

Marcel Nahum Wellner, February 8, 1930\_–

Marcel Wellner arrived in the United States, together with his younger brother Daniel and sister Myriam, in the fall of 1949. Marcel came to study as an undergraduate at MIT and his siblings had yet to complete grade school. They were brought to the United States by an uncle who had survived World War II as an administrator in the Belgian Congo. After the war, he returned to Antwerp to reunite with his family. He found that Marcel's parents had died at Auschwitz in September 1942, among the many Belgian Jews who suffered that fate. However, he also found that his nephews and niece had been cared for by a Belgian family, with eight other children, which Marcel refers to as his "War Family". The family members had risked their lives by refusing to release the children to the Nazi official who had demanded them.

From the time their parents were taken away until the war ended, the Wellner children were unable to go to school. But there were many books in the house and people brought gifts of books. Marcel read voraciously. In particular, he read Jules Verne in the Edition Hetzel and was impressed by the technical details (physical or unphysical!) described. He also read other authors including H.G. Wells which gave him an interest in science. In this time, he also heard Bach on the radio. He remembers specifically the Brandenburg Concerto No. 4 for two flutes or recorders. This led to a life-long interest in baroque music that he later learned to play on the recorder.

When the war ended, the Wellner children remained with their war family and were able to go to school. Marcel had missed two years of schooling, but had been able to go to school even during the German occupation until 1942. Before those events, he had been somewhat ahead of schedule. After liberation, he considered his prospects to be grim. Graduation required six years of Latin (already partially completed) and four years of Greek. However, the government organized a full year of study in half a year. Thus Marcel and his classmates at the Royal Athenaeum of Antwerp were not far behind the normal curriculum. His schooling in Latin was almost entirely by rote. The students had to memorize a weekly ration of verses, mostly by Virgil, and had to recite them when called upon. Marcel's resulting dislike of rote learning may have been a factor in his choosing physics as his career. At any rate, he revolted against studying Greek and was allowed to substitute advanced mathematics in his curriculum. He had an excellent mathematics teacher, and the standard math was augmented by projective geometry and spherical trigonometry. (Marcel recalls that his teacher once mentioned functions that were continuous and yet nowhere differentiable. However, the class was told not to worry about such things.) In contrast to the mathematics, the physics teaching was run-of-the-mill. Thus, in spite of having lost two years' schooling, Marcel got his high-school diploma in 1949. (His irregular schedule had to be overridden by a special State examination).

After the Wellner children arrived in the United States, they were supported by American members of their (real) family until they were able to care for themselves. (Members of the Wellner and Rappaport families had come to the United States before the war.) Marcel had applied to MIT from Belgium. In Boston, he shared a house with other students for \$10 per week and they took meals in nearby cafeterias and restaurants. He took the usual undergraduate courses for a physics major. In particular, he remembers the courses in E&M taught by Victor Weisskopf and in Modern Physics taught by Hans Mueller (the inventor of a matrix method to characterize compound lenses). Marcel was eager to make up his lost year, so he completed his work at MIT in three years by taking summer courses. His senior lab project was to measure the speed of light. He worked with two other students, each one assigned to build a part of the apparatus. Marcel recalls silvering mirrors for a Fizeau-type measurement, in which the toothed wheel's role was played by a Kerr-cell-plus-electronics. They spent more than a semester

on the project, their results were not very close to the established value, but they were given full credit for the effort expended. For his senior thesis, Marcel wanted to do a measurement related to Einstein's theory of Brownian motion. He prepared a suspension of plastic particles in water and applied an ultrasonic wave. The procedure was known to concentrate the particles around the nodes. Using Einstein's Brownian motion equations he was able to describe the observed particle behavior statistically.

He received his BA in 1952.

Although Marcel could have stayed at MIT for his graduate work, he decided on going to Princeton as that was closer to Great Neck, Long Island where his brother and sister were living with his uncle. At MIT, Marcel recalls being a machine for absorbing physics. At Princeton he became a person. He had friends with similar interests and made use of the cultural life in going to non-physics lectures and to many musical events. He taught himself to play the recorder and "shoe horned" himself into groups where he could play. The social life at the university was somewhat handicapped by the men-only policy of the times. However, many young women came to the town as baby-sitters, as we would be calling them today, or au-pair girls, as they were known then, and they happily completed the picture. Marcel recalls, however, that he kept most of his studious and rather retiring habits.

Among his classmates were Charlie Misner, Wally Greenberg, Steve Weinberg, and Arty Komar; he shared an office with the latter. During his first two years at Princeton Marcel lived in the Graduate College which was near the Institute for Advanced Study. Five or six French students were also in the Graduate College. They would wait for the limousine that brought Einstein to the Institute. Then they would pile into the limousine with one sitting next to Einstein and another student taking a picture. This continued until each had his picture with the famous man.

First-year graduate students at Princeton were assigned to faculty members as research assistants. Marcel was assigned to Arthur Wightman who, at the time, was collaborating with Louis Michel on the problem of fitting beta-decay data into a theoretical model. This was before parity violation was discovered (Lee and Yang, 1956). The data on which Marcel had to work for Wightman (crunching numbers with a Marchant electric calculator) fortunately did not fit any of the available, parity-conserving theories.

Among his teachers, John Wheeler became a role model for his much-admired teaching style in his course on general relativity. In that year, Wheeler made arrangements for the class to meet with Albert Einstein at his Mercer Street home. Rashomon-like reminiscences were written up by Gerald Tauber and published by Crown Publishers. Others whom Marcel particularly remembers were Robert Dicke, who was teaching quantum mechanics, Fritz Rohrlich, who was teaching quantum field theory, and Eugene Wigner, who was teaching group theory. On the qualifying exam, there was a question involving the Wigner-Eckart theorem – a theorem in representation theory that states that matrix elements of spherical tensor operators acting on angular momentum eigenstates can be expressed as a product of two factors, one of which is independent of the angular momentum orientation and the other a Clebsch-Gordan coefficient which does. Marcel had insufficiently studied this, but did know that group theory was involved. He managed to work through to the correct answer. This success gave him the Princeton University Procter Fellowship.

In his third year, Marcel began his dissertation research with Wigner as his thesis advisor. In spite of receiving Army generals and Nobel laureates in his office, Wigner was remarkably accessible to students. His politeness to all was legendary. Marcel's dissertation was on the topic of functional integration (related to Feynman's sum over histories). Marcel recalls that he learned much by working on that

thesis, but that it did not shake the field of physics. He completed the dissertation in 1957 and was awarded the PhD the following year.

In the year 1957-58, Marcel was an Instructor at Brandeis University. The position became available when Wally Greenberg left Brandeis to go to a tenure track position at the University of Maryland. At the time, Marcel was living in Brookline with Wally and Danny Greenberger. They accepted Marcel as a housemate although they would have preferred someone named 'Greenbergest'. At Brandeis, Marcel was kept busy teaching introductory physics. Nonetheless, he was able to meet Stan Deser, Lochlainn O'Raiheartaigh, and Sam Schweber. During the summer of 1957 there was a summer school on general relativity that he was able to attend.

After two years Marcel was ready for something else. While being away from Princeton, he had his Ph.D. degree sent to him by mail. On a visit to Princeton somewhat later, he enjoyed a Ph.D. party organized for him by Charlie Misner. During Marcel's Brandeis year, Eugene Wigner recommended him for a postdoc position at the Institute for Advanced Study. Marcel wrote a proposal for an NSF Fellowship which he received. At the IAS, his office was next door to that of Bram Pais. While there, he worked on a quantum field theory formulation of the then-popular S-Matrix theory. He wrote a paper with R.B. Curtis on the asymptotic condition in Lagrangian quantum field theory. At the end of the year, he met with Robert Oppenheimer for the annual visit to describe how he spent his time. The IAS was host to many visitors and Marcel attended lectures not only in the forefront of physics, but other topics as well. In the course of time, he met and was able to talk with George Kennan. Kennan is remembered as a diplomat, but was also a virtuoso on the classical guitar, which he would play while walking the hallways of the Institute.

After his year at the IAS, Marcel had no problem getting another position. He was offered a position (1960-63) at Indiana University (Bloomington) as a Research Associate with Emil Konopinski who, at the time, was working with John Bahcall on muon neutrinos. Marcel was not drawn into their research. He was free to choose his own interest. He became friends with Roger Newton and Marc Ross. Marcel became interested in strong interactions and wrote an article on energy renormalization in wave mechanics and began to study meson decay and mass spectra. These were about particles which were related through Gell-Mann's 8-fold way and the Goldberger-Treiman way of calculating the pion masses. Toward the end of his appointment, as he began to search for an academic position, Marc Ross suggested that Marcel could benefit from a stay in England at the Rutherford Laboratory, so he applied for, and obtained, an NSF Fellowship.

Since leaving Belgium, Marcel had kept his relationship with his "war family". During a visit in 1960, he noticed that a young daughter in the family, Magdeleine, had grown up and was quite attractive. They were drawn to each other and a year later, in April 1961, they were married. Marcel had never been very outgoing, but after he and Magdeleine were married, they became involved with a group of young married faculty members with young children. He also formed groups of amateurs to play baroque music.

During this last year at Indiana University, Peter Bergmann had come to Bloomington to give a colloquium on general relativity. Marcel was much impressed and one of his applications went to Syracuse University. Fritz Rohrlich had accepted a position at Syracuse and he encouraged him to accept. While he had other offers, Syracuse offered him a position with a year's leave for a fellowship year in England before joining the department. So in the summer of 1963, Marcel, Magdeleine, and

their soon-expected son Pierre went off to England. Pierre was born in Belgium while they were on a visit there.

Marcel was connected with the particle theory group in the Rutherford Laboratory, but his office was at the physics center in the Atomic Energy Research Establishment at Harwell. It was built on an old RAF field and was largely engaged with armaments, but there was also a theoretical group. Marcel had a huge office with a very large desk and two large windows with two views. As they were arriving from a visit with the family in Belgium, the Harwell lab sent a limousine to meet the family at the ferry landing. The limousine, complete with uniformed chauffeur, brought them to the Laboratory and, then when they left, to the port of departure. With the help of the housing office, they rented a small 15<sup>th</sup> century house in the Cotswolds. At the Institute for Advanced Study, he had shared an office with a physicist from Cambridge, Richard Eden. Richard had founded Clare College at Cambridge that catered primarily to people who came from abroad to study in England. Richard helped introduce Marcel to the physics community at Rutherford and Cambridge.

Marcel found the physics people at Rutherford very stimulating. In December the theoretical group sponsored a symposium at which he met Paul Matthews, John Polkinghorne, and Richard Dalitz who came from the US. He also met and interacted with RJN Phillips, who was working on Regge trajectories, closely related to a field theory of strings. S-matrix theory was in its heyday. Marcel absorbed much of it at lectures and at the sacred institution of afternoon tea, but he had more faith in Lagrangian quantum field theory. In Indiana, he had left behind a Ph.D. student, Moorad Alexanian, who was constructing a model for the scattering of scalar bosons. Their calculations were of a high order in the coupling constant and used closed loops in Feynman diagrams. Much calculational effort was required, but it was successful and helped Alexanian get his Ph.D.

To get around, Marcel had bought an old car from a departing visitor. He, Magdeleine, and Pierre would explore the English countryside on weekends. With Pierre safe in a carriage, they would visit churches and cemeteries, of which there are many. With crayons and large sheets of paper they would copy ancient tombstones. This brass rubbing was very rewarding as the carvings are historically interesting and well rendered in the sharp black-and-white of the figures.

In the fall of '64, they arrived in Syracuse and quickly bought a house on Ransom Road beyond Jamesville Reservoir, about ten miles from the University. Ransom Road is half way up a long hill and they were warned that in winter it might be difficult to get to the university. Nevertheless, they did enjoy living in the countryside and were not defeated by the winter. Marcel and Magdeleine's daughter Lucie was born in 1965.

Bill Fredrickson, the Physics Department Chairman, placed Marcel in an office with Martin Wilner, a postdoc in Fritz Rohrlich's group. Some other researchers in this group were Robert Brunet, Ludwig Streit, and John Klauder. These people slowly drifted away, as did the funding, and thus the field theory group was reduced to Marcel and Fritz. In the department, Marcel also became friends with Nathan Ginsburg, a spectroscopist, and John Trischka, with interests in molecular beams, and they frequently had lunch together.

Before coming to Syracuse, Marcel had written a paper on Isospin Purity of Lambda and Sigma-Zero Hyperons. This made him interesting to the experimental group. However, Marcel was a disappointment as he did not work closely with the group. With Guido Sandri, whom he knew at the IAS, he wrote an article elaborating on Nordstrom's scalar theory of gravity. They submitted the paper

to the Babson Gravity Foundation and won second prize in 1964. Joe Weinberg and Gerald Tauber won first prize. The paper was published in the American Journal of Physics. Marcel also sent to the AJP a simple derivation of Levinson's theorem about the number of bound states in a scattering potential. He was later told it should have gone to the Physical Review.

Marcel began to work on a field-theoretical basis for S-matrix theory, a topic which was also of interest to Fritz. Rather than using the trinity of "Unitarity, Analyticity, and Crossing symmetry," he treated the problem of pion decay to a mu meson and a neutrino via strong interaction followed by a weak decay. He found that adding up coherently the intermediate strong interactions leads to a finite result only if the coupling constants had a specific relation which happens to be experimentally verified. Today the Standard Model treats such problems in a far more general manner.

For a sabbatical leave, in 1968, Marcel, Magdeleine, Pierre, and Lucie went to Cambridge, England. Marcel was at Clare College with his friend Richard Eden who had a large research group there. The family enjoyed their stay so much that they remained at Cambridge for another semester without pay. There, he worked on spin-zero mesons and current algebras. Eventually, several papers on a mass formula and a theory of elementary couplings were the result.

On returning to Syracuse, he continued that line of work. In 1980, Lochlainn O'Raifeartaigh invited him to spend a semester at the Dublin Institute for Advanced Studies. On arriving, they rented a house whose windows could not be closed. Noise and smoke kept them awake. They were advised not to buy a car as labor strikes had pretty much cut off the gasoline supply. Errands were run on a bicycle. Marcel was able to meet a lot of people at work, but it was more difficult for Magdeleine. Social interactions took place in pubs and Marcel had to buy her beer. For a time Magdeleine had to be in Antwerp as her mother became sick and died. In physics, Marcel worked on Poincaré invariance and gauge independence of field theories. He developed a beautiful formalism, but sadly, interactions spoiled the invariance. He came back to this work after returning to Syracuse.

Back in Syracuse, Marcel began to write a textbook on introductory physics that was published in 1991. This took up all his effort and left little time for research. The book was used in a few departments, but it never took off. Marcel thought it was somewhat too difficult. After completing the book, he attended a lecture by Mandelbrot and became interested in fractals. He wrote a short article for PRL on Evidence for a Yang-Mills Fractal.

Magdeleine had gotten a teaching degree and taught mathematics at the Manlius-Pebble Hill School. They hosted musical programs of baroque music at which Marcel played the recorder. Together, they were active in the Syracuse Friends of Chamber Music. And for all the winter problems in Syracuse, they have continued to live on Ransom Rd.

He began to think about retiring. He was teaching the introductory physics courses, PHY 211 and 212, in two classes of 300 each and speculated after a short time that he was communicating only with 30 students. By 1995, he decided it was only 3 students. At that time, the University was having financial problems and offered a buy-out deal over a three-year period. Marcel accepted the offer and retired from the Physics Department in the spring of 1995.

Marcel was only 65 when he retired and he was not ready to end his research life. He read some papers on cardiology and went over to the Upstate Medical School across the street, where he talked to José Jalife, chair of Pharmacology. One of the papers he read was by Arkady Pertsov, of that department,

who was studying electric currents in the heart. Marcel was hired on the spot and was given an office that he shared with Jacques Beaumont who was also French speaking. He studied the dynamics of cardiac cells, cell walls, and ionic channels. Arkady was using a reaction-diffusion equation to study rotating wave patterns (spiral waves). The equation is like a wave equation with dissipative first-order terms. Marcel was stimulated by the problem and this became a very productive chapter in his career. He could work either as a team member or by himself. Several people in pharmacology had a good background in physics. In addition they could tell him what the important problems were. He had a lucky break in 2002 when he found that the filament of a scroll wave followed a geodesic of a metric defined by the inverse of the diffusion matrix. This work was published in Proceedings of the National Academy of Sciences.

Back when he had arrived at the Medical School, and was ignorant of cardiology, he had needed a problem to work on. Arkady knew of a simple problem. Under pathological conditions, a spiral wave can develop on the surface of the heart. Under an applied field, the spiral will undergo translation in addition to its rotation. Both Arkady and Marcel thought it would be easy to predict the angle between that drift velocity and the external field. Strangely enough, the problem is still unsolved. As funds dried up, Marcel retired once again in 2013. As of this writing, he is an unpaid visitor in the Pharmacology Department, still working on the simple problem posed 20 years ago.