



Andrew S. Grove

ANDREW S. GROVE

1936–2016

Elected in 1979

“Leadership in semiconductor technology, particularly in contributions to the understanding of structure and instabilities of the silicon-oxide interface.”

BY EUGENE S. MEIERAN

ANDREW STEPHEN GROVE died March 21, 2016, at age 79 in Los Altos, California. He was a major force in the science, technology, development, growth, and unprecedented expansion of the semiconductor industry from 1963 to the present day.

These factual statements are 100 percent accurate but convey nothing of the substance of Andrew Grove, or Andy—or ASG, or “A.,” or “a.,” or “G.,” or Grove, nicknames he was accustomed to use and respond to throughout his 53-year career. And these were not just simple nicknames; each conveyed a message! A recipient immediately understood by the way Andy signed his missives whether he was pleased, dismissive, upset, or merely impartial in his response (a message signed with a simple “a.” was always treasured!). But noting the effect (reverence—or dismay) of receiving an “andygram” does not substantially help define Andy’s impact on people.

If Andrew Grove were but a brilliant scientist, writing a memorial testament for him would be fairly easy: list his books, accomplishments, and awards, and state that the world is better off for his having lived and contributed much to society. Similarly, if he were a great engineer one could recite his accomplishments, or if he were a great manager or educator, one could mention the organizations or organizational processes he created or name the many influential students he

trained. On the human side, if he overcame enormous physical or mental obstacles to achieve success, one could marvel at how he achieved so much in spite of life's difficulties and challenges. If he shed his personal privacy to assist in helping patients and doctors come to grips with prostate cancer by publishing an article such as "Taking on prostate cancer: What to learn from a 15-year survivor" (*Fortune* magazine, May 13, 1996), one could point to a compassionate and involved senior executive willing to reach out to improve health care.

If the accomplishments in each domain were meritorious, each would deserve several pages individually. But what does one do when the person, this Andrew S. Grove, does *all* these within his short life span, at a level acclaimed by his peers as *expert* or *genius*?

How does one describe a person who survived Nazi and then Communist tyrannies, who through his enormous talent and skills created a technology that became globally pervasive, then went on to manage one of the greatest technological revolutions in history, and who in failing health himself contributed to medical science in helping understand and lead to possible cures for not one but two degenerative, disabling, and life-threatening diseases? Much has been written about Andy Grove; none of it adequately chronicles this extraordinary man's global impact on technology and society.

András István Gróf was born to Maria and George Gróf in Budapest on September 2, 1936. At age 4 he acquired scarlet fever, a disease that nearly cost him his life and left him with a severe hearing impairment for most of his adult life.

Living in Hungary under an authoritarian regime during his early years was nothing compared to what happened after the Nazis invaded in 1944. Hundreds of thousands of Jews were rounded up and deported to the Nazi killing camps; Auschwitz alone was said to have executed as many as 400,000 Hungarians within a few months. András and his mother assumed false identities and, sheltered by friends, survived the war. His father was taken to a forced labor camp, but survived and was reunited with his family after the war's end.

The demise of the Nazi regime led to the creation of the equally totalitarian Communist regime in Hungary. During the ill-fated Hungarian revolution in 1956, András decided to escape and, after a tortuous journey across Europe (detailed in his captivating book *Swimming Across: A Memoir*; Warner Books, 2001), landed in the United States in 1957, where he anglicized his name to Andrew Stephen Grove. As he wrote in his book,

By the time I was 20, I had lived through a Hungarian Fascist dictatorship, German military occupation, the Nazis' "Final Solution," the siege of Budapest by the Soviet Red Army, a period of chaotic democracy in the years immediately after the war, a variety of repressive Communist regimes, and a popular uprising that was put down at gunpoint . . . [where] many young people were killed; countless others were interned. Some 200,000 Hungarians escaped to the West. I was one of them.

In 1957 Andy also met Eva Kastan, an immigrant from Austria; the two were married in 1958 and remained together for the next 58 years.

Then began the education of one of America's most influential citizens. Andy started with studies in chemical engineering at City College of New York, where he received a BS in 1960, followed in 1963 by a PhD from the University of California, Berkeley, after which he joined Fairchild Semiconductor R&D in Palo Alto. That is where he met Gordon Moore, director of research and development. His relationships with Gordon and Bob Noyce, two of the eight cofounders of Fairchild, led to one of the greatest impacts on technology and economy in history.

At Fairchild, known for the bipolar silicon technology developed by Noyce, Moore, and the other "Fairchild 8," Andy started looking at the technology and properties of silicon-silicon dioxide interfaces. His seminal work eventually led to the commercial manufacture of metal oxide semiconductor (MOS) devices, which became the workhorse devices of the emerging silicon technology revolution.

When Andy joined the company it was making individual transistors, and when he left in 1968 it was a pioneer in integrated circuits (which Bob Noyce had co-invented). Equally noteworthy, Gordon Moore had created a diagram, soon to be labeled Moore's Law, that became the driving force for the semiconductor industry and remains valid today. Over the next 45 years Andy had a major role in turning this prediction of technology growth into reality.

His technical work and the publication of his first and extremely popular book *Physics and Technology of Semiconductor Devices* (Wiley, 1967), together with his acknowledged aggressive behavior, led him, then assistant director of research at Fairchild, to be selected to join Moore and Noyce when they formed Intel Corp. in 1968 (he was employee #4; numbers 1–3 were Noyce, Moore, and Leslie Vadasz¹).

Thus began Andy's next journey, from technical research scientist to manager and eventually CEO of what was for a while considered the most important and valuable company in the world. This transition from a fairly undisciplined research scientist to a senior manager fundamentally impacted the role of senior managers throughout Silicon Valley and the world of technology enterprises, as Andy developed his management philosophy and skills and implemented them, however unpopular, through Intel and eventually through many Intel-style management emulators.

Basically, although Andy's first role was that of Intel's director of engineering, he quickly started to formulate what was to become his management style, as described in his first managerial book, *High Output Management* (Random House, 1983). In this book he champions a disciplined operation at Intel that differed markedly from that of Fairchild and all the startup companies that Fairchild birthed.

There were no executive dining rooms, Mahogany Rows, or sacred parking places (everyone parked wherever they could find a spot), and everyone—engineers, scientists, and

¹ Les Vadasz escaped from Hungary at about the same time as Andy; the two men were colleagues and the closest of friends for 53 years.

top management—was expected to show up on time (leading to the notorious “sign-in lists” that even Bob and Gordon complied with). Floors, desks, and offices were expected to be neat (the equally notorious Mr. Clean inspections were initiated, where senior people at Intel would inspect *every* office, lab nook, and cranny to ensure that the place was kept neat).

In fact, Intel’s winning the war of the PC over Apple was probably a direct result of the 1973 slogan, “Intel Delivers.” Andy’s corporatewide focus on discipline ensured that Intel could meet market demands by meeting internal timetables and schedules.

At the same time, sabbatical leave was provided for all employees. And other management practices emerged, such as the introduction of flexible, nonsolid walled offices with no doors—“cubicles”; even Grove’s and Moore’s offices were open, roughly 8’ by 9’ squares with furniture, computers, and desks identical to those of all other employees. Cubicles could be easily reconfigured to meet changing business and lab space growth needs.

Intel was admittedly a demanding and stressful place to work, but also an energetic, challenging, and thriving environment where the senior management, from Bob, Gordon, and Andy on down, were highly visible and easy to approach. The Mr. Clean tours, for example, not only ensured discipline throughout the company but also allowed workers who otherwise would never personally meet Andy, Gordon, Bob, or other senior managers to talk with them on a periodic basis. (There was a genuine love-hate response to the Mr. Clean visits!) Many companies have copied Andy’s and Intel’s disciplined work style.

Technology was driven by support for innovation and adherence to delivery—the EPROM, the conceptually new microprocessor, the static RAM, the DRAM technologies—all were encouraged and became hugely successful even though highly risky. Andy’s earlier work on MOS technology paid off in a big way, and Intel thrived and grew as no other company in history. Moore’s Law required that Intel coordinate new process technologies (scaling), new architectures (devices),

and new facilities (manufacturing) to turn out a product on a given date; there was little latitude for failure.

Andy still had to make hard and often unpopular business decisions. For example, in the face of emerging stiff Japanese competition in the memory market he chose, against strong opposition, to discontinue producing the solid-state memory DRAM chips pioneered by Intel. These were the critical “test devices” used to generate and debug new process technology changes. The focus changed to using microprocessors; their design was less structured and therefore more difficult to use when evaluating a new process or design. As mentioned, Intel’s success in getting IBM to continue to use Intel technologies led to the dominant role of microprocessors in the world’s economy, one of the great success stories of the Information Age.

Eventually, Bob Noyce left to become president of Sematech, and Gordon moved on to chair the board. Andy assumed the CEO position (he also continued to write books; *Only the Paranoid Survive* [Doubleday Business, 1996] is probably his most widely read book). In this position he was recognized as the major driving force behind the emergence and growth of Silicon Valley. Intel itself grew from a \$3,000 gross revenue company to a \$30 billion company, whose logos—“Intel Delivers” and later “Intel Inside”—were often regarded as the most valuable in the world, exceeding those of Coca Cola and IBM!

Andy was named *Time* Man of the Year in 1997. Many corporate rivals became his greatest admirers. Included in that list are Steve Jobs and Bill Gates; Bill and Microsoft were close partners with Intel (often referred to as “Wintel”).

But another term was once used to describe Grove’s work with or study of other companies’ processes: McDonald’s. The fast-food restaurant’s french fries are made with identical processes and materials, and Andy believed that principle should be applied to the making of semiconductor chips (leading to another Intel slogan, “Copy Exactly!”). Hence the relatively unknown term, McIntel. There is even a rare photograph of Andy emerging from a large “McIntel” hamburger box made

to look like an Intel device package! Although unpopular with process development engineers, “Copy Exactly!” did ensure that products manufactured at all Intel facilities were the same and contributed enormously to the company’s profitability and success.

While enjoying fame and reputation—numerous honors and honorary doctorates that he had earned as a survivor, a technologist, and a manager—another period of Andy’s life began as he battled first prostate cancer and then Parkinson’s disease. He left his position as CEO at Intel, but remained active in other ways. He became chair of the board at Intel and started teaching management and innovation courses at Stanford University.

At the same time, he fought personally for his own health and publicly to help anyone else with this disease, conferring with doctors to suggest ways of defeating it. He used the same discipline and detail orientation he had exercised at Intel, and was acclaimed by the medical profession for his scientific and disciplined approach. He offered advice to other cancer victims.

Parkinson’s struck Andy in 2000, and he succumbed to it after a 16-year struggle. But in spite of even this malady, he maintained a rigorous and busy work and education schedule. He traveled, consulted, taught, was interviewed, and remained an icon of Silicon Valley to the very end.

He leaves behind his wife Eva, and two daughters and their families, which include 8 grandchildren. And he leaves behind a legend.

Andrew Grove, the man, has left us; but his technology, his style, his ideas, his vision, his strength and inspiration live on. As said at the beginning of this testament to Andy, there are many people who are giants in their fields of expertise. But there are few, very few, that become respected giants in numerous domains. Andy Grove was one of these very rare individuals.