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A Biographical Memoir by

DONALD MURPHY

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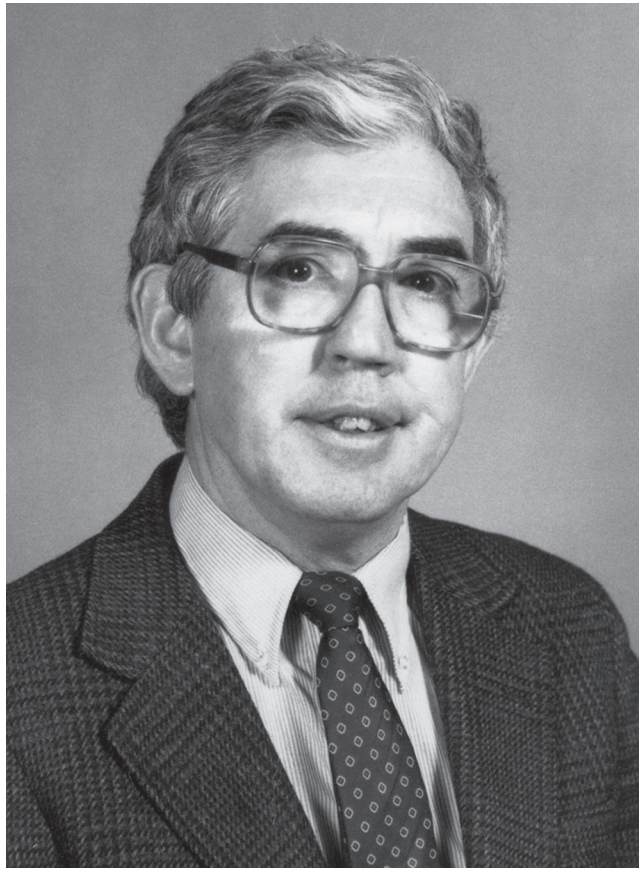

R. A. Fowler

ROBERT ALFRED LAUDISE

September 2, 1930–August 20, 1998

BY DONALD MURPHY

ROBERT A. LAUDISE GAINED his initial fame as a scientist and engineer by developing a manufacturable process for the growth of quartz single crystals and following the process through to industrial production. The passion he showed in that early work continued and broadened throughout his professional career and was evident in his relationship with his family, his colleagues, and the entire scientific community. His goal was to make the world better for posterity. Electronic and communications technology today is at a level unimaginable in Bob's youth, and much of that technology resulted from the science he did himself or championed as a Bell Labs manager and as a leader in the scientific community.

Bob was born and raised in the small town of Amsterdam, New York, the only child of parents who were both teachers in the public schools.[1] His parents encouraged his intellectual pursuits and as a child he was a voracious reader of all subjects. His broad knowledge and appreciation of a wide variety of topics continued throughout his life, but his future was cast when he received a chemistry set and his father built a "lab" in the basement for him at age 10. I did not know Bob as a child, but I am sure he was an egghead (the "nerd" of that era) and proud of it. Even as a youngster he

knew how to gain the respect of his peers, by setting off stink bombs one April Fool's Day.

Bob graduated from Union College in Schenectady, New York, in 1952. He was an active alum, often hosting visits to Bell Labs by groups of students, often with a stop at the Laudise's home for pizza. Bob earned his Ph.D. in chemistry in 1956 from the Massachusetts Institute of Technology, where he worked on the coordination chemistry of tungsten. Following graduation Bob took a job at Bell Laboratories, which was in expansion mode following the invention of the transistor.

Laudise spent his entire scientific career at Bell Labs. He was a member of the technical staff from 1956 to 1970, head of the Crystal Chemistry Research Department from 1970 to 1978, assistant director and director of the Materials Research Laboratory from 1972 to 1978, director of the Materials and Processing Research Laboratory from 1978 to 1992, and adjunct chemical director from 1992 to 1998. Beginning in the 1980s he also held adjunct professorships at MIT (materials science) and Rutgers (ceramics). He maintained his personal research throughout his career, even while managing as many as 150 scientists. During his last few years, he stepped down from management to concentrate fully on research and professional society activities. His last research effort was aimed at making electronic materials from organic molecules.

Bob was a devoted family man. He met his wife, Joyce, at a "mixer" while he was a graduate student at MIT and she was an undergraduate at Simmons College. Joyce told him she was having difficulty with chemistry, and Bob volunteered to meet her once a week at the Simmons Library to answer chemistry questions. The tutoring sessions ended with coffee dates and eventually Saturday night dates. Joyce says she learned a lot more about Bob than about chemistry.

They were married in 1957 shortly after Bob started working at Bell Labs. Bob was an only child and wanted a big family. Together they had five children.

Scientifically, Bob was renowned as a leading authority in the growth of single crystals and is often credited with transforming the field from an art to a science. He wrote the first comprehensive book on crystal growth, *The Growth of Single Crystals* (1970). His initial specialty was hydrothermal crystal growth. He began work on hydrothermal crystal growth to synthesize quartz (needed as an oscillator in electronics) with properties more reproducible than natural quartz at a reasonable cost. His research on synthetic quartz in the 1950s and perseverance through development and manufacture led to replacement of the highly variable, mined quartz with synthetic quartz that was cheaper and had better performance (a high quality factor). By the end of the twentieth century, quartz was second only to silicon in tonnage of single crystals used for electronics. Many of his colleague's desks were adorned with quartz crystals passed out by Bob.

Bob was widely recognized for his scientific accomplishments. He was elected to the National Academy of Engineering in 1980 and the National Academy of Sciences in 1991, as well as the American Philosophical Society in 1997 and the American Academy of Arts and Science in the following year. He received numerous prizes and awards for his work, including the Orton Lecture Prize of the American Ceramic Society, the Sawyer Prize for contributions to piezoelectricity, the Applications to Practice Award of the Materials, Metals and Minerals Society, and the Materials Chemistry Prize of the American Chemical Society. In 1984 he was awarded the first experimental award of the International Organization of Crystal Growth, which was renamed the "Laudise Prize" in 1989 in his honor. Also named for

him is the "Robert Laudise Medal for Industrial Ecology" of the International Society of Industrial Ecology.

He belonged to at least 10 professional societies and was editor of the *Journal of Crystal Growth* for 15 years and the *Journal of Materials Research* until his death. He served in advisory roles to several National Laboratories, universities, and National Research Council committees, including a term as chair of the National Materials Advisory Board. Bob worked aggressively to foster cooperation among the different professional societies to positively influence government action related to the research and development of materials. He was so identified with materials that following his death, the National Academy of Engineering dedicated a symposium ("Materials—The Opportunity") in his honor at the 1998 annual meeting, which was attended by his family.

Laudise first became a manager at Bell Laboratories at a time of enormous importance for crystal growth as a subject. Not only were silicon and quartz critical to electronics but large, high-quality crystals were needed for other emerging applications, such as lasers, nonlinear optics, and magnetic bubble memory. It was the heyday of crystal growth, and Bob was in his element. He was a visionary and knew the world was in a rapid state of change, and he always focused on opportunities while some saw only the obstacles. In a 1970 profile (Chemical Innovators, 1970) he talked about recruiting MIT students to work at Bell Labs in communications technology. Paraphrasing his retort to those who thought work with greater social consequences was a loftier aspiration, he said that communications was morally neutral and there might be great benefit if we had cheap, two-way picture phones and devices for ordering merchandise without struggling through traffic or crowded store aisles. He added that he did not see improved communications as a panacea, but he added, "Wouldn't it be nice to explore

these technological implications in a sensible sort of way, to be in a position to do some of these things if they really seem useful?" Over the years Bob was a very effective recruiter of young talent to Bell Labs.

As a manager Bob championed research in a wide variety of areas that he imagined could help bring about the vision of better communications. These included materials such as optical fibers, thin films, superconductors, and nanoparticles. While he is best known as a champion of materials, he also stressed the idea that AT&T's (later Lucent's) factories were chemical plants and that processing and reliability were key to success. In the 1990s he was instrumental in advancing the concepts of industrial ecology as a critically important field. Just outside what was his office at Bell Labs is a garden marked by a plaque that reads,

This garden is dedicated in the memory of Robert A Laudise, Director, Lucent Bell Labs Physical Science Research by his friends and colleagues in recognition of his contribution to Electronic Material and Industrial Ecology September 1999.

I credit Joyce's love of nature and ecology with inspiring Bob to make the field of industrial ecology a part of his legacy. They had a vacation home in the Pocono Mountains on Twin Lakes. There they taught their children to swim, row, canoe, and sail. Bob and Joyce's mutual interest in the environment and lake ecology blossomed at Twin Lakes, as they became concerned that many Pocono lakes were being damaged by acid rain and that alga blooms appeared with greater frequency. Beginning in 1987 they were a team of two collecting lake samples, sending them off to a laboratory for analysis, and writing annual reports on the quality of the lake.

At Twin Lakes Bob loved to combine business with pleasure. I was there on the way to a Gordon conference

with the imminent French solid state chemist Paul Hagenmuller. We had a swim, a barbecue, and taught Paul how to play monopoly. The Laudises were there several times with his colleague, Bob Barns, and his wife, both to have fun and examine the ice, with the intention of writing papers on ice crystals. They published an article showing that icicles had regions as long as 8 inches that were single crystal (Laudise and Barns, 1979) and another showing that single crystals of ice from Twin Lakes and a neighboring lake could be larger than a foot long (Barns and Laudise, 1985).

I learned many lessons of management and life in general from Bob. He may not have originated these thoughts, but he ingrained them in me and my contemporaries. A few that come to mind include

1. Remember, everything is made of something (and don't ever let those software guys forget it).
2. To ask permission is to seek denial.
3. Get people to do what you want by making them think they thought of it.
4. Research will not thrive if you throw it over the fence unless you follow it.
5. Do not have any meeting devoid of technical content.
6. The amount of angst each person feels is fixed, but you can control whether you worry about important things or unimportant things.
7. Ninety percent of the people go through life without really knowing what is going on 90 percent of the time.

He was anything but a "by the book" manager. He believed in shielding the troops as much as possible from constantly changing business pressures coming down from the top, but he had his nose to the internal political winds and

would also pass along information he felt we needed to know even when instructed otherwise.

He demanded excellence from those who worked for him and rewarded those who truly did excel. Bob wrote more nominations for various forms of recognition than anyone else who comes to my mind. He truly reveled when his colleagues received accolades, often hosting impromptu wine-and-cheese parties to celebrate. He could also recognize an excuse a mile away and would give a little smile and say, "What's the matter? Did the dog eat your homework?" Joyce said he did this at home with the kids too.

One of the most intense experiences for managers at Bell Labs was performance review, and Bob's personality revealed its true nature during those reviews, which determined raises for the year and, more importantly, how your organization was viewed by those that controlled the resources. During much of the 1980s and early 1990s the group of department heads that reported to Bob (including myself) got pretty familiar with one another and Bob's performance review style, which was more intense, franker, fairer, and more time consuming than I experienced with any of my other bosses. The process was basically that everyone wrote what Bob called an "I am great letter," telling what their accomplishments for the year were and why they were world class. Then department heads would get together with directors and use these as the basis for evaluating people doing quite different work across department lines. This process was repeated at successively higher levels of management until, in principle, the entire company had been cross compared. Our first-level review generally took a week, often with pizza brought in on the weekend and even moved to Bob's basement on occasion. During that time we all learned a lot about what other groups were doing and made lists of opportunities we wanted to emphasize in the coming year.

Bob had to feel he understood and believed everything in all the I-am-great letters before he declared the review finished. It was certainly the most intense week of the year for most of us. At some point during the review he would inevitably become irate that someone he judged as underperforming was making double the salary of his daughter, who was a nurse and had patients' lives depending on her performance. At the conclusion of one such review (celebrated at a local pub over beer) the department heads presented Bob with their own jocular review of his performance, which rendered him uncharacteristically speechless and embarrassed. At the conclusion of another equally intense review, Bob closed his notebook and said words to the effect of "I have prostate cancer and will be operated on next week, and I want each of you to go get a PSA test if you haven't had one recently." I sat stunned at how he showed no hint of what was facing him through that entire week. He did well through the surgery and had several more very productive years before the cancer metastasized, leading to a premature death.

Life with Bob as a boss could also be challenging at times. Over the years Bob owned two Volkswagen convertibles, which he loved to drive around with the top down. None of my peers really enjoyed riding around with the top down on a hot, humid New Jersey summer day, and I admit to conspiring to avoid riding with him. Occasionally I showed up in his office with a small problem that triggered a venting of some pent-up frustration. I soon learned that before long he would come to my office in a much better mood to apologize. I saved up my most important requests for those occasions, and they were almost always approved. These were small prices to pay for the best boss I ever had.

Bob had been a runner in high school, and he sired a second generation of high school track runners. The book,

Going the Distance by George Sheehan, a medical doctor, runner, and prostate cancer victim, was especially meaningful and helped Bob's family though his last days. Bob's youngest son, Ed, operates a homeless shelter on Main Street in Immokalee, Florida, where Bob and Joyce often spent vacations helping out. There is now a bench in front of the shelter with a plaque that reads, "To my father. He ran the distance, making the most of every moment and bringing out the best in every person he met along the way."

I THANK BOB'S WIFE, Joyce, for sharing personal information for this memoir and for being a good friend for many years. I also benefited from helpful suggestions from Bob's friend and colleague, Paul Fleury.

NOTE

1. Personal information about Bob's youth and family used throughout this memoir were graciously provided by Joyce Laudise in several communications in early 2004.

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