Great Temples of Learning on Temple Hill

ERIC "RICK" N. JELLEN

I feel humbled to be honored with this award and to address the university community on this occasion. BYU has exceeded my wildest dreams and expectations as the setting for my career. I owe everything that I am and that I have accomplished to the divine hand I have felt throughout my journey; to my loving and supportive family; to inspired and dedicated BYU faculty colleagues, staff, and administrators; to a myriad of talented BYU and external research collaborators, many of whom have become good friends; and, of course, to the remarkable students of this institution that is "unique . . . in all of the world."[1]

On the road here to campus for the first time in August of 1980, I felt that I received two spiritual confirmations that I was on the right path: the first was when we drove into St. George and I saw the white temple silhouetted against the backdrop of the red cliffs; the second was at my first glimpse of the massive white Y on the mountainside in Provo. Each day I have a comforting reminder of that confirmation with my view of the Y through my office window.

I love our brand-new neighborhood temple in Orem. Jesus proclaimed Himself to be "the way, the truth, and the life,"[2] whose life was "the light of men," a light that "shineth in darkness; and the darkness comprehended it not."[3] The light emanating from the art glass windows and illuminating the exterior of the Orem temple are metaphors of His divine light. As spiritual darkness descends, the virtuous Savior and His light grow ever more visible as a beacon to the world. His gospel is *the* way back to our heavenly home. His truth brings me understanding, purpose, hope, and joy in that journey. He not only gives me hope for eternal life, but He is also "the light of the sun"[4] that perpetuates all earthly life—even the life of those beautiful flowers on the temple grounds.

Eric "Rick" N. Jellen, BYU professor of plant and wildlife sciences and recipient of the Karl G. Maeser Distinguished Faculty Lecturer Award, delivered this forum address on May 21, 2024.

Great Temples of Learning

I invite you to consider another temple—maybe it looks more like a ziggurat—where I work each day: the Life Sciences Building here on the south side of the BYU campus. Nearly 150 years ago, one of BYU's early presidents, Karl G. Maeser, had a remarkable vision that convinced him of this institution's divine mission. He stated, "I have seen Temple Hill filled with buildings—great temples of learning, and I have decided to remain and do my part."[5]

Just as with the Orem Utah Temple, there is a light that emanates from the BYU campus atop what was known to Brother Maeser as Temple Hill. We are metaphorically "a city . . . set on an hill [that] cannot be hid": our light is not "put . . . under a bushel, but on a candlestick; and it giveth light unto all that are in the house" so that all "may see [our] good works, and glorify [our] Father which is in heaven."[6] Thus God is glorified when the world sees the good works of His followers.

God's Glorification

Doctrine and Covenants 88:119 defines a temple as "a house of prayer, . . . fasting, . . . faith, . . . learning, . . . glory, . . . [and] order"—"a house of God." Joseph Smith reiterated this definition in his divinely inspired Kirtland Temple dedicatory prayer.[7] Temples are houses of glory because they offer the covenants and ordinances that fulfill the Father's work and glory, which is "to bring to pass the immortality and eternal life of man."[8] However, Doctrine and Covenants 93:36 indicates that God is also glorified by "intelligence, or, in other words, light and truth."

We should therefore view BYU campus learning spaces as sacred precincts where the BYU community engages in the discovery and transmission of light and knowledge. In other words, the good works that we do within these sacred buildings is of divine nature, to God's glorification, and is, or is meant to be, consecrated. All of us on this campus are teachers—faculty, staff, administrators, and even students—who approach our subjects "bathed in the light . . . of the restored gospel" of Jesus Christ.[9]

Sacred and Secular Truths

Truth is defined scripturally as "knowledge of things as they are, and as they were, and as they are to come."[10] In 1912, U.S. president Theodore Roosevelt observed:

Surely we must all recognize the search for truth as an imperative duty; and we ought all of us likewise to recognize that this search for truth should be carried on, not only fearlessly, but also with reverence, with humility of spirit, and with full recognition of our own limitations both of the mind and the soul. . . . To those who deny the ethical obligation implied in such a faith, we who acknowledge the obligation are aliens; and we are brothers [and sisters] *to all those who do acknowledge it, whatever their creed or system of philosophy.*[11]

Truth comes to God's children in many different ways, but all truth comes from one source. We were recently reminded of this in the October 2022 general conference when President Russell M. Nelson taught:

God is the source of all truth. The Church of Jesus Christ of Latter-day Saints embraces ***all*** *truth that God conveys to His children, whether learned in a scientific laboratory or received by direct revelation from Him.*[12]

As a scientist, I believe that when we engage in what science calls *basic* research, we are working with God to uncover fundamental truths about how the natural world operates. Some of us who do *applied* research—mostly biomedical and agricultural scientists as well as engineers—seek to mobilize basic knowledge in the service of humanity to better the world. Social scientists and philosophers may use some of the same methodologies and often rely on deductive reasoning to understand truths. My friends in the humanities may discern truths within the context of human emotions, while those in the creative arts portray truths in ways that enhance the beauty in the world and thus contribute to God's glorification.

To emphasize this, in a 2018 general conference talk Elder Gerrit W. Gong quoted another member of the Twelve, Elder Richard G. Scott, who said: "Creativity can engender a spirit of gratitude for life and for what the Lord has woven into your being."[13] Elder Gong also quoted President Henry B. Eyring, who said our Creator "expects His children to become like Him—to create and to build."[14]

Within the spiritual realm, all of us are commanded to seek understanding of saving truths through prayer and fasting. All these efforts to uncover truth require diligent study and faith, for "faith is not to have a perfect knowledge of things; therefore if ye have faith ye hope for things which are not seen, which are true."[15]

Endowments of Light

We serve in the house of the Lord to receive a special endowment of spiritual knowledge, including sacred truths about God's plan for us and the eternal roles the Savior plays in that holy plan. This light is accompanied by power to enable us to accomplish the spiritual tasks God would have us perform in preparation for eternal life with Him.

I believe that, similarly, in the dedicated academic temples on Temple Hill, we receive endowments of light and power that enable us to magnify our talents and personal missions in this temporal life—should we so elect to use them for God's consecrated purposes. If we recognize and retain in remembrance the sacred nature of this university, I believe it will impact the way we view our work here at BYU. For the student body, maybe the great question should be, What talents or life missions will the curriculum of *this course* help me fulfill—and how? For the faculty, the great question might be, How can I tailor and teach this subject in a way that enhances its ability to inspire my students to live consecrated lives? For the staff, maybe that question is, How can I perform my work in a manner that exemplifies and evidences my commitment to a consecrated life? The task of BYU administrators is to cultivate this precious tree with great intention in a manner that not only responds to but proactively *anticipates* opportunities for students to positively impact mankind through consecrated service.

Personal Consecration

For my first decade or so on the BYU faculty, I had an assignment to teach Book of Mormon classes. Gradually, during that time, the passage in 2 Nephi 32:9 became magnified in my mind and heart:

I say unto you that ye must pray always, and not faint; that ye must not perform any thing unto the Lord save in the first place ye shall pray unto the Father in the name of Christ, that he will consecrate thy performance unto thee, that thy performance may be for the welfare of thy soul.

I would add "and for the building up of Thy kingdom, the blessing of my students, and in some small way for the blessing of Thy children in other parts of the world."

At some point I adopted this plea into my morning prayers; from then on, a fundamental transformation began to occur in my work as a BYU faculty member. For one thing, I started becoming more aware of ways I could share my testimony with students in my classes and lab. I also saw doors for international research collaborations begin to open and had a flood of ideas about how I could direct my research in ways that would have more impact. As I stepped through those doors, I was led to some amazing like-minded people, while others started seeking me out. I would like to elaborate a little on how this process unfolded.

My Research Work

As a professor and research scientist, I have dedicated my professional life to uncovering truths about plant evolution, genome structure, and selective breeding of allopolyploid crops, which include quinoa and oats, through experimentation and careful observation and then sharing those truths with upcoming generations of scientists. An allopolyploid is a plant originating from the cross-pollination of two or more different diploid ancestor species. This process is rare in animals but common in the evolution of plants. One reason it is thought to be common is that the new allopolyploid is typically more vigorous and more resilient to environmental changes than its two diploid ancestors. My colleagues and I work to figure out allopolyploids' ancestries and genetic behaviors—the basic research part—and then employ applied genetic approaches to devise improvement strategies.

My work has been focused mostly on two neglected, or orphan, crops: quinoa and oats. As a graduate student at the University of Minnesota in the early 1990s, I conducted microscopy- and DNA marker-based research that led us to suspect that the allopolyploid oat genome is very dynamic and that its genome has reshuffled through its history of multiple genome "marriages," its dispersal and adaptation to new and varied environments, and its multiple domestication events. One of our discoveries was that several chromosomes in the oat nucleus had exchanged pieces, which in genetics terminology we call a translocation or interchange. These interchanges are important because when two individuals form a hybrid through cross-pollination, if they differ for one or more of these interchanges, the hybrid will be partly sterile.

One interchange was most interesting, and it involved chromosomes that I knew at the time as 17A and 7C. While most wild oats had the switched 17A and 7C chromosome pieces, approximately 30 percent—from Northwest Africa and northern Iraq—had the ancestral or non-interchanged form. When we looked at the three known types of cultivated or domesticated oats, essentially all strains of white European and Chinese hull-less oats had the 17A-7C interchange, while the non-interchanged form was predominant in red Mediterranean oats. Red oats are uniquely adapted to production under the Mediterranean winter rainfall regime but have little resistance to subfreezing temperatures and typically do not mature until after the rains stop in the spring. I knew from research reports on other organisms that, due to the hybrid sterility barrier, translocations and other chromosome rearrangements rarely become fixed in natural populations unless they confer a selective advantage; I therefore wondered if this interchange might be associated with genetic control of traits that permitted oats to grow in summertime and at higher latitudes.

For the better part of a decade, these results, which were very exciting to me, attracted little attention and very few citations. Then out of the blue, a team of oat geneticists at North Carolina State University contacted me. They were seeing abnormal breeding behavior in Mediterranean by-spring oat cross-populations, where they were selecting for tolerance to subfreezing temperatures. After screening the two parents and showing that they differed for the 17A-7C interchange, I then did microscopy work on these lines and found that almost all of the lines carrying the interchange were cold tolerant. It turns out that oat breeders have been crossing parents with different chromosome rearrangements for the past 100 years, and this has been a major reason why improvements in oat yields have been relatively modest in comparison with other crops such as corn, rice, wheat, and barley.

BYU is now part of the international Oat Pangenome project, which has confirmed the precise breakpoints of these chromosome rearrangements through whole-genome sequencing of more than thirty oat varieties—no small feat, considering the common oat genome is approximately four times larger than the human genome!

In my third year on the BYU faculty, I had the singular opportunity to do sabbatical research at the Hebrew University of Jerusalem in Israel under the tutelage of the great plant geneticist Gideon Ladizinsky, who, along with other research, had made innovative crosses to transfer domestication genes from common 42-chromosome oats into a high-protein but wild 28-chromosome oat species from northern Morocco. Several years later, I became friends with a bright and energetic new USDA research hire named Eric Jackson, and together we began work to turn this neodomesticated high-protein oat into a crop suitable for protein-starved regions of Africa.

I was familiar with quinoa, the other crop I work on, as a food I had eaten once on my mission in Peru. Although it was first domesticated in the Peruvian-Bolivian Andes, quinoa suffered from a legacy of stigmatization by the European colonists in Latin America. I started working on quinoa in the year 2000, my fifth year on the BYU faculty, due to the convergence of six phenomena in rapid succession:

The first was a hallway encounter with the new dean, who challenged me to elevate my research focus from oats to other crops that might hold greater potential for food security in poor areas of the world.

The second was a visit to my office by a precocious undergraduate student named Brian Gardunia who was looking for a research advisor after having secured a promise of graduate funding by the Ezra Taft Benson Agriculture and Food Institute—if he would work on quinoa genetics.

The third event was a meeting involving me and three other BYU plant genetics faculty in which we decided to lobby the aforementioned dean to move all of us into the same department in order to better share equipment and coordinate our complementary research skill sets while focusing on a single research organism: quinoa.

The fourth event was a call from the McKnight Foundation Collaborative Crop Research Program for competitive grant proposals that would team U.S. researchers with scientists in the developing world to focus on improving a crop of local importance.

The fifth piece of the puzzle was a Bolivian BYU doctoral student named Alejandro Bonifacio, who happened to be running Bolivia's national quinoa breeding program while working on his dissertation.

The last was an invitation from Dr. Ouafae Benlhabib—a Moroccan plant geneticist and last month's recipient of the BYU College of Life Sciences' Distinguished Service Award—for me to travel to that country to work with her in initiating a quinoa introduction and adaptive-breeding project.

There was a seventh "coincidence" about three years later: some unidentified celebrities started putting out on the internet that quinoa is a superfood, which caused an overnight explosion in its popularity. Also, the BYU quinoa genetics team effort was blessed by the early addition of Professor Jeff Maughan to the faculty and, just within the last decade, Professor David Jarvis, one of our early students on the project.

There were three major obstacles to quinoa research in 2000. First, there was hardly any information in the scientific literature on the species, especially in botanical taxonomy. Second, there was only a meager amount of genetic material—we call it germplasm—available in publicly available gene banks. And third, even worse, there were a series of very restrictive international seed-exchange laws enacted beginning in the early 1990s, and the Andean countries were not very willing to share their materials with U.S. scientists.

From the limited amount of taxonomic information that was available, I noted that there appeared to be a larger number of unique species within North America, especially the United States, than in other parts of the Western Hemisphere, so by 2004 we decided to assemble our own seed collections for researching quinoa's ancestry and biogeographical diversity. Thanks to a growing array of strong international collaborations as well as tens of thousands of road miles on seed-collection trips, my colleagues, my students, and I have been blessed to uncover many fascinating aspects regarding the quinoa genome and its ancestry. We have identified one of quinoa's most likely wild diploid ancestors, sandhill goosefoot from western North America, which is therefore the most likely region of the Americas where the wild allopolyploid first appeared. We discovered that quinoa's wild North American allopolyploid ancestor was independently domesticated in ancient Mexico as well as in the Andes, that it is exceptionally diverse, and that it can be bred with quinoa to improve the crop's adaptation for production in lowland tropical regions of countries such as Malawi and Guyana. We have also learned that the quinoa genome, like the oat genome, has a highly dynamic chromosome structure with interchanges, inversions, and repetitive element expansions.

This wild sister species that can be bred with quinoa is commonly known as pitseed goosefoot, and we have identified at least eight wild races or ecotypes within the Americas. A pitseed goosefoot population grows in a disturbed site along University Parkway in Provo next to wild sunflowers, and it is interesting that both of these plants occupy the same sandy, disturbed habitats and were codomesticated by the indigenous peoples of North America.

Resolving Conflicts

As I stated previously, throughout the history of the Church of Jesus Christ, its leaders have repeatedly stated that the gospel embraces *all* truth. Sometimes there may appear to be conflicts between spiritual and secular truths; when these arise, we can have faith that we are missing critical information. Even more critical in these situations is to have humility. The gospel Restoration is a work in progress. As disciple-scholars of science, we can look back and see the Lord's Spirit inspiring people's minds hundreds of years before the First Vision in 1820: The invention of the printing press, the invention of ground and polished glass lenses for microscopes and telescopes in the late sixteenth and early seventeenth centuries, the founding of Virginia Colony in 1607, the publication of the King James Bible in 1611, and the publication of Francis Bacon's scientific method in 1620 were all key events that helped lay the foundation for the coincident spiritual restoration and scientific revolution.

If we look carefully and honestly at the history of the Church since the First Vision, we can see that the Lord continues to pour out light and knowledge not only in the fields of science but also in the doctrines and governance of His kingdom. Truths from one discipline will never contradict truths from another, be they spiritual or secular, if "truth is [the] knowledge of things as they are, and as they were, and as they are to come."[16]

Treasure Up All Truth

In closing, I remind us of the words I shared earlier from President Nelson:

*God is the source of all truth. The Church of Jesus Christ of Latter-day Saints embraces **all** truth that God conveys to His children, whether learned in a scientific laboratory or received by direct revelation from Him.*

The days of the lone scientist toiling in a lab are long gone. Nowadays, most of our research is done in large, collaborative groups that extend well beyond continental and hemispheric boundaries. As I have consciously sought to consecrate my efforts for God's kingdom and for blessing His children, I have encountered and been sought out by a host of people, now friends, who share not only research interests but also values—friends including Evangelicals, Catholics, Seventh-day Adventists, Muslims, Ethiopian Orthodox, Jews, Agnostics, and even a few members of The Church of Jesus Christ of Latter-day Saints. This experience has minimized the temptation to seek individual fame and glory and instead has provided greater opportunities for me to share my faith in Jesus Christ in professionally appropriate ways and has increased my desire to glorify God and serve humanity.

Hopefully this is a small example of the metaphoric light that President Karl G. Maeser envisioned emanating from Temple Hill. This should remind us that here at BYU, where we strive to build an academic community of Zion, if we are not "of one heart and one mind, and [dwell] in righteousness; and [have] no poor among [us],"[17] not only can we not expect to be God's,[18] but success will be more difficult to achieve.

I can testify by my own experience that our diligent pursuit of knowledge "by study and also by faith"[19] will enrich our lives, enhance our happiness, glorify God, and magnify our talents and abilities to provide consecrated service to the blessing of His children and the edification of His kingdom. As we do so, let us always humbly acknowledge what we do not yet know and turn away from the temptation to seek individual glory.

I testify that there is a God who can help direct our lives, that Jesus is our Savior and the embodiment of virtue and holiness, and that we have been given our lives at this time and place for a reason and not by accident or chance. I leave that with you in the name of Jesus Christ, amen.

Notes

1. Spencer W. Kimball, "The Second Century of Brigham Young University," BYU devotional address, 10 October 1975.

2. John 14:6.

3. John 1:4–5.

4. Doctrine and Covenants 88:7.

5. Karl G. Maeser, in letter to L. John Nuttall (secretary to the First Presidency), 4 May 1887,

L. John Nuttall Papers; quoted in Ernest L. Wilkinson and W. Cleon Skousen, *Brigham Young University: A School of Destiny* (Provo: Brigham Young University Press, 1976), 85.

6. Matthew 5:14–16.

7. See Doctrine and Covenants 109:8.

8. Moses 1:39.

9. Spencer W. Kimball, "Education for Eternity," address to BYU faculty and staff, 12 September 1967.

10. Doctrine and Covenants 93:24.

11. Theodore Roosevelt, "The Search for Truth in a Reverent Spirit," *Outlook* 99, no. 14 (2 December 1911): 826; see Edmund Morris, *Colonel Roosevelt* (New York: Random House, 2010), 157.

12. Russell M. Nelson, "What Is True?" *Liahona,* November 2022; emphasis in original.

13. Richard G. Scott, *Finding Peace, Happiness, and Joy* (Salt Lake City: Deseret Book, 2007), 162–63; quoted in Gerrit W. Gong, "Our Campfire of Faith," *Ensign,* November 2018.

14. Henry B. Eyring, art exhibit entrance welcome, *A Visual Journal: Artwork of Henry B. Eyring*, BYU–Idaho, 2017; quoted in Gong, "Our Campfire."

15. Alma 32:21.

16. Doctrine and Covenants 93:24.

17. Moses 7:18.

18. See Doctrine and Covenants 38:27.

19. Doctrine and Covenants 88:118.