Autobiography of Giacinto Scoles

Earlier Years and World War II

I was born in Torino, Italy, on April 2, 1935, the son of Maria Scoles née Fiorio (1904−1946) and Mario Scoles (1897−1982). My father, a mechanical engineer who worked for FIAT, had, recently, completed the engineering of the body of the first half-liter engine car ever produced on a large scale: the FIAT Topolino. Two years before Italy was thrown into WWII, we moved to Milan, when my father was hired by Alfa-Romeo for his expertise in car aerodynamics. In the early 1940s, during a bombing of Milan by Allied planes, a couple of five story buildings not far from ours were gutted by bombs, causing us to move out of the city, first to a small lake to the west (Lake Orta) and then to a village in the mountains near Bergamo. The move was not ideal because the fear of the bombs was soon replaced by the fear of learning that, during one of his many weekend visits, my father might not make it through one of the numerous decimation points set up by the German troops every time one of them had fallen victim of an ambush by the "partigiani" guerrilla fighters. The difference of growing up during a war is perhaps best explained to the youth of today by remembering here that, as an 8 year old, I was in charge of killing the rabbits that we were breeding to put meat on the table at least once a week!

A year or so before the liberation of Italy by the Allied troops, we moved to a small village near Vicenza, about 60 miles northwest of Venice, where in huge artificial tunnels excavated by the Romans that could have resisted even a nuclear attack, my father was supervising the production of spare parts for army trucks. The end of the war arrived fortunately just as the first spare parts were being delivered and was seen by me in a similar way as by the kid in the well-known movie *Life is Beautiful* (in Italian *La Vita è Bella*) by Roberto Benigni. I also saw my first real life tank on that occasion, with the variation that the soldier coming out of it was a black man who reached for a bunch of wisteria flowers from our garden and ate them. The fact that he was eating flowers remained stamped in my memory together with the huge smile that he flashed in my direction as I sat, perched in a tree, not knowing what to make of the fact that, suddenly, half the world's supply of soldiers seemed to be parading on the country road just outside my garden fence. Since that day, the sight of the smile of a black man is particularly welcome to me.

High School in Spain

After the war was over, we moved again (to downtown Vicenza), but after my mother's death and because my father's Alfa-Romeo dealership sold the grand total of one car in its first year (that was the time when in Italy the tires of the car would cost as much as the car itself), we moved yet again, but this time to Barcelona, Spain. In Spain my father tried first to introduce the art of car body making (actually he was making buses at that time) to the precursors of SEAT but eventually established (when he was 60 years old!) his own business making and selling machines for the ceramic industry.

In the meantime, I was having my first formative encounters (both negative and positive) with the teachers of the Italian High School of Barcelona. It is interesting to note that Barcelona, with an Italian population of only a couple of thousand people, had an excellent Italian High School at that time, while New York and Toronto, with orders of magnitude larger Italian communities, did not have one. The reason for this discrepancy can be found easily if one considers the very different socioeconomic backgrounds of both populations: mostly white collar workers in Barcelona and mostly blue collar workers or former farmers in New York and Toronto. Quite clearly the government in Rome cared much more about the former than the latter.

As an example of a negative but formative encounter with a teacher, I will mention that in grade nine I was permanently kicked out of Religion class because, having been asked to write about the role of liturgy in religion, I tried to prove that it was a negative one. Still remaining within the framework of Catholicism, I argued that the rules and pomp of liturgical practice were standing in the way of a good and spontaneous communications between people and God.

The positive experiences that I remember are mainly two. A math professor (his family name was Luzzi) taught us how to use logic by letting us compete to establish who could demonstrate a geometry theorem using the least number of words and a minimum of punctuation, without losing any of the original meaning. It was during those long and open discussions about the possible losses of meaning that I believe I learned how to write up a scientific argument. The second teacher who made an important contribution to my intellectual development was an excellent professor of history and philosophy (his name was Elio Rossi, and he was a survivor of the WWII concentration camps) who hammered into us that generating new ideas was very important. This is because people will often spontaneously work, with or without compensation, for the person who has good ideas and knows how to explain them. Focusing on the development or our minds, instead of on specific notions, Professor Rossi was using a very modern teaching method that, unfortunately, only now, some 50 years later, is beginning to emerge. In fact only now are there programs like Google that make the teaching of facts (like the dates of birth and death of important writers that I had to spend several frustrating hours trying to memorize) clearly and completely obsolete. That kind of information can now be obtained in 0.3 s whenever one needs it.

Genoa and Its University

Because of the deplorable state of higher education in Spain in the 1950s, reluctantly, because I loved the country and its people, I went back to Italy to study engineering at the University of Genoa, which happens to be the Italian University nearest to Barcelona. In the first 2 years of basic engineering education I got a solid background in math and physics from a set of outstanding teachers (among others Guido Stampacchia for Calculus, Eugenio Togliatti for Geometry, and Ettore Pancini for Physics) and even more from a set of really outstanding student colleagues. After 2 years of fundamentals, I was supposed to move to the next 3 years of applied engineering. However, curious about the future, in the middle of the second year I went to listen to a few classes of "real world engineering". As I found the complicated description of how the cutting tool of a lathe cuts into steel excruciatingly boring and next to

10.1021/jp710058g CCC: $37.00
Published on Web 12/06/2007

impossible for me to absorb, I moved, against the opinion of my father, to pure Chemistry instead. Two years later, when the time had arrived to choose a thesis supervisor, I got stuck again because the Chemistry Department in Genoa was at that time not exactly a user-friendly place and the only organic chemistry professor that I liked had just left for a 2 year stay in Canada. I migrated then to the neighboring Physics Department where the library was open day and night and where, under the leadership of Ettore Pancini, already in the late 1950s a group of young professors was keeping the windows on interdisciplinary research wide open.

In Genoa at that time, while one of the first bubble chambers and one of the first pattern recognition machines anywhere were being assembled, I helped build the first Nier-type mass spectrometer in Italy for the precision measurement of isotope abundances, under the guidance of Giovanni Boato and the late Maria Emila Vallauri. From Boato, who had two degrees (one in Physics and the other in Chemistry), I learned to "see and touch" the atoms and molecules of the system investigated and to guess the results of my measurements before carrying them out for design or optimization purposes. Vallauri, on the other hand, taught me the rudiments of experimental physics while she was preparing to give birth to her first child, providing me with excellent supervision until 3 days before the delivery! Among many other things, she taught me the important, and at that time undervalued, role that women can play in science. In February 1959, I obtained the equivalent of a M.Sc. in Chemistry, defending a thesis on the isotopic fractionation factor at the liquid/gas interface.

When I graduated, no Ph.D. degrees were granted by Italian universities. With my "dottore in chimica" degree, which was approximately equivalent to a M.Sc. with a research thesis, I applied to the graduate program of the University of British Columbia in Canada. As that university not only did not recognize my M.Sc. but wanted me to requalify for their B.Sc., I decided to shelve any plans to go to North America at that point. Fortunately, due to a lack of personnel at the University of Genoa at that time, I was, not long after that, asked to teach a lab course for physics sophomores. "Scoles, we are scraping the bottom of the barrel", Professor Pancini told me when he asked me to teach that course. Indeed, while I could "make things work", I was only an average student and a chemist to boot! On that occasion, however, I learned the usefulness of being almost brutally honest with the students. Knowing that the assessment of the boss was an accurate one (but recognizing that he would not have asked me if he had thought that I could not handle it) and wanting to show that I was worth the trust that the department had put in me, I worked like a horse for a year, doubling the number of experiments available in that lab and learning in the process an incredible amount of practical physics that was to be of great help throughout my career as a physical chemist. Ten years later Professor Pancini asked me to join him in building up the Physics Department at the University of Naples, and I would have rushed there if I had not received his letter only a couple of months after starting at the new job in Canada (see below). Twenty-five years later, instead, I got even greater personal satisfaction when the Chemistry Department at the University of British Columbia asked me to be part of a review committee that was to assess their scientific position at that time and to give them some guidance for the future!

Leiden and the Kamerlingh-Onnes Laboratorium

The year after teaching my first course, I applied for and obtained a fellowship to study abroad from the Italian National Research Council. I started immediately to apply for a post-doctoral position in the USA and got an offer from Professor David White, who was then at Ohio State University. Getting the visa to be allowed into the country proved to be more difficult than I had guessed. Not only was the Genoa Physics Department the reddest spot in town, but I was also known to the local police for having organized a strike against the administration of the student residence at Genoa as they were giving us rotten food and, adding insult to injury, they were selling us the food that the Marshall Plan was giving them "Gratis et Amore Dei". The Latin expression is particularly appropriate here because the student residences were administered at that time, directly or indirectly I do not recall, by the clergy that gravitated around the Bishop of Genoa of that time. Indeed the person who showed up for the final negotiations was a Monsignor!

Much before the 11 months that it took the U. S. State Department to find out that I was not a threat to the country were over, I was already working at the Kamerlingh-Onnes Laboratorium of the University of Leiden in The Netherlands under the supervision of the late prof. J. J. M. Beenakker, a molecular physicist who was one of the best exponents of the propagation in time of the great Dutch traditions in an area that could count among its founding fathers names such as J. D. van der Waals, J. de Boer, and H. Kamerlingh-Onnes himself. When I started in Leiden, Beenakker gave me the choice between a safe equation-of-state type of experiment (at the end of which, after a few examinations, I would have obtained a Ph.D.) and an experiment with an uncertain outcome that consisted of exploring whether the Sentfleben effect was only limited to paramagnetic molecules or was a more general effect that could be useful to study nonspherical intermolecular forces. I was looking at a real experiment and no exams on one side and a series of measurements with exams on the other. I do not remember how long it took to me to choose the former over the latter, but I am sure that I did not loose any sleep over that decision!

Soon, however, my limitations in dealing with tensors stimulated me to move from a field where the measurements were relatively easy but the theory (Boltzmann's equation in external fields) was awfully complicated to one in which the theory was relatively simple while the experiments were the challenging part. This is why I decided to try using molecular beams to study intermolecular forces by colliding beams of atoms and molecules directly with each other. After having built in collaboration with the late Kees van den Meijdenberg (one of the finest human beings I have ever met) the first Leiden molecular beam scattering apparatus, I returned to Italy in October 1964 immediately after marrying Giok-Lan Lim, who I was fortunate enough to meet in the environment of the International Students Club in Leiden where I used to spend the time waiting for the trams of the city to stop running after 1 a.m., so that I could go to the lab to do my experiments in a vibration-free environment. The last minute advice that I got from Professor Taconis, the senior experimentalist at K.O.L. at that time, when I went to take leave from him ("Scoles, you should decide first to use low temperatures in your machines and only thereafter you should ask yourself why") proved to be one of the best pieces of advice that I have received in my career!

Back to Genoa's Physics Department

Returning to Genoa as an assistant professor, with the help of a superb group of technicians (most of them fired from large companies because of their union organizing activities) and a

great group of talented students and postdocs, we built the first of a series of four molecular beams laboratories (the others being those built later at the Universities of Waterloo, Trento, and Princeton) in which we carried out several breakthrough atomic scattering experiments. We had to work very hard both for trying not to inhale too much dust in the wake of the (mostly American) competition and because we had to deal with the randomness and arrogance of Italian bureaucracy of the times (things have improved a lot since then) that was forcing us quite often to do things, such as paperwork to get things through customs, two or three times over. We could have never done what we did if I had not avidly read and spread around in the group (every week in a photocopied newsletter called "Molecole" and later in Canada "The Mad Molecule") the information contained in ICI's Current Contents literature awareness service, of which I was one of the early Italian subscribers.

In 1969, with a group of laser science colleagues and friends from the University of Pisa, we tried, perhaps a bit naïvely, to set up a molecular beam laser spectroscopy laboratory as a collaboration between the Universities of Pisa and Genoa. This was a full 5 years before the well-known 1974 paper of Smalley, Wharton, and Levy explained to the world the beauty and power of supersonic rotational cooling for the simplification of molecular spectra. We got the funding, but, because of university politics (at a level higher than that of the people who had made the proposal) the new laboratory remained a Pisa-only operation and changed program.

The Canadian Years

Several months after the Pisa affair, I accepted an offer to become a professor of Physics and Chemistry at the University of Waterloo, 60 miles west of Toronto in Ontario, Canada. They knew about my work through Fred McCourt, a Canadian theoretical chemist who had joined the same university not long after his long-term visits to the K.O.L. in Leiden, where we had met, and to our department in Genoa. After getting used to the Canadian cold and the consequent, pleasant, lack of need for umbrellas, I learned, and grew to love, the relaxed and democratic way in which Canadians do their business (or at least did their business at that time in Waterloo!). Furthermore, I also had to learn to slow down my rate of making proposals for change and/or innovation, because, surprisingly, people were listening to me, and there was an (unheard of in Italy) one-to-one correspondence between what was discussed at meetings and what was acted upon afterward.

I felt accepted and appreciated in Canada as in no other place where I have worked before or after. Soon after I had established my lab there, the University asked me to help them to go through an evaluation exercise required by the Provincial Government. We responded to the challenge by creating the Guelph−Waterloo Center for Graduate Work in Chemistry or $(GWC)^2$. With a few colleagues we wrote the "white paper" and withstood the scrutiny of three of the best examiners one could dream of finding. After 1 year of intense discussions and preparations, we started operating the first true interuniversity graduate school in Canada that, among other things, was soon also provided with the first closed circuit TV pair of classrooms for distance teaching and scientific discussions. I do not even wish to speculate how long it would have taken to assemble the same amount of organizational achievements in Europe at that time or, for that matter, nowadays.

Other collective accomplishments were the Center for Molecular Beams and Laser Chemistry (that survived my leaving Waterloo for many years) and the organization, with my colleague and since that time good friend Bob Le Roy, of a yearly Chemical Physics meeting that is still going as strong as ever more than 20 years after I left. The laser chemistry center, started with a Chemistry colleague (Terry E. Gough), was built after the Smalley et al. paper mentioned above was published and happened only because Terry and I closed ourselves in an office for 3 days, having decided not to come out until we had found a feasible experiment that required my molecular beam know-how and his expertise in spectroscopy. It was for me urgent to find what to do with beams and lasers, because not long before then (just after Udo Buck had published his

He−Ar differential scattering cross-sections that showed that his Goettingen apparatus had 10 times better resolution than ours) I had gone down into the lab, taken the guts of our crossed beams scattering machine out of the vacuum chamber, and had placed them in a cabinet that was instantly labeled "Museum"!

I frequently think and am sometimes asked about what distinguishes Americans from Canadians. I believe that it is the intrinsic Canadian desire toward stability and the tremendous thirst of Americans for change (sometimes for the sake of change). This thirst gives Americans their innovative edge, but it makes them also the unchallenged champions of waste.

In Canada Giok-Lan and I became the happy owners of our first home that in 1976 became illuminated by the happy sounds and sights of our daughter Gigi'. In 1977, I became a Canadian citizen, while Giok-Lan followed a few years later.

The Trento Interlude

Earlier in the 1970s, at an IPEAC meeting in Belgrade, I had met Fabio Ferrari, the Dean of Science at the University of Trento, who asked me to help him to set up the Condensed Matter and Surface Physics section of the Physics Department there. At that time the University of Trento, located in one of the few administratively independent regions of Italy, was administered locally as opposed to centrally from Rome, as is the case at present. The idea was to help build up a "different" university ignoring, however, the sound principle that it is society that shapes universities and not the other way around.

In spite of the fact that, after spending a couple of extended leaves at Trento, I ultimately decided to stay in Canada, the time that I spent at that University was, for the most part, productive and pleasant. Most of the people who I attracted or helped educate there did stay and did quite well for the university and research community, and the local molecular beams laboratory is still conducting state-of-the-art experiments at the time of this writing.

The Princeton Years

Perhaps to understand why we left Canada, I need to go back to the fact that my father had spent from 1923 to 1929 in the USA and that I grew up listening to his "American stories" and watching the 16 mm movies that he had made in Toledo, Buffalo, and New York with a boxy Kodak camera. More infrequently I was allowed to use the tools of the tool box that he had brought back with him after leaving his last job, which I believe was with the Pierce-Arrow Motor Car Company in Buffalo. I must be the only Italian kid for whom the smell of old Bostik glue reminds him of home more than the smells emanating from the kitchen! Due to all that and also because of the fact that my scientific mentors and role models at that time (John Fenn and Dick Bernstein) were American, a year or so after Hersh Rabitz had called from Princeton to find out if

I was interested in joining their Chemistry Department, I called him back for the second time, telling him that I was ready to do so.

America and Princeton turned out to be all I expected and more. After the smoothest negotiations that I recall having ever carried out (with Tom Spiro the Chemistry Chair at that time, Provost Neil Rudenstine, and President Bill Bowen) and with the excellent help of an expert architect (Mary Baum), we built the best technically fitted molecular beams laboratory that I have ever seen. My beginner's luck was completed a few months later when Kevin Lehmann joined our faculty, and under the paternal encouragement of Bill Klemperer and against the advice of almost everybody around us ("you are going to ruin the young man's career"), we started working together. Approximately 50 common papers later, his easy tenure at Princeton, and a bunch of recognitions for both of us, we can both look back now with satisfaction, and I am sure to interpret also the thoughts of Kevin by acknowledging here, with our gratitude, Bill's wise and warm advice.

When he hired me, President Bowen (an economist who had learned the details of molecular beams research before he talked to me!) had told me that two things were expected from me by Princeton. The first was the obvious one of doing my job as a Physical Chemist, which I did for 20 years. (I would have preferred to call it Chemical Physics, but that turned out to be much trickier than I had expected, in spite of the fact that the title that I happily accepted when I got there was that of Donner Professor of Science.) The second was to help Princeton in opening the door of the ivory tower and start communications flowing between the Sciences and Engineering, starting with the field of Materials Science. And here Lady Luck struck for the second time with the arrival at Princeton of Peter Eisenberger, just a few weeks after I had given up any hope to be able to get something done in that area in addition to the discussions on how to do it.

The approximately 10 years of the tenure of Peter at Princeton were a fantastic experience, as finally I had found somebody who worked harder than me and knew equally well the importance of structuring things properly for them to have a chance to work. Working for Peter in setting up the Princeton Materials Institute (PMI) was not always easy, but always interesting and rewarding. Getting to his PMI office before 7 a.m., to squeeze in a couple of hours of discussions on our collaborative work on the structure of organic monolayers before the rest of the crowd would join us for the more mundane organizational jobs, was what I had come to the U. S. to do, and I felt very lucky to be able to do it with him. As always, things were not meant to last forever, as institutional interdisciplinarity is not yet a "fait accompli" anywhere as far as I know and may have to wait for the basic structure of university education to change, perhaps under the stimuli of the new tools for information retrieval available to us at present. In addition, Peter went "environmentally global" on us, and I did not resist the lure of going back where I came from, trying in the process to change the field of work one more time in my career and (as a real American in exile) to liberate myself from the sights and sounds of the most negative president in the history of the country.

I believe that the best way to close these notes is to give thanks to all of the people who have given me massive doses of help in my work exactly when I needed them. To all my students and collaborators (both scientists and technicians) goes my sincere gratitude for their friendly and enthusiastic cooperation. The love and support I got from my family has given me strength to go through the difficult times and has provided me with the overall reason to go forward. Last but not least I thank the many people who have decided to spend generously their time in putting together this, to me very "special", issue of the *Journal of Physical Chemistry A.*

Giacinto Scoles