Gerald Holton Bio

Gerald Holton is an American physicist, historian of science, and educator, whose professional interests also include philosophy of science and the fostering of careers of young men and women. He is Mallinckrodt Professor of Physics and Professor of History of Science, Em, at Harvard University. His contributions range from physical science and its history to their professional and public understanding, from studies on gender problems and ethics in science careers to those on the role of immigrants. These have been acknowledged by an unusually wide spectrum of appointments and honors, from physics to initiatives in education and other national, societal issues, to contributions for which he was selected, as the first scientist, to give the tenth annual Jefferson Lecture that the National Endowment for the Humanities describes as, “the highest honor the federal government confers for distinguished achievement in the humanities.” However, his life story is also punctuated by improbable rescues during the dark time of the 20th century.

EARLY LIFE AND EDUCATION

Holton was born on May 23, 1922 in Berlin, when Germany was in turmoil and sliding toward disaster. In June, the Foreign Minister, Walter Rathenau, was one of the more than 350 politicians and intellectuals assassinated by fascist gangs that already commanded the streets. Albert Einstein was told he was next on the list, so he fled the country.

Holton's parents were Austrians: Emanuel, an Attorney-at-Law specializing in International Law, and Regina, a physiotherapist. Forced by the rise of fascism in Germany, and one physical attack on the young family, they returned early to Vienna. Growing up in Vienna, Holton received his education through most of the Humanistische Gymnasium. Family life was typically that of professionals enamored of Germanic Kultur; indeed, his parents had met first in a Poetry Club.

But in 1938, the annexation of Austria by Germany made life for Jews there also life-threatening, as was widely understood after the nation-wide Pogrom of November 8-9. Yet, soon thereafter he and his younger brother, Edgar, were luckily granted a place on the British Quakers' Kindertransport, to flee to England. There, Holton studied at the School of Technology, City of Oxford, receiving the Certificate of Electrical Engineering in June 1940. At that point, he was able to leave for America with his luckily rejoined family, just days before having to report for incarceration for the duration, as was required for all male adult German refugees, by Prime Minister Churchill’s directive.

---

1 Holton, Gerald J. "United States Public Records Inde". See also: http://holton.physics.harvard.edu/
3 Holton, Gerald J. "United States Public Records Inde".
6 http://www.kindertransport.org/
Shortly after arriving in the U.S., out of the blue, Wesleyan University in Middletown, CT offered Holton a place as a refugee from Europe (as many American Colleges and University did similarly⁷). At Wesleyan, studying under his mentor, Professor Walter G. Cady, he received a B.A. in 1941 and an M.A. in 1942. From the outbreak of the war he found himself officially among the “Enemy Aliens”, as marked by President Roosevelt’s directive for all holders of German passports. Yet, he was asked to join the Harvard-based war-time research unit, the Electric-Acoustic Laboratory, OSRD, and also was Teaching Assistant on the staff to train Naval Officers in the use and repair of Radar equipment.

Upon the end of WWII, he enrolled as a graduate student at Harvard. In 1947 he received his Ph.D. for research on the structure of matter at high pressure, as a student under Professor Percy Williams Bridgman, who in 1946 was awarded the Nobel Prize in Physics for his remarkable research in the field he effectively founded. Upon Holton's graduation he was asked to remain at Harvard as Instructor in the Physics Department. His academic professional life had begun, and his association with Harvard has lasted for over 70 years. So has also his marriage to Nina, a sculptor.⁸ They have two sons, Thomas and Stephan.

CAREER

Holton went through various faculty ranks at Harvard, starting in 1947, and was tenured in 1952 at age 30. For 30 years, starting from his thesis, he ran a high-pressure laboratory, specializing on the structure of liquids, and having the usual flow-through of research students and publications.

Among the courses he taught in the Physics Department was an unusual one – an introduction to Physics seen as part of a cultural tapestry that included astronomy, chemistry and technology as well as history and philosophy of science. It resulted in his publication of his first book, *Introduction to Concepts and Theories of Physical Science* (Addison Wesley: 1952, and later editions and adaptations), which has been called a seminal work. Its approach and structure was later incorporated in the National Curriculum Project requested by the NSF, called *The Project Physics Course*⁹. He headed it with colleagues F. James Rutherford and Fletcher Watson. It was also adapted in a number of foreign countries.

In these, as in Holton’s other educational opportunities, he has been guided by the advice of Alfred North Whitehead, that “In the conditions of modern life, the rule is absolute, the race which does not value trained intelligence is doomed”. As well, he is based on his firm belief that in education a multi-cultural approach is necessary, both to help immunize against the seduction of narrowness, and to obey the moral imperative to foster a liberal education. For the same

---


reason, Holton wrote extensively against the destructive excesses of Structuralists and Postmodernists in their writings against science.\(^{10}\)

Holton's service at Harvard included chairmanship of the Concentration on Physics and Chemistry, of the initial General Education Course, membership on the Faculty Council, and on the Advisory Board of the Radcliffe Institute for Independent Study. From 1976 to 1982 he was concurrently Visiting Professor at the Massachusetts Institute of Technology, as a founding faculty member of the Program on Science, Technology and Society. At various times he was visiting professor (or similar title) at the Institute for Advanced Study at Princeton; New York University; Leningrad University; Imperial College, London; University of Rome; CNRS-Paris; and invited lecturer in China and Japan.

Here it is appropriate to mention two of Holton's other educational efforts. In 1956, having been elected as Fellow of the American Academy of Arts and Sciences\(^1\), he was asked to be its Editor. For a couple of years before, the Academy had been publishing an experimental, annual, in-house volume called *Daedalus*, distributed to its members. But Holton realized the opportunity to change *Daedalus* to a publicly, widely available, quarterly journal. As he put it in his first issue (Winter 1958)\(^{12}\), the new journal aimed "to give the intellectual community a strong voice of its own", and to lift each of us above our individual cell in the labyrinth, so as "to see the entire structure".

In addition for the journal serving as a sort of Adult Education, several issues looked ahead at problems that were coming over the horizon and had an effect on public policy--such as those on "Arms Control and Disarmament" (Fall 1960), on "The Woman in America" (Spring 1964), on African Americans (Fall 1965, with a Foreword by President L.B Johnson), and on "Ethical Aspects of Experimentation with Human Subjects" (Spring 1969).

In 1955, another unexpected event occurred, one which caused Holton to make an important turn in his studies. When Albert Einstein died on April 18, 1955, Professor Philipp Frank, Holton's colleague in the Physics Department and proponent of the American continuation of the *Vienna Circle* philosophy\(^13\), suggested that a memorial occasion should be arranged, and that as one part Holton should present the history of Einstein's achievements. But Holton found that apart from Einstein's own essays there was then still little solid scholarship on this topic.

With Professor Frank's recommendation, Holton went to the Institute of Advanced Study, where Einstein's enormous and largely unstudied correspondence and manuscripts were kept, still under the supervision of Einstein's long-time secretary, Helen Dukas\(^14\). This excursion resulted in Holton, on and off for two years, helping to make the haphazard collection into an Archive

---


\(^{11}\) *Book of Members, 1780–2010: Chapter H*. American Academy of Arts and Sciences.

\(^{12}\) Later issued also as a book - *Science and the Modern Mind*. (Boston: Beacon Press), 1958 - as were most of his issues.


usable by scholars, while he, reading through the collection, was learning from it how to see its historical value. Over the years that followed, Holton's researches on Einstein have occupied a large part of his publications. Eventually, this initiative helped launch an academic industry, analogous to the ones concerned with Newton and Darwin. But as the scholar in this field, Tesu Hiroshige, wrote, someone had to take a "first step".

While studying the rich contents of Einstein’s collection, Holton came to realize a fact that led to a new and fruitful part of his researches on this and other scientists. As shown in Einstein’s work, Einstein brilliantly but silently drew again and again from a set of fundamental guiding concepts that were neither verifiable nor falsifiable. These concepts included, in his theory construction, the primacy of the search for unity; invariance; formal rather than materialistic explanation; logical parsimony; symmetry; the continuum, causality, and completeness. In addition, their contraries held by other scientists, such as acausality and uncertainty, were strongly opposed.

Holton called all such motivating concepts Themata (sing. Thema). He found these crucial, style-defining and differing thematic sets to be also at the core of research of many other scientists, from antiquity to Johann Kepler to Niels Bohr. This insight was later used as well by other historians of science, and by scholars in other fields. His findings led Holton to the publication of his book, The Thematic Origins of Scientific Thought (Harvard University Press, 1973, revised edition 1988).

Different sets of themata were and are being held by individual scientist so inclined, as their subjects advanced over time. In that respect, this concept differs profoundly from the idea of a series of incommensurable, non-progressive, so-called “paradigms”. Each of those, in turn, was said to infect the whole social group of scientists at a given time and in the same way—as is disproved even by the famous mutual oppositions between contemporaries such as Einstein, Schroedinger, and Heisenberg.

Occasionally, a public issue became so important that Holton felt he could contribute to its deeper understanding and amelioration. One of these was the general realization that among working scientists in most fields, women were underrepresented and often not sufficiently valued. Therefore, with his colleague Dr. Gerhard Sonnert, a sociologist of science, he initiated a long-term research effort, called Project Access. It yielded two books, Who Succeeds in Science?: The Gender Dimension (Rutgers University Press, 1995), and Gender Differences in Science Careers: The Project Access Study (Rutgers University Press, 1995, with a Foreword by Robert K. Merton).

---


16 Holton, The Advancement of Science, xvi.


A second occasion for engaging in a thorough study arose when it became of general interest to explore what immigrants can bring to the betterment of society in the U.S.A. Dr. Sonnert and Holton committed to a several-years study, called Second Wave, to determine, by questionnaires and face-to-face interviews, what was achieved by a particular group-- immigrants who had come as children to the U.S.A. as refugees from Nazi persecution-- compared to American-borns. The startling results were published by them in a book, What Happened to the Children Who Fled Nazi Persecution (Palgrave Macmillan, 2006, with a Preface by Bernard Bailyn; German translation, Was geschah mit den Kindern, Lit Verlag, Muenster, 2008). Noting that the findings in that book appeared to have applications for immigrants to the U.S. in our time, Dr. Sonnert and Holton published another book, Helping Young Refugees and Immigrants Succeed (Palgrave Macmillan, 2010).

Holton's researches in the history and philosophy of science as well as in education were published in a number of works, most of them available online and many of them translated into other languages. They include:


A selection of Holton's books and essays can be downloaded on DASH (Digital Access to Scholarship at Harvard). Among the essays are those in which Holton called for the wider adoption of what he called Jeffersonian Research—one with the double purpose of serving both basic investigation and the needs of society, as Thomas Jefferson had done repeatedly.

Holton also engaged in considerable editorial work apart from *Daedalus.* It included, as General Editor, the series of books on history of science by the Arno Press, and another, called *Classics of Science,* by Dover Publications, Inc. He also served for some years, from its beginning, on the Editorial Advisory Board and Editorial Committee of *The Collected Papers of Albert Einstein* (Princeton University Press, 1987 ff.). In 1972 he founded the *Newsletter on Science, Technology, and Human Values,* known since 1976 as the journal *Science, Technology and Human Values.*

While his professional memberships are collected below, one such service required a great deal of time and energy: the Presidency of the History of Science Society (1983-1984), after two years as Vice President. This Society, founded by George Sarton, was highly distinguished in its essential mission; but he found on election that a great deal of work, managerially and financially, had to be done.19

PROFESSIONAL MEMBERSHIPS, FELLOWSHIPS AND OTHER HONORS

*PROFESSIONAL EXPERIENCE:*


---


COMMISSIONS and TRUSTEESHIPS:


AWARDS:


Updated March 2018.