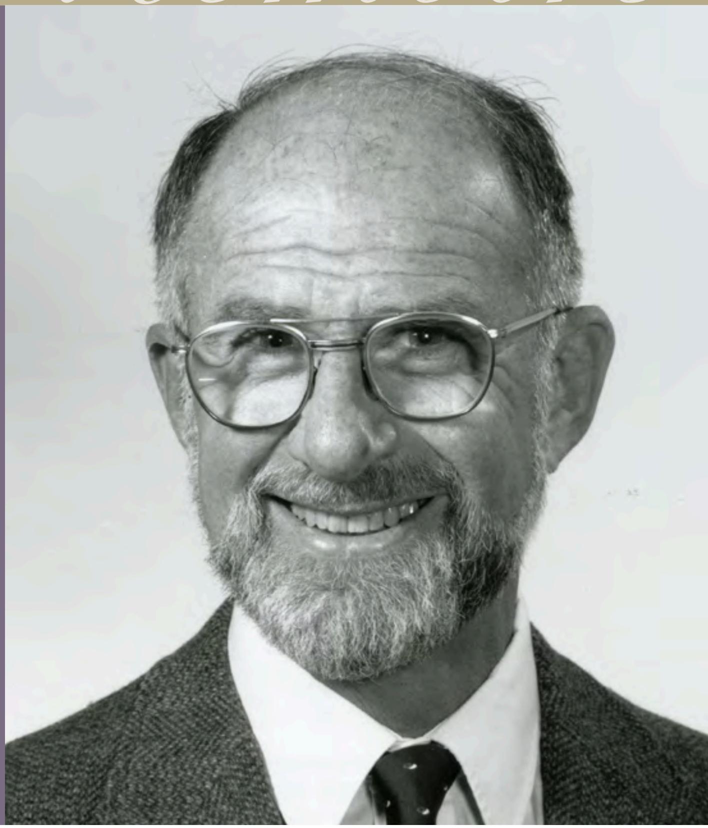
Andrew M. Sessler

1928–2014

BIOGRAPHICAL *Memoirs*



A Biographical Memoir by
E. J. N. Wilson

NATIONAL ACADEMY OF SCIENCES

ANDREW MARIENHOFF **SESSLER**

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Elected to the NAS, 1990

By E. J. N. Wilson

Andrew M. Sessler was internationally known for his many contributions to accelerator and particle-beam physics. Indeed, there is hardly a topic in the field of accelerator beams to which he did not made a seminal contribution. Without the base of beam physics knowledge he established, the storage rings, high-energy colliders, and synchrotron light sources vital to so many scientific discoveries, would not have been possible.

Sessler was an outstanding leader of the U.S. physical science research community and helped usher in a new era of inquiry into energy and the environment. He was instrumental in building the research agendas of the Atomic Energy Commission, the Energy Research and Development Administration, and the Department of Energy. In particular, he was recognized for outstanding leadership in transforming the energy research landscape toward sustainable energy and global environmental protection.

Sessler was notable for his leadership not only in science per se. He tirelessly pushed for freedom of scientific inquiry and the betterment of humankind, and he was an advocate for scientists' rights worldwide. He was particularly proud of the role he played in arms control and especially in emphasizing the futility of antimissile defense.

Early Years

Virtually all who met Andy Sessler were struck not only by his scientific skills but also by his ability to convey enthusiasm to his colleagues. He himself was fortunate to have had excellent teachers in his elementary- and high-school years who gave him early opportunities in science communication. For example, when he only 10 years old, Andy instructed his class with "lectures" aided by apparatus brought home by his father—a high-school science teacher. At this tender age he already had dreams of becoming a scientist.

Like many youngsters, Andy at first had to be convinced of the importance of working hard on subjects he considered dull, simply to obtain the grades necessary to move on to better schools. His first lesson came when he failed to achieve the standard for a special science high school. He reacted by teaching himself algebra, thereby obtaining admission to the special school; but he then attended the local Forest Hills High School, which was coed and closer to home.

There Andy was fortunate enough to be taken under the wing of Dr. Paul Brandwein, who inspired him to work during his free periods and before and after school on preparing demonstrations for the class. Teacher and student alike considered the associated sample gathering, laboratory efforts, and report writing—the stuff of science—wonderful training for a young person interested in science. Andy described his debt to Brandwein as too great to ever be repaid, not that this remarkable teacher ever expected a reward other than helping students succeed. Brandwein's masterful but light and subtle touch spurred Andy to higher achievement—an object lesson in what true mentoring and teaching is all about. Andy, perhaps unconsciously, learned to practice these same skills throughout his professional life.

A score of kids under Brandwein's tutelage became a social group, and though too young to go on dates they had parties and spent time together learning social as well as scientific skills. This combination of skills was later to distinguish Andy as someone who could entertain, engage, and motivate his audience.

The 16-year old Andy, armed with a Westinghouse Award (the first for Forest Hills High School) and what he later described as an advanced understanding of the makings of scientific research, gained early entry to Harvard University. He initially intended to major in biology, but finding his first course in botany uninspiring he turned to mathematics, for which his honors thesis advisor was George Mackey. Andy later recounted:

> *As a thesis topic, Mackey suggested developing Banach spaces. Now [although] Banach, and others, had done all that, I was not to look at the literature but do it myself. Every week, we had a formal session [in which Mackey] would look at the theorems I had proved and the progress I had made. And, if I was stuck, Mackey would give me a hint. It was, for me, an exceptional education in research at a very early age.*

Mackey was sparing in his praise, however, and in the absence of any encouraging words, Andy mistakenly gathered that he wasn't very good at mathematics. So when he graduated, he switched fields from mathematics to physics. Years later, Andy met Mackey at a National Academy of Sciences meeting and remarked that he, Andy, had done well in physics and it was good that Mackey had made it clear that he shouldn't remain in mathematics. Mackey replied, "But you were one of the best students I ever had." Andy claimed that if Mackey had conveyed that to him at the time, he would not have become a physicist. Still, he found that his solid mathematics background was excellent for his chosen profession—as Andy always found the math part easy, he could focus on the physics.

For his graduate studies, Andy chose Columbia University's physics department, which in those days was a special experience, as the faculty and the graduate students were exceptional and the research first-rate. At Columbia he took courses taught by Nobel Prize winners Isidore Isaac Rabi and Hideki Yukawa, as well as by Polycarp Kusch, Charles Townes, Tsung-Dao Lee, James Rainwater, and Willis Lamb, all of whom were later to become Nobel Prize winners themselves. And among Andy's fellow graduate students, five went on to win Nobel Prizes (Leon Lederman, Melvin Schwartz, Martin Perl, Val Fitch, and Leon Cooper) and many of the others had excellent physics careers.

Andy vividly remembered the most curious manner by which the introduction to his doctoral research came about. One day, en route to the physics building's library on the eighth floor, he had to pass the office of Rabi, who was standing at its door and invited Andy to come in. Rabi explained that in his old age he couldn't read the numbers on the slide rule so well, and asked Andy to please help him. They thus spent the afternoon doing computations—Rabi would call out "Raise 57 to the third power," for example, and Andy would call out the answer. The next day, the very same thing happened. At that point Andy asked Rabi what he was doing, and the grand old man explained the problem he was working on: to theoretically determine q, the electric field gradient at the nucleus of a complicated atom, in order to determine the nucleus quadrupole moment, Q. The experiments measured only the product, qQ, and because an outer electron polarized the core, it was not trivial to determine q. Soon, Andy was doing complicated quantum mechanics perturbation theory calculations himself.

The first day he had some results Andy came to Rabi with great enthusiasm to show him the work. Rabi never even looked at it; he only wanted to know what the result meant. Andy later reflected:

> *I had no idea [what it meant. But] I realized that Rabi's method of doing physics required understanding at each line of what one was doing. I have*

adopted that method and used it throughout [my] life. That is in marked contrast with some of my colleagues, who can simply do formal calculations for pages and pages. On another occasion I came in with clouds of mathematics (remember I had been a math major), out of which popped a hairy formula. Rabi didn't want to even look at the calculation. He asked, 'Explain it in words.' What I learned was that [Rabi] had tremendous insight into atomic physics. It was as if he had spent his life inside an atom. He would say that an electron just can't do that, and he would be right. Through the years I have tried to develop just such insight, call it intuition, in the field I have primarily worked in—particle beam physics. Those years at Columbia shaped my life, and I think most of my fellow graduate students would say the same thing. I left Columbia able to be comfortable, in future years, in teaching quantum mechanics, nuclear physics, statistical mechanics, and field theory; and able to do research in elementary particles, atomic structure, liquid helium, plasmas, lasers, and particle beams. I could see the different approaches to physics and why they all were, in their way, successful. What a wonderful education!

Scientific Research: Mostly Accelerators and Storage Rings

Sessler's physics career was long and illustrious. Over more than 50 years he was responsible for many crucial advances in his chosen field of accelerators that stand out as innovations that have driven the field. They include the development of storage rings, a deeper understanding of collective phenomena, and the design of linear colliders, muon colliders, and free electron lasers. Sessler was an essential contributor at the start of all of these advances, energetically participating in the workshops and study groups that formed around each new concept, sustaining the enthusiasm of all, and focusing their attention on the eventual aim of their work. He never retired, and even in his last months he was involved in research on improving the performance of free electron lasers (by modifying the noise in the drive beam) and on developing fixed-field superconducting gantries for beam delivery in the treatment of cancer.

Early in his career, at a time when the world had a need for electron storage rings and colliding beam accelerators, Sessler played a principal role in establishing their practicality. He developed the theory of radio-frequency (RF) interactions with beams, which allowed the creation of intense beams, and he created the tools to analyze instabilities that limited high-current beams. He then applied these advances to the design of specifications that enabled storage rings and colliders to reach high luminosities.

These efforts began when Sessler joined the Midwestern Universities Research Association (MURA) in 1957 to work on RF theory with Keith Symon and Donald Kerst, who had already set out to make a collider using the recently invented FFAG (fixed field alternating gradient) principle (Kerst et al. 1956). Sessler and Symon developed a Hamiltonian to describe acceleration and study how one could build up intense beams that would last a long time in such a storage ring (Symon and Sessler 1956). A computer program based on this Hamiltonian approach enabled them to invent and model methods of phase displacement, stacking and gutter acceleration, and even stochastics. This important work was to become the basis of the first hadron collider—the Intersecting Storage Rings—at CERN (European Center for Nuclear Research), and of all colliders since.

In 1959, Sessler went on to study dynamical instabilities. From his explorations, with Carl Nielsen and Symon, of the negative mass instability emerged the first realization that particle beams could have dynamical instabilities due to their space charge. The researchers invoked Landau damping as a cure for these instabilities, and they developed techniques that have been used to study the other kinds of instabilities discovered since (Nielsen, Sessler, and Symon 1959).

Sessler's next contribution was a study, with Kelvin Neil and Jackson Laslett, of the resistive wall. The Stanford rings had an instability and Neil (at Livermore) and Sessler (in Berkeley) became interested and worked in turn at each other's home institutions for periods of one to two years. They came to wall resistance as the avenue out of desperation (having eliminated, one by one, all other effects).

In subsequent studies with Ernest Courant, Sessler became interested in single bunches rather than a continuous beam, and he realized that wall resistance is only one aspect of the general concept of impedance—later to be developed with Vittorio Vaccaro (Laslett, Neil, and Sessler 1965; Courant and Sessler 1966; Sessler and Vaccaro 1967). Sessler had a high opinion of Vaccaro, whose ideas had not been so well received at CERN. Nowadays, however, everyone uses their work to calculate, measure, and control impedance in order to limit instabilities.

Sessler's insights advanced the beam intensity and luminosity performance of circular machines, which were to make possible the critical experimental discoveries that led to the Standard Model of particle physics in the last century—and now, already in the 21st century, to the discovery of the Higgs boson as the origin of mass. These same tools enabled the development of the high-current, low-emittance electron storage rings presently in use at leading electron synchrotrons throughout the world. These synchrotrons form the backbone of advances in materials science, chemical spectroscopy, and protein structure analysis that benefit the high technology, sustainable energy, and biomedical industries. In 1970, Sessler was awarded the Ernest Orlando Lawrence Award for his numerous accelerator-science advances.

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Because of MURA, he spent a year at the University of Illinois just when the BCS theory of superconductivity (proposed by John Bardeen, Leon Neil Cooper, and John Robert Schrieffer) happened to come on the scene. Sessler had the idea that BCS theory could also be applied to strongly interacting systems. He pursued this objective, together with Bob Mills, Leon Copper, and Vic Emery, and made numerical predictions for helium-3 to become superfluid (Cooper, Mills, and Sessler 1959; Emery and Sessler 1960). Another group (led by Phil Anderson at Princeton University), working independently, made the same prediction at about the same time. Much experimental work ensued, and some 15 years later superfluid helium-3 was seen at Cornell University and Nobel Prizes went to the three experimentalists.

Gordon Baym spent a year at UC, Berkeley, and he and Sessler applied quantum electrodynamics perturbation theory to many-body quantum systems (such as atoms or molecules). As a result, they derived a Feynman diagram and a simple perturbation theory that is still in use (Baym and Sessler 1963).

In the late 1960s, V. I. Veksler's idea of accelerating protons within electron rings (the "smokatron") became a major program at a number of labs, as it seemed to offer a compact way to produce energetic beams. Sessler worked with Denis Keefe, who led the activity at Lawrence Berkeley National Laboratory (LBL) and later with Laslett, Dieter

Mohl, and Claudio Pellegrini (Keefe et al. 1969; Pellegrini and Sessler 1970; Mohl, Laslett, and Sessler 1973). Sessler's presentation of the LBL work when he came to CERN was typically lively and enthusiastic. It greatly impressed John Adams, who set up a study on this option, fearing it might prove to be a rival to Adams's more conventional design of the SPS (300 GeV Accelerator). Sadly, experimental attempts to make a controlled collective accelerator came to naught, as the high gradients desired were not attained. But in the last few years of his life Sessler became convinced that this idea should be revisited "now that we know much more."

In the 1980s, Sessler contributed to the development of high-intensity free electron lasers (FELs), codirecting the pioneering FEL experiments at LBL. Notable among Sessler's many contributions to the development of the microwave FEL include a well-known experiment that demonstrated a tapered amplifier and was the first step toward X-ray FELs (T. Orzechowski et al. 1986). From 1982, Sessler, together with Donald Hopkins and Glen Westenskow (Sessler 1982), was a prime mover in experiments demonstrating high-efficiency and high-power FEL operation at gigahertz frequencies. He also proposed beam conditioning with David Whittum and L.-H. Yu (Sessler, Whittum, and Yu 1992), an idea that was picked up by a number of groups; though not yet in a convenient form at the time, this process improved FELs' efficiency. Another contribution vital to X-ray FELs was optical guiding, which Sessler developed with Jonathan Wurtele and Ted Sharlemann (Sharlemann, Sessler, and Wurtele 1985).

All this work became critical for the successful operation of FELs and ultimately contributed to the recent establishment of new FEL research facilities in the United States and Europe. These new FELs have, among other things, revolutionized how synchrotron radiation may be used to investigate the molecules that translate the genetic code to control our bodies.

For advanced colliders of the future, Sessler pioneered the development of the two-beam electron accelerator, now central to the CERN linear collider scheme for multi-TeV electron-positron collider physics. More recently, he advanced our understanding of muon storage rings, and he was spokesperson of the U.S. Neutrino Factory and the Muon Collider Collaboration during some crucial years. He was also engaged in the application of accelerators to medicine, including the design of ion beam machines for the treatment of cancer.

Sessler made contributions as well to other fields of physics: atomic physics, nuclear physics, plasma physics, planetary science, and medical physics—including anesthesiology (in collaboration with his son Daniel, an anesthesiologist).

In 1990, together with John Dawson, Sessler showed that moving fronts of plasma could up-shift light shining on the plasma (Joshi et al. 1990). He also developed the idea of an adiabatic focuser, with Pisin Chen and Simon Yu (Chen et al. 1990), which was a way to get around the Oide limit and is used in the final focus of heavy-ion inertial fusion. And from 1994 onward, he studied crystalline beams with Jie Wei, Hiromi Okamoto, and others to develop the criteria necessary for using them in practical machines (Wei, Li, and Sessler 1993).

There were also many other general contributions, involving planet Mercury (Laslett and Sessler 1966), thermal studies (Sessler and Sessler 1998), DNA (Dawson and Sessler 1989), the design of gantries and FFAGs (Trbojevic et al. 2007; Keil, Sessler, and Trbojevic 2007), nuclear structure (Sessler and Foley 1953a; Sessler and Foley 1953b; Sessler and Foley 1954; Sessler and Foley 1955), and the nonlinear human ear. But perhaps his most important work—in fields other than accelerator physics, that is—was the 1960 prediction, together with Victor Emery, of the superfluidity at very low temperature of helium-3. This prediction, made as well by an independent group, was honored in a special session of the American Physical Society (APS) 50 years later.

The breadth of Sessler's research achievements were recognized by a U.S. Particle Accelerator School Prize in 1988, his election in 1990 to the National Academy of Sciences, his citation in 1991 by the Brookhaven National Laboratory as Leland Haworth Distinguished Scientist, and his receipt in 1997 of the APS Robert Wilson Prize for Achievement in the Physics of Particle Accelerators.

Having Original Ideas and Sharing them with the Community

Sessler was known for his "Jeffersonian science"—that is, research that has a defined long-term goal. This is in contrast with "curiosity-based" scientific research. Thus although his efforts on radio-frequency manipulation of particles and the understanding of beam instabilities were basic science, they were needed for the development of colliders. Similarly, his work on optical guiding and beam conditioning was done to improve the performance of free electron lasers.

It was also true that Sessler was satisfied when he understood and had solved a problem. Rather than pursue the subject for decades, he would immediately go on to another problem that needed solving (so as to achieve a desired goal). In this way, Sessler formed many firm friendships worldwide and across at least three generations of scientists. No one could attend a scientific meeting where he was present without wanting to spend an hour or so to catch up on his latest thoughts. The danger for those who so generously share their insights is that their initial contribution is soon forgotten; but their potential reward will be to look back with satisfaction on a lifetime of major contributions.

Energy and Environment

Sessler was based for most of his career at the Lawrence Radiation Laboratory (LRL), now called the Lawrence Berkeley National Laboratory (LBL). He joined in 1961, following a sabbatical year at the institution, and quickly became a major figure in physics research in general and a leader in the science of improving the performance of accelerators in particular. From 1968 on, Sessler wanted to see the laboratory apply its expertise to national and worldwide environmental issues. He worked with colleagues, most importantly Jack Hollander, to establish the laboratory's Office of Environmental Research. During the early 1970s, Sessler and Hollander brought to the attention of federal agencies—especially the Atomic Energy Commission (AEC) and the National Science Foundation (NSF)—the scientific challenges underlying novel technologies that might improve the energy and environmental picture, and the two researchers repeatedly urged these agencies to support such research.

In 1973, Sessler was rewarded for his leadership by being named the LBL's director. During his first day on the job, he established the Energy and Environment Division (EED), with Hollander as its leader. Together they initiated a program of energy and environmental science and engineering, which in its first year alone began more than 50 research projects. The National Academy of Sciences decided in 1975 to conduct a broad study of energy technologies. Thus was formed the Committee on Nuclear and Alternative Energy Systems (CONAES), co-led by Hollander, which helped form an emerging U.S. energy policy. In 1977, LBL scientists played important roles in developing the first National Energy Plan.

With Sessler's support and encouragement, the EED established the nation's largest geothermal research program, initiated major energy-efficiency research efforts, began a major research program on air-pollution chemistry and physics, and established a highly productive energy-conservation program (involving buildings, windows, lighting, and appliances) program led by physics colleague Arthur Rosenfeld.

By 1980, under Sessler's leadership, the LBL had grown to more than 5,000 employees, many of whom were dedicated to energy and environmental research for the new Department of Energy (DOE). He had transformed LBL, which was already leading in physics, chemistry, and biology, to also encompass a full spectrum of first-rank energy and environmental research programs. As similar transformations began in the other DOE research laboratories, Sessler's early vision set an example of excellence for the agency, enabling it to lead the nation in these vital areas of research.

Over than five decades, Sessler played a major part in the history of the LBL, and not only regarding energy and environmental issues. For example, his initiatives included the Neutrino Factory and Muon Collider collaboration—a project for constructing a muon storage ring that produces intense directed beams of neutrinos for research.

He continued, after retiring, to be an active presence at the LBL as distinguished scientist emeritus and director emeritus.

Leadership in the Science Community

Throughout his career, Sessler led science-community efforts for the American Physical Society. He served as president in 1998, after having been vice president in 1996 and president-elect in 1997. Most of his efforts for the APS were devoted to preparation of its centennial (in 1999), which was a large and most successful event. In addition to this high-priority effort, he strongly promoted APS outreach to Latin America, and he also worked to increase the number of APS geographical sections in the United States. Earlier, Sessler was chair of the APS Panel on Public Affairs. While he was the leader of the Topical Group on Accelerator Physics he proposed, and succeeded in creating, a new APS division—the Division of Physics of Beams. Not long before his death, he chaired the APS Forum on Physics and Society.

Sessler had always been tireless in promoting the importance of accelerator and beam physics. This activity took the form, in large part, of many nominations and support letters for prizes and positions. He also was instrumental in *Physical Review*'s initiation of a new journal: *Physical Review Special Topics: Accelerators and Beams*. For students and the general public, he coauthored a book with me, E. J. N. Wilson, *Engines of Discovery: A Century of Particle Accelerators* and we completed an expanded second edition in 2014 that the publisher, World Scientific, was able to print before his death.

Sessler also served the science community on more than a dozen committees. Some were simply reviews of physics departments, but others were much more extensive. His first committee membership, from 1969 to 1972, was with the AEC's High-Energy Physics Advisory Panel. He later was a member, from 1981 to 1985, of the Review Committee for the Princeton Plasma Physics Laboratory; and in the last decade of his career he served on the National Research Council's Committee on High-Energy-Density Plasmas and Committee on the Commercial Aspects of Inertial Fusion.

Service to Society

Sessler was very active in serving on committees, sometimes chairing committees, that addressed problems of importance to society. In all, he participated in some 40 different committees; some were only a few days in duration, but many involved activities that lasted for years. He felt strongly that scientists should take the time to apply their expertise to issues of national or international importance.

One of his earliest such involvements was with the Cooperative Program for the Improvement of Science Education in India, which included his spending the summer of 1966 at the Panjabi University in Chandigarh, India.

Sessler was highly involved in the initiation of the laser/gravity wave observatories in the United States. He chaired the panel (1986) that secured the National Science Foundation's approval, and subsequent project support, of the corresponding proposal by MIT and CalTech; and he again was involved, some years later, in reviewing the effort. Subsequent to the launching of the U.S. program, laser/gravity wave observatories were built in other countries as well.

Sessler played a role in arms control through the Federation of American Scientists, where he was vice chairman and then chairman during 1987 to 1991. He also was a participant in the APS Study of Directed Energy Weapons, which extended over many years and had a significant impact on defeating President Ronald Reagan's proposed Strategic Defense Initiative ("Star Wars"). He returned to this issue through the Union of Concerned Scientists report, *Countermeasures* (2000), which argued that it was rather easy to defeat a missile-defense system.

He played a role as well in the development and subsequent activities pertinent to synchrotron radiation, first at Stanford University and then at the SLAC National Accelerator Laboratory. At around the same time (early 1990s), Sessler was involved in making the APS more sympathetic to physicists in industry. In that regard, he was instrumental in forming an APS Committee on the Applications of Physics, which he chaired in 1993.

Sessler concerned himself with a wide range of nuclear radiation issues, from medical-isotope needs to the handling of the nuclear weapons program's wastes, and toward those ends he served on the National Research Council's Nuclear Radiation Studies Board from 2005 to 2009.

I have mentioned only a few of Sessler's many committee activities, but I believe they show the diversity of his interests and the importance he ascribed to using his scientific training and knowledge to elucidate issues of national importance.

Human Rights

Sessler's leading role in promoting scientists' human rights and free inquiry was made possible by his broad contacts among the international accelerator community and the U.S. scientific leadership. He cofounded, with Morris Pripstein, Scientists for Sakharov, Orlov, and Shcharansky, an international human-rights group. In 1982 he served as second chair of the APS Committee on International Freedom of Scientists, which he and Kurt Gottfried had been instrumental in creating. As a prominent scientist, Sessler worked to expose the former Soviet Union's policies that made open scientific inquiry difficult, if not impossible. He went to the USSR several times on personal missions to advance that objective, lending his stature to the campaign that eventually led to the release of imprisoned and exiled scientists. Honoring these efforts, in 1994 the APS awarded him the first Dwight Nicholson Medal for Human Outreach.

Sessler was a member of the Committee on Human Rights—a standing committee of the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. He was also a national sponsor of the Committee of Concerned Scientists (a human rights organization) and a faculty advisor to the University of California Center for Human Rights. He initiated the idea, and then raised an endowment, for the APS's establishment of the Sakharov Prize, which honors human rights advocates.

Near the end of his life, Sessler said:

> *I have lived a long time and thus I have experienced five major U.S. wars (and some minor skirmishes and peacekeeping activities) as well as periods of peace. I have lived through times of economic prosperity and also periods of stagnation, recession, and even depression. I have seen great advances in technology, both the vastly improved capability of killing people, [such as] atomic weapons, ICBMs, and smart bombs; and the many conveniences of civilian life, [such as] jet airplanes, TVs, CDs,*

computers, and wireless communications. I have seen vast improvements in medicine (and personally benefited from a few of them).

I have seen vast changes in the world, and I have seen many improvements in our country, but [there are] many things I consider still to be in need of further change ([such as] universal health care, a better education system, and a lifting of more [people] out of poverty).

What have I learned? Well, that social change takes longer than the youthful are inclined to believe, but also that it is often those youth who make the changes. I have seen the effectiveness—over the long run—of special-interest nongovernmental groups. Thus I support the efforts of small groups (often of young people) to accomplish change ([as in] civil rights, environmental matters, and human rights). I have seen the world become more and more tolerant, but it still has a long way to go ([as in] respecting the choice of women in childbirth, or the choice of partners in marriage). I have seen a growing effort to punish dictators and those who have wrongly hurt others (peacekeeping activities and the International Court of Justice), and I have seen the effort to prevent proliferation of nuclear weapons (the International Atomic Energy Agency), but on both we still have a long way to go. I have seen the effort to prevent wars (the United Nations), and I have seen efforts to reduce poverty and improve health, but on both, we still have a long way to go.

Philanthropy

In the last few decades of his life, Sessler was in a position to engage in philanthropy. His wife was no longer alive, his children were well established, and he lived very modestly. As a result he was able—on an academic salary, but having made wise investments—to give a few millions of dollars to charity. Particular recipients included Earthjustice (environmental matters), CARE (providing food and other goods for the poor), Habitat for Humanity (housing for the poor), and Amnesty International (human rights). He was particularly proud to be able to set up a trust fund in the name of his parents, Mary B. and David Sessler, in the physics department of the University of California, Berkeley. The interest on its principal—one million dollars—would forever support needy students.

Looking Back

Sessler's many contributions were honored by President Barack Obama, who bestowed on him, and on chemist Allen J. Bard, the Enrico Fermi Award of 2013. The ceremony at the White House took place on February 3, 2014. On receiving the medal, Sessler said:

> *Actually, it has been great fun developing all these things. I had more fun doing that—through the years—than I am enjoying even now on this happy day. Most importantly, this event shows to the general public that not only movie stars and athletic heroes are recognized. It provides young scientists with the understanding that scientific work is appreciated, valued, and even rewarded.*
>
> *I am pleased that this award recognizes the activity of accelerator and beam scientists. I was fortunate to be in, almost at the beginning, when the power of theoretical physics was first brought to bear on accelerators. …[W]e developed colliders and learned how to manipulate beams in and out of machines. The work of accelerator scientists—and it is real science—not only influenced high-energy and nuclear physics but [also] has made possible the great facilities of basic energy science: synchrotron rings and free electron lasers for X-rays, and spallation neutron sources.*

President Barack Obama presenting the Enrico Fermi medal on Sessler (facing camera) and chemist Allen J. Bard (back to camera) The ceremony at the white house took place February 3, 2014.

In conclusion, I once again use Sessler's own words, which give a vivid impression of the man:

> *In my private life I have also been most fortunate. I have three children—Daniel, Jonathan, and Ruth—and I believe my former wife, née Gladys*

Lerner, and I raised them to be moral people, compassionate people, and charitable people; to have a thirst for knowledge; and yet to enjoy other people, travel, art, music, the outdoors, and simply life itself. My two sons are professors (medicine and chemistry) and my daughter has two masters degrees and a Doctor of Management degree. I have six grandchildren and they are all doing very well. My former wife (we were married for 30 years; separated in 1982) is no longer alive. I have had a close friend for 13 years, Carol Hanson, and now a second friend, Sandra Adams, for the last 15 years. These women have brought human warmth into my life, and furthermore have been companions at social events, theatre, opera, symphony, …and also on extensive travels (often adventure trips) to faraway places in the world. As with my students, I recommend [that] my children follow my path: have a family at an early age; raise your children to be good people and also have a thirst for knowledge; enjoy family; enjoy the outdoors; travel a lot; [and] save money for later years. So, all in all it has been a wonderful life. I am ready to do it again!

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