titled "Is Faith Reasonable?" In that context he declared, "We claim that the difference between the results of scientific experimentation and religious experience is not the difference between knowledge and faith, but between two different kinds of knowledge, each resting on faith, each established on experimentation after its own kind. Science uses the perceptive and the distinctively intellectual faculties in her operations; religion assumes that the heart has reasons as well as the intellect, that conscience is a doorway into reality, that the imagination and the will are also pathways to truth."[12]

Among current members of the Quorum of the Twelve are two other scientists, Elder Russell M. Nelson, trained in the medical sciences, and Elder Richard G. Scott, educated as a nuclear engineer. In 1984, Elder Nelson told a BYU audience, "In the Church, we embrace *all* truth, whether it comes from the scientific laboratory or from the revealed word of the Lord. We accept all *truth* as being part of the gospel."[13] In a devotional address given at BYU, Elder Scott warmly reminisced on some of his pioneering experiences as a nuclear engineer and then observed, "I find a combination of the scientific method and that

11. James Harris, *The Essential James E. Talmage* (Salt Lake City: Signature, 1997), 5.
12. Joseph F. Merrill, *Is Faith Reasonable; a series of radio addresses delivered Sunday evenings, April 5th to September 27th inclusive, 1931* (Salt Lake City: The Church of Jesus Christ of Latter-day Saints, 1931?), 2.
13. Russell M. Nelson, "Begin with the End in Mind," in *Brigham Young University 1984–85 Devotional and Fireside Speeches* (Provo, UT: University Publications, 1985), 17.

of seeking pure truth by prayer to be a tremendously effective way of solidifying a foundation of knowledge in our lives."[14]

Just as some trained as scientists have provided leadership to our faith at the highest levels, others, while maintaining faith in the restored gospel, have made tremendous contributions to their scientific fields. One of our favorite examples is Dr. Henry Eyring. After receiving degrees in mining, engineering, and metallurgy from the University of Arizona, Brother Eyring received a PhD in chemistry from the University of California at Berkeley. He taught at Princeton for fifteen years and then moved on to become the dean of the graduate school at the University of Utah. By the time he finished his career, he held fifteen honorary degrees, both national and international, and eighteen prizes, including the National Medal of Science, the Priestly Medal, the Berzelius Medal in Gold awarded by the Swedish Academy, and Israel's Wolf Prize. He published more than six hundred papers and ten scientific books. He was president of the American Chemical Society and American Association for the Advancement of Science. Perhaps his most notable contribution to his discipline is the Absolute Rate Theory of Chemical Reactions. He spoke often about the relationship between his faith and science. "I am now going to venture to say that science has rendered a service to religion," Dr. Eyring declared. "The scientific spirit," he said, "is a spirit of inquiry, a spirit of reaching out for truth. In the final analysis, this spirit is the essence of religion. The Savior said, 'Ask, and it shall be given you; seek, and ye shall find; knock, and it shall be opened unto you.' (Matthew 7:7.) The scientist has, in effect, reaffirmed this great fundamental laid down by the Master, and in doing so has given a new impetus to religion."[15]

Another faithful Latter-day Saint who excelled as a scientist was Dr. Harvey Fletcher. He first graduated from BYU and then obtained a PhD in physics from the University of Chicago, where he graduated summa cum laude. He returned to BYU and was appointed chair of the

14. Richard G. Scott, "Truth," in *1978 Devotional Speeches of the Year* (Provo, UT: Brigham Young University Press, 1979), 101.
15. Henry Eyring, *Reflections of a Scientist* (Salt Lake City: Deseret Book, 1983), 39.

Physics Department. Five years later he was advised by Joseph F. Smith to accept an offer at Western Electric Company in New York. Later he was appointed director of physical research at Bell Telephone. He then taught for three years at Columbia University before again returning to BYU to direct research and help to set up a new Department of Engineering and the College of Physical and Engineering Sciences. Dr. Fletcher is perhaps best known for pioneering the development of stereophonic sound reproduction. By the time he finished his career, he had published more than fifty papers and two books, as well as obtained nineteen patents. He received honorary degrees from Columbia University, Stevens Institute, Kenyon College, Case Institute of Technology, and the University of Utah. He was the first president of the American Acoustical Society and an honorary member of the American Otological Society, the Audio Engineering Society, and the American Speech and Hearing Society. He received many awards and citations during his life, including one from President Harry S. Truman. He is especially remembered as the first Utahan and Latter-day Saint to become a member of the National Academy of Sciences. Brother Fletcher also found that one can be a faithful scientist. He explained, "I have a fair reputation as a scientist and I have a firm faith in God. I did not obtain this faith through scientific reasoning, but through spiritual experiences which are difficult to explain to other persons, but are nevertheless very real."[16]

The legacy of these faithful scientists is being carried on well at BYU today. It is an exciting and wonderful experience to learn of the remarkable contributions being made to various scientific disciplines by faithful members of our faculty in every college and department. Many speak of the roles that faith, prayer, and inspiration have played in their research. I would like to share a few examples.

Dr. Scott D. Sommerfeldt currently serves as the department chair of physics and astronomy. Like Harvey Fletcher, his primary research is in acoustics. He is a pioneer in "active noise control," a science that

16. Harvey Fletcher, "Science and Religion," in *Science and Your Faith in God* (Salt Lake City: Bookcraft, 1958), 49.

studies how to cancel noise with noise. Dr. Sommerfeldt describes an experience and principle that many faithful scientists can recognize:

> I feel that religion is not just a Sunday thing and is not just for answering questions about the gospel. When I was in school as a graduate student, I would regularly pray about various problems I was facing and ask for insights. I believe there is a role that faith can play in seeking direction to solve a problem. Obviously we have to do our part and do some work. But there have been times as I lay in bed at night pondering a problem and praying about it that I have had to hurry and jump out of bed and turn on the light because I just had an idea of how I could solve the problem, and I want to jot something down before I forget about it.

Dr. Kyle Rollins, a professor of civil and environmental engineering, has had similar experiences. Dr. Rollins's specialty is geotechnical earthquake engineering. His work saves lives as he studies how to predict and respond to earthquakes and how to prevent damage. In discussing the role of faith in his work, he explains:

> A lot of people would not necessarily be praying about engineering answers, but that is how I perform. I try to do everything I can think to do to understand a problem, and then I ask for assistance through prayer. There have been a number of cases where I feel that the Spirit has guided me in solving engineering problems. It typically happens early in the morning when I am very relaxed and my mind is not engaged with everything else. That is when I often get an answer or a solution. My experience has been that once you have done all that you can do, you are in a position to get guidance and inspiration from the Spirit to help you with gaining knowledge in any field. I have had a number of those occasions. They are pretty sacred things to me.

Dr. Larry L. Howell would agree. He currently serves as the chair of the Mechanical Engineering Department at BYU. Dr. Howell has distinguished himself as a researcher in compliant mechanisms, microelectromechanical systems, nonlinear mechanics, and machine design. He currently has twenty patents issued or pending. In discussing how

inspiration has assisted his work, he spoke of an experience he had in graduate school:

> I was working on a problem with really difficult mathematics. It was something that was not typically taught in courses, so I had to learn it on my own. I was trying to solve this particular problem and wasn't able to solve it. I got frustrated after working on it for weeks, so I decided I should do something more productive. I began to work on another part of my research, but after a while I had a feeling I had to go back to that problem. I tried it again and worked for a long time, but after still failing I gave up again and decided once more to go do something more productive. Still the same feeling kept coming until finally I returned to the problem and solved it. The consequences of solving that problem have led to many things in my career. It opened up new knowledge that hadn't been there before. It led to a best paper award and many other theories. Those theories have ended up doing well not only in journals and a book but also in implementing and creating real devices that couldn't be done before. I look back on that experience, and I see two things. I see that the Spirit prompted me to go back to that problem even though it seemed frustrating, and I see that the Spirit helped me solve the problem after I had done all that I could do.

Dr. William S. Barrett likewise feels that inspiration is critical to his research. Dr. Barrett is a computer scientist specializing in computer vision, pattern recognition, and image processing. He has made tremendous contributions to the field of medical imaging that are finding wide application throughout the discipline. If you have ever used Adobe Photoshop, you likely have used technology, algorithms, and tools developed by Dr. Barrett. In speaking of inspiration, he explains:

> I try to listen carefully to the promptings, but it is like anything else. Ninety-nine percent of it is perspiration, but the one percent inspiration is very critical. I would say without qualification that the really great breakthroughs and innovations come from the Spirit. The rest of the stuff we just labor over and try to make work. I was fortunate enough to have a great ad-

> viser, Homer Warner, when I was a PhD student. Someone said about him, "He has really dumb ideas, but he makes them work." I hope that someone says that about me sometime. There is a tenacity that accompanies science that you just have to have. As much as we rely on the Spirit or really stop to listen, it gives us knowledge about all things. By the Holy Ghost we may know the truth of all things. That does mean all things. I can tell you the Spirit knows all about differential equations, any mathematics you care to bring up, any algorithms or information processes. If we are persistent in that and look for it, it will give us the right insights at the right time.

Many of the faithful scientists at BYU find their faith confirmed by their research. Dr. Shauna C. Anderson, who specializes in clinical chemistry and hematology, is an example. She is a gifted teacher who currently serves as the program director of clinical laboratory science and the biology office at BYU. Dr. Anderson consistently stresses the importance of integrity to her students, noting that dishonesty in the laboratory could cost a patient's life. One can feel the appreciation she has acquired for her faith in God through her research. She explains, "You just look at the marvels of the human body and you start to get a look into the intricate systems of coagulation or hematology, and you can just feel the power of the Creator that designed it. There is no other explanation; it is just miraculous how all things fit together."

My good friend, Dr. Wilford M. (Bill) Hess, is another fine example of this principle. Dr. Hess is a professor of botany who specializes in electron microscopy. His recent work with entophytic microbes has and will bless millions as he and his associates work to identify natural plant products that fight diseases in both humans and animals. Dr. Hess especially enjoys discussing how his science supports and informs his understanding of the Book of Mormon record. He explains, "When you think about dissemination of domesticated plants then you start thinking about people moving around taking those domesticated plants and animals with them. Then you start thinking about the movement of people, and that brings you to thoughts about the Book of Mormon people and people like the Jaredites and what they moved around with them and what they took with them. It all fits together. It is so much

fun to look at these issues from a scriptural point of view and also from a biological point of view because it all fits together so well."

Dr. Daniel L. Simmons finds that his faith helps him keep a proper perspective in his work. Dr. Simmons is a chemist specializing in oncology and currently serves as the director of the Cancer Research Center at Brigham Young University. He is well known for identifying genes and proteins involved in cancer and other physiological processes. He is perhaps best known for his discovery of the cyclooxygenase (COX-2) enzyme that has led to medicines that provide comfort to so many arthritis sufferers. Dr. Simmons explains:

> I think that the teachings of the gospel are what have helped me keep perspective about life. To do good science, hard science, is very tough. It's very competitive and very demanding. It's easy to lose that perspective. I think it [the gospel] has had its major influence in helping me to keep things in perspective. . . . To the extent that I think I am obedient, it, in the long run, keeps me happy and keeps me sane. Also it is important to the quality of science because science, ultimately, is dependent upon honesty. You're trying to find truth. The hardest thing in the world about science is that you are frequently wrong. It's the only discipline where you can be right fifteen percent of the time and be a fabulous success. But the important thing is that as Henry Eyring once said, "Most of your theories die before the day is over." You are constantly disproving yourself. The hardest thing sometimes is to face up to the fact that you are wrong, that this idea or hypothesis you had that seemed so perfect is not the answer. That is especially hard after you have invested a lot of time and effort. Religion, in its purest sense, allows one to say "No, I am interested in truth, and it doesn't matter if I am already heavily invested in this; it's got to go." That's hard. My approach to science has been that when one does science, one is actually investigating God's handiwork.

Dr. Larry L. St. Clair likewise feels that his commitment to the gospel demands that he be absolutely honest in his science. Dr. St. Clair is a botanist who currently serves as the director of the Monte L. Bean Life Science Museum. He specializes in the study of lichens. He has dis-

tinguished himself over the past twenty-five years as he has worked to develop a comprehensive air quality monitoring program using lichens. One can feel the depth of his commitment to the values and principles of his faith as he explains: "So much of what my standards are in terms of ethics is dictated by what I believe as a member of the Church. It says so emphatically in the thirteenth article of faith that we seek to have the best qualities and virtues in our lives. I feel like being honest and responsible, disciplined and meeting commitments is an important part of everything I do, whether it is in the way I deal with my family or a funding agency that wants me to work for them. I want to always make sure that I do what I have agreed to do, and I do it in a timely way."

The marvelous examples of these faithful engineers, chemists, botanists, and other scientists are of the very principles this conference seeks to promote! They confirm that one truly can be a world-class scientist and a person of faith. Both religion and science have the capacity to cure much of what ails the world today. What a wonderful thing it is when one can be a skilled and dedicated practitioner of both disciplines! In a very troubled world, such faithful scientists do indeed leave much needed progress, hope, healing, comfort, happiness, trust, and love in their wake as they pursue the betterment of humankind. How wonderful it is to know such people! Even better, how wonderful it is to try to be such a person!