NATIONAL ACADEMY OF SCIENCES

SOLOMON J. BUCHSBAUM

1924—1993

A Biographical Memoir by

KENNETH G. MCKAY

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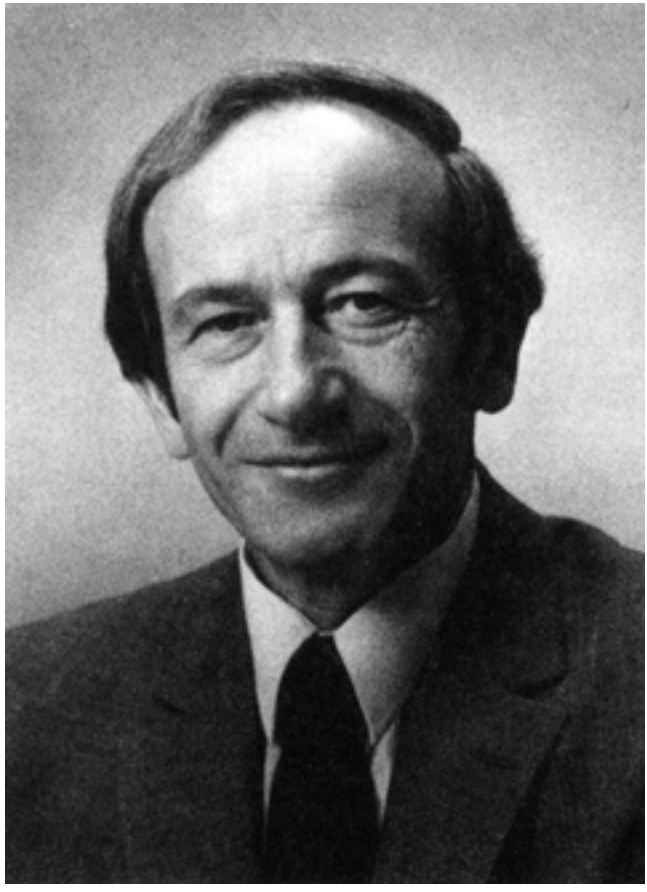

SOLOMON J. BUCHSBAUM

December 4, 1924–March 8, 1993

BY KENNETH G. MCKAY

SOLOMON J. BUCHSBAUM IS DEAD. That fact is as shocking now as it was on March 8, 1993. It rattled around academia, government, and the AT&T Bell Laboratories where he was employed for thirty-five years. He was alert and insightful, with a broad range of knowledge. His interests extended from plasma and solid-state physics and nuclear weaponry to demonstrated leadership in determining and promoting public policy in science and technology. As senior vice-president of technology systems at AT&T Bell Laboratories, he was responsible for product realization planning and engineering, government systems, the architectural framework for AT&T products, systems and services, and R&D in support of manufacturing. He was a well-rounded man.

Sol (he was always called "Sol," and this usage will be followed throughout this memoir) was essentially a forward-looking individual; he never looked back. So the facts about his extraordinary early life are largely gleaned from his wife of thirty-seven years, Phyllis Isenman Buchsbaum, to whom I am extremely grateful.

In 1941, two years after the Nazis invaded Poland, Jacob Buchsbaum, Sol's father, was "removed" along with other

businessmen in the town of Stryj and never heard from again. Two and a half years later, all the other Jewish residents in the area—including thirteen-year-old Sol; his mother, Berta; and one sister, Judy—were rounded up and jailed. His mother told them that if they had the chance they should run away. His sister refused to leave their mother, and Sol never saw either of them again. But Sol fled barefoot to a factory where his other sister, Dorothy, had been taken. There he obtained some money and supplies and took the train to Warsaw. He found refuge in a Catholic orphanage—no questions were asked. There he recited Mass every week and even became an altar boy.

Without formal schooling, Sol "read and survived." He learned Latin, which proved useful when he later studied French and English. After the war, the Canadian Jewish Congress helped him emigrate to Canada just two weeks before his eighteenth birthday—the age limit for acceptance. Within a year Sol taught himself English with a Polish accent, obtained his high school equivalency, and found work in a hat factory.

Sol was always good with numbers and life in the hat factory was definitely limited, so, thinking that he might become an accountant, he applied for and received a one-year general studies scholarship to attend McGill University in Montreal. Later that year he won a full scholarship in mathematics and physics. McGill's curriculum for honors students was different. After one year of general subjects, the student received one course in physical chemistry, and all the other courses for three years were solely in mathematics and physics. Clearly, this was no hindrance to anyone with Sol's breadth of interests, and he graduated in 1952 with the Anne Molson Gold Medal for Science, Mathematics, and Physics. Professor Gar A. Woonton had established the Eaton Electronics Laboratory at McGill, so Sol

continued for a master's degree while working in the lab. At that time, the research in Woonton's group concentrated on the theory and measurement of the electromagnetic fields that exist in an illuminated aperture in a metal screen. Sol did his master's thesis on the EM fields in an elliptical aperture.

With another scholarship, Sol entered MIT aiming at a Ph.D. in physics. Unlike today, the MIT student was very much on his own. I entered MIT with a M.Sc. from McGill in 1939 and found it to be mysterious, not user friendly. Today the student, upon entering, is given sheets of information, is assigned a mentor, and is given assistance in selecting a thesis professor. It is more efficient, although we question whether it builds self-confidence. But clearly it did not affect Sol. Professor Will Allis, aided by Professor Stanford Brown, was studying microwave plasmas in magnetic fields; Sol eagerly plunged in. There followed a long-time fascination with plasmas and the beginning of a substantial outpouring of publications, some experimental, some theoretical, which swelled as he took on plasma research at AT&T Bell Laboratories. Meanwhile, during his first year at MIT, Sol met Phyllis Isenman, a freshman at Simmons College. They were married in 1955 and both graduated two years later. The following year Sol was an instructor at MIT pursuing his favorite research interest.

Let us appreciate what Sol had accomplished up to this point. He had no formal education until he arrived at McGill University. However, within a relatively short time, he accumulated a B.Sc., a M.Sc., and a Ph.D., while later he had over fifty peer-reviewed technical papers to his name.

In 1958 Sol accepted a research position at Bell Laboratories. He intended to stay but a few years and then return to academic research. However, every time the opportunity to leave arose, he found that he was involved with more

and more interesting things where he was. So he continued studies in plasma research, branching out into solid-state physics. Within three years he became head of the Solid-State and Plasma Physics Research Department. Research Vice-President Arno Penzias said, "The work that was done in Sol's lab in quantum electronics, which led to lasers and the whole era of lightwave communications, influenced not only Bell Labs, but pretty much the whole world."

Sol left Bell Labs in 1968 to become vice-president of research at Sandia National Laboratories in Albuquerque. Sandia is responsible for the design of the nonnuclear components of our nuclear arsenal, and its research effort lies on the cutting edge of technology. In 1971 Sol returned to Bell Labs and, after a series of promotions, became responsible in 1979 for product realization planning and engineering, government systems and the architectural framework for AT&T products, and systems and services. Again to quote Penzias, "He became what I would call 'Executive Vice-President of Everything Else.' John Mayo (ex-President Mayo) headed the part of Bell Laboratories that served the telephone companies; everything else—computers, information systems (which later became American Bell), the communication products folks who make the phone you buy at Sears these days, government work that dealt with under-water sound, the architecture area—all nestled under Sol. More recently, he tried his hand at new things, like high-definition television."

If all this action were not enough, Sol expanded his interests into the scientific and political life of the nation. He was an associate editor of *Physics of Fluids* (1963-66), *Journal of Applied Physics* (1968-70), and the prestigious *Review of Modern Physics* (1968-76). His participation in professional societies was impressive. For example, in 1973 he was elected to membership in the National Academy of Engineering

and in 1975 to the National Academy of Sciences—the top scientific and engineering bodies in the country. Also in 1975 he became a fellow of the American Academy of Arts and Sciences, the American Association for the Advancement of Science, and the American Physical Society. In 1972 he became a senior fellow of the Institute of Electrical and Electronics Engineers; in 1968 he was chairman of the American Physical Society's Division of Plasma Physics and a member of its council in 1973.

As far as universities are concerned, Sol was a member of the School of Engineering Advisory Board of Stanford University, which took the board's recommendations very seriously. At MIT he was a member of the Lincoln Laboratory Advisory Board, the Corporation Development Committee, and the Physics Visiting Committee. He was also on the board of two non-profits: the Rand Corporation (1982-) and the Charles Stark Draper Laboratories (member, 1983-; director, 1984-). I was chairman of Draper Laboratories when Sol joined the board with a minimum of arm twisting. He was a most effective member—always asking pertinent and sometimes embarrassing questions and at the same time having relevant answers.

For all of these activities, Sol was given substantial public recognition. As mentioned earlier, he received the Anne Molson Gold Medal upon graduation from McGill University. In 1987 he was given the IEEE's Frederik Philips Award. In 1977 he received the Medal for Outstanding Public Service from the Secretary of Defense, and four years later the Award for Exceptional Public Service from the Secretary of Energy. In 1986 President Reagan presented him with the National Medal of Science.

Much of Sol's work never appeared in print. Five U.S. presidents and their administrations benefited from Sol's personal scientific and technological counsel during the

past three decades. In addition to his rigorous service on more than a dozen advisory councils concerned with defense, energy, and the state of American science, Sol was frequently called on by congressional committees to comment on matters of technology. His expert testimony included such recent subjects as the role of American corporations in supplying high-definition television systems, research into high-critical-temperature superconductivity materials, and the health of the semiconductor industry in the United States. His promotion of better understanding of technology in the government was matched by his active coordination of communication between industrial, university, and government policymakers, who knew him best for his twenty-two years of service on the Defense Science Board, where he was chairman from 1972 to 1976.

An overview of Sol's national advisory activities follows.

• *Energy Research and Development Advisory Council's Fusion Power Coordinating Committee.* Sol served as a consultant on this committee from 1972 through 1978. The council was established to provide advice on the overall direction of the federal energy research and development effort; to suggest new energy research and development programs, including technical approaches that may contribute to the solution of energy-related problems; and to examine specific recommendations by federal agencies regarding energy-related research and development.

• *Naval Research Advisory Committee.* Sol served on this committee from 1978 through 1981. The committee is the senior scientific advisory group to the Secretary of the Navy, Chief of Naval Operations, Commandant of the Marine Corps, Chief of Naval Research, and the Chief of Naval Development. It is the task of the committee to know the problems of the Navy and the Marine Corps, to evaluate the current

solutions, and to suggest appropriate means for improvement.

- *White House Advisory Group on Technical Advances.* Sol was a member of this group from 1975 to 1976.
- *President's Science Advisory Committee.* Sol functioned on this committee from 1970 until it ceased to exist in 1973. The committee advised the president on matters relating to science and technology, and it developed a national policy on space in light of the Russian Sputnik launchings.
- *Energy Research Advisory Board.* Sol chaired this board from 1978 to 1981 and continued as a member until his death. The board consists of twenty-five members who represent a cross-section of industry, local and state governments, and utility commissions, as well as residential, commercial, and industrial users. It advises the Secretary of Energy on energy policy and on scientific and technical matters of interest to the Energy Department. Specifically, the board provides advice on overall research and development being conducted in the department and provides long-range guidance in these areas.
- *Defense Science Board.* Sol chaired this board from 1972 through 1976 and was a senior consultant since 1978. The board consists of 150 civilian members representing the industrial, academic, and scientific communities. It advises the Secretary of Defense and the director of defense acquisitions on overall scientific and technical research and engineering and provides long-range guidance in these areas.
- *White House Science Council.* Sol chaired this council since its inception in 1982. Its thirteen members advise the director of the Office of Science and Technology Policy on science and technology issues of national concern. The council studies issues assigned by the director to keep him informed of changing perspectives in the science and technology communities.

• *President's Council of Advisors on Science and Technology.* President Bush named Sol to membership in this group in 1990.

The other side of these extraordinary activities was that Sol was often late for scheduled meetings and was difficult to locate. However, a very efficient secretary eased this situation; he tried to be and, usually was, accessible.

Sol's other world was his home, family, and synagogue. In addition to his wife, Phyllis, and sister, Dorothy, he had three children—Rachel, David, and Adam, and three grandchildren, Hannah, Jacob, and Joshua. He was an avid tennis player; he went west for a skiing vacation every spring; and he was competitive at the bridge table. This enthusiastic and competitive spirit permeated Sol's entire life except with his family. There he relaxed and showed a softer side of his personality, that of a loving husband and father. While he was often asked to relate his wartime experiences, he preferred not to dwell on the painful part but rather to enjoy the present and anticipate the future.

Now we come to the unusual circumstances concerning his death, an event that was anticipated yet unexpected. Several years before he died, a routine examination by the Bell Laboratories doctor disclosed that Sol had developed multiple myeloma, a cancer of the bone marrow. He underwent treatment while, in typical fashion, he performed just as usual without disclosing the situation to anyone but his immediate family. However, his condition worsened, until finally he had to make the ultimate decision concerning treatment: whether to undergo a bone marrow transplant. Sol, as usual, agreed to proceed. After the arduous treatment, he had to remain for a month in isolation until his white corpuscle count regenerated. Meanwhile, he was equipped with a telephone, a facsimile machine, and all the equipment that enabled him to carry on "business as

usual." In fact, I attended a meeting in the auditorium in Holmdel, New Jersey, at which Sol was expected to participate—and so he did, via a microphone and loudspeaker system while in his Boston germ-free room. He sounded as cheerful and as smart as ever. Finally, he was released. His platelet count was still far below normal, but it was increasing. He was overjoyed and continued to work at home. However, during the post-transplant period, he died suddenly of complications. It seemed particularly ironic that, after he had survived so much, the end came just as he was celebrating another victory.

Sol left behind eight patents, over fifty technical publications, a large hole in governmental advisory committees, an unusually large range of friendships, and a loving family. He is sorely missed.

I WISH TO EXPRESS my appreciation to John S. Mayo, Ian M. Ross, A. Penzias, and Dan van Atta of AT&T Bell Labs, whose words I have woven into this memoir.

SELECTED BIBLIOGRAPHY

1957

With S. C. Brown. Microwave measurements of high electron densities. *Phys. Rev.* 106:196-99.

1960

Resonance in a plasma with two ion species. *Phys. Fluids* 3:418-21.

Ion resonance in a multicomponent plasma. *Phys. Rev. Lett.* 5:495-97.

With L. Mower and S. C. Brown. Interaction between cold plasmas and guided electromagnetic waves. *Phys. Fluids* 3:806-20.

1961

With E. I. Gordon and S. C. Brown. Experimental study of a plasma column in a microwave cavity. *J. Nucl. Energy, Pt. C, Plasma Phys.* 2:164-68.

With P. M. Platzman. Effect of collisions on the Landau damping of plasma oscillations. *Phys. Fluids* 4:1288-93.

With J. K. Galt. Alfven waves in solid-state plasmas. *Phys. Fluids* 4:1514-17.

1962

With W. P. Allis. Coupling between electromagnetic and electron waves in a plasma. *Nucl. Fusion* 2:49-53.

With others. Containment of plasmas by high frequency fields. *J. Appl. Phys.* 33:2429-34.

With L. Mower. Interaction between cold plasmas and guided electromagnetic waves. II. *Phys. Fluids* 5.

With G. E. Smith. Microwave induced a.c. voltage in bismuth. *Phys. Rev. Lett.* 9:342-43.

1963

With G. E. Smith and L. C. Hebel. Hybrid resonance and "tilted-orbit" cyclotron resonance in bismuth. *Phys. Rev.* 129:154-68.

With W. B. Cottingham. Electron ionization frequency in hydrogen. *Phys. Rev.* 130:1002-6.

With G. A. Baraff. Anisotropic electron distribution and the dc and

microwave avalanche breakdown in hydrogen. *Phys. Rev.* 130:1007-19.

With P. M. Platzman. Transmission of electromagnetic waves through plasma slabs. *Phys. Rev.* 312:2-9.

1964

With P. M. Platzman and N. Tzoar. Light-off-light scattering in a plasma. *Phys. Rev. Lett.* 12:573-75.

With C. S. Roberts. Motion of a charged particle in a constant magnetic field and a transverse electromagnetic wave propagating along the field. *Phys. Rev.* 135:A381-89.

1965

With A. G. Chynoweth and W. L. Feldman. Microwave emission from indium antimonide. *Appl. Phys. Lett.* 6:67-69.

With W. B. Cottingham. Diffusion in a microwave plasma in the presence of turbulent flow. *J. Appl. Phys.* 36:2075-78.

With G. A. Baraff. Surface wave instability in helicon wave propagation. *Appl. Phys. Lett.* 6:219-21.

With P. A. Wolff. Effect of open orbits on helicon and Alfven-wave propagation in solid-state plasmas. *Phys. Rev. Lett.* 15:406-9.

1966

With A. G. Chynoweth and W. L. Feldman. Low-field microwave emission from indium antimonide. *J. Appl. Phys.* 37:2922-24.

With A. Hasegawa. Longitudinal plasma oscillations near electron cyclotron harmonics. *Phys. Rev.* 143:303-9.

With G. A. Baraff. Surface-wave instability in helicon-wave propagation. *Phys. Rev.* 144:266-76.

1967

With P. M. Platzman. Nonlocal damping of helicon waves. *Phys. Rev.* 154:395-98.