

CHEMICAL HERITAGE FOUNDATION

**MORRIS TANENBAUM**

Transcript of an Interview  
Conducted by

David C. Brock and Christophe Lécuyer

at

Bell Telephone Laboratories, Inc.  
Murray Hill, New Jersey

on

3 May and 26 July 2004

(With Subsequent Corrections and Additions)

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## MORRIS TANENBAUM

1928 Born in Huntington, West Virginia, on 10 November

### Education

1949 A.B., Chemistry, John Hopkins University, Baltimore, Maryland  
1952 Ph.D., Physical Chemistry, Princeton University, Princeton, New Jersey

### Professional Experience

Bell Telephone Laboratories  
1952-1956 Chemistry and Chemical Physics Division, Technical Staff  
1956-1962 Assistant Director of Metallurgical Department  
1962-1964 Director, Solid-State Development Laboratory  
1975-1976 Executive Vice President, Systems Engineering and Development

Western Electric Company  
1964-1968 Director of Research and Development  
1968-1972 Vice President, Engineering Division  
1972-1975 Vice President, Manufacturing: Transmission Equipment

The AT&T Company Laboratory  
1976-1978 Vice President, Engineering and Network Services  
1980-1984 Executive Vice President

New Jersey Bell Telephone Company  
1978-1980 President

AT&T Communications  
1984-1986 Chief Executive Officer and Chairman of the Board

AT&T Corporation  
1986-1988 Vice Chairman, Finance  
1988-1991 Vice Chairman, Finance and Chief Financial Officer

### Selected Honors

1970 Institute of Electrical and Electronics Engineers (IEEE) Fellow  
1972 Vice President and member of the National Academy of Engineering

1975 ASM Campbell Lecturer  
1980 New Jersey Institute of Technology Honorary Doctor of Science  
1981 Seton Hall University Honorary Doctor of Science  
1982 Stevens Institute of Technology Honorary Doctor of Engineering  
1983 Worcester Polytechnic Institute Honorary Doctor of Science  
1984 IEEE Centennial Medal  
1990 Fellow, American Academy of Arts and Sciences  
1992 Lehigh University Honorary Doctor of Science  
1996 Elected Life Member of MIT Corporation  
1999 John Hopkins University Heritage Award

## ABSTRACT

**Morris Tanenbaum** grew up in Huntington, West Virginia, one of three children. His Jewish parents had come from Russia and Poland by way of Buenos Aires, Argentina; they owned a delicatessen, in which Morris worked after school. He liked and did well in school, always interested in science. A trip to the 1939 World's Fair further focused his interest in science. He graduated from high school and chose Johns Hopkins University because of its reputation for chemistry. He liked physical chemistry and physics and somehow found himself often being the business manager of college organizations. One of his professors, Clark Bricker, who was leaving for Princeton University, convinced Tanenbaum to accept a research assistantship there and to obtain a PhD. Tanenbaum worked on spectroscopy in Bricker's lab. He married Charlotte Silver whom he had met during his sophomore year at Johns Hopkins. For his thesis, he moved to Walter Kauzmann's lab to study the mechanical properties of metal single crystals; he won the DuPont and Proctor Fellowships.

After being awarded his PhD, Tanenbaum went to work at Bell Laboratories where he did the original studies of single crystal III-V semiconductors. He was asked by William Shockley to head a group to determine if transistors could be made using silicon. Up to that time, all semiconductor technology had employed germanium where the transistor effect had first been discovered. Within a year, Tanenbaum, with the assistance of Ernest Buehler, made the world's first silicon transistor. A few months later, Gordon Teal at Texas Instruments made a similar transistor. Working with Calvin Fuller, Tanenbaum invented the diffused base silicon transistor using solid-state diffusion.

When Shockley left Bell Labs, he invited Tanenbaum to join him to start up a silicon device company funded by Arnold Beckman. After much consideration, Tanenbaum decided to remain at Bell Labs and moved from semiconductors to the broader field of Metallurgy and Materials Science where he led a group including Gene Kunzler who invented high field superconducting magnets. He then moved from the Research Division of Bell Labs to the Electron Device Division where he directed the Laboratory responsible for the development of new devices other than semiconductors, such as solid-state lasers and magnetic memories.

Western Electric recruited Tanenbaum to lead its new Engineering Research Center. He recruited PhD's in the physical sciences and engineering with an interest in applications for the manufacturing floor. He later became Vice President of Engineering for all of Western Electric and then moved from the technical side to become Vice President for Transmission Equipment with responsibility for the several plants that manufactured transmission equipment. Tanenbaum was called back to Bell Labs as Executive Vice President with responsibility for all of development. Then he moved to AT&T Corporate Offices as Senior Vice President of Engineering and Network Services. He later served as President of New Jersey Bell.

In 1980, he was called back to AT&T as Executive Vice President for Administration. During that period, he was much involved in the Federal antitrust case against AT&T that was eventually settled by a Consent Degree that separated AT&T into several independent companies (the "Baby Bells") providing local telephone service and AT&T retaining Western Electric, most of Bell Labs, and the long distance services. As Tanenbaum says, that separation while maintaining quality telephone service was like trying to separate a Boeing 747 into two 737s while in flight. He became Chairman and CEO of AT&T Communications with

responsibility for all long distance service. His final position was CFO and Vice Chairman of the AT&T Board of Directors.

Recognizing that his position, though perhaps more exalted, no longer provided the “fun” he had always sought and found, he prepared to retire. He continued to serve as a Trustee at Johns Hopkins and MIT and on a number of corporate boards. After retirement he consulted for General Motors on their Board’s Science Advisory Committee and served as the Vice President of the National Academy of Engineering and a member of the Governing Committee of the National Research Council of the National Academies. He and his wife have always loved classical music and he was a Founding Director of the New Jersey Performing Arts Center while his wife, Charlotte, served on the Board of the New Jersey Symphony. He also served on the Board of the New York Philharmonic.

Throughout the interview Tanenbaum reflects on his enjoyment of his work; his interactions with his colleagues; his retrospective view of the history of transistors, semiconductors, and electronics; his fascination with and insistence on the importance of chemistry; and his long and deep association with AT&T in its various stages.

## INTERVIEWERS

**David C. Brock** is a senior research fellow with the Center for Contemporary History and Policy at the Chemical Heritage Foundation. As a historian of science and technology, he specializes in the history of semiconductor science, technology, and industry; the history of instrumentation; and oral history. Brock has studied the philosophy, sociology, and history of science at Brown University, the University of Edinburgh, and Princeton University.

In the policy arena Brock recently published *Patterning the World: The Rise of Chemically Amplified Photoresists*, a white-paper case study for the Center’s Studies in Materials Innovation. With Hyungsub Choi he is preparing an analysis of semiconductor technology roadmapping, having presented preliminary results at the 2009 meeting of the Industry Studies Association.

**Christophe Lécuyer** is a graduate of the École Normale Supérieure in Paris, and he received a Ph.D. in history from Stanford University. He was a fellow of the Dibner Institute for the History of Science and Technology and has taught at the Massachusetts Institute of Technology, Stanford University, and the University of Virginia. Before becoming a senior research fellow at CHF, Lécuyer was the program manager of the electronic materials department. He has published widely on the history of electronics, engineering education, and medical and scientific instruments, and is the author of *Making Silicon Valley: Innovation and the Growth of High Tech, 1930–1970* (2005).

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| Early Years   | 1  |
| <p>Family background. Childhood in Huntington, West Virginia. Impressions of school. Early interest in chemistry as demonstrated by experiments. Visit to 1939 World's Fair in New York City cements desire to be scientist. Conservative Judaism. Work in parents' delicatessen. Father's early death and mother's remarriage.</p>   |    |
| College and Graduate School Years   | 7  |
| <p>Youthful matriculation at Johns Hopkins University. Ira Remsen's reputation's influence. Business manager of several organizations. Likes physical chemistry and physics. Worked summers on nerve gas and mustard gas. Always saw himself working in industry. Persuaded by Clark Bricker, just leaving for faculty position at Princeton University, to accept research assistantship in Bricker's lab. Spectroscopy work cemented love of physical chemistry. Became interested in electronics. Married Charlotte Silver. Took exams his first year and moved into Walter Kauzmann's lab. Used Bridgman method to grow crystals. DuPont and Proctor Fellowships. PhD granted in 1952.</p>  |    |
| Early Years at Bell Laboratories  | 27 |
| <p>Visited and loved Bell Laboratories. William Shockley's group. Floating zone technique. Oxygen impurities in crystals. Invention of silicon transistor. Ernest Buehler and the need to grow silicon crystals. Worked with Calvin Fuller to develop gaseous diffusion silicon transistor. Semiconductor group at Bell Labs. Organization of departments and hierarchy. Exciting environment of openness, sharing with other brilliant individuals. Patents and cross-licensing. Masers, lasers. Refuses Shockley's offer to join his company. Interest in superconductivity. Talks about colleagues Gene Kunzler, Bernd Matthias, Rudolf Kompfner, Carl Frosch. Superconducting magnets. Disappointment at Bell's ceding of leadership in silicon transistor field. Watching integrated circuits invented and developed elsewhere.</p>                                |    |
| Promotion Years   | 84 |
| <p>Becomes Director, Solid-State Development Laboratory and heads the solid-state development laboratory in the Electronic Components Division. Interest in solid-state lasers. Telstar. Moves to Western Electric. Strives to reduce gap between new technology and the manufacturing process itself. Cutting diamond dies become first use of lasers in manufacturing. Recruits PhD's in chemistry, chemical engineering, and physics to invent and develop new manufacturing technology. Extrusion of plastics. Importance of communication. Becomes Vice President, Engineering Division, Western Electric. Gradual change from technology into business aspects of company. Introduces concept of case analysis. Becomes Vice President of Manufacturing Transmission Equipment. Competition from International Telephone and Telegraph, especially in digital</p> |    |



|   |     |
|---|-----|
| transmission equipment. Increases and improves marketing. Builds smaller and more flexible plants. Satellite communications business forbidden to AT&T, given to Comsat.  |     |
| Back to Bell  | 117 |
| Returns as Executive Vice President of Systems Engineering and Development. Metallization failures in field. Integrated circuits make digital switches possible; used first for toll switches, finally for local.   |     |
| Engineering and Network Services at AT&T  | 121 |
| After eleven months accepts job as Vice President of Engineering and Network Services at AT&T. Top technology post in company; very exciting. Staff mostly technical people, many from Bell Labs. Transition to digital and then to optical transmission, supported by lasers and semiconductors. Reflects on development of semiconductors and contribution of chemists.   |     |
| Career Transition to New Jersey Bell Telephone Company  | 130 |
| Becomes President of New Jersey Bell. NJ Bell largest employer in state except for government. Relations with Governor Kean. Main responsibilities consist of marketing and community relations.  |     |
| AT&T Years  | 134 |
| Leaves NJ Bell to become Executive Vice President of AT&T Corporate Staff. Discussion of political responsibilities. Antitrust suit. Dealings with U.S. Congress. Acts as technical consultant for final Consent Decree. AT&T permitted long-distance operations only. Western Electric stays with AT&T. Establishment of Bellcore (Bell Communications Research). After official reorganization becomes CEO and Chairman of AT&T Communications. Hectic, stressful years. After two years becomes Vice Chairman for Finance and CFO of AT&T Corporation. New organization and hierarchy. Difficulties and responsibilities include distance from operating part of business; regulatory problems; financial responsibilities; developing new, foreign markets; diversification into non-telecommunications activities. |     |
| Retirement Years  | 145 |
| Knows retirement is near when he stops “having fun.” Continues as trustee of Johns Hopkins University and Massachusetts Institute of Technology. Becomes member of Science Advisory Committee of General Motors. Serves on a number of corporate boards of technically-oriented companies. Responsibilities of trustees. National Action Council for Minorities in Engineering. National Academy of Engineering. National Research Council. Helps establish New Jersey Performing Arts Center in Newark.  |     |
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