Elliott Waters Montroll was a distinguished theoretical physicist, a gentleman and a scholar. He had the talent to present ideas in an extraordinarily interesting and clear fashion. He made breakthroughs in every new area he entered and his papers were instructive and a delight to read. Paul Meijer tells the story that he gave his secretary a Montroll paper to Xerox. After a while when she did not return he found her at the copier reading Elliott's paper. In part the work was about enzymes for blood clotting and the role hemophilia played in the Romanov dynasty.

Elliott held high position at universities, industry, and government. But in his heart, his home was the Institute for Physical Science and Technology (IPST) at the University of Maryland. Elliott moved to the Washington area in 1948 to head up the recently created Physics Division at the Office of Naval Research. He got the job by happening to be in Frederick Seitz's office, I believe at Carnegie Tech (later called Carnegie-Mellon) when a phone call came asking Seitz if he knew anyone who might be interested in the ONR job. In those days ONR was located in a Quonset hut on the Smithsonian Mall. Elliott bought a large house in Chevy Chase where he lived with his wife Shirley and ultimately their ten children. He once remarked that he had to drive through a forest to get to work and people were surprised that he moved so far out away from downtown DC. Today Chevy Chase is considered "close in" to DC. Thus not only in physics were his instincts ahead of the crowd, but also in real estate. In 1950 he moved to the University of Maryland and joined the Institute when it was known as the Institute for Fluid Dynamics and Applied Mathematics. He stayed until 1960 and had a "decade mirabilis" with innovative work on phase transitions, lattice dynamics, irreversibility, finite temperature quantum statistical physics, and traffic flow. In this time period he attracted an array of outstanding people, later famous in their own right, to the University of Maryland including Cyril Domb, Renfrey Potts, Alex Maraduddin, John Ward, Gordon Newell, Peter Mazur, George Weiss, Barry Ninham, and Leo García-Colin. His work with Kurt Shuler initiated the role of stochastic processes to chemical kinetics.

He moved back to IPST in 1980 when he retired as Einstein Professor from the University of Rochester. From that time until his passing in December of 1983 he was very productive with early work on Levy flights and fractal stochastic processes with Barry Hughes and Michael Shlesinger, stretched exponential relaxation in polymers with John Bendler from GE and Shlesinger, and aspects of social phenomena recounted in his 1982 Gibbs lecture, "The dynamics and evolution of some socio-technological systems" to the American Mathematical Society.

Elliott's career began as a graduate student at the University of Pittsburgh where he had the good fortunate to overlap with Gregory Wannier. Elliott was asked, by Wannier, to review Joe Mayer's work on imperfect gases for a seminar. This led him deep into the work which he then advanced by recognizing that in Fourier space ring diagrams could be summed. This was perhaps the first diagrammatic expansion in physics and Elliott's Ph.D. thesis. Elliott postdoc'ed with Mayer at Columbia University, initially without a salary. He brought up this memory when I postdoc'ed with him and there was no salary for the first three month.

Wannier also introduced Elliott to the Ising model. By inventing the transfer matrix method Elliott could solve the 1D case and calculate upper and lower bounds for the critical temperature in 2D. In their famous Ising model paper, Hendrick Kramers and Wannier thank Mr. Elliott Montroll for his transfer-matrix insight. Elliott next went to Yale University to work with Lars Onsager. He taught Onsager the transfer-matrix method which Onsager then used to solve the 2D Ising problem. Montroll, Potts, and Ward were later able to extend this Ising work to correlation functions using a Pfaffian approach. When Elliott worked on the Ising model the field was largely covered by C. N. Yang, Lars Onsager, Hendrick Kramers and Gregory Wannier. Elliott was amused much later to visit universities where more than that number of people were engaged in Ising model problems. When too many people entered a field, Elliott left it for new pastures.

His last postdoc position was with Peter Debye at Cornell University were he developed lattice dynamics in the harmonic approximation. He later exactly calculated the frequency spectrum of a square lattice in terms of elliptic integrals and discovered what later became known, in the general case, as Van Hove singularities. Montroll pointed out a connection to Maxwell's topological paper "On Hills and Dales" in calculating how many Van Hove singularities should appear. With Alex Maraduddin and George Weiss the work on lattice dynamics has become a standard part of solid state physics.

During WWII, Elliott worked with the Kellex Corporation on the theory of a cascade separation for the diffusion separation of U235 from U238. Lord Rayleigh's Nobel Prize winning work used a cascade technique to separate argon from air and Elliott was guided by Rayleigh's work in this and other matters, especially random walks. Elliott and Gordon Newell reviewed their cascade separation work in the Reviews of Modern Physics in 1953. It was from this work that Elliott began his study of random walks on a lattice when studying pressure changes between cascade layers. Elliott's Green's function approach opened this field to physicists. He found analytically for the first time the probability for a random walker to return to its origin in 3D in terms of the same elliptic integrals from lattice vibration theory. With George Weiss he generalized discrete time random walks to continuous time random walks (CTRW). Work with Harvey Scher at Xerox again generalized the random walk to allow for waiting times between jumps to be a slow algebraic fall off to produce an infinite mean waiting time. This work, which described charge transport in xerographic amorphous semiconductor films has received well over 1000 citations and opened up the new area of fractal time transport. Conferences are still held each year on aspects of CTRW-related fractal transport in space and time in topics from turbulent diffusion to the movement of fluids in water tables to trajectories in non-integrable Hamiltonian systems.

After leaving the University of Maryland in 1960, Elliott became the Director of General Sciences at IBM, Yorktown. At this time he also became the founding editor of the Journal of Mathematical Physics. Three years later he became Vice President for Research at the Institute for Defense Analysis, back in the Washington DC area. In 1966 he accepted the position of New York State Einstein Professor at the University of Rochester where he stayed from 1966-1980. During these DC absences, Elliott rented out his house with the idea to return eventually. One notable tenant and friend was D. Carleton Gajdusek, a Nobel Laureate in Medicine. It was at the University of Rochester that I met Elliott in 1970 and did my Ph.D. research under him. He created the Institute for Fundamental Studies where any topic was open to mathematical analysis. One of his postdoc's was Bruce West who went to work in Elliott's La Jolla based company, Physical Dynamics focused on DOD work, sometimes at the classified level. Bruce helped spin off the La Jolla Institute which was devoted to basic research. As an indication of Elliott's influence on defense issues, Bruce became a Chief Scientist at the Army Research Office and I became a Chief Scientist at the Office of Naval Research. Elliott was a member of the JASON's DOD advisory group and had a leadership role in physics at the National Academy of Sciences.

At Rochester, Elliott focused on social phenomena and his classroom notes were published, with Wade Badger, as a book entitled “Quantitative Aspects of Social Phenomena”. At the time in the 70’s it seemed strange that Elliott would work on topics like how steam ships replaced sail ships and how countries shift from agriculture to industry to service sectors, or how entropy plays a role in the prices in the Sears catalog. In retrospect, this work was a precursor to what is today called the expanding fields of econophysics and complexity theory. A topic in his book was on economic bubbles, a topic that sounded quaint to me in the 1970’s, but came roaring back recently with the dot.com bubble and the subprime housing bubble.

I only met Elliott, somewhat late in his career, in 1970 when I began my graduate studies at the University of Rochester. He paid my salary that summer with the advice to travel to Europe because once I got married and had a family travel would be more difficult. I did, during my graduate studies, spend two summers in Europe. Elliott himself was gone every summer to JASON meetings in La Jolla and his summer home in Woods Hole.

Elliott Montroll was a private person and didn’t discuss his personal business or travels. So Elliott could tell a much more interesting story, but I hope to have given you a flavor of his rich varied life. When I meet people who have known Elliott they all invariably make the same remark, that he was a nice man.

Michael Shlesinger
Chief Scientist for Nonlinear Science
Office of Naval Research
Arlington, VA 22217