Edward L. Kimball

Harvey Fletcher and Henry Eyring: Men of Faith and Science

The year 1981 saw the deaths of Harvey Fletcher and Henry Eyring, men of great religious faith whose superb professional achievements placed them in the first ranks of the nation's scientists. (See Steven H. Heath's "The Reconciliation of Faith and Science: Henry Eyring's Achievement," this issue.) Both could be said to have had simple religious faith — not because they were uncomplicated people incapable of subtlety, but because their religious character was early and firmly grounded in a few fundamentals. This freed them from a life of continuing doubt and struggle.

The two men, seventeen years apart in age, had a kind of family relationship. Henry Eyring's uncle Carl Eyring (after whom BYU's Eyring Science Center is named) married Fern Chipman; Harvey Fletcher married her sister Lorena. After their spouses died, Harvey Fletcher and Fern Chipman Eyring married. As a result, Henry Eyring called him Uncle Harvey. But that was not unique. Nearly everyone else did, too.

Harvey Fletcher was born in 1884 in a little frame house in Provo, Utah. Among his memories are attending the dedication of the Salt Lake Temple and shaking President Wilford Woodruff's hand. As a young boy, he recited a short poem at a program in the Provo Tabernacle; and after he finished, Karl G. Maeser, principal of the Brigham Young Academy, stopped him before he could resume his seat, put his hand on Harvey's head, and said, "I want this congregation to know that this little boy will one day be a great man." Instead of being pleased, Harvey was bothered; he perceived it as a prediction of political leadership, which he did not want.

Later, when he was president of the deacon's quorum, his bishop called on him to speak extemporaneously to the other deacons. Unable to think of anything to say, he stood first on one leg, then the other, and rubbed his head. Finally he blurted out, "I'd rather be good than great," and sat down. He often said that this was his best sermon.

When he graduated from eighth grade and took a job as delivery boy for a grocery store, he considered his education ended, but friends who went to high

EDWARD L. KIMBALL is Wilkinson Professor of Law at Brigham Young University, a nephew of Henry Eyring and a neighbor of Harvey Fletcher. He is coauthor (with Andrew Kimball) of biographies of Spencer W. Kimball and Camilla Eyring Kimball, and compiler of The Teachings of Spencer W. Kimball *(Bookcraft, 1982). Harden Eyring's biographical study of his father, Henry Eyring, including his philosophy and a compilation of anecdotes about him, will be published by Deseret Book in February 1983.*

school at BYA influenced him to follow. He failed physics because he did not complete his laboratory journal, but the next year he earned an A+ and was hired as a laboratory assistant.

He received a college degree from BYU in 1907, one of six graduates that year, taught at BYU in 1907–1908, married Lorena Chipman, took leave of absence the same year, and went to the University of Chicago to obtain a Ph.D. He borrowed money for his first year of graduate work, then earned additional funds by teaching high school science and running the projector for lecture classes.

At the beginning of his second year Harvey Fletcher started work with Robert A. Millikan, then a young assistant professor. Fletcher tells what happened in this excerpt from his unpublished autobiography:

> I went to Professor Millikan to see if he could suggest a problem upon which I could work for a doctor's thesis in physics. He was a busy man and I had a hard time making an appointment with him. Finally, he told me to come down to one of the research laboratories where he and Professor Beggeman were working and he would talk to me. First he and Professor Beggeman showed me the research work that they were doing on the electronic charge, and reviewed the work that J. J. Thompson and Regener had been doing along this line in Cambridge, England.
>
> They had arranged a little box having a content of 2 or 3 cubic centimeters which was fastened to the end of a microscope. A tube was attached from an expansion chamber to the little box. By opening suddenly a petcock, a sudden expansion of the air in the little box was made which caused a cloud of water vapor to form. When viewed through a microscope this cloud was seen to be composed of a large number of tiny water drops. The droplets would soon drop from the top to the bottom of the box under the influence of gravity. A conducting plate was arranged at the top and another one at the bottom of the box so that an electric field could be produced.
>
> When this electric field was turned on it would retard the fall of some droplets. They were trying to make the field just right so that the droplet would be suspended in the air between the plates. From the speed of the droplet, that is the fall speed, and the intensity of the field to stop the droplet, one could calculate the electrical charge on the droplet. This was essentially repeating the experiment that Regener did in England. However, the water forming the droplet evaporated so fast that the little droplet would only stay in view for about 2 seconds. So it was difficult to get more than a rough estimate of the charge.
>
> We discussed ways and means of getting around the difficulty, and I think we all agreed that we should have a droplet that did not evaporate if we could get it small enough and could control it. Mercury, oil, and two or three other substances were suggested. In a discussion of that kind, it is rather difficult to be sure who suggested what. I left with the impression that I had suggested oil for it was easy to get and to handle. However, in Professor Millikan's memoirs he said he had been thinking of this before this conference. Of course, I cannot say yes or no to that but I do know what happened after this conference.
>
> Professor Millikan said to me, "There is your thesis; go try one of these substances which will not evaporate." So out I went to do this and get started on my thesis. To build an apparatus like they were using would take considerable time. So I decided to make a crude setup in the laboratory and try it before designing an elaborate one. So I went out to the drug store that afternoon and bought an atomizer and some watch oil. Then I came back to the laboratory and set up the following apparatus:
>
> First an arc light with two condensing lenses in front of it was set up. The combination made a bright beam of light. The experience which I had with projection lanterns for lectures made it possible to get this together very quickly. I then

used the atomizer and squirted some oil spray so that it fell through the beam of light. The light made these tiny drops of oil look like tiny stars. This indicated this part of the experiment would probably work. I then went down to the student shop and found some brass sheets about one-eighth of an inch thick. From them I cut two circular plates about 20 centimeters in diameter. Then I fastened (soldered) a stem onto each one so that they could be held by an ordinary laboratory stand with clamps. A small hole was then bored in the center of the top plate. These plates were then set up horizontally, being about 2 centimeters apart. In this first set-up the air between the plates was not enclosed. So I moved the stands holding the two plates over into the beam of light. I then put a large cardboard between the light and the plates and cut a hole just large enough to permit the light to go between the plates without touching them. I then found a cathetometer (an instrument commonly used around a physics laboratory) and placed it so the telescope on it was turned and raised and lowered until its line of sight went between the two plates and at about 120° from the direction of the light beam. The distance from the telescope to the plates was about one meter. I then tried out the apparatus. I turned on the light; then focused the telescope; then sprayed oil over the top of the plate; then came back to look through the telescope. I saw a most beautiful sight. The field was full of little starlets, having all colors of the rainbow. The larger drops soon fell to the bottom but the smaller ones seemed to hang in the air for nearly a minute. They executed the most fascinating dance. I had never seen Brownian Movements before; here was a spectacular view of them. The tiny droplets were being pushed first that way and then this way by the actual molecules in the air surrounding them. I could hardly wait until I could try an electrical field upon them to see if they were charged. I knew there were two or three banks of small storage cells in the laboratory. A large number of these small storage cells had been connected in series and mounted in storage compartments on a small trunk. Each one of these units would produce 1,000 DC volts at its terminal. So I soon rolled these into place near my crude apparatus. Insulated wires were attached electrically to each of the plates. The other ends of these wires were attached through a switch to the two terminals of the 1,000 DC battery. I finished most of this that first afternoon. The next morning I spent some time adjusting it and installing a meter to read the volts applied by the big storage battery. I was then ready to try the battery on these tiny oil drops.

The atomizer was used to spray some of the oil across the top plates. As I looked through the telescope I could see the tiny stream of oil droplets coming through the hole. Again I saw beautiful stars in constant agitation. As soon as I turned on the switch some of them went slowly up and some went faster down. I was about to scream as I knew then some were charged negatively and others positively. By switching the field off and on with the right timing one could keep a selected droplet in the field of view for a long time. I went immediately to find Professor Millikan, but could not find him so I spent the rest of the day playing with these oil droplets and got a fairly reasonable value of e [the charge on a single electron] before the day ended. The next day I found him. He was very much surprised to learn that I had a set-up that was working. He came down to the laboratory and looked through the telescope and saw the same beautiful sight of the starlets jumping around that I had already seen. He was very much excited, especially after turning on the field. After watching for some time he was sure he could get an accurate value of e by this method. He stopped working with Beggeman and started to work with me. We were together nearly every afternoon for the next two years. He called the mechanic who worked in our physics shop and we outlined a new design for our apparatus and asked him to build it. The principal changes were to make the plates more accurate and enclose the air between the plates to prevent air drafts. Also we obtained a radium source or X-ray source which we could shoot at the chamber to produce a greater ionization.

This took about a week after which we started in earnest on this research work which was later to become so famous. After working five or six weeks we had the press come into our laboratory and see and hear our results. We also made a popular presentation. The papers were then full of this wonderful discovery. It was the first real publicity that I had received. My name ran right along with Professor Millikan's in the newspaper. I spent considerable time showing these experiments to various VIPs from all over the country.

I remember one of them was the great hunchback from the General Electric Company [Charles Steinmetz]. He was one who did not believe in electrons. He could explain all the electrical phenomena in terms of a strain in the "Ether." After watching these little oil droplets most of one afternoon he came and shook my hand and said, shaking his head, "I never would have believed it; I never would have believed it," and then left.

This was all great publicity for Professor Millikan. At that time his rank was only assistant professor. He had never published a noteworthy research. But he and Gale — another faculty member — had published an excellent high school physics text. I began to wonder if this work was to be my thesis as Professor Millikan promised at that first conference. We had never spoken about it since that first conference in December 1909. However, during the spring, we started together writing a paper to be published about the new research.

I wrote more of it than he did, particularly about the modification of Stokes' law and the arrangements of the data. He went over it all and changed the phrasing somewhat to make it read better. All the time I thought we were to be joint authors.

Phyllis was born May 21, 1910, about the time we finished this paper. When she was about one month old, I was baby sitting with her. Answering a knock I went to the door and was surprised to see Professor Millikan. I wondered why he had come to our humble apartment. I soon found it was to decide who was to be the author of the paper referred to above. There were four other papers in the formative stage that were coming out of these oil drop experiments and I expected they would all be joint papers.

He said that if I used a published paper for my doctor's thesis that I must be its sole author. The five papers on which we did the experimental work together were:

1. The Isolation of an Ion, a Precision Measurement of its Charge and the Correction of Stokes' Law. *Science*, September 30, 1910 — Millikan.

2. Causes of Apparent Discrepancies and Recent Work on the Elementary Electrical Charge. *Physik Zeitschrift*, January, 1911 — Millikan and Fletcher.

3. Some Contributions to the Theory of Brownian Movements, with Experimental Applications. *Physik Zeitschrift*, January, 1911 — Fletcher.

4. The Question of Valency in Gaseous Ionization. *Philosophical Magazine*, June, 1911 — Millikan and Fletcher.

5. A Verification of the Theory of Brownian Movement and a Direct Determination of the Value of Ne for Gaseous Ionization. *Physics Review*, Aug. 1911 — and *Le Radium*, July 11 — Fletcher. This was my thesis.

It was obvious that he wanted to be the sole author on the first paper. I did not like this but I could see no other out and I agreed to use the fifth paper listed above as my thesis and would be listed as the sole author on that paper.

People have frequently asked me if I had bad feelings toward Millikan for not letting me be a joint author with him on this first paper which really led to his getting the Nobel prize. My answer has always been no. It is obvious that I was disappointed on that first paper as I had done considerable work on it and had expected to be a joint author. But Professor Millikan was very good to me while I was at Chicago. It was through his influence that I got into the graduate school. He also found remunerative jobs for me to defray all my personal and school expenses for the last two years. Above this was the friendship created by working intimately together for more than two years. This lasted throughout our lifetime. Remember when we worked together he was not the famous Millikan that he later became. When he wrote his memoirs shortly before he died he had probably forgotten some of these early experiences.

I graduated with a Ph.D. in Physics in 1911 with an honor "Summa Cum Laude." This was the first such high honor that was given to a physics student at Chicago.[1]

One can sense in this account a struggle between his desire to be recognized for his part in one of the most famous scientific experiments of modern times and a desire to be fair to Millikan, who had a different perception of the significance of a graduate student's contribution to his ongoing work.

Harvey Fletcher had offers to teach at the University of Chicago and to work at Western Electric Laboratories upon graduation but chose to return to BYU to teach because of his loyalty to the institution which had granted him leave to pursue graduate studies. He served as head of the physics department but spent much of his time teaching elementary mathematics while continuing some further experiments growing out of those he started at Chicago.

Every spring I received a letter from Dr. Frank B. Jewett [of Western Electric] asking me this question, "Which is more important in your mind this year, business or sentiment?" After five years of this I finally accepted his offer to have me join his organization in New York City.

When I told President Brimhall of my intentions, he thought I was being disloyal to the church, and asked, Why don't you talk to President Joseph F. Smith and ask his advice? President Smith . . . was coming to Provo to attend a board meeting of the BYU and so I made a date to see him. I explained Dr. Jewett's proposition and then told him about the research department of the Western Electric Company. I said this department did most of the research and engineering for the entire American Telephone and Telegraph Company. So I just felt an urge to try my skill against the intellectual giants in this laboratory. After listening to my story he sat quietly in a thoughtful mood for a few minutes (it seemed forever) and then said, "Yes, I want you to go and take this position, but promise this, that you will keep your testimony strong and keep up your Church activities. If you do so you can do more good for the Church in New York City than you could do here at the BYU at the present time and you will be successful in your work. We need more Mormon boys to go out into the world of business and scientific research to represent our ideal of living."[2]

Harvey Fletcher spent the next thirty-three years with what later came to be known as Bell Telephone Laboratories. Because others were already engaged in working with electronics, he moved into acoustics, a field new to him. Out of these studies came a flood of wonderful acoustic devices, such as high fidelity recording, stereophonic sound, talking motion pictures, hearing aids, the artificial larynx, sonar, audiometers, and so on. An early hearing aid made especially for Thomas Edison weighed approximately 100 pounds.

Fletcher was the first Latter-day Saint to be nominated to the National Academy of Sciences, the premier organization in the United States to honor scientists for great accomplishment. He was nominated in three areas rather than one — in physiology for his study of the anatomy of speech (he had published *Sound and Hearing* in 1929), in engineering, and in physics.

Gradually he added administrative responsibilities, becoming director of acoustical research in 1925 and director of physical research in 1933. Under his administration three researchers at the Bell Laboratories developed the transistor and received the Nobel Prize for their work. Another researcher developed the semi-conductor.

His goal of reproducing sound with realism had its first public demonstration in 1933. The *New York Times* of 24 January 1934 said that the audience was "mystified" and "often terrified. . . . Had it not been for the knowledge that they were witnessing a practical scientific demonstration," the report stated, the audience "might have believed they were attending a spiritualist seance. Some women in the audience, admitting a feeling of 'spookiness,' left the auditorium in fright. Airplanes flew from the stage and circled over the heads of the audience with so much realism that all present craned their necks in fright." With the cooperation of Leopold Stokowski, he demonstrated stereophonic sound by transmitting to Constitution Hall in Washington, D.C., a live performance of the Philadelphia Orchestra from Philadelphia.[3]

He became first president of the Acoustical Society of America in 1928 and helped form the American Institute of Physics in 1932. He also served as president of the American Association for the Advancement of Science in 1937 and president of the American Physical Society in 1945. He belonged to many other societies, honorary and professional. Six universities gave him honorary degrees.

When Fletcher retired from Bell in 1949 at age sixty-five, he taught at Columbia, then returned to BYU in 1952 as director of research and head of the Department of Engineering Sciences. He became first dean of the College of Physical and Engineering Sciences in 1954. The Engineering Sciences Laboratory Building was named in his honor. After a few years he returned to acoustical research and retired from teaching and administration. In his career he published more than fifty technical papers, held twenty patents, and received various medals and public recognitions.

Throughout, Harvey Fletcher remained true to the commitment he had made to President Joseph F. Smith. In New York City his home had been the center of Church life for the few members living there in the early days. He served ten years as president of the New York Branch and served a like period as president of the New York Stake, beginning in 1936.

His coworkers knew what he stood for — at least in a general way. One day as Stake President Fletcher was riding the ferry to work in Manhattan, he overheard two other Bell Laboratory employees talking behind him. One said, "Did you know that Harvey Fletcher is a bishop in the Mormon Church?" The other corrected, "Hell, he's not a bishop. He's an archbishop!"

A typical example of his kindly and realistic counsel was his wise approach to a member of the ward whose marriage broke up. Devastated, the man could see nothing worth living for. Brother Fletcher pushed an apple under the man's chin and asked, "What do you see?" Baffled, the man replied, "Nothing." Fletcher then held the apple out where the man could see it clearly and said, "You're just too close to this tragedy now. You need to give it time. Then you'll be able to see it in perspective." This homely illustration made the point.

Successfully rearing a faithful family far from the Mormon community could not have been done without Lorena Chipman Fletcher. In 1965 she was named Utah Mother of the Year and also national Mother of the Year. It pleased her husband Harvey to be able to take a supporting role for a change. He kept her scrapbook with care and showed it with pride.

The family's high standards are evident in the accomplishments of the five surviving sons, a son and daughter having died previously. Stephen was vice president and general counsel for Western Electric until his retirement; he now teaches part time at BYU Law School and is copyright lawyer for the Church. Harvey J. is professor of mathematics at BYU. James was president of the University of Utah, then head of NASA, and is now engaged in energy research. Robert is executive director of the integrated circuit development division of Bell Laboratories. Paul is an administrator in the field of lasers in the government laboratory at San Diego.

Harvey Fletcher wrote a 1961 Sunday School manual called *The Good Life*, a publication which deserves continued reading. He divided the good life into three aspects — love of God, love and use of knowledge, and love of fellow men. Few people have better exemplified "the good life" than he did, and the choice to be "good" was made early. When he was a boy in Primary, his teacher drew a chalk line on the floor of the classroom and said, "Here's the big difference in life — who's on the Lord's side and who isn't. I want you to make a decision whether you're going to be on the Lord's side or not." He remembered all his life the good feeling of rushing over to the right side of the line.[4]

Henry Eyring was born in 1901 in Colonia Juarez, one of the Mormon colonies in northern Mexico. After initial hard times his father had developed a 14,000-acre ranch with 600 cattle and 50 to 100 horses. Henry remembered his childhood as an idyllic time, riding the range beside his father.

When he was four he suffered from typhoid fever. During the illness his Sunday School teacher, "Miss Allred . . . an attractive young lady," visited him. "I was proud and happy that she cared enough to visit me. She spoke to me cheerfully, and after a brief visit with my mother and me, went on her way. But something important had happened to me. I had been a vital part of a fine teacher-student relationship that I have never forgotten. I learned that day how important it is to care about people even when they are small and may not seem very important." [5]

In 1912 the Eyring family became refugees from marauding bands of Mexican revolutionaries, along with approximately five thousand other Mormon colonists. They spent a year in El Paso hoping to return to their homes. Henry illustrated early an unusual tenacity. He worked in an El Paso grocery store, rollerskating to work. At the bottom of his hill the sidewalk ended two feet above the road. Daily he tried to make the jump at full speed, nearly always falling and dropping his lunch pail. Only a few times during the year did he make a successful jump, but he kept trying.

His father settled the family again in the Gila Valley of Arizona on a ninety-eight-acre farm only partly cleared of mesquite. The rigors of dirt farming in arid country gave him incentive to succeed at his studies as a way out and he received a county scholarship to attend college.

As he was about to leave for school his father said to him, "Son, in this Church you don't have to believe anything that isn't true. You go over to the University of Arizona and learn everything you can, and whatever is true is a part of the gospel. The Lord is actually running this universe. I'm convinced that he inspired the Prophet Joseph Smith. If you'll live in such a way that you'll feel comfortable in the company of good people and seek the truth, then I don't worry about your getting away from the Lord." His mother advised him not just to be good, but to be good for something.[6]

Young Henry waited on tables and graded papers at the university to support himself while he obtained a bachelors degree in mining engineering, then went to work in the copper mines in Arizona. He says that having a rock smash his foot in the mine persuaded him to switch to metallurgy for a master's degree, and the noxious fumes of the blast furnaces then persuaded him to return to college for a career as a teacher. He obtained his Ph.D. in chemistry at Berkeley in 1927 under Professor George E. Gibson and was also greatly influenced by Gilbert N. Lewis.

With doctoral degree in hand he started teaching at the University of Wisconsin. At a Christmas party for Mormon students he met Mildred Bennion, then pursuing graduate study while on leave from her position as chairman of the women's physical education program at the University of Utah. They married in 1928. At Wisconsin Eyring became interested in reaction kinetics and studied it for a year in Berlin and another at Berkeley.

At Berkeley he used hydrogen and fluorine to test his theories. Conventional wisdom said that these chemicals, united in pure form, would explode, but Eyring's quantum mechanical calculations indicated no explosion at normal temperatures. He and a friend mixed the pure gases by remote control while they hid behind a barricade, and the mixture did not explode. To flush out the dangerous gases, they had arranged to use a tank of nitrogen but had forgotten to run the control to the place where they were sheltered. Eyring crawled across to turn the valve and the mixture promptly exploded, presumably catalyzed by material introduced from the nitrogen tank or the tubing. Fortunately, no one was injured by the flying glass.[7]

This vindication of his theoretical approach to chemistry drew an invitation from the American Chemical Society to participate in a special symposium on "Applications of Quantum Theory to Chemistry" and that exposure in turn brought him an invitation to join the faculty at Princeton University, which he accepted. His first public acclaim came in 1932 when he received a $1,000 prize from the American Association for the Advancement of Science for a paper that further illustrated how the principles of quantum mechanics applied to organic as well as inorganic chemical reactions.

In 1934 Eyring submitted a paper, "The Activated Complex in Chemical Reactions," to the *Journal of Chemical Physics*. The editor sent it out for review and the reviewer replied that "the method of treatment is unsound and the result incorrect." Eyring persisted, however, and obtained the endorsement of other scientists whose judgment carried more weight. They persuaded the editor to publish the paper, and it proved to be the single most influential paper he ever wrote. He later stated wryly, "Ego is no small thing in the success of a scientist," yet his was the ego of confidence, not of arrogance. His absolute rate theory, as it is now called, is said to have been one of the most potent ideas to appear in chemistry in the last fifty years. It applies not only to chemical reactions but also to numerous physical and biological processes.

For this and other contributions to chemistry, he was repeatedly nominated for consideration by the Nobel Prize Committee. When asked about his not receiving the prize, he quipped, "I'm available!"[8] In all probability the fact that his most significant single contribution to science came so early in his career and waited for some time to be fully appreciated limited his chance to receive the highly publicized prize. At Henry Eyring's funeral Dr. Dan Urry, his colleague, called him "one of the principal architects of physical-chemical theory of this century" for his theory of rate processes, the significant structure theory of liquids, and the theory of optical rotation, among other things.

In awarding Eyring the prestigious Swedish Berzelius Gold Medal in 1979, King Karl Gustav of Sweden said, "You are the only true alchemist; you have turned the hydrogen atom into pure gold." Eyring had started the development of his theory of rate processes by treating the reactions of hydrogen atoms and had rapidly expanded it to the more complex reactions in polymers and textiles, chemiluminescence and enzyme mechanisms, biological connective tissue and membrane permeability, and the physical chemistry of nerve action.

In New Jersey Henry Eyring served the Church well. He became branch president (1932–1944) and then was called as president of the New Jersey District (1944–1946), the spiritual head, as he said, of three million persons, "though most of them were blissfully unaware of the fact."[9]

He flourished professionally, sometimes so engrossed in his work that he forgot where he was. On one occasion he missed his train stop and went right on past Princeton. Getting off and boarding a return train, he missed Princeton a second time.

Albert Einstein was at the Institute for Advanced Study at Princeton during this period and Eyring enjoyed that association. Of Einstein he said, "He was first rate, there is no question about it, . . . but the picture some people have of him as a lone intellectual giant is a wrong one. I prefer to think of him as a man with few peers. There are other people who are comparable. Neils Bohr was another physicist of comparable scientific influence."[10]

Of this period a former student of his recalled: "When I came into Henry's lecture room for my orals, only Henry was there. The other members of the committee had not yet arrived. He sensed my anxiety and in an attempt to relax me asked if I had ever seen him jump to the table from a standing position. I had never seen him do this so he made a mighty jump which didn't suffice. He cracked both shins on the edge of the table. For a few moments I thought the oral would have to be cancelled, but with pain and determination he backed off and tried it again, this time succeeding."[11]

In 1946 Eyring received an invitation from President A. Ray Olpin of the University of Utah (who by coincidence was Harvey Fletcher's former student, brother-in-law, and colleague at Bell Laboratories) to come teach at the University of Utah and establish a graduate school. He considered the offer, then declined. When his wife Mildred learned of this decision she did not trust herself to say the right thing and wrote him a long letter to read at the office expressing her feelings that it was time for them to "go home." He immediately wired President Olpin to disregard his earlier letter; he was coming.[12]

For twenty years he was the dean of the graduate school, the catalyst and leader needed to establish the University of Utah as a first-rate research institution. In his career he published 622 scientific papers and a dozen books, with collaborators, edited thirty-eight volumes in several series, and served as the personal mentor for 118 doctoral students. He taught actively until his last illness at age eighty, a unique resource for the university. University president David P. Gardner is quoted as saying, "Retirement? The university is not accustomed to retiring geniuses."[13] The university's new chemistry building bears his name. Many other honors came to him, also, including fifteen honorary doctoral degrees, the National Medal of Science in 1967, the Priestly Medal in 1975, and the $100,000 Wolf Prize in Israel in 1980, as well as more than a dozen other major medals and prizes. He served as president both of the American Chemical Society and the American Association for the Advancement of Science. No Latter-day Saint scientist was as widely known as he.

Eyring prided himself on his fitness. He walked to and from his office, politely waving off offers to ride, did standing jumps from the floor to the top of his desk, and, until 1978, challenged his students to an annual foot race, putting up cash prizes for the first four places. He pursued his scientific work with the same vigor and irrepressible excitement.

An affable speaker, quick with a witty aside or self-deprecating remark, he was popular as a scientific lecturer and as a Church speaker. As a teacher he made concepts vivid with images. Chemical reactions might involve bouncing ping pong balls, mountain passes, springs, or marching soldiers. "Dr. Eyring used to say that you must have a model before doing quantitative deductive thinking. A good model is best, but a bad model is better than none at all," recalls Dr. Milton Wadsworth, associate dean of the University of Utah's College of Mines and Mineral Industries. "He said it's not a sin to be simple and wrong, but it is a sin to be complicated and wrong, and he had a marvelous way of simplifying complicated material."[13]

Something of Eyring's personality and work style can be glimpsed in a report a Donald Carr made to the head office of Phillips Petroleum Company during a visit in September 1961 to the company research facilities in Oklahoma:

> Henry Eyring took us over. I believe that this is the greatest "visitation" we have ever had (I use this much misemployed word deliberately, as one talks of visitations by kings, ghosts and billionaires).
>
> Never have most of us seen such a man. Perhaps an instance from many may give an idea of his terrific impact. . . . The last day of Henry's visit, when he was about to take off with Ray Arnett and my wife for a whiz through Woolarco, Bill Nelson called me on the phone and with a bit of a sob in his voice said, "I just want to say, Don, that this is the greatest thing that has ever happened to the R & D department in the nineteen years I have been here."

The spell of Eyring is magical. It is compounded of what? Enormous ability, curiosity, imagination, kindness, inexhaustible energy, the incredible combination of a poet's facility with the English language and an advanced physicist's gift for higher mathematics, — above all, *happiness*. I believe he is the happiest man I have ever met, and this spreads, as it must spread from all great geniuses. I wonder how many Eyrings there are in the world? If there were enough we would have nothing to fear, nothing at all to fear.

A man of his accomplishments could afford complete egotism. But what was our toughest problem? To steer him with expedition through the laboratories, since he insisted on talking with everybody he met, asking him what he thought about this and that, fanning a little flame of genuine fellowship here, there, everywhere.

Since the unexpected is what one expects of Henry, his last lecture on the superficially rather unappetizing subject of optical rotation was, to me at least, his best. Here he delved into the theory of origins of life and the nature of things, even the true inwardness of light. With his beautiful surgeon's hands, he imitated a ghostly "dipoleness," a sort of Carrollian grin of the cat, being propagated through space. He concluded that the most important thing in our history was that we were created as matter rather than anti-matter and close upon that was the biochemical triumph of the laevo rather than the dextro-alpha amino acids.

Even from the standpoint of time alone, he earned much more than his honorarium. His lectures were always at least two hours, and would have lasted longer, except for nervous monitors such as Don Smith and myself. His afternoon discussions were continuous eruptions of intellectual richness. At luncheon and in the evening, his charm dominated every table, every minute.

Even in the most complicated presentation in the Adams Building auditorium, he managed with his resonant actor's voice (without loudspeaker) to make everything seem clear and even cozy. He has a way of personalizing. At the blackboard, he would say, for example, "Now, since Don Carr and I went to Berkeley, we'll write this F instead of G, for free energy." And again: "Now, Don (Smith), doesn't that sound reasonable and good to you? If that isn't the truth (his liquid theory), it's the cutest pack of lies I know about."

Except for the great scientific stimulation, what can we learn from Henry the Great? Is it perhaps that, when you are born a genius, a fastidious clean and hardy life pays great dividends, whether you are a Mormon, a Catholic, a Jew or an atheist? He walks to work and back four times a day (10 miles total) and, when nobody is looking, he runs. In fact, he challenged everybody he met here to a fifty-yard dash, and had only one half-hearted taker in Bob Sears, although, unfortunately, there was no time to stage the sprint of the century.[15]

He lived chemistry. Even in the midst of a family group his mind used the odd moments to work at problems; in a meeting he might pull out an envelope and start writing equations.

He took immense pride in the professional accomplishments of his three children, all sons, but equal satisfaction in their service as bishops. His son Edward is professor of chemistry at the University of Utah. Henry has been professor of business administration at Stanford University, president of Ricks College, and is presently Commissioner of Church Education. Harden, an attorney, is executive assistant to the commissioner of the Utah System of Higher Education.

He could comfort with stories of his own foibles. When Harden had wrecked the family car, Eyring told him how he had once taken his father's gun down from above the fireplace and gone out on the front porch to frighten a neighbor boy who was walking past. He aimed at the boy, pulled the trigger, and the "unloaded" gun went off with a roar. "Fortunately," he said, "I was a terrible shot." [16]

Elder Neal A. Maxwell said, at his funeral, "Henry's humility and humor kept him from becoming a brilliant but irascible eccentric. Indeed, the humor of great individuals is possible because they are not preoccupied with their own ego concerns. Thus they are free to observe the incongruities and inconsistencies of life and themselves. Henry was good-natured and good-humored because he was good — laughter did not come at the expense of others, but . . . was the self-effacing kind." [17]

With so much commitment to his career in science it would have been easy to have neglected his spiritual life, but Henry Eyring served the Church with unflagging energy and openness. In Utah, where he served for twenty-five years on the General Board of the Sunday School, his favorite assignment was helping prepare Gospel Doctrine lessons for adult classes each year. A favorite anecdote concerned a meeting to plan the new Church magazines.

> I got a letter from Richard L. Evans to come down to a two o'clock meeting for the new magazines, along with a great many other people. I was visiting my sister [Camilla, wife of apostle Spencer W. Kimball,] and I said, "I am going to a meeting for the magazines." Spencer said, "I am going, too, at nine o'clock." I had forgotten in the meantime that mine was for two o'clock and assumed it was the same meeting. My secretary was not there that morning and I was a little bit late, so I hurried down to the Church Office Building. When I got there, I went in and said to the receptionist that I was supposed to go to a meeting. He said, "Well, isn't it this afternoon?" I said, "No, it is this morning." So he took me in and there were four apostles — Spencer Kimball, Marion Romney, Brother Evans and Brother Hunter — and the magazine editors. I was quite surprised that there was no one else from the Sunday School but I thought, well, they must regard me very highly, and so I just sat down. Everyone shook my hand so I sat down. The discussion went around and I was willing to offer my views quite freely. I told them that the Church magazines never would amount to a damn if they did not get some people with independence in there who had real ideas and would come out and express themselves. If they were going to rehash old stuff, they would not hold the young people. I told them I thought that *Dialogue* had caught the attention of more people and had more influence than our own Church magazines did. It has some of the kind of independence that I think is a good thing. I think it is walking a very dangerous road and could easily go sour, but so far it has been good. And I told them that if they left out people like Brother Wheelwright, who had been working with the *Instructor*, they would be making a big mistake, and so on. I gave them quite a bit of very fine advice and I damned a little when I wanted to and when I got through, Brother Evans said, "I do not know anyone who characterizes the idea of independence any more than you do; are you applying for the job?" "No, I am not applying for the job, but I think I have given good advice." Everyone was very nice to me.
>
> I did not have any feeling, even after I had been there, that there was anything wrong, and thought that they must have a high opinion of my wisdom. When I got back to my office, my secretary asked, "Where have you been?" I said I had been down to the Church magazine meeting. She said, "That is this afternoon at two o'clock."
>
> What is so funny is not that I made a mistake, but that I was so insensitive as to not realize it. I did not go to the two o'clock meeting. I felt I had done my work. Brother Evans got up in that meeting and, I am told, said that they had had a meet-

ing in the morning and that very useful advice had been supplied by Brother Eyring. He did not say I had not been invited.

I am amazed at the graciousness of the brethren in making me feel I belonged, when any one of them might well have been annoyed. They are a most urbane group. On my part, there was no holding back; I just tried to help them all I could.[18]

In 1969 Mildred Bennion Eyring, his wife of forty-one years, died. Two years later he married Winifred Brennan Clark, who added her four daughters to his family circle.

To the end of his life he was deeply involved in the three great loves of his life — chemistry, family, and church.

From 1974 on he was a faithful high councilor. During his last year, seriously ill, he still turned out to help weed the onion field at the stake welfare farm.

During the last, painful illness Henry Eyring asked rhetorically, "Why is God doing this to me?" He then fell asleep and when he woke up he said, "God needs men of courage. He is testing my courage." [19]

NOTES

1. Harvey Fletcher, *Autobiography* (Provo, Ut.: privately published, 1967), pp. 29–36; copy in BYU Archives.

2. Ibid., pp. 42–43.

3. As cited in Harvey Fletcher obituary, *New York Times*, 25 July 1981.

4. Harvey J. Fletcher, remarks at funeral of Harvey Fletcher, 27 July 1981.

5. Henry Eyring, "South of the Border," *Instructor*, Aug. 1967, p. 322.

6. As quoted by Harden Eyring at the funeral of Henry Eyring, 30 Dec. 1981, in Salt Lake City. Variations on the same conversation appear in a number of places: by Henry Eyring, "My Father's Formula," *Ensign*, Oct. 1978, p. 29; "Gospel Teaching I Remember Best," *Instructor*, April 1957, p. 107 (this source also includes the conversation with his mother); "Wisdom — Human and Divine," *Improvement Era*, March 1954, p. 146; and *The Faith of a Scientist* (Salt Lake City: Bookcraft, 1967), p. 66.

7. Steve H. Heath, "Henry Eyring, Mormon Scientist" (M.A. thesis, University of Utah, 1980), pp. 48–49.

8. Edward L. Kimball, "A Dialogue with Henry Eyring," DIALOGUE 8 (Autumn/Winter 1973): 100.

9. Ibid.

10. Ibid., p. 107.

11. Reminiscence by John R. Morrey, *Chemical Dynamics*, festschrift ed. by Joseph O. Hirschfelder and Douglas Henderson (New York: John Wiley & Sons, 1971), p. 318; as cited in Heath, "Henry Eyring," pp. 148–49.

12. Heath, "Henry Eyring," p. 75; Mildred Bennion Eyring, *My Autobiography* (Salt Lake City: privately published, 1969), p. 87. Harden Eyring has written a biography of Henry Eyring, soon forthcoming.

13. Twila Van Leer, "Fellow Scientists to Honor U's Dr. Eyring," *Deseret News*, 3 April 1976, p. 8A.

14. Dorothy Stowe, "Science Was Art to Henry Eyring," *Deseret News*, 10 Feb. 1982, p. 1C.

15. D. E. Carr to J. A. Reid, 4 Oct. 1961, as quoted in Heath, "Henry Eyring," pp. 98–100.

16. Harden Eyring, remarks at funeral of Henry Eyring, 30 Dec. 1981.

17. Neal A. Maxwell, remarks at funeral of Henry Eyring, 30 Dec. 1981.

18. Kimball, "Dialogue," pp. 101–2.

19. Harden Eyring, remarks at funeral.