

NOMINATION COVER SHEET
2012 Virginia Outstanding Faculty Awards

1. <u>NAME</u>	
Full (Legal): Robert Miller Hazen Preferred First Name: Bob	
2. <u>INSTITUTIONAL INFORMATION</u>	3. <u>PROFESSIONAL INFORMATION</u>
Institution: George Mason University	Academic Discipline: Natural Science
Rank/Position Title: Clarence Robinson Professor of Earth Sciences	Specialization/Field: Astrobiology and Mineralogy
Year Rank/Title Attained: 1989	Type of Terminal Degree: Ph.D.
Years at Institution: 22	Year Awarded: 1975
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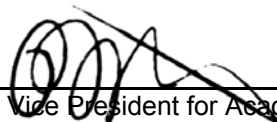
Please check only one box:

- RESEARCH/DOCTORAL INSTITUTION NOMINEE:**
MASTERS/COMPREHENSIVE INSTITUTION NOMINEE:
BACCALAUREATE INSTITUTION NOMINEE:
TWO-YEAR INSTITUTION NOMINEE:
TEACHING WITH TECHNOLOGY NOMINEE:
RISING STAR NOMINEE:

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Signature (President or Chief Academic Officer)



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II. Mission Statement

George Mason University is innovative and entrepreneurial in spirit and utilizes its multi-campus organization and location near our nation's capital to attract outstanding faculty, staff, and students.

Mason will:

- Educate the new generation of leaders for the 21st Century men and women capable of shaping a global community with vision, justice, and clarity.
- Encourage freedom of thought, speech, and inquiry in a tolerant, respectful academic setting that values diversity.
- Provide innovative and interdisciplinary undergraduate, graduate, and professional courses of study that enable students to exercise analytical and imaginative thinking and make well-founded ethical decisions.
- Nurture and support a highly qualified and entrepreneurial faculty that is excellent at teaching, active in pure and applied research, capable of providing a broad range of intellectual and cultural insights, and is responsive to the needs of students and their communities.
- Maintain an international reputation for superior education and public service that affirms its role as the intellectual and cultural nexus among northern Virginia, the nation, and the world.

III. Summary of Accomplishments

Robert Hazen is an award-winning scientist and educator who has achieved major advances in forefront research on life's origins and the co-evolution of the geospheres and biospheres; presented science to millions of students, readers, and viewers through varied media; exerted a major influence on science education reform in the United States from K-12 through undergraduate curriculum design; and served the academic community in numerous roles at the local, state, national, and international levels.

Introduction (The Years to 1989): In 1989, Robert M. Hazen was given the opportunity to become Clarence J. Robinson Professor of Earth Sciences at George Mason University. Mason's Robinson Professors are distinguished faculty who are top scholars in their fields and who elevate Mason's stature through outstanding research and undergraduate teaching. The events leading up to that position set the stage for his subsequent leadership in science education reform and international research programs. Yet his earlier scientific career presents a contrast to the subsequent 22 years.

As graduate student at Harvard University, Hazen pioneered new techniques in high-pressure and temperature crystallography, the study of atomic structures at conditions found in Earth's deep interior. His PhD (1975) was followed by a NATO-sponsored postdoctoral fellowship in Cambridge, England, where his mandate was to introduce these new techniques to British scientists—techniques used there to this day. The year in England resulted in landmark publications and a consequent postdoctoral fellowship at the famed Geophysical Laboratory of the Carnegie Institution. Two years later, Hazen was offered a revered lifetime Staff Scientist position at Carnegie—an opportunity called a “permanent MacArthur Fellowship.” Shortly thereafter, Hazen wrote the monograph *Comparative Crystal Chemistry* (Wiley, 1982) with Carnegie colleague Larry Finger—a book that sealed his reputation as the world's leading expert in crystallography at high-pressure. That book and a stream of other publications led to several honors, including the 1982 MSA Award, the American Chemical Society's 1986 Ipatieff Prize, and being named the youngest Life Fellow in the history of the Mineralogical Society.

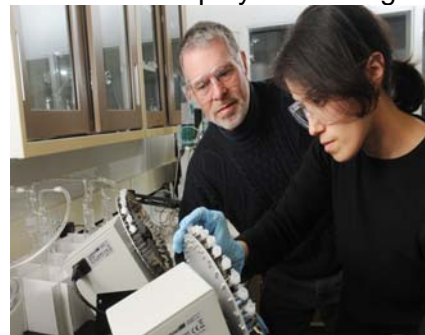
With his growing reputation, Hazen was asked to lead an urgent effort to determine the physical and chemical characteristics of the first high-temperature superconductor (a remarkable material that conducts electricity with no energy loss). His small research team accomplished this task in an intense two-week period, as chronicled in his popular bestseller, *Breakthrough: The Race for the Superconductor* (Simon & Schuster, 1988).

Hazen, eager to develop new science education approaches and to integrate courses in arts and sciences, welcomed the opportunity provided by Mason. He had already demonstrated a commitment to science education in numerous articles and books (many co-authored with his historian wife, Margaret Hindle Hazen) on aspects of science, technology, and culture, including histories of American mining (*Wealth Inexhaustible*, 1984), the American brass band movement (*The Music Men*, 1987), and 19th-century geological poetry (*The Poetry of Geology*, 1982).

Hazen's candidacy was bolstered by his parallel career as professional trumpeter. He studied at the New England Conservatory concurrently with his PhD studies at Harvard. He was a tenured member of the Washington Chamber Symphony, the National Gallery Orchestra, and the National Philharmonic until his retirement in 2010. He was extra trumpeter with numerous ensembles, including the Boston and National Symphonies (joining the NSO's 2004 national tour), Orchestre de Paris, the New York, Boston, Washington, and Metropolitan Operas, and the Jeffrey, American, Kirov, and Royal Ballets. He performed under many of the most famous conductors of the late 20th century, including Rostropovich, Leinsdorf, Dorati, and Slatkin, and his discography includes numerous labels, including DDG, AML, Nonesuch, and ProArte.

These diverse and internationally-recognized efforts in science, the arts, and public outreach set the stage for Hazen's new path as faculty member at Mason, where he began teaching in January of 1989.

Teaching: “His passion for the subject is contagious.” “Great, enthusiastic teaching, awesome attitude.” “Prof. Hazen is the absolute best instructor I have ever had.” Hazen receives many such comments every semester from enthusiastic students. He displays the highest commitment and effectiveness in George Mason’s central mission to “educate the new generation of leaders for the 21st century—men and women capable of shaping a global community with vision, justice, and clarity.” As an educator devoted to undergraduate teaching, Hazen has developed and taught 7 new broadly interdisciplinary courses, each of which targets key areas of Mason’s Mission Statement, notably to “encourage freedom of thought, speech, and inquiry” while “providing innovative and inter-disciplinary undergraduate and graduate courses of study.”



The success of Hazen’s teaching is demonstrated by outstanding student and faculty evaluations, a constantly growing demand for his courses (now ~200 students per semester), the national distribution of his science lectures on video/audio collections, and sustained requests for his advice and counsel on education policy at state and national levels (see Knowledge Integration). His large undergraduate science courses for non-majors (the type of required course sometimes viewed as an undesirable hurdle to be overcome and quickly forgotten) consistently receive student ratings of 4.5 to 4.8 on a 5.0 scale—exemplary results that have prompted several letters of commendation from the Provost’s Office. His smaller seminars have received even higher student ratings, including several semesters with perfect 5.0 evaluations from every student.

As a Robinson Professor, Hazen immediately displayed a commitment to the scholarship of teaching, notably in areas of reform of undergraduate science education for non-science majors and the integration of other academic disciplines with science. In collaboration with Robinson Professor James Trefil, he emphasizes that undergraduate science education should strive to achieve “scientific literacy” by focusing on a few overarching principles that crosscut all scientific fields, rather than requiring in-depth study of one subject (i.e., physics or biology), as the terminal science course for non-science majors. Science is central to our lives, and a firm grounding in scientific literacy informs our citizens in vital topics related to health, environment, resources, business, and education. Science is also an engine of discovery, a driver of innovation, and represents a great human adventure. Thus, to achieve the mission of “educating the new generation of leaders,” a new kind of science curriculum is essential. The result was “Great Ideas of Science,” a course specifically targeted for undergraduate non-science majors. Thousands of Mason students (and hundreds of thousands of students around the country and beyond) who have taken this popular course experience science in a new way, as an integral part of their day-to-day lives, and as a way of knowing that informs and enlightens personal decisions, professional pursuits, their role as parents, and their sense of place in a Cosmos governed by immutable natural laws. Little wonder that this offering, though a required science course for many science-shy students, has been rated year after year as one of the most popular courses at Mason. Equally impressive, peer teaching evaluations by faculty from many different campus departments at Mason have garnered similar enthusiastic praise.

In addition to the popular “Great Ideas of Science,” which Hazen has taught since 1989 and now offers to 200-student classes twice a year, he has created 6 other broadly interdisciplinary courses, all of which exemplify his teaching philosophy and support Mason’s mission. “Symmetry in Art and Science,” taught with enthusiastic evaluations to Freshman Honors students, integrates principles of science, literature, art, and philosophy in a mixed lecture, discussion, and laboratory context to examine how humans use patterns to perceive their world. “Image of the Scientist in Popular Culture,” another Freshman Honors course, emphasizes classroom discussions and critical thinking through analysis of fictional portrayals of scientists

from *Frankenstein* to *Dr. Strangelove* to *Jurassic Park*. Students discover that oft-used stereotypes of scientists—absent-minded, power-hungry, thoughtless or mad—are pervasive examples of the more pernicious tendency to stereotype individuals who are different from ourselves. “Visual Thinking,” a general education course developed jointly with members of the School of Art and Psychology Department and offered to undergraduates from majors across the university, engaged students in a richly multi-disciplinary experience. By contrasting science, art, and psychology as different ways of knowing, students not only learned the subtleties of how we see the world, but they also begin to realize that a thoughtful life entails a balance of epistemologies.

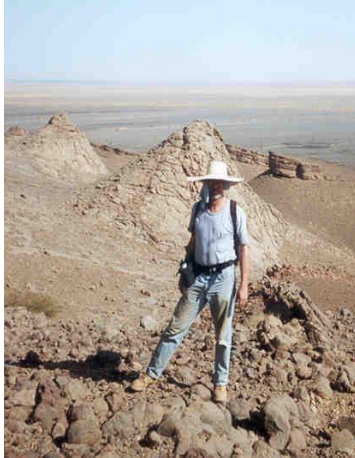
Hazen has also designed several interdisciplinary courses specifically for advanced undergraduate science majors. “Scientific Ethics” is a seminar that engages students through discussion and critical thinking about real world ethical dilemmas in the lab and classroom. Many examples come directly from Hazen’s extensive files as an independent evaluator of cases of scientific misconduct and fraud. This class directly addresses Mason’s mission to guide students in making “well-founded ethical decisions.” In Hazen’s demanding seminars “Origins of Life” and “Literature of Astrobiology,” he provides high-level surveys of primary scientific literature, building on themes related to his lab research. Every class, students are required to read several seminal scientific articles, with one student designated discussion leader for each article. In addition to exploring the rich scientific content, students develop critical skills as discussion facilitators and as professional presenters of highly complex technical material.

A complementary facet of Hazen’s teaching is mentoring young researchers in advanced laboratory projects in mineralogy and origins of life. Since 1989, he has guided 40 high school, undergraduate, graduate, and postdoctorate-level students. These activities have led to 14 Master’s and PhD theses, dozens of student presentations at national conferences, and more than 20 peer-reviewed publications with student co-authors.

The effectiveness of Hazen’s teaching is demonstrated in part by hundreds of glowing student and faculty teaching evaluations. However, the most gratifying evidence comes from notes of thanks from past students who have begun successful careers, both in science and in other diverse domains. A common theme in these letters is the feeling that Hazen’s courses opened their minds to new ways of thinking about their world—ways that have direct and daily impact on their lives. The course was “a huge stepping stone for me,” one student wrote. Another recounted how it “opened my eyes to science and how important it is in our lives.”

Hazen’s teaching abilities have been recognized by The Teaching Company (based in Chantilly, Virginia) through their “Great Professors” program, which has produced audio and video versions of 3 courses for national distribution, with a 4th course on Earth history currently in development. These courses have reached more than 100,000 households, many in Virginia home-schooling environments, while Teaching Company publicity that highlights Hazen’s teaching at Mason reaches millions of consumers nationally. Hundreds of unsolicited letters from students and teachers, doctors and business leaders, artists and musicians, parents, retirees, and even prison inmates hail these courses as “remarkable,” “inspirational,” “phenomenal,” and “superb.” “You are truly a gifted teacher.” Hazen’s science education efforts have also been recognized by a number of awards, including the 1992 Education Press Award, the 1989 ASCAP Deems-Taylor Award, the 1998 Elizabeth Wood Science Writing Award, and the Mineralogical Society of America’s 2010 Distinguished Public Service Medal.

Discovery: Robert Hazen’s original scientific research, presented in more than 380 peer-reviewed articles and 24 books (with many foreign language editions), places him among the highest ranks of American researchers. His research, based primarily at lab facilities of the Carnegie Institution and at field areas in Morocco and Montana, focuses on several aspects of the fascinating field of astrobiology (the search for the origins, evolution, and distribution of life in the Cosmos), as well as a strikingly original approach to mineralogy called “mineral evolution”



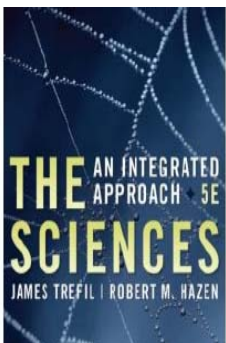
that examines the 4.5 billion year co-evolution of the geosphere and biosphere. In 1996, thanks to the new perspective on science research opportunities fostered by his teaching of integrated science and inspired by theoretical studies of Mason colleague Harold Morowitz, Hazen began research on high-pressure organic synthesis and the varied plausible roles of minerals in processes that led to the origins of life. Working with a team of scientists at the Carnegie Institution, in 1997, he developed a successful proposal to join NASA's Astrobiology Institute to study the physical and chemical environments of high-pressure hydrothermal systems (especially deep-ocean volcanic "black smokers") and their possible role in prebiotic organic synthesis and the origin of life—an effort that has now led to more than \$16 million in new NASA funding.

One facet of Hazen's groundbreaking origins of life research focuses on varied roles of mineral surfaces in selecting, concentrating, protecting, and organizing biomolecules from a dilute prebiotic "soup." His thesis, expounded in *Genesis: The Scientific Quest for Life's Origins* (National Academy Press, 2005) and his Mineralogical Society of America Presidential Address (2006), is that biogenesis occurred in a sequence of emergent steps, each of which is amenable to laboratory research. Furthermore, minerals played pivotal roles at several stages in this chemical evolution. Hazen is also active in studies of emergent systems, quantification of complex systems (through the formalism of functional information), and evolution of complex systems under selective pressures.

In 2007, Hazen began to study the changing diversity and distribution of minerals in crustal environments of Earth and other terrestrial planets and moons—a field that he called "mineral evolution." Earth's mineralogical history was divided into ten stages, each of which saw significant changes in near-surface mineralogy. Principal findings include the realization that different planets and moons achieve different stages of mineral evolution. Furthermore, fully two-thirds of known mineral species on Earth probably could not have appeared prior to the origin and evolution of life. The influential weekly journal *Science* called this original and widely discussed framing of mineral research "the first paradigm shift in mineralogy in 200 years." A dozen publications have followed the original 2009 article and many more manuscripts are in progress. Hazen's next book, *The Story of Earth* (to be published by Viking in 2012), will expand on this thesis to present a sweeping narrative of Earth's evolving geosphere and biosphere.

Hazen's research has been recognized by many awards and honors, including the Mineralogical Society of America Award, the Linnaeus Prize and Lecture, the Ipatieff Prize of the American Chemical Society, Fellowship in the American Association for the Advancement of Science, as well as more than 20 named scholarly lectureships and visiting professorships at universities and institutions in North America and Europe.

Knowledge Integration: Development of influential new interdisciplinary curricula and knowledge integration has become the central theme in Hazen's career. Foremost has been recognition that science is central to all our lives; scientific literacy informs citizens in a broad range of topics related to health, environment, resources, business, and education. Science is also an engine of discovery and the greatest ongoing human adventure. However, traditional undergraduate science education based on specific disciplines may not prepare citizens to understand, much less deal with, the interdisciplinary scientific and technological needs and opportunities facing society. A new integrated science education is essential. This thesis was expounded in the influential national bestseller, *Science Matters: Achieving Scientific Literacy* (Doubleday 1990, 2010). The detailed curriculum, presented in Trefil and Hazen's textbook, *The Sciences: An Integrated Approach* (Wiley; now entering its 7th edition), is taught in



hundreds of colleges and universities. Faculty have called the course “revolutionary” and “transformational,” and the textbook “outstanding,” “lucid,” and “lively and comprehensive—a tour de force.”

Expanding on this theme, Hazen has written extensively on science education policy in *The Chronicle of Higher Education*, *Journal of Geological Education*, *Journal of Chemical Education*, and numerous volumes on education policy, as well as such national publications as *Newsweek*, *Smithsonian Magazine*, *Scientific American*, and *The New York Times Magazine*. He contributed further as a co-author of K-12 content standards for *The National Science Education Standards*, as well as several National

Academy of Sciences publications on teaching about evolution and the nature of science. Hundreds of thousands of copies of these documents have been distributed.

Hazen’s writings are complemented by service on such national educational panels as the Executive Board of National Committee on Science Education (National Research Council), National Science Education Resources Center, the Committee on Public Understanding of Science and Technology (American Association for the Advancement of Science), the Carnegie Council, and advisory boards of *NOVA* (WGBH-TV Boston), *Earth & Sky* (NPR), *Encyclopedia Americana*, and other organizations. Hazen has also served as advisor on undergraduate science education to many state-level university systems, including those in Arizona, California, Connecticut, Idaho, New York, New Hampshire, North Carolina, Texas, and West Virginia.

Hazen’s development of interdisciplinary undergraduate courses has had a profound influence on his research. Hazen’s formal training was in mineralogy and geology, but teaching integrated science to undergraduates opened his eyes to a much wider and richer world of research possibilities, especially those integrating themes in biology, geology, physics, and chemistry. Most of his 150+ publications from the past fifteen years reflect this influence. His first shift in research led to a focus on the geochemical origins of life—work that required input from diverse areas of chemistry, geology, and biology. His subsequent studies of complex evolving systems added physics to the mix, while his invention of the rapidly expanding field of mineral evolution spans all major disciplines of science from astronomy to zoology. These efforts have been endorsed by the awarding of major grants from NSF, NASA, the Keck Foundation, and other organizations, with more than \$31 million in research funding since 1997.

In recognition of his efforts in knowledge integration, in 2009, Hazen was named Principal Investigator of the Deep Carbon Observatory (DCO), a major 10-year research program sponsored by the Alfred P. Sloan Foundation. The DCO’s central objective is to achieve transformational understanding of the chemical and biological roles of carbon in Earth’s deep interior. This effort, modeled in part after Sloan’s just-completed Census of Marine Life (10 years, 2700 collaborators, 80 countries, \$650 million in total funding), has aspirations of integrating the research of 2,000 collaborators from 60 countries, with a 10-year budget approaching \$1 billion. The Sloan Foundation has already provided \$12 million in new funding, with an equal amount in matching funds coming from varied government, private, and corporate sources. Hazen’s role as Principal Investigator is to provide scientific oversight and integration for the remarkable group of scientists—chemists, geophysicists, biologists, engineers, information specialists, and more. In this capacity, he has been meeting with scientific, government, corporate, and foundation leaders from around the world in an effort to forge a truly integrated international collaborative network of scholars. For more information on this exciting new scientific research program, please see <http://dco.ciw.edu>.

Service: Robert Hazen spends an extraordinary amount of time and effort in service at the regional, national, and international levels. In recognition of his accomplishments and dedication, he has been elected to office in several scientific societies. He was elected Councilor (1985-89) and President (2003-2005) of the Mineralogical Society of America, Chair

of the Gordon Research Conference on the Origins of Life (2007-2008), and Councilor of the International Society for Study of the Origins of Life (2011-). He served as Editor or Associate Editor for numerous periodicals and collected volumes, including *American Mineralogist*, *EOS*, *Elements*, and *Reviews in Mineralogy and Geochemistry*. He serves on the influential Advisory Committee for Biosciences of the National Science Foundation and has been a member of numerous national science education boards and committees, including the highest-level committees of the National Research Council, the National Academy of Science, the American Association for the Advancement of Science, and the Smithsonian Institution.

Among Hazen's principal outreach activities is public speaking. He has been Distinguished Public Lecturer for Sigma Xi (2007-2010) and the Mineralogical Society of America (2003-2004), and in the past 3 years has presented more than 100 public lectures at 80 institutions in North America, Europe, and Asia. He has been awarded 20 named lectureships at universities and institutions, including the Vision Lecture (George Mason), the Dibner and Senate of Scientists Lectures (Smithsonian Institution), the Sokol Lecture (Montclair State), the Baldwin Lecture (Miami



University, Ohio), the Bradley Lecture (Geological Society of Washington), the Elsasser Lectures (Johns Hopkins), the Charter Lecture (University of Georgia), the Capital Science Lecture (Carnegie Institution), and the Darwin Lecture (Northwestern University).

Hazen also appears frequently on TV and radio to discuss issues of scientific discovery and science education. In conjunction with the publication of *Science Matters*, Hazen appeared on NBC's *The Today Show*, CBS's *Nightwatch*, *NOVA* (WGBH-TV Boston), and numerous other national and local TV and radio programs. Recent appearances have included *Science Friday* (NPR), *The Diane Rehm Show* (NPR), *NOVA* (WGBH-TV Boston), *Sci-Fi Science* (Discovery Channel), *Book TV* (CSPAN-TV), *Origins* (National Geographic-TV), and national TV programs in the United Kingdom, Brazil, and Japan. In parallel to these outreach efforts, Hazen's research, teaching, and philanthropy have been featured in recent articles on his work in *The Baltimore Sun* (July 9, 2007), *The Mason Gazette* (March 2008), *Smithsonian Magazine* (October 2010), and *Applause* (May-June 2011).

In addition to his numerous efforts in outreach and education, Hazen is deeply committed to philanthropy. In 2007, he and his wife, Margaret, established the Robert and Margaret Hazen Foundation, which supports science, education, and the arts. All profits from Hazen's publications and lectures are redistributed through this philanthropic foundation. Hazen also donated his vast collection of trilobites (fossil arthropods from the Paleozoic Era) to the Smithsonian Institution. Many of the specimens collected by the Hazens in Europe, Africa, and North America have been used in ongoing investigations of the evolution of arthropod exoskeleton biochemistry. Approximately 100 specimens of the 2,000-piece collection are prominently displayed at the Museum, including 60 specimens in the new Hall of Ocean Life, which opened in November of 2008. An illustrated catalog of the collection is in preparation.

Finally, Robert and Margaret Hazen are loaning a substantial part of their collection of 19th-century American art for a 2012 University of Virginia exhibition. This collection of dramatic landscapes by Hudson River School painters explores the close connection that American artists of the 1850s and 1860s saw between their art and science—connections that reflect Hazen's personal philosophy of education, teaching, and life.

In summary, Robert Hazen's extraordinary contributions to teaching, discovery, knowledge integration, and service are inextricably linked and they reflect his deep commitment, in every facet of his life, to broadly interdisciplinary education and outreach.

IV. Personal Statement

Every day when I enter the classroom, or go to the lab, or sit on the concert stage, or travel as invited speaker to another university, I feel amazingly lucky, and I owe that good fortune to my teachers. From the time I was a mediocre 8th grader in northern New Jersey, to my first semester as a wide-eyed and uncertain MIT freshman majoring in earth science, to aspiring trumpeter at the New England Conservatory, to budding scientist as a graduate student at Harvard, a cast of gifted, dedicated, and inspiring teachers has pointed the way. I knew that somehow, someday, I wanted to be like them.

For a time, until shortly after my 40th birthday, high-pressure mineralogical research tempered by an active orchestra schedule at the Kennedy Center became my dual passions. In grad school, I helped to develop new tools for studying matter at deep-Earth conditions; several agencies and foundations, most notably the Carnegie Institution's Geophysical Laboratory in Washington, DC, gave me the chance to pursue that research. At the same time, thanks to a few successful auditions, I was playing as a regular alternate in all the big orchestras in town. Teaching and learning were always part of the laboratory life—I trained a steady stream of predocs and postdocs, even as I learned as much from them as they did from me, but something was missing.

Since I was a boy, I have loved science, perhaps the greatest of human adventures. I've long wanted to share my excitement with others. Margee, my wife and longtime collaborator, always encouraged my enthusiasms; my ever-curious children, Ben and Liz, reinforced my passion to engage young learners. But I was not affiliated with any great university, nor had I any class to teach.

My life changed in 1987-88, when I was given the opportunity to be part of one of the greatest scientific gold rushes of the 20th century. The discovery of high-temperature superconductors—magical materials that conduct electricity with no energy loss—electrified the physics world. I was given those first enigmatic samples and was tasked with learning what they are. I led a small team of postdocs and senior scientists in that adventure—work that received international attention and led to a popular book, *The Breakthrough*, which chronicled the intense months of discovery.

At the time, it became a cliché to say that “superconductors will change our lives.” Well, they certainly changed mine, but in an unexpected way. As a consequence of the book, I was nominated for a Robinson Professorship at George Mason University—a unique kind of teaching position that provides senior scholars with broad interests a chance to develop and teach new interdisciplinary undergraduate courses. In particular, I was invited to work side-by-side with master teacher and renowned physicist, James Trefil, to develop a new kind of interdisciplinary undergraduate science curriculum targeted for non-science majors. It was a dream come true, and I never looked back.

I have to confess that some of my research colleagues were skeptical of my choice. I was at the top of my research game and poised for new opportunities—new postdocs, international travel, big grants, and other honors. Why jeopardize all that to teach undergraduates, most of whom weren't going to join the scientific ranks, they asked? But I knew this was what I had to do—what my whole life was leading towards.

Jim Trefil and I developed a radically different, hotly-debated, and now widely-adopted undergraduate science curriculum that emphasizes the epistemological unity of all the branches of science and relies on the fact that all of the big issues of concern to non-scientists and scientists alike—health, environment, climate, resources, national security, innovation, and deep questions about the origins, meaning, and future of life—are inherently multi-disciplinary. The traditional way of teaching undergraduate science, with narrow courses in physics or chemistry or biology, often fails to serve our students (and by extension, our state and our nation) in the immediate and long-term needs of their personal and professional lives. Perhaps because I spent almost two decades in a laboratory that emphasized interdisciplinary studies, perhaps

because I had so many opportunities to tell fellow musicians about the joys of science, I was totally committed to developing and promoting the new integrated science curriculum.

The early 1990s, a time of questioning and education reform, was poised for such a logical and effective alternate approach. Our popular book, *Science Matters: Achieving Scientific Literacy*, became a national bestseller and served as a blueprint for change, from the influential *Project 2061* of the American Association for the Advancement of Science to the *National Science Education Standards*, of which Jim and I were among the co-authors. We followed with the first edition of our textbook, *The Sciences: An Integrated Approach* (now entering its 7th edition and used in approximately 200 colleges and universities). And, in the form of my “Great Professors” audio and video courses produced and distributed by The Teaching Company, this new concept for science education has now reached an international audience of more than 100,000 additional learners, from homeschoolers to retired seniors. The hundreds of letters I’ve received, inspired by those courses, are a constant source of inspiration and renewal.

Education policy is important, but teaching is the fun part. I love teaching “Great Ideas of Science;” every semester at George Mason University, I lead a section of the high-demand offering to 200 students. It’s amazingly satisfying, semester after semester, to watch so many initially science-phobic undergraduates become science enthusiasts. Equally fun has been the chance to develop interdisciplinary undergraduate courses that exemplify my philosophy of knowledge integration. I’m sure I’ve learned as much or more than my students while creating Honors seminars on “Symmetry in Art and Science,” “The Image of the Scientist in Popular Culture,” “Scientific Ethics,” and “The Literature of Astrobiology,” as well as “Visual Thinking” (developed jointly with members of the School of Art and the Psychology Department).

As I look back on two decades of teaching undergraduate non-science majors, the biggest surprise is how focusing on broadly interdisciplinary themes in science has produced powerful and transformative feedbacks to my own research. Teaching others led to an intense examination of my own research priorities and a realization that my efforts, however successful, were narrow and arcane. So I decided to shift my research focus to big questions of life’s origins and the co-evolution of the geosphere and biosphere. Strongly influenced by my Robinson Professor colleagues at Mason, Harold Morowitz and James Trefil, I persuaded a research team at the Carnegie Institution of Washington to engage in the fascinating field of astrobiology—the search for the origins, evolution, and distribution of life in the Cosmos. My origins of life research focuses on the varied roles of mineral surfaces in selecting, concentrating, protecting, and organizing biomolecules from the dilute prebiotic “soup.” My thesis, expounded in *Genesis: The Scientific Quest for Life’s Origins*, is that biogenesis occurred in a sequence of emergent steps, each of which is amenable to laboratory research. Furthermore, minerals played pivotal roles at several stages in this chemical evolution.

My formal training was in geology and mineralogy, but teaching integrated science to undergraduates has opened my eyes to a much wider and richer world of research possibilities, especially those integrating themes in biology, geology, physics, and chemistry. Most of my publications from the past 15 years reflect this multidisciplinary influence. Furthermore, thanks to new research programs at NASA, NSF, and private foundations, my expanded focus and new collaborations have led directly to more than \$31 million in new research funding since 1997. Most recently, in 2009, I was named Principal Investigator of the Deep Carbon Observatory, a 10-year interdisciplinary research program sponsored by the Alfred P. Sloan Foundation. This ambitious effort has aspirations of integrating the research of 2,000 biologists, chemists, geologists, and physicists from 60 countries, with a 10-year budget approaching \$1 billion.

All of these new opportunities stemmed directly from the extraordinary opportunity to teach undergraduates at George Mason University about the great ongoing human adventure of scientific discovery. My debt to the great teachers of my past is as yet unpaid, but I will continue to dedicate myself and to cherish the opportunities to pursue teaching, research, knowledge integration, and service for as long as I am able.

V. Abbreviated Curriculum Vitae - Robert Miller Hazen

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Education: 1971 B.S. and S.M., Earth Sciences, Massachusetts Institute of Technology
1975 Ph.D., Mineralogy & Crystallography, Harvard University

Positions: 1989- Clarence Robinson Professor of Earth Sciences, George Mason Univ.
1976- Senior Staff Scientist, Geophysical Laboratory, Carnegie Institution
2007- Research Associate in Paleobiology, Smithsonian Institution
2008- President, Robert & Margaret Hazen Foundation
1994-2007 President, Hazen Associates Ltd.
1967-2010 Professional Symphonic Trumpeter; numerous ensembles, including the National Symphony, the Royal Ballet, and the Metropolitan Opera

Selected Awards and Honors:

2011: Linnaeus Prize and Lecture, Uppsala, Sweden
2011: Elected Counselor, International Society for the Study of the Origins of Life
2009: Distinguished Public Service Medal, Mineralogical Society of America
2007-2008: Elected Chair, Gordon Research Conference on the Origin of Life
2003-2005: Elected President, Mineralogical Society of America
1998: Elizabeth Wood Science Writing Award, American Crystallographic Association
1996: Elected Fellow, American Association for the Advancement of Science (AAAS)
1992: Educational Press Association Award (for "Why my kids hate science," Newsweek)
1989: ASCAP Deems Taylor Award (for *The Music Men*, Smithsonian Press, 1988)
1986: The Ipatief Prize, American Chemical Society
1982: Mineralogical Society of America Award and Life Fellowship
1996-2011: More than 20 named lectureships, including Vision (GMU), Dibner and Senate of Scientists (Smithsonian), Carnegie and Capital Science (Carnegie Institution), Sokol (Montclair State), Pardee and Bradley (Geological Soc.), Baldwin (Miami Univ.), Reed (Ohio State), Elsasser (Johns Hopkins), Charter (Univ. Georgia), Darwin (Northwestern), Mineralogical Society, National Science Foundation, AAAS, and Sigma Xi.

Teaching Experience (1990-2011): Developed and taught 7 highly-rated interdisciplinary undergraduate courses, including "Great Ideas of Science" (with James Trefil), "Visual Thinking" (with Evans Mandes), "Scientific Ethics," "Literature of Astrobiology," "The Origins of Life," "Symmetry in Art and Science," and "Images of the Scientist in Popular Culture." In addition, Hazen has supervised the research projects of 40 young scientists, from high school students to postdoctoral fellows.

Selected Professional and Committee Service: Hazen has served on dozens of US and international committees for the National Research Council (Committee on K-12 Science Education and Executive Committee, 1995-2001; *National Science Education Standards*, writing team; Working Group on Teaching Evolution and coauthor *Teaching About Evolution and the Nature of Science*; writing team for *Evolution and Creationism*, 2004-2007; others); National Academy of Sciences, various education committees; National Science Foundation, Biosciences Directorate Advisory Board, 2009-; American Association for the Advancement of Science (Committee for the Public Understanding of Science, 2001-2008); Earth & Sky (NPR; Advisory Board), 1999-; NOVA (WGBH TV, Boston) Advisory Board, 1993-; advisor to state higher education boards in CT, ID, NY, NH, NC, TX, and WV; Advisory Board, *Encyclopedia Americana*, 1995-; National Philharmonic, Board of Directors, 2003-2011; Carnegie Council.

Selected Recent Grants:

2007-2013: "Chiral Adsorption on Mineral Surfaces," National Science Foundation	\$1,170,000
2007-2013: "The Deep Carbon Observatory," Alfred P. Sloan Foundation.	\$12,700,000
1998-2015: NASA Astrobiology Institute (Hazen and others PI)	\$16,055,000
2007-2010: "Biosphere's Roots in Deep Earth Geochemistry," Keck Foundation	\$1,200,000
1978-2002: "High-Pressure Crystal Chemistry," National Science Foundation	\$1,853,600

Selected Books (from 24 titles: 35 U.S. editions and numerous foreign language editions)

- Hazen RM (2012) *The Story of Earth*. NY: Viking, in press.
- Hazen RM & JS Trefil (2009) *Great Ideas of Science Reader*. San Diego: Cognella, 256 p.
- Hazen RM (2005) *Genesis: The Scientific Quest for Life's Origin*. DC: National Acad., 339 p.
- Trefil JS & RM Hazen (2004) *Physics Matters*. NY: Wiley, 691 p.
- Hazen RM (1999) *The Diamond Makers*. Cambridge: Cambridge University Press, 236 p.
- Hazen RM & M Singer (1997) *Why Aren't Black Holes Black*. NY: Doubleday.
- Trefil JS & RM Hazen (1995) *The Sciences: An Integrated Approach*. NY: Wiley, 634 p. Now entering its 7th edition, with numerous foreign language and special editions.
- Hazen RM (1993) *The New Alchemists*. NY: Doubleday, 286 p.
- Hazen MH & RM Hazen (1992) *Keepers of the Flame*. Princeton (NJ) Univ. Press, 281 p.
- Hazen RM & JS Trefil (1991) *Science Matters*. NY: Doubleday. (2nd edition, 2010)
- Hazen RM (1988) *Breakthrough: The Race for the Superconductor*. NY: Summit Books, 271 p.
- Hazen MH & RM Hazen (1987) *The Music Men*. Washington: Smithsonian, 225 p.
- Hazen RM & LW Finger (1982) *Comparative Crystal Chemistry*. London: Wiley, 231 p.

Video/Audio Courses (for The Teaching Company, Chantilly, Virginia)

- Hazen RM (2013) *The Origin and Evolution of Earth* (48 lectures; 24 hours)
- Hazen RM (2005) *The Origins of Life*. (24 lectures; 12 hours)
- Hazen RM (2004) *The Joy of Science* (60 lectures; 30 hours)
- Hazen RM (1999) *The Great Principles of Science*. (60 lectures; 30 hours)

Selected Recent Peer-Reviewed Articles and Book Chapters (of ~380 total)

- Hazen RM et al. (2012) Mercury (Hg) mineral evolution. *Am. Mineral.*, in review.
- Hazen RM et al. (2011) Opportunities in mineral evolution research. *Am. Mineral.* **96**:953-963.
- Hazen RM & JS Trefil (2010) Scientific literacy: A modest proposal. In J Meinwald & JG Hildebrand (Eds), *Science and the Educated American*. Cambridge, MA: AAAS, pp.57-69.
- Hazen RM (2010) How old is Earth, and how do we know? *Evolution: Educ. & Outr.* **3**:198-205.
- Hazen RM & N Eldredge (2010) Themes and variations in complex systems. *Elements* **6**:43-46.
- Hazen RM et al. (2009) Evolution of uranium minerals. *Am. Mineral.* **94**:1293-1311.
- Hazen RM et al. (2008) Mineral evolution. *Am. Mineral.* **93**:1693-1720.
- Hazen, RM et al. (2007) Functional information. *Proc. Nat. Acad. Sci.* **104**:8574-8581.
- Hazen RM (2006) Mineral surfaces and the prebiotic selection and organization of biomolecules (Presidential Address to the Mineralogical Society of America). *Am. Mineral.* **91**:1715-1729.
- Morowitz H, RM Hazen & JS Trefil (2005) Intelligent design has no place in the science curriculum. *Chron. Higher Ed.* **52**, #2 (September 2, 2005), B6-B8.
- Hazen RM & D Sholl (2004) Chiral selection on crystalline surfaces. *Nature Material* **2**:367-74.
- Sharma A, RM Hazen, et al. (2002) Microbial activity at gigapascal P. *Science* **295**:1514-1516.
- Hazen RM (2001) Life's rocky start. *Sci. Amer.* **284**:76-85. Also in *Best 2001 Science Writing*.
- Hazen RM, TR Filley & GA Goodfriend (2001) Selective adsorption of L- and D-amino acids on calcite: implications for biochemical homochirality. *Proc. Natl Acad. Sci.*, **98**:5487-5490.
- Cody GD, RM Hazen, et al. (2000) Primordial carbonylated Fe-S compounds and the synthesis of pyruvate. *Science* **289**:1337-1340.
- Brandes J, RM Hazen et al. (1998) Abiotic nitrogen reduction in early earth. *Nature* **395**:365-67.
- Hazen RM & H Yang (1997) Increased compressibility of pseudobrookite-type MgTi₂O₅ caused by cation disorder. *Science* **277**:1965-1967.

VI. Excerpts from Letters of Support

From National Science Leaders:

“Bob Hazen is an exceptional and wide-ranging scientist, whose research is world-class. He has had a remarkable role in knowledge integration through his articulation of “mineral evolution,” bringing an exciting new organizing principle to an established field. And his service to the scientific community at large is exceptional, most recently through his leadership of scientists around the world in connection with the Deep Carbon Observatory.” *Dr. Richard Meserve, President, Carnegie Institution and former Chairman, Nuclear Regulatory Commission*

“Robert Hazen epitomizes the scientist-citizen. In addition to his superb research, Dr. Hazen devotes great energy and skill to sharing science with the public and ensuring that there is a receptive audience for the products of science. He is a fine teacher and is very successful in making complex scientific advances understandable and meaningful to public audiences.” *Dr. Alan Leshner, Executive Director and CEO, American Assoc. for the Advancement of Science*

“Clarity of thought and presentation in scientific exposition are the hallmarks of Professor Robert Hazen’s lectures, whether they are in a classroom or large, public hall. They are also the hallmarks of his approach to scientific concepts, whether he is planning challenging laboratory experiments or introducing a broad and original synthesis, as in his recent innovative ideas concerning the evolution of Earth’s minerals. These are not common talents, and they make Hazen unique as a superb teacher to student, specialist, and layman alike.” *Dr. Maxine Singer, Senior Researcher, National Institutes of Health and former President, Carnegie Institution*

From George Mason University Faculty and Administrators:

“Congratulations on your strong annual performance. Your range of achievements and activities continues to be outstanding, and you have my warmest congratulations as well as appreciation.” *Dr. Peter N. Stearns, Provost, George Mason University. Excerpted from an unsolicited letter, May 12, 2011*

“Bob has been a major spokesman for scientific literacy and the public understanding of science through his books, his public lectures, and his co-authorship of a major textbook (*The Sciences: An Integrated Approach*). He is a master at synthesizing material from diverse areas of science and in presenting those syntheses to both scholarly and lay audiences. His work on the evolution of minerals, in particular, is an example of this kind of scientific integration at its best.” *Prof. James Trefil, Clarence Robinson Professor of Physics, George Mason University*

“Dr. Hazen has the talent, background, and perspective to present lectures on most areas of science in an engaging way. He has given outstanding lectures to diverse audiences: from his undergraduate classes to international scientific speaking tours. Dr. Hazen has always been involved in cutting-edge research, more recently in the areas of deep carbon and the origin of life.” *Prof. Richard Diecchio, Associate Dean for Science, George Mason University*

“I have known Robert M. Hazen for over twenty years. Hazen’s work in developing science teaching for the broad general public is of national significance. I have read much of this material and have attended several of his lectures. This represents teaching at its finest, true to the integrity of the material while making it understandable to the non-specialist. The second aspect I wish to comment on is his ability to integrate science across the disciplines. In particular, he has seen the relations between geochemistry and biogenesis, developing these into a coherent view of the biosphere as the fourth geosphere. In doing this, he has collaborated with scientists in a variety of specialties and gotten them to see the coherence of the material. This is a very special role, for which Hazen is to be commended.” *Prof. Harold J. Morowitz, Clarence J. Robinson Professor of Biology and Natural Philosophy, George Mason University*

From Professional Colleagues:

“Robert Hazen is one of the most prominent and successful scientists in the entire Earth and Planetary Sciences field and in the field of Astrobiology today. He is the founder of the new area of research entitled ‘Mineral Evolution,’ as well as being a leader in placing the long-standing

and controversial topic of 'Origin of Life' studies on a scholarly basis. Professor Hazen is engaged in intense outreach and educational activities, ranging from the careful and close mentoring of individual high school students, graduate students, and postdoctoral fellows, to radio broadcasts, interviews, lectures and books for the public. Throughout all of these activities, his passion for communicating the excitement and relevance of science shines through." *Prof. Dimitri Sverjensky, Department of Earth Sciences, Johns Hopkins University. Sverjensky is Robert Hazen's closest scientific collaborator.*

"Bob has had and continues to have an extraordinary career in the mineral sciences. He has worked tirelessly to promote scientific literacy in numerous monographs and articles. He has spearheaded a long-term dialog about national science education standards through major national TV, radio, and print media, and through lectures, seminars, and workshops at over one hundred colleges and universities across the country. Bob has been an articulate spokesperson in the creationism and intelligent design debates; he most recently helped write *Science, Evolution, and Creationism*, published by the National Academies. He continues to maintain a vibrant research program. An outgrowth of his recent research is summarized in his paper "Mineral Evolution," a synthesis for Earth history that also lays out a paradigm for an entirely new way of teaching mineralogy, and which currently is the most downloaded paper in the *American Mineralogist*. Most recently, Bob has embarked on a major 10-year international initiative to understand carbon in the deep earth, a project that is also aimed to enhance public understanding and has the potential for major societal impacts." *Dr. Russell J. Hemley, Director, Geophysical Laboratory [extracted from American Mineralogist v.95, p.666 (2010)]*

"Over a span of thirty years, I have had the good fortune to count Bob Hazen as one of my colleagues in the field of professional music performance, most often in orchestras in the Washington-metropolitan area. Bob has, on every occasion, demonstrated a complete command of the trumpet. More importantly, he understands how composers of every period, from J.S. Bach through our contemporary repertoire, use the trumpet—an easy statement to write, but extremely difficult to realize in performance, requiring a level of sympathetic insight that is all too rare even among world-class trumpeters." *Prof. Chris Gekker, Principal Trumpet of the National Philharmonic and Professor of Trumpet, University of Maryland School of Music*

From Former Students and Postdocs:

"You were one of the 'guiding lights' at a critical stage of my career. During my two years at the Geophysical Laboratory as postdoctoral research associate, you were an incredible mentor, providing support at all levels from selection of high-impact projects, teaching me new skills in high-pressure mineral physics, and expanding my knowledge base in the field of crystal chemistry. I especially remember your generosity of time, our broad-ranging scientific discussions and discoveries. You set a very high standard of excellence, one that I have tried to emulate in my career." *Prof. Nancy L. Ross, Associate Dean for Research, Graduate Studies and Outreach, College of Science, Virginia Tech*

"Bob Hazen was my postdoc advisor for 3 years until 1996. My postdoc experience was the best professional experience of my life, and I attribute this entirely to the relationship with Bob. He challenged me to follow my research interests and produce publications. He gave me the freedom to do whatever I wanted, and yet kept me focused on the important projects, ones that would have impact. If I went to his office, he always dropped whatever he was doing and gave me his attention. Now that I have my own research group, I realize how remarkable that was, and I make sure that I remember how he treated me when my students and postdocs knock on my door. Bob was all about motivation and the love of science. A fantastic combination! I once had an occasion to watch him teach one of his large general science classes at George Mason. He walked up and down the aisles, talking to the students in a way that looked like it was one-on-one. He didn't lecture so much as hold a conversation. The class was very high-energy, with ideas flowing back and forth. Hazen is an outstanding teacher, whether in the large classroom

or one-on-one, and I was the luckiest postdoc in the world.” *Prof. Robert T. Downs, Department of Geosciences, University of Arizona*

“I really do owe you a debt of thanks. Without you, I may have been another lost graduate. I may not be the best student, though I have tried to my potential. I hope to carry an excellent tradition into my years. Thanks again!” *Stephen Elmore, George Mason University Master’s degree recipient, from an unsolicited e-mail (April 10, 2010). Hazen became Elmore’s thesis adviser when his previous adviser left unexpectedly.*

“I have had the pleasure of working with Dr. Hazen for the past two years at George Mason University as teaching assistant for his class, ‘Great Ideas in Science.’ Throughout this time, Dr. Hazen has been very passionate about his classroom and teaching and has been an excellent mentor for me and other TAs. He is always helpful and available, offering good advice and suggestions. I always hear back from students that his is the best science class they have ever taken, this from a science class composed predominantly of non-science majors. I truly think that Dr. Hazen is one of the best professors I have encountered throughout my time in academia.” *Ms. Anne Hansen, Graduate Student in Ecology, George Mason University*

Excerpts from Unsolicited Letters: Robert Hazen’s lectures and writings have prompted hundreds of unsolicited letters. The following excerpts reflect the diversity of his outreach.

“I’m not in the habit of writing fan letters, but in this case, I feel compelled. As a science enrichment situation for my 15-year-old son, we just finished the last episode of the ‘Joy of Science’ lecture series you delivered for the Teaching Company. It took us 18 months to get through (one lecture most Sunday nights).” *Greg Fox, Chief Technology Officer (CTO), Northrup Grumman (November 18, 2004)*

“I am an emergency department physician in Lexington, KY. I have an approximately one-hour drive to the hospital I work at. I spend the time listening to tapes of your ‘Joy of Science’ course, and I can’t tell you how much I enjoy them. I have listened to each at least two times, some more.” *Mark Rukavina (March 19, 2006)*

“I have been reading your lecture series, ‘The Joy of Science,’ as a starting point for re-energizing my interest in physics and as a warm-up for returning to the classroom. As I approach the end of my military and federal service, I always pictured myself teaching physics, math, or chemistry later in life.” *Mark Schanuel (April 28, 2006)*

“I am the homeschooling parent of a 14-year-old who is very interested in studying earth science this fall. We used ‘The Joy of Science’ the last two years and felt that we learned an incredible amount. Thank you so much.” *Mary Lou Schillinger (July 29, 2009)*

“I am from a working class family in Pittsburg. I have watched your ‘Joy of Science’ lectures and am amazed at not only your incredible ability as a teacher, but also your wealth and breadth of knowledge and experience. You are an inspiration to anyone of any age.” *Michael Inouye, MD, Naval Medical Center, Portsmouth, VA (August 21, 2009)*

“I’m sure I am not the first poet to have been inspired by your book, ‘Genesis,’ but perhaps it will intrigue you to see how entropy and emergence have worked their way into a poem I’ve just written for the opening of our refurbished parish hall in the village in Northumberland, UK, where I live. Thanks for your excellent work.” *William Radice (January 21, 2010)*

“I wanted to thank you for your plug for mentors for women in the sciences [in your lecture series]. One of the reasons I am not in the sciences today is that I did not have proactive mentors in the 60s. Thank you for your encouragement of women.” *Betsy Glanville, Director of Doctoral Studies, Fuller Theological Seminary, Pasadena, CA (February 26, 2008)*

“I’m the facilitator of an inmate-guided education program here at our prison, whose purpose is to reduce the rate of recidivism through education. We are currently on your lecture series, ‘The Joy of Science.’ I just wanted to let you know that there is a group of men out there that you might not have expected who are benefiting greatly from your lecture series.” *Jesse Van Winkle, South Central Correctional Facility, Licking, MO (September 12, 2008)*

VII. Additional Documentation

Anonymous Student Feedback: The following are unsolicited comments extracted from anonymous student course evaluations. These remarks are typical of hundreds of positive comments from 20 years of evaluations.

“Professor Hazen is one of the best teachers I have ever had. He loves what he teaches, and it is obvious. He is a great, great teacher.” (2008)

“Opened my eyes to science and how important it is in our lives. Also re-taught and reminded me of concepts I enjoy. Excellent class! Excellent professor!” (2008)

“He is an engaging and dynamic teacher! His style of teaching makes it easy to learn. I have enjoyed taking this course and would recommend it to all undergraduates.” (2008)

“He loves what he teaches. His passion for the subject is contagious.” (2008)

“It’s a great course. Passion for the subject, respect for the students, fairness, eager to challenge the non-science student without discouraging them with too much detail (but in no way talking down to the students).” (2008)

“Prof. Hazen is the absolute best instructor I have ever had. He was very organized and explained everything beautifully. The iClicker was great, and I highly recommend future use of it.” (2009)

“I think Prof. Hazen is a great teacher. He is so excited about what he teaches and makes the class as lively as it can be. This is the best science class I’ve ever taken!” (2009)

“I very much enjoyed this class. Professor Hazen is an excellent instructor, and the material was absolutely fascinating.” (2009)

“The professor was really good, and he definitely made the course interesting. I love the visual aspect of the course (PowerPoint slides). Robert Hazen is a great professor.” (2010)

“Robert Hazen is the best instructor I have had so far at Mason.” (2010)

“This was my favorite class, ever! Loved every lecture, even the homework assignments were fun! More classes should be like this one.” (2010)

“Every aspect of this course is fabulous. This is a great experience attending this class.” (2010)

“The best science teacher I had in my entire life. He made me like science more than I can imagine.” (2010)

“The lectures and the way the professor was enthusiastic about the topic helped me retain the material better.” (2011)

“The material was very well explained. I walked away with a great understanding of the topics discussed.” (2011)

“I liked the class, because Prof. Hazen was a great instructor.” (2011)

“I think you do a great job making the material interesting. I usually don’t like science. Also you were so respectful and informative when discussing the Evolution/Creationism stuff. You’re really great at what you do.” (2011)

“One of the best professors I’ve had in all 4 years at Mason. It is amazing how organized he is and the amount of control he has over such a large class.” (2011)

“Professor Hazen is the most interesting man in the world.” (2011)

“He has so much real life experience. Since he knows what he’s talking about, it makes class much easier to understand. He knows how to get information across, and by using relevant examples, everyone gets the point.” (2011)

“I really enjoyed the subject matter and Prof. Hazen’s efforts on making science interesting. I even liked the assignments. They encouraged us to engage in school activities and events around us.” (2011)

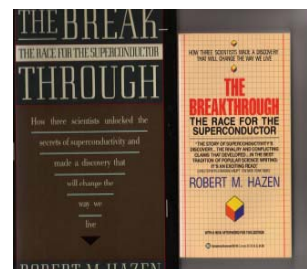
“Professor Hazen is an excellent professor, probably the best I’ve ever had. He did well in explicating tough material and a true passion for the sciences.” (2011)

“I loved this class and wouldn’t change anything.” (2011)

Published Book Reviews: The following excerpts are from published book reviews.

1. *The Breakthrough: The Race for the Superconductor* (Summit 1988; 8 foreign editions) describes the intense competition to discover superconductors that work at practical temperatures. *The Washington Post* Nonfiction Top 10 Bestsellers List.

“Hazen writes with wonderful clarity about science... *The Breakthrough* remains in the best tradition of popular science writing. It’s an exciting read that effortlessly teaches as it zips along.” *Christopher Lehmann-Haupt, The New York Times*



“A lively, pungent description of life in the laboratory... There are not many books about science that read so well.” *Philip J. Hiltz, The Washington Post*

“*The Breakthrough* is an enthralling account of leading-edge science being carried out at breakneck speed, leading up to a tense climax.” *Robert Matthews, The Times, London*

“Part diary, part cliffhanger, Hazen’s book brings home the thoroughly human side of science—the high-pitched emotion, clashing egos, and occasional betrayals. Deftly woven with scientific details, *The Breakthrough* is itself a kind of breakthrough.” *David Stipp, The Wall Street Journal*

“An exhilarating account of one of the most exciting technological developments of the century.” *Kirkus Reviews*

2. *Science Matters: Achieving Scientific Literacy* (Doubleday 1991) with James Trefil outlines a strategy for reforming science education and summarizes the great principles of science. The book rose to #6 on *The Washington Post* best-seller list, with more than 250,000 copies in print.

“For overall page-turning readability, *Science Matters* is as good as they get. Lucid and lively. Hazen and Trefil have a genius for picturing even formidably abstract ideas in concrete images.” *Curt Suplee, Washington Post*

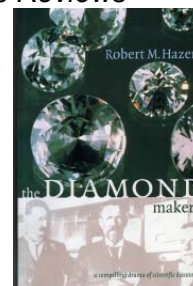
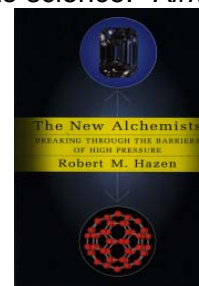


“Good, down-to-earth, we-can-explain-anything science teachers, the kind you wish you had but never did.” *The New York Times Book Review*

“A first-rate exposition—thorough, accessible, and entertaining—of the rudiments of scientific knowledge. Easily one of the finest single-volume introductions to science.” *Kirkus Reviews*

3. *The New Alchemists: Breaking Through the Barriers of High Pressure* (Times Books 1994; Cambridge 1999) is a historical review of efforts to synthesize diamonds.

“Hazen makes the story profoundly exciting, conveying the scientific passion of the researchers, himself included. It’s a gem.” *Curt Suplee, The Washington Post*



“Written in a style that has the drama and suspense of a murder mystery, yet it is true to the science. A thorough and exciting account of the history of diamonds.” *Physics Today*

“A brilliant exposition, very absorbing and gripping. I could not put the book down... Reads like a first-rate novel.” *A. Jayaraman, Science*.

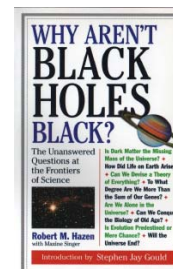
“Multifaceted and glittering with drama and wit.” *Kirkus Reviews*

4. *Why Aren't Black Holes Black: The Unanswered Questions at the Frontiers of Science* (Anchor, 1997), with Maxine Singer.

“For the non-technical layman, it is simply the best, liveliest, and most accessible broad summary of the hottest topics in science today.” *Curt Suplee, Washington Post, Book World*

“Very refreshing. A timely counterweight to the many things physicists don’t really understand.” *Michael Redhead, New York Times*

“A well-written popular account of the whole of science.” *Lewis Wolpert,*



Nature

"This exceptionally cogent introduction should well acquaint the curious with the foci of contemporary research." *Booklist*

5. *Genesis: The Scientific Quest for Life's Origins* (Joseph Henry Press, 2005) is a first-hand account of research on chemical evolution and the origin of life.

"Hazen's mesmerizing *Genesis* [is] an account of the exciting and often eccentric quest for answers to the great conundrum on the outermost frontier of the earth sciences...[a] delightful guided tour of the wild theories, daring experiments and raging feuds." *Andrew O'Hehir, Salon.com*

"[Hazen's] writing is clear and entertaining, giving a delightful look into his unpredictable experimental work without shying away from the complexity of the science." *Publishers Weekly*

"A lively insider account of the various ongoing scientific investigations into the origin of life... (An) evenhanded and compelling read." *Library Journal*

"Clear, direct, friendly, and occasionally philosophical or poetical, he makes an excellent guide through some difficult and arcane thickets of scientific inquiry." *David Loftus, California Literary Journal*

"Hazen has constructed a beautiful, interesting account of this research field, full of discoveries and tragedies, large and small... This is the best origins-of-life account that I have seen." *Jack Cohen, BBC Focus*

"This book provides the best overview of the origin of life field for the non-specialist reader that I have encountered. I think that even those who are familiar with most of its contents will enjoy the presentation." *Leslie Orgel, Scripps Institution, Nature*

"Wonderfully engaging. Among its other virtues, the book demonstrates comprehensively the vast gulf between real science and the creationist 'theory' of 'intelligent design.' A happily humanized overview of the current theories of how life on Earth arose." *The Guardian*

Additional Excerpts from Unsolicited "Fan" Letters:

"I recently purchased 'The Joy of Science,' because I have a 12-year-old daughter who inherited my inability to comprehend basic science concepts. The presentation makes the information accessible to someone not predisposed to science. This course has enabled me to impart some of the excitement to my daughter." *Theresa Hutchinson (April 18, 2008)*

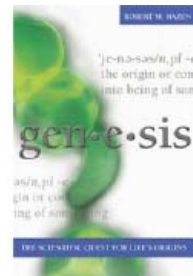
"Your audiotapes reignited my sense of wonder about science. Thanks for making science so comprehensible—my young children really enjoy listening to the tapes with me. Thanks for your contribution to the world!" *Patricia Neleski (September 4, 2005)*

"I decided to write simply to complement you on your skill as a lecturer and your ability to communicate your joy as a scientist. Thank you for stimulating my intellect." *Donald A. McAfee, Chief Scientific Coordinator, Cardiome Pharma Corp, Vancouver BC, Canada*

"For Christmas, my husband gave me the set of videos on 'The Joy of Science.' As soon as I am able to wrest it from his grip, maybe I can enjoy the lectures! I thank you for all the non-scientists around the English-speaking world who, unbeknownst to you, have had our lives touched and perhaps even changed considerably by contact with these marvelous lectures." *Karen Batres, Monterrey, Mexico (August 7, 2005)*

"I recently finished the 'The Joy of Science' lectures. Your genuine, almost giddy excitement about everything you discussed has profoundly affected me. I'm twenty-five, and since I was a teenager have been fascinated by science. I did not have a formal education available to me. You really have touched deeply somebody out there, and I thought you might like to know." *Jesse Giles, Houston, TX (April 30, 2004)*

"I have just completed your latest Teaching Company course, 'The Origins of Life.' As with 'The Joy of Science', I had a wonderful experience listening and learning. What provocative



information and theorizing! Your intellect, enthusiasm, application, and superb teaching style/delivery come through clearly yet again.” *W. Thomas “Tom” Landen, MD (March 23, 2006)*

“I just finished ‘The Joy of Science.’ I thoroughly enjoyed your overview of science. I think I came away with a better understanding of the many facets of science than I ever did as a college student. Congratulations on your fine work.” *Ivan Turpin, MD (January 7, 2007)*

“My mother was unable to attend college when she was young, but she has always been very interested in science. She watches [‘The Joy of Science’] nearly every day. Her short-term memory isn’t very good anymore, so she will often watch the same tape a number of times.” *Nancy Hellander Pung, Robbinsdale, MN (January 9, 2006)*

“I enjoyed your series ‘Origins of Life’ very much. I think it was by far the best exposition of this important topic I’ve ever encountered.” *James Buzonik (October 3, 2006)*

“THANK YOU for your remarkable ability to teach! After many years of feeling scientifically incompetent, I now know that will change.” *David Porter, Kansas City, MO (September 29, 2007)*

“I wrote earlier about how much I enjoyed the ‘Joy of Science’ series. I’ve become so enthralled with science that I’ve applied and been accepted at Millsaps College here in Jackson, MS, to complete coursework for a BS in science.” *Reeves Jones (April 3, 2008)*

“I want to let you know how much I enjoyed ‘The Joy of Science’ and your remarkable skill as a teacher. I am currently going through the course for the fifth time and find that I retain more each time. I am a retired physician (University of Iowa—1958); I am learning strictly for the joy of learning, and you have certainly made this a joyful task.” *Don Limesand (January 16, 2010)*

“On behalf of the Brookings Institution and the many federal agencies participating in our Science and Technology Policy Issues seminar, I want to thank you. You clearly resonated with the audience; they loved you.” *Peter Schoettle, Brookings Institution (July 7, 2011)*

“Wow! Tour de force. Sensational. Colossal. C.B. DeMille. Better than a cast of thousands! I am describing my opinion about ‘Joy of Science.’ The whole series was so good, I cancelled a couple of evening events so I could watch more, sooner. Bravissimo!” *Stephen Case, New York, NY (June 7, 2010)*

“I’m having a blast working through your lecture series on ‘Origins of Life.’ Your lectures are probably the best I’ve come across.” *Andrew Perash, Fairfax City, VA (November 4, 2008)*

“I write to complement you on your skill as a lecturer and your ability to communicate your joy as a scientist to a faceless audience. Thank you for stimulating my intellect.” *Donald A. McAfee, Chief Scientific Coordinator, Cardiome Pharma Corp, Vancouver BC, Canada (December 13, 2008)*

“I just wanted to let you know how much I enjoyed your course. A dyed-in-the-wool liberal arts major at Princeton and now public interest lawyer in Maryland who represents children with disabilities, I made it into my 40s with very little scientific literacy. Your passion for science is inspiring.” *Leslie Seid Margolis, Managing Attorney, Maryland Disability Law Center*

“I just wanted to let you know how inspiring you are in ‘The Joy of Science’. I’m one of those musicians/music teachers who is reviewing and trying to learn more about science. Keep up the good work!” *Marsha S. Harris, Burke, VA (Jan. 24, 2005)*

“I wanted to thank you so much for ‘The Joy of Science.’ A couple of years ago, my singer and I...decided to start trying to read 50 books a year. Your ‘Joy of Science’ was a huge stepping stone for me.” *Brian Sandau, Calgary, Canada (January 1, 2009)*

“I am a high school science teacher in California. I have listened to ‘The Joy of Science’ and have found it to be an incredible inspiration for me personally. I want to thank you [for approaching] science in such broad strokes while still remembering the importance of details. It is a personally influential body of work.” *Robert Vanderschraal, California (June 8, 2009)*

“I am a retired emeritus professor in biology. I wanted you to know how much I enjoyed your [lectures], not only the depth, but your down-to-earth presentations for a lay audience.” *George M. Krise, Ph.D., Bryan, TX (July 26, 2006)*