Lewis McAdory Branscomb

August 17, 1926–May 31, 2023
Elected to the NAS, 1970

A Biographical Memoir by Ann K. Finkbeiner and William H. Press

Figure 1 Lewis Branscomb. *AIP Emilio Segrè Visual Archives, Physics Today Collection*.

We celebrate scientists and scientific discoveries as if they are achievements only of the people whose names are on the published papers. But such discoveries are invariably rooted in the science enterprise, comprising a community of shared values and a network of institutions spanning industry, government, and academia. How often do we take the opportunity to celebrate a hero on this, the antecedent side of discovery, a steward of science, paladin of planning, intimate of the infrastructure, overseer of organizations, or further, in the case of Lewis M. Branscomb, an inspirer of interdisciplinarity? Here, we take that opportunity. Let us dispel from the start any vision of Lew (as he was universally known) as one of the stuffy, generally male and grey-suited, administrators of his generation. Far from it. Lew combined managerial leadership with a lifelong playful sense of adventure, a twinkle in the eye, and (as an interviewer put it), "a boyish enthusiasm that suggests that everything is going to be all right, if we work at it." Lew himself described his personal philosophy as, "pick the most interesting thing there is at hand to do, and do it, and let the future take care of [itself]." It almost always happens, he added, that seemingly disparate endeavors will turn out to be mutually supporting.

Family History and Early Life and Education

This suzerain of science sprang from uncommon roots for a scientist, a family with deep connections to the American South and Christian ministry. Lew's paternal grandfather, Lewis C. Branscomb (1865–1930), was a Methodist minister in Alabama, remembered mainly as president of the Alabama Anti-Saloon League and, less cited, as a champion of women's education. Lew's father, Harvie Branscomb (1894–1998) was a theologian and Biblical scholar, a Rhodes Scholar at Oxford, and a Guggenheim Fellow in 1930s Berlin and Marburg. He served in World War I, was briefly an instructor in philosophy at Southern Methodist University, and in 1921 married Margaret Vaughan, the daughter of a lawyer from Greenville, Texas. In 1925, Harvie moved to Duke University in Durham, North Carolina, as a professor of New Testament literature (he was competent in Greek, Latin, and Hebrew), rising over time to dean of the theology school. But Lew later described his father's values, especially Harvie's commitment to rational thought and objective inquiry, as more the reflection of Oxford high table than of Christian theology.

Much later, in 1946, when Harvie became chancellor of Vanderbilt University in Nashville, Tennessee, he and Margaret attracted opprobrium when they invited faculty from neighboring, historically Black, Fisk University to participate in Vanderbilt social functions. Harvie Branscomb is today remembered for forcefully leading the university to full racial integration during his fifteen-year tenure as chancellor.

Harvie and Margaret had three sons. Lew, the youngest, was born August 17, 1926, in Asheville, North Carolina. He grew up in Durham, attended Asheville School (where he showed talent in art and learned to paint in oils) and then the Webb School in Bell Buckle, Tennessee, a school whose mission was, "to turn out young people who are tireless workers and who know how to work effectively; who are accurate scholars, who know the finer points of morals and practice them in their daily living; [and] who are always courteous without the slightest trace of snobbery." The lessons must have stuck: that list captures Lew perfectly as his colleagues knew him.

World War II dominated all planning in 1943 when Lew left high school a semester early to enroll at Duke in the U.S. Navy's accelerated V-12(S) Officer Training Program undergraduate track for scientists. Technically an apprentice seaman in the Naval Reserve, Branscomb studied physics and mathematics. But the university's requirements for course distribution led him to enroll in a political science course taught by John Hallowell. He found the subject so compelling that he enrolled in all of Hallowell's courses. By the time he graduated, Lew had completed all requirements for both the physics and political science degrees, and he wrestled with which would be his career after the war. In fact, the choice was three-way because he had become editor of the student-run *Duke Chronicle*, so a career in journalism was also a possibility.

Branscomb later described the "singular event" that clarified his thinking. Paul Gross, chair of Duke's chemistry department and a friend of the family, "grabbed me one day, and took me on an illegal tour of all of the secret war research going on at Duke," work that included the development of homing torpedoes and graphite bullets that could be used to train tail gunners against actual (friendly) aircraft, leaving marks of success without causing actual damage. This live-fire training was necessary because gunners (and even generals, as Lew relates in his memoir *Confessions of a Technophile*) just wouldn't accept that, because of the vector addition of the velocities of bomber, bullet, and target, they needed to aim *behind* an aircraft approaching from the side. "Professor Gross's final argument with this eighteen-year-old senior," Branscomb wrote, "was that any undergraduate who insisted on taking graduate courses in mathematics had no right *not* to be a scientist." Another version of the story that Lew liked to tell was that he chose physics because he occasionally earned only a B in some physics courses but made straight As in political science—meaning to him that physics was the more challenging career.

Lew assumed that the Navy, having paid for him to be trained as a scientist, would make use of his abilities. Instead—one of many such World War II stories—he was sent to the backwater of Samar Island in the southeastern Philippines, where, as a nineteen-year-old ensign, he assumed command of the USS *APL-3,* a large barge. "It did not even have a propeller," he wrote, "but I learned a lot about human nature and the art of survival in a hostile managerial environment." Whether because of his naval career or despite it, Lew kept a love of sailing. In later decades, his boat (one of three over many years) was often seen moored offshore of the National Academy of Sciences summer meeting facility in Quissett, Massachusetts. His more ambitious trips included sailing into the Saint John River via the Reversing Falls. And on land, he was throughout life an ambitious hiker and skier.

After the war, Branscomb was admitted to Harvard University's Ph.D. program in physics. All thoughts of journalism or the study of government were now put aside. He must survive among a cohort of twenty-one new Ph.D. students, twenty of whom had graduated from college with *summa* honors in physics. (In telling this story, Lew only after a pause reveals that he was one of the twenty, not the unfortunate one.)

Branscomb liked to cite "three special reasons" that his years as a graduate student at Harvard, and then as a Junior Fellow in the Harvard Society of Fellows, were "glorious." We mention all three, but first mention a different kind of special event from that time: his introduction to Anne Wells, herself a graduate student in the Harvard government department. She was a fellow Southerner; in fact, she grew up in the 1835 mansion residence of the ante-bellum governors of Georgia and later the presidents of what is now Georgia College and State University.

When Anne returned from a 1950-51 Rotary International Fellowship at the London School of Economics, she and Lew were married on October 13, 1951. Anne later earned a law degree from George Washington University and became an acknowledged expert in communications and computer law. Among many other achievements, she was chair of the Communications Law Division of the American Bar Association and the author of several books. Lew and Anne raised two children and remained married for forty-six years, until her death in 1997.

But back to the post-War years, where Lew's first special reason for loving Harvard was his research supervisor, Otto Oldenberg, a pioneering plasma physicist—a field then called "gaseous electronics." Oldenberg had emigrated from Göttingen to Harvard in 1930 and became physics department chair in 1948. Branscomb's Ph.D. thesis, completed in 1949, demonstrated experimentally, and also explained theoretically, an effect of molecular rotation that produced anomalous temperature measurements of the Earth's upper atmosphere: atomic physics (as then misunderstood) indicated a low temperature, yet radio waves reflected off a hot, ionized F-layer.

No professor ever treated his students better than did Oldenberg, Lew later opined. Notwithstanding, by the time Branscomb began a two-year postdoctoral appointment in the Harvard Society of Fellows, Oldenberg was not shy about assigning the new now-postdoc the nearly impossible problem that was to define the first part of his career, which we will presently describe.

Lew's second special reason for loving his time at Harvard was the extraordinary quality of his fellow graduate students and Junior Fellows. The fellows came from all fields and included, during Lew's tenure, economists Carl Kaysen and David Landes, historian and philosopher Thomas Kuhn, information-theory pioneer Peter Elias, and future Nobel laureate in physics Nico Bloembergen. Of the group, Branscomb was the one chosen to serve as the unpaid (and silent) secretary/rapporteur of a Saturday morning Harvard faculty discussion group that included physicist Edward Purcell, anthropologist Clyde Kluckhohn, and East Asia scholars John Fairbanks and Edwin Reischauer. Their topic: What to do about the Soviet Union. So, Lew's political science and journalism itches were certainly being scratched.

Included in the second special reason, and often nostalgically recalled in later years, were the interactions of Lew and the other physics graduate students with a particular mathematics graduate student, the absurdly talented (as musician and satirist, alas not as mathematician) Tom Lehrer. Tom wrote a one-hour musical show titled *The Physical Revue* [sic.], in which Lew starred as "The Professor." The show includes early versions of Tom Lehrer songs that are familiar to two generations of later Tom Lehrer fans, including the authors of this memoir. The revue was performed fewer than half a dozen times, but there exists on the web, immortalized in a lo-fi recording (originally on a magnetic wire recorder—the technology before magnetic tape) in which one hears Lew's clear, high tenor, a voice easily recognizable as the same as that of the influential science policy-maker many decades later.

Lew's third special reason, at any rate in hindsight, was the special time that it was for physics in the immediate post-war period. "It was as though all the new scientific knowledge that might have been discovered by those diverted to the war came pouring out of American university laboratories," he wrote. Funding was abundant, with the government supporting basic research on many fronts. "There was more exciting physics to do than anyone could hope to accomplish in a lifetime," Branscomb later wrote.

The "nearly impossible" problem that Oldenberg assigned to his former graduate student, now new postdoctoral fellow, was that of measuring the spectrum of the H^- ion (a hydrogen atom with an additional weakly bound electron). Astrophysicist Rupert Wildt, another German emigree, had proposed in 1939 that the observed solar surface temperature could be explained only by the existence of a new, undiscovered source of opacity. The H^- ion was a possible candidate. Another student of Oldenberg's, Wade Fite, had already failed to measure its spectrum because the necessary high vacuum and beam intensity could not be produced with resources available at Harvard. Regardless, the problem was now assigned to Branscomb, and he was determined to succeed one way or another.

The National Bureau of Standards Years

Oldenberg introduced Branscomb to physicist Edward Condon, who after the war had become director of the National Bureau of Standards (NBS, later NIST). Condon appreciated that the H^- experiment required just the kind of instrument-building talent at which NBS excelled. In brief, the experiment required crossing a beam of light with a beam of extremely fragile negative ions, then trying to detect the electrons that were knocked off by the light, in a background of millions of times more electrons produced by collisions of the ions with the residual vacuum. Condon invited Lew to visit NBS to meet people and perhaps to move his experiment there. Branscomb remembers paying for the overnight train ticket from Boston to Washington with his own money and recalls hitting it off immediately with NBS Section Chief Robert D. Huntoon.

Condon had let it be known that Branscomb was someone to be recruited. When Lew's Junior Fellowship ended in 1951, he moved to NBS as a research scientist. Later he recalled, "I went to Washington only because I was doing an experiment at Harvard that was too hard to do at a university. The Bureau of Standards had the facilities. It was my intention to stay two years, do the experiment, publish three or four papers, avoid the agony of being an instructor, and get my assistant professorship the easy way." That was not how it turned out. He would stay at NBS for more than twenty years.

After Branscomb brought Stephen Smith, a recent Ph.D. of Ed Purcell's, to NBS as his collaborator, the difficult experiment began to progress. The pair first robustly detected negative ions in 1953. A paper with the results in detail was submitted to *Physical Review* (not Revue!) in January 1955 and published the following May. In fact, crossed-beam negative-ion experiments were so difficult that, for nearly twenty years after that, NBS was the only place that such experiments were done successfully. By 1956, when Branscomb became Section Chief of Atomic Physics (later, Division Chief), negative ions of many other chemical elements were being observed and measured. Branscomb (with Smith and soon others) had become a world leader in negative ions and in high-precision atomic beam measurements generally. Between 1953 and 1970, Branscomb was author or co-author on more than 100 published science papers in the field.

The high-precision laboratory measurements of chemical elements applicable to the Earth's atmosphere and the Sun's surface also applied to stars' atmospheres. At the time, the idea of making precise laboratory measurements on elements in gases of and around stars was new, and without an obvious institutional home—outside NIST's remit, but not happening in academia. Branscomb and NBS colleagues Dick Thomas and John Jefferies thought that if atomic physicists with an interest in astrophysics could work together with astrophysicists with an interest in quantum atomic physics, "we would do this great thing." They proposed to create a laboratory for understanding the ionized gases that were important to both physics and astrophysics. Specifically (Branscomb pitched), to understand the atmospheres of stars, you needed to know both how radiation moves through hot gas and how to make absolute measurements of the atoms and molecules colliding in those atmospheres.

Creation of JILA and Colorado Years

Ironically, it was this scientific goal that led Branscomb out of science and into the management of institutions. It took four years, until 1962, to raise the money and negotiate the partnerships that merged the atomic physics group at NBS, the astrophysicists at NBS's Boulder laboratories (including a group relocated en masse from Washington under his leadership), and a number of interested science faculty and graduate students of the University of Colorado Boulder into one new institute, the Joint Institute for Laboratory Astrophysics (JILA). Under JILA's unique governance, the two institutions, NBS and CU Boulder, were financially and professionally responsible for their own people. Each contributed unique capabilities and expertise. Both were governed by a group of fellows (of whom Branscomb was the first chair) with, as he said, "a minimum of unnecessary bureaucracy."

The JILA ethos refused to distinguish between basic and applied research: a basic-physics attempt to measure gravitational waves by shooting a laser beam through a gold-mine tunnel resulted in an applied-physics high-resolution wavelength standard. JILA (today formally known only by its initials) prospered and continues to do so, in part by branching out from laboratory astrophysics into subjects including quantum information science, nanoscience, and chemical and biophysics. Branscomb later recalled with particular pride his role in establishing JILA's visiting international fellow program. He told one interviewer that JILA was "his greatest institutional achievement" and told another that "JILA was the most wonderful place to work I ever worked."

While there, from 1962 to 1969, Branscomb participated in a number of influential groups at the interface of science and policy. One was JASON, an independent and self-selected group of scientists responding to questions that usually came from the Department of Defense, that were usually classified, and that were often highly technical. Branscomb applied his own expertise in negative ions to JASON studies on the detection of the wakes of missiles and the effects on the atmosphere of high-altitude nuclear explosions. He was one of a small number of JASON members who were experimentalists, remarking that he enjoyed being impressed by the capabilities of the theorists.

Around the same time, Branscomb was appointed to another group, the President's Science Advisory Committee (PSAC), a committee of the country's top scientists. Unlike JASON's technical-only advice, PSAC could advise on national policy. Lew's political-science mindset noted that PSAC, despite political pressure for geographical diversity, was dominated by the same academic "Northeast Mafia" that had produced him. On PSAC, Branscomb was chair of the Space Science and Technology panel, which issued a report following up on NASA's Apollo mission, recommending that NASA no longer focus on such single enormous programs. Branscomb thought that Apollo, in spite of having achieved the seeming impossibility of landing people on the Moon, ultimately affected neither the public perception of the power of science and engineering nor the country's considerable social problems. He hoped that after Apollo people would stop "confusing technology demonstrations with solving real problems."

Return to NBS

In 1969, Branscomb left bench physics, the science advising groups, and JILA to become NBS's director. Given the recognition that his managerial talents attracted, the move from hands-on experimental physics to the leadership of scientific enterprises was all but inevitable. By around 1965, his published papers had shifted to being divided almost evenly between science and policy. By 1970, the transition was complete: on the subjects of national and international policy, Branscomb would go on to publish an additional nearly 400 articles and papers.

Branscomb's directorship at NBS was brief but described by *Science* magazine as raising "the low-profile and somewhat sleepy agency" to prominence. He began by thoroughly understanding NBS's mission: to create national standards for materials, products, and quantities, that is, to make sure that the carbon steel used to build bridges wouldn't fracture, that firehoses in one city could be attached to the firehoses in a neighboring city, that a gallon or a meter in one place was the same as a gallon or meter in another. And the meter, during Branscomb's directorship, was standardized to a precision based on a wavelength of light. Branscomb understood that such standardization, precision, and accuracy underpinned NBS's reputation for integrity and that NBS, to be effective, "must be above reproach." Because of this unimpeachable reputation, he said, its director could, for example, testify at a congressional hearing, be asked a question "where the political right answer is yes and the truth is no, and you could say, 'I'm sorry, the truth is no,' and you'd get away with it. They respect you."

As a great believer in NBS's mission, he worked pragmatically to raise its profile. To mitigate NBS's relative isolation, he set up a program to fund university programs working on measurements of interest to NBS, not because NBS had any extra money but because alliances with academia opened NBS to the world outside its own walls. To ensure that NBS was seen as relevant, he worked "very hard," he said, on NBS's program structure. This meant, according to David Lide, who was his friend and colleague at NBS, that its organizational structure should include an office to assess the country's scientific and technological problems and set NBS's priorities accordingly. The new program structure in turn gave him a case for raising NBS's budget on the grounds of national relevance. The budget did, in the next years, go up by 36 percent. A contemporary article in *Science* attributed the budget rise to a new view of NBS as the National Science Foundation's partner in being "the government's instrument in stimulating industrial technology."

He was also a great believer in NBS's people. The reputation that was responsible for NBS's effectiveness, Branscomb said, depended on its people: "the very careful, lifelong devoted to calibrating one kind of thing like the volt, that kind of person, if they are good," he told an interviewer, "are jewels in the technology crown of the United States. They are the salt of the earth and they exist in the Bureau of Standards and a few other places." He thought that the NBS attracted "brilliant people" who wanted to do basic research but not subject themselves to the academic "publish or perish" rule, people who like to "look for the subtleties," and do absolute measurements or careful research on the properties of materials. Branscomb was skilled at "attracting capable people to take jobs," Lide said, and was especially interested in hiring women at higher organizational levels. "He just did it," Lide said, "he didn't go around bragging about it." But he did, at least once, conspicuously bring a woman guest into the Cosmos Club through the front door, rather than (as then required) a side entrance leading to a "ladies lounge."

The IBM Years

Brancomb's directorship did not last long. In 1972, he left NBS, where he'd been since 1951, after only three years as director. He told an interviewer that he looked back on those three years as very exciting. "It seemed like a lot longer than three years," he opined. He had been offered the job of chief scientist at IBM. It was a "non-turn-downable job," he said, "the best technical job in America." The salary was double, the budget was a hundred times NBS's. And he thought that the technology most likely to matter significantly to the future was information technology. "If you have the opportunity to be chief scientist of the largest enterprise dealing with the key technology," he said, "that's the place to be."

The job of chief scientist didn't have a specific description, so Branscomb, working with his own advisory committee, was free to define it. At the time, IBM's research laboratory had a broad remit, from chaos theory to semiconductors to networking technologies to the properties of magnetic thin films. The company itself was building computer mainframes and competing in the market for personal computers. Branscomb described his job with several analogies—the company's "technical conscience," "a safety valve," "an open door"—and thought of it generally as ensuring that IBM's research programs meshed with the IBM company's long-term needs. One of those needs was surely computer privacy and security; another was, in Branscomb's words, "humanizing computers." He recommended computer scientists work with behavioral scientists and bioengineers to move personal computers out of the domain of the specialist and become friendly to the user who would be, eventually, everybody.

While at IBM, between 1980 and 1984, Branscomb was also chair of the National Science Board, the body that sets the policies and direction of the National Science Foundation. NSF at the time funded most of the country's academic science—but only basic science research, not engineering research, on the grounds that the latter was applied science. Under Branscomb's leadership, the National Science Board reconsidered that policy: it declared that engineering and applied science were two different entities, eventually added a new directorate of engineering to NSF, and meanwhile directed that the line between basic and applied science be less rigid and that funding for applied sciences be dispersed among the relevant basic sciences.

The issue of applied vs. basic science—neither term is tightly defined—is vexing and, aside from NSF funding categories, is partly sociological: basic science is seen by scientists as more prestigious, and applied science is seen by the public and politicians as more relevant. Applied scientists feel like second-class citizens; basic scientists have to explain why they study apparently useless subjects. The issue was important to Branscomb. He'd been thinking about it since his time at the NBS when he was arguing that this applied-science bureau could justifiably conduct research with no obvious applications. Once Branscomb became chair of the National Science Board, the divide between basic and applied science, he later wrote, was his "first concern."

He didn't think that a distinction between the two was necessary or meaningful. In the first place, when researchers are asked whether their own work is basic or applied, he wrote, they answer according to whichever is more likely to get funding. In the second place, "applied" refers to two different kinds of work. One is research done according to a commercial or governmental plan for application of the results, for example when IBM wants to build a more user-friendly computer. And the other is research that is useful, proposed by a researcher, peer-reviewed, and public. Confusingly, this second definition is not very different from "basic science." "By now you should appreciate my frustration with the 'basic' versus 'applied' debate," he wrote. "The language we choose to use draws its distinction in the wrong place." He thought a more sensible distinction would be between "problem-focused versus investigator-initiated research," and "these should be measured and managed somewhat differently." He said JILA never bothered to distinguish between basic and applied research, and at IBM, "nobody even used these words."

Branscomb remained at IBM for fourteen years. One of the best things his office did, he told IBM's *Think* magazine, was to create the environment in which "people know the best ideas will always get a good hearing." Branscomb's reputation as a leader probably depended at least in part on his perceptiveness about the people he led—as was obvious in his appreciation of his colleagues at NBS and JILA. "He was definitely very good with people," said Lide, his colleague at JILA. "He wasn't defensive, if someone else's solution was better, he'd accept it." He thought that an organization's mission was unlikely to be realized if you "beat [the employees] on the head every morning and ask them to again tell you what the mission was." Instead, he said, just make sure they understand the mission and appeal to their personal desires to do good work. Branscomb's interviews are plain-spoken, funny, self-deprecating, and notable for the number of names of people to whom he gives credit.

Retirement and Later Years

When Lew retired from IBM in 1986, he took a job as professor and director of the Science, Technology, and Public Policy Program at Harvard's John F. Kennedy School of Government, teaching courses at the intersection of science, technology, and policy. The last job of his career was thus a return to the university he'd loved as a graduate student, thinking about the policy issues that he'd loved since he was an undergraduate. He credited these interests, along with his renewed connection to the "Northeast Mafia," with his history of appointments to "a whole variety of government agency advisory committees on various things," as many as fifteen governmental science advisory committees (this including PSAC). In *Confessions of a Technophile*, a collection of his autobiographical essays, he wrote down some take-home lessons that he had assimilated: Anyone attempting to advise the government about science should understand that advisors "function best when dealing with specific technical issues in a defined policy context," and, "any organization incompetent to understand and implement good advice will gain little benefit from soliciting it." But he noted that scientists are desirable advisors nevertheless. A scientist is trained to look for questions that are valuable for where they lead and what they say about our priorities, and this in turn makes the scientist valuable to politicians, who then know to ask questions like, "Have we focused our political agenda on the right questions? Will future generations agree? Did we direct our technologies in the directions that scientific and humanitarian values suggested we should?"

Branscomb retired from the Kennedy School in 1996 but continued teaching as an adjunct in other universities. He also served on nearly uncountable corporate and academic committees, boards of directors, and trusteeships. His family recall his pride in his role in establishing the Center for Science and Democracy at the Union of Concerned Scientists through a generous donation of $1 million.

Branscomb died on May 31, 2023, at age ninety-six, four years after falling and suffering severe brain trauma. His obituaries mention honorary doctorates from fifteen universities; his many awards including NSB's distinguished Vannevar Bush Award; his presidency of the American Physical Society and editorship of the *Reviews of Modern Physics*; his hundreds of published papers and more than a dozen books; and his membership—along with only a handful of other scientists—in all three National Academies.

Lew believed in what he called the power of assertion—we might call it willpower. He claimed to his family that he could will himself to feel no pain. (Was his model Lawrence of Arabia?) In *Confessions of Technophile*, he described himself as "an incurable optimist." But he added the telling proviso: "I do not believe there is a rational basis for choosing optimism about the future prospects of humankind rather than pessimism. Indeed, the evidence seems to tip the scale the other way. I am an optimist by assertion; I believe that life as an optimist is almost certain to be more pleasant and more motivating than it would be as a pessimist."

Acknowledgments

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