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## My Italian Connections: Otto Vogl in Italy

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**my  
ITALIAN  
CONNECTIONS**

**(Otto Vogl in ITALY)**

**August 2010**

My  
*Italian Connections*

*(Otto Vogl in ITALY)*



*in co-operation with  
Gerald S. Kirshenbaum*

## ***MY ITALIAN CONNECTIONS***

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## **A. Introduction**

Italy is a fascinating country. It always was and still is a country of culture, art, music, fashion, and cuisine of the highest standing. Parts of Italy were parts of empires, city-states and the papacy. The boot in the Mediterranean, which is now Italy, has contributed to world history for nearly 3 millennia.

No wonder that people from Central and Northern Europe had an urge to visit Italy or have connections with Italians. I was born and brought up near Vienna, the capital of Austria 2,000 years ago. This region, South of the river Danube, was for several centuries part of the Roman Empire. As a consequence, I had an early interest in Italy. In the Gymnasium I tried to take Italian as a foreign language but when it was offered, my interest had focused on the Sciences and Chemistry.

Still the desire to go to the sea, the Adriatic Sea, was and remains a desired vacation location for many Europeans. Venice and Lombardy with its capital, Milan were for almost a century part of the Hapsburg Empire.

Chances in life, when recognized, are often important driving forces for personal development. In my case, it was meeting Giuseppe Bianchetti at the II. Chemical Institute of the University of Vienna that first inspired my interest in Milan. Then came the competitive work of my Exploratory Group at the Polychemicals Department at Du Pont with the Politecnico of Milan on polypropylene (PP). I was not directly involved but the work on propylene polymerization around me kept me in the competitive spirit and renewed my interest in Milan (Italy). A few years later my discovery of the polymerization of higher aldehydes brought me in further contact and competition with the group at the Politecnico. This interaction

developed into a long lasting friendship with individual members of the Natta School. By then, my Italian language was not flawless but fluent. I had accepted a position of Professor at the University of Massachusetts, had been consulting for Eastman Chemicals and had the ingredients for a person that Montedison had been looking for, for their immediate and urgent needs in their Department of Plastics Materials. Over the next two decades I had extensive interaction in Italy with Montedison, Enichimica and later with the Austrian company Chemie Linz, with its Italian branch involved in their melamine production.

## B. As Student

My first contact with Italy came when I had decided to have my first vacation. It was a two-week vacation with my friend Kurt Bachmayer on a lake near Hermagor in Carinthia. Kurt, born and brought up in Vienna, was much more sophisticated than I and said: Why don't we take a two-day bus trip to Venice from here. Venice was not too far, perhaps 100 miles, from Hermagor and we agreed. It would have to be a "budget" trip. We took a tour bus to Venice and



OV in Venice, 1951



Basilica San Marco, Venice



with Kurt Bachmayer  
and friend, in front of the Doge Palace

stayed in a dormitory type accommodation, in the upper story of a mansion with 20 other people. We saw Venice and inhaled for the first time the atmosphere of Italy, the Venetian version. We saw San Marco, the Rialto Bridge, the Grand Canal and the Doge Palace, not to speak of various churches and naturally the Lido of Venice and Murano.

The next year, a group of us from the youth section of the French-Austrian Club took a trip to the Riviera, France. A few years before I had taken some French courses for a semester at the Vienna branch of the Sorbonne, the University of Paris and a number of us attended the monthly meetings in the Hotel de France in Vienna. We took the train to La Ciotat, but interrupted the trip and stayed for one day in Genoa, Italy.



On the Lido, Venice



near Genoa on the way to France, 1952, in Genoa



One day, shortly after I had received my degree, a young, new Dr. named Giuseppe Bianchetti arrived and wished to work with Professor Galinovsky. He came from Milan, Italy, was paid by an Italian Bank, and wanted to spend a post doc year with our group in Vienna. By then I was Galinovsky's senior co-worker, was already entrusted with the supervision of two graduate students and Galinovsky said to me, "be nice to him". Dr. Giuseppe Bianchetti (Pippo as he

was called), worked with Galinovsky on the alkaloids of the bark of the pomegranate tree. Pippo and I worked together on the subject and actually published two papers on punica granatum alkaloids.

More importantly, working in the Galinovsky laboratory together we became good friends. With my other close friend Karl Schloegl we went to parties and “DID THINGS TOGETHER”. I still remember one party in Galinovsky’s house in Rodaun, a suburb of Vienna. Galinovsky had a Russian Colonel in residence (Rodaun was in the Russia zone of lower Austria) who joined us and provided the necessary refreshments (Vodka). Not all the members of the occupation troops were true occupiers, most higher officers were well educated!



Galinovsky Group, sitting Giuseppe Bianchetti



OV in Como

Pippo and I started to enjoy lunch and dinner together at a restaurant on the Liechtensteinstrasse, near the famous Strudelhofstiege. We called it the Koenig Restaurant, actually it belonged to the old Mrs. Kammermayer and her son Karl. Koenig was the waiter and boyfriend of the daughter of Mrs. Kammermayer. We became regulars and friends of the establishment. As students with limited

resources, it was very convenient and we provided a respectable academic atmosphere, which was frequented by local workers.

Soon Pippo and I agreed that we should make an organized attempt to learn each other's language. We established a rigorous regime. At lunch we spoke Italian (I had to learn Italian) and at dinner we spoke German (with my Viennese dialect) – Pippo had to learn German. For me, the success was marvelous – I learned Italian as children learn to speak, word-by-word, sentence-by-sentence.

Pippo (1/2 a year younger than I) had a sister, Enrica, she was 4 years older than Pippo. She and her girl friend decided to visit Vienna. Pippo and I arranged lodging nearby and they stayed for 2 weeks – they spoke no German. I had to rapidly improve my Italian to impress the Bianchetti family, because they had invited me to Milan to spend a month with them in the summer. Enrica, Pippo's sister, in her later life, became a principle in a lycee in Milan.

During the coming summers, I spent several weeks with the Bianchetti family in their apartment at 7, via Corridoni in Milan, where I was treated like a son. Pippo showed me Milan and introduced me to some of his friends.

Father Bianchetti was originally from the city of Parma. Mother Bianchetti came from Asti. Consequently, every April a delivery truck came from Parma bringing cheese and Parma Ham (prosciuto) for much of the rest of the year. At about the same time the delivery truck came from Asti with the wine that was needed in the household. No wonder I still like the Asti Spumante and not Champaign.

Father Bianchetti was very thoughtful, but quite withdrawn. In his earlier years, he had been the first violinist in the orchestra of the Teatro alla Scala in Milan under

Toscanini. When I became acquainted with him in the early 50's, Mr. Bianchetti had already retired from playing the violin. He had started to work for the publishing House Mondadori. Every evening he spent about 4 hrs from 8-12 p.m. editing the classical section of the famous publishing house. In fact, Enrica, later in her life, was also involved as an Editor for Montadori.

As I said I stayed, lived and ate in the Bianchetti household, I had no obligations. Consequently I investigated Milan and the neighborhoods that could be reached in one-day trips. In Milan, much was done by walking. I learned to know and understand Milan, as well as most of the important churches, the Brera, the Art Museum of Milan. I started to follow the "successes" of F.C. Ambrosiana, one of the famous soccer teams of Milan. Today F.C. Ambrosiana is called F.C. Internazionale or Inter. I still follow its successes and failures; this year, in 2010, they won the European Championship League.

Learning some of the local trivialities, helped me enormously when I had a responsible position with Montedison. It was important to know about soccer, read the numerous newspapers with the different political views and know the art and history of Lombardy and for that matter of Italy.

Coming back to soccer, I remembered when I was a boy and had followed soccer not only in Austria but also in Europe. Austria also had a good and for a short time a very successful team called the Wunderteam. Austria and Italy played in the Mitropacup and were fierce competitors. I still remember the famous Italian team with Olivieri in goal and in the offense the dream team of Meazza (Ambrosiana), Piola (Roma) and Ferrara. Later the famous Stadium in Milan, the San Siro stadium, was named after Meazza.



As I mentioned before, I learned the history of Milan, its culture and architecture, from the Duomo of Milan to San Babilo to San Ambrosio and all the other important monuments, including Michelangelo's last supper in Santa Maria delle Gracie. I went to see the Certosa di Pavia, and the Certosa di Chiaravalle. Occasionally I took day trips to interesting places nearby in Lombardia, to Como, Lugano and Chiavenna.

After I left for America, Pippo continued his successful academic career. Soon he received a call for a Professorship in Calgari. After a few years he was called back to the University of Milan as Professor of Pharmacy. He became a co-owner of a smaller pharmaceutical company. Later in Milan he joined a Patent office in the via Senato. It became widely known and was most successful.

We have maintained a very close and trusted relationship since our younger days. He married and has two daughters, Marina and Cecilia. I still remember when he sent me his recent book, a novel, entitled *La Dogana del Duca* (Editione San Paolo, 2000) a non-scientific novel.

I had gone to America and Pippo had continued to pursue his successful career in Italy.

I almost forgot to mention that my wife and I spent a short "driving vacation" in the early 60's in Trento-Alto Adige, the former Suedtirolo and visited the Dolomites. We went from San Candido (Innichen), Dobbiaco (Toblach) to Bolzano via the traditional Dolomite road. The highlights were the Pustertal, Lake Misurina, Cortina d'Ampezzo, Monte Cristallo, Tre Croci Pass, then the Pordoi Pass with the Sella Group on the right and the Marmolada Massif on the left; then the Gardena Pass and the Gardena valley (val Gardena).

## **C. Montedison**

20 Years had gone by; I had concluded my 13 years at Du Pont in 1970 and was now a Professor at the University of Massachusetts in Amherst. One day I received a phone call from Milan asking me to consider an important relationship with the Divisione Materie Plastiche (DMP) of Montedison SpA, the largest chemical company in Italy. Montedison had acquired one or two other companies and was preparing to restructure their operation. In these acquisition proceedings the structure of the research organization was somehow neglected or at least the research organization was put together in haste. In other words, DMP and its President, Dr. Italo Trapasso, were anxious to reorganize the research organization of DMP. I accepted the original proposition and the wheels began to turn. Of course, Montedison had checked my background and the potential compatibility between us.

We agreed that we meet in my house in Amherst. One day in April of 1975, a Black limousine drove up to 212 Aubinwood Drive and out came Dr. Bianchi, the Vice President of the DMP of Montedison and Mr. Aloisio, the Personnel Committee Chairman of Montedison SpA. We had a most pleasant discussion; my wife was able to make a superb espresso at 10:00 a.m. and we served our excellent cognac with the appropriate espresso. The initial proposal was that President Trapasso would have liked to appoint me as research director of the organization. As could be expected I asked to have a chance to evaluate the situation.



Bianchi and Aloisio came also with an alternative proposal, that I would be invited to come to Milan and discuss the matter and that I would bring my lawyer with me.

Since I did not have a lawyer I called my friend Earl Tyner Esq., who had written my patent work when I was at DuPont. I asked him if he would act as my lawyer, We would travel with a first class plane ticket, stay in the best Hotel in Milan, and a limousine for the weekend would be at our disposal to explore Milan and my potential future environment. Earl agreed and we went to Milan each of us stayed in a suite in the Excelsior, at that time the most expensive Hotel in Milan, near the Stationer Centrale (Milan railroad station) and investigated this fascinating City. Earl enjoyed himself in Milan, and with the prestige of his responsibility in Mlan behind him, visited subsequently another of his customers in Europe. He checked the proposed contract and agreed with trivial changes. The most important one was an annual cost of living adjustment. This was important because the Italian Lira was a very unstable currency at that time.

Then I had a real problem. I had to ask myself: could I really handle the reorganization of research as a new Research Director in a major Italian company with local business, politics and personalities involved? I decided to do one thing at a time. My wife and I went to Milan and spent a week to look for housing. We went to a number of realtors and concentrated on a housing development north of Milan near the San Siro Stadium that I had mentioned before. The houses were all painted pink and the people that lived there came from the upper class of the Milanese society.

After all our investigation, we decided that it was not possible to take the position of Vice President of Research. In spite of all the knowledge we had about Milan

and Italy, we were just too “foreign”. As a consequence, I refused the position of Director of Research for the DMP.

After having investigated how I could permanently function in an Italian company I decided it could not be done this way. I made a counter-proposal: Could I help Trapasso and DMP in the reorganization of research with substantial authority and help select the appropriate people for the individual positions. President Italo Trapasso agreed. He wanted an outsider that spoke Italian “fluently”, knew Italian culture and politics and was willing to make direct and blunt proposals. Trapasso



with Italo Trapasso, President of Montecatini, ~1992

created a committee for me to function properly; I was named a Director of Montedison SpA and had access to the President of DMP any time I wanted or, when I needed his authority. I had my office in Largo Donegani, the headquarters of DMP, had a competent secretary, Liliana Tosini, whom I shared with Dr. Diaz, the Vice President of Marketing of the Divisione.

### ***a. In Milan***

The time of my sabbatical leave from the University of Massachusetts had arrived. My family and I left Amherst for our one year sabbatical leave in Europe

(Strasbourg/Berlin) on August 16, 1976 from Montreal with the Polish ship tss Stefan Batory from Montreal, Canada for Rotterdam with our car on board. On August 25, we arrived in Rotterdam and drove to Strasbourg.

Soon after I was established in Strasbourg and had started my three credit hour lecture course on "Degradation and Stabilization of Polymers" (in French) I paid my first visit to Montedison and Italo Trapasso. In the beginning I worked very closely with President Italo Trapasso, "to learn the trade". He had worked with Shell and knew the "non-Italian" way, the requirement to accomplish, not just to make a deal.

It became very clear that a rigorous reestablishment of research for the Divisione was needed. I would like to point out that this was not all negative. When the DMP was separated from the Division of Petrochemical Chemistry, it was done in a hurry. Each operating unit was assigned a "research section". The research managers were actually very competent persons but with limited knowledge as to what research was all about.

In actual fact, an entirely new research structure had to be invented for the Company but, more importantly, for each section of the plant sites and defined for every location. When I arrived, Dr. Diaz was the Vice President for Marketing, Reichenbach for Production and Dakli the Acting Director of Research. The first problem was to establish a permanent Director and Vice President for Research. The next step was to establish principles of research and most importantly to find and appoint the Director of Research at the primary Center in Ferrara. I started with the first objective.

***b. The Restructuring – Management of DMP R & D***

My next immediate objective was the search and selection for a Research Director for DMP– Dakli, the then current Research Manager, was to be retired. Several people had been mentioned to me as possible candidates. It was clear, it should be someone from the factory in Ferrara, the largest research structure in any of the locations of DMP. Ferrara also had most of the potential promising candidates. Giovanni DiDrusco was mentioned favorably. One of the decisions was that the position of the new Research Director be elevated to Vice President of Research, equivalent to Reichenbach, the Vice President of Production and to Diaz, the Vice President of Marketing.

Reichenbach and I had long discussions, because Dakli had previously reported to Reichenbach and the new Director was to be independent from and equivalent to Reichenbach. We decided it was important to make the decision to select the new Research Director as soon as possible. We desperately needed competent research support for production and sales and we had the uncertainty that Montedison was losing money and needed stability.

I believe it was on a Wednesday afternoon, when Reichenbach and I left Milan for Ferrara. We had scheduled a meeting at 19:00 at the plant in Ferrara and demanded that everybody (including Union representatives) who was needed should be there. Naturally everybody was furious, the Factory Director Ermanno Lanzoni, the Union head and others because (after work) they all had to wait for us to arrive from Milan (three hours by car on the Autostrada away). We questioned several candidates; plant Managers in Ferrara, including Giovanni DiDrusco. I remember our meeting very well. He came across as a highly

intelligent even tempered person, competent and knowledgeable, with a pleasing personality. He was an Engineer by training, had gone to the Polytechnic University of Torino and was, to my surprise, very up-to-date on NMR; It turned out that he had been very well trained in chemistry and “technology” in Torino.

Reichenbach and I made a preliminary decision and we continued the same night to Venice, and on to Porto Marghera. Porto Marghera was the plant site of Montedison that produced PVC, polyurethanes and other polymers. I still remember the famous fish restaurant, “Trattoria dell Amelia” outside Mestre where we ate that evening; we had arrived from Ferrara just as they were ready to close at 23:00. I still have a plate from the restaurant, which they gave to their customers as presents, especially when the customers were well known or had an expensive meal. Leaders from our Porto Marghera factories used this restaurant for entertaining. Reichenbach and I were both under pressure to solve the problems of the research organization of DMP, successfully and as soon as possible.

Now, the first step was done. The DMP had a potential Vice President of Research, at least in our mind. The next step was that research at Montedison, at the DMP needed a detailed reorganization. Dakli, the former research director retired and was to be replaced by DiDrusco.

The DMP had locations and plants in a number of places; each one had a research component. First of all Ferrara, then Porto Marghera, Mantova, Castellanza, and the fluorocarbons in Milan. I had visited all of the plant locations and investigated who had been in place and who needed to be replaced.

Ferrara was the most important plant and the most important location. It was where Montecatini started the PP venture and was most successful with it. Through Professor Natta's friendship and with the leadership and personal relationship with key leaders, PP was commercialized in 1957 and licensed to other companies, i.e. Danubia in Austria. The leadership of scientists was comprised mainly with scientists of the second generation of the Natta school. PP was produced with a yield of 10,000 gm/milli-equivalent per catalyst with an expensive work up procedure. However it was soon found that PP was a highly desirable product of polymer commerce. The pressure was on for me to see that future scientists were Politecnico graduates and maintained the leadership, at least in research. I was more interested in having a young, vigorous and ambitious leader as the Director of their research laboratory in Ferrara.

I visited Ferrara several times and finally decided to propose Paolo Galli, then 38 years old for this position. It was not easy to convince the Montedison leadership (now Montedison not DMP) that my selection was the right one. Galli was an excellent scientist and a group leader with established scientific and administrative initiative.

The promotion of Galli to research Director in Ferrara required time and understanding. He could not be promoted directly. He had to be promoted first to a position of a Manager and within a few months he could be promoted again, this time directly to Director of Research at the Ferrara factory. He had to be able to manage and administer 550 scientists and staff, which were on hand for research in Ferrara. How was it done?

I proposed my ideas to Trapasso and what I thought the structure should be like and he told me he would find a way to do it. Trapasso did the necessary

preparatory work. One day I received a phone call in Berlin (I was then teaching at the Free University in Berlin) from Aloisio, the Director of the Personal Division, and was told: We have a meeting at 19:00 at the Fuoro Bonaparte in Milan, with Lucca, the Vice President of Montedison in charge of Personal (Lucca was a Christian Democrat). I took the next plane from Berlin. It was not easy to travel in and out of Berlin at that time (1977) because one had to go through Frankfurt. We met at the Montedison Headquarters' on Fuoro Buonaparte, sat down with Trapasso, Aloisio and Lucca and it was formally agreed that DiDrusco would be the Vice President of Research of DMP and Galli the Director of Research in Ferrara. What a relief! This was actually only the beginning.

### ***c. The Organization of Research***

The first part of our reorganization of the Research Organization of the DMP was completed; DiDrusco was designated as Research Director and Vice President of DMP. But my assignment was not complete. It was still my responsibility, as defined by Trapasso, to organize and establish the research groups in the individual plant locations and establish directions.

Trapasso asked me how I would like research to be established in the individual plant locations. I told him:

I proposed to adapt for DMP a plan, a modification suitable for industry, which I had worked before in academia for my large research group and it worked.

I proposed the principle of a 6:3:1 for the structure of the research organization for our industrial objectives at DMP: 60% of our research was to be short-range research, supporting and improving the efficiency of established products and

processes, meaning research objectives of a 6 months range. The second objective (30%) was longer-range research, meaning objectives in the 2-year range. In addition a smaller group (10%) of highly motivated scientists was to be assigned to long range objectives, industrial dream objectives, related to DMP. Ultimately it did not work exactly this way, because there were also personalities and personal ambitions involved. Still, my plans, where properly implemented, worked remarkably well, especially in Ferrara.

I had to be careful because Montedison SpA had an Institute of (Fundamental?) Research in Novara, staffed primarily by members of the Natta school.

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This concept for my 6:3:1 proposal was easy; I had already established it in my own research organization at the University of Massachusetts: I had designed my research group into three units: 60% of the research (for B students) was simpler and with a “guaranteed” research objective, supported by industry or block grants. 30% of the research was for A/B students. Their activities were supported by individual NSF or PRF grants and 10% of the research reserved for far reaching and highly speculative research was reserved for A+ students. The innovative character of their research was not supportable from grants based on regular official proposals even with advanced ideas.

The exploratory research group for the DMP (not Montedison, per se) was to be located in Mantova. It was to consist of 8 people led by one of Trapasso’s former associates. I knew the director of the plant facilities in Mantova well, we had similar ideas. The Mantova plant was compact and independently functioning within DMP.



For our research objectives at DMP, I also insisted on a committee on “Polymer Stabilization”. DMP produced and sold many polymers. To sell them for their superior properties required knowledge of how to produce and sell excellent products. Stabilization of the polymers against aging and other deteriorations were important factors. Each polymer required some stabilization. I thought that coordination of stabilization knowledge within DMP would simplify the production of all our excellent polymers.

This concept of the “Stabilizer Committee” worked for a while but the distance of traveling for stabilizer experts from one plant location to plant location to another and the limited commitment of the individuals finally limited the effectiveness of the committee only for a relatively short period: It was ultimately important after several visits to the three key institutions, Mantova, Porto Marghera and Ferrara to make the final decisions: 60% should be oriented toward the immediate support of the production and development – with a 6 month objective, 30% should be directed toward longer range research and learning about what type of research the competitors were doing and how risky was it for our business – 2 years objective. I told Trapasso, that I would like to have 10% for research for a 5-year objective. I had explained to Trapasso that I used the same principle in my (at that time) rather large research group: 60% research objectives for B graduate students supported by industry and block grants, but still with an objective of completing a nice thesis worth a good doctoral degree carried out under my supervision, 30% research objectives for A/B students supported by NSF or PRF grants and 10% for A+ students, in fact unsupportable by regular means of written proposals. This was long range and highly speculative research, often done with outside cooperation.

This was the principle. Now I had to worry about locations other than Ferrara. We placed the so-called basic research in Mantova. We selected some of the old friends of Trapasso for this initiative. – the exploratory group never worked very well. It was an example of where industrial objectives vs academic ambitions could not be duplicated.

For the research group supporting the plant operation, Barbé as the manager did a magnificent job and it worked. He provided excellent leadership for the research organization to support the production at the Mantova plant,

We had to initiate the research organization and appoint the research manager in Porto Marghera for polyurethanes. Talamini was the obvious choice and a very good one. He was an expert in polyurethanes, a little academic minded and a part of the Venice community. His brother played the first violin in the orchestra at the Teatro Fenice, the Opera of Venice. There was also Dr. Vidotto, an expert in PVC structure/property relationship, and located in the plant in Porto Marghera; he was the choice for research on PVC. He actually lived in Padua and commuted daily to the plant.

A similar situation existed in Castellanza, where PMMA was produced. We appointed a token “research leader”. There was no need for much research: The production of PMMA sheets was established. The sheet extrusion of PMMA, our main product and the entire process obviously needed a major overhaul, but we (DMP) had had no intention of doing it. Similar was the situation with the fluorocarbon polymers in Linate. The fluoro-carbon business was quite profitable for Montedison but required more “knowledge”; only a small research effort was sufficient. We could not really compete with the big American or Japanese companies that produced fluoro-carbon polymers.

By the time the year was over, I felt I had accomplished what I had been asked to do, to “suggest” a detailed reorganization of research at DMP that had sales of 1.5 billion \$ (in today’s money probably \$ 10 billion) at that time.

As I look back on my initiatives and decisions: Some worked well, especially those in Ferrara. With Galli’s leadership, his research organization was reorganized and the initiative of research was refocused. Specifically, he focused on catalyst research and put 1/3 of the research capability of the Ferrara team on catalyst research. Within one year and under his leadership his group had discovered catalyst systems that produced 50 times the polymerization efficiency for isotactic PP and methods that allowed them to retain the catalyst in the polymer at 2 ppm, a harmless quantity. It could be left in the polymer without influencing the aging behavior of PP. It needed only the regular stabilizer to be added. Today about 60 million tons of PP are produced world wide using this (Spheripol) process and subsequent technologies.

Over all these years I kept in close contact with Galli, followed his splendid career and the development of PP in Ferrara and worldwide. I am quoting what Paolo Galli written about what we accomplished in those years of the mid 1970’s and I am including it.



Paolo Galli

#### ***d. Professor Otto Vogl and the Rebirth of the Ferrara R&D Center***

*In the years 1970-74 the Montedison Ferrara R&D Center, in spite of its past brilliant and important scientific traditions and of the presence of some skilled teams of scientists was in a very regressive phase.*

*The Montedison Company was very disappointed and was planning to demobilize the Ferrara Center. In his comment the new Director of the Center, Professor Galli commented and continued:*

*“But, luckily for the future of the Polyolefin Technology they met and engaged Prof. Otto Vogl of the University of Massachusetts! He was at that time a consultant for the Montedison R&D reorganization. He committed immediately in the understanding of the complex Ferrara R&D, mainly characterized that time by the presence of some islands of prepared and skilled scientists in the middle of lack of qualification and inconclusiveness. Prof. Vogl started immediately his analysis of the situation, visiting Ferrara, interviewing people at every level. His*

*diagnosis of the spoiled situation arrived soon: an obsolete, old style bureaucratic, undecided management, unable to understand and manage the R&D problems and...the people!.*

*His therapy was flashy: a total change of the obsolete management and have the way of (not) doing the R&D. It was not an easy job among non-cooperation and all types, negative reactions on behalf of the old system .In spite of that he engaged himself in the attempt of a radical reorganization of the entire Ferrara system. On the bases of the information collected on the good / bad results achieved in the last years and of the skills of the people he had the capability to recognize, he was able to promptly propose his plan: on those bases he selected a person as future leader of the Ferrara R&D; Prof. Paolo Galli.”*

*“Paolo Galli was approved by the Montedison Direction as the new Director of the Ferrara R&D Center and Prof. Vogl fully committed himself in helping him in the non easy reorganization job, supporting him against the reaction of the old management and the jealousies of the colleagues, working together in the elaboration of a new managerial style and efficient approach to the R&D activity. They worked hard but in the space of one year, from 1975 to 1976 the Ferrara R&D system has been completely revolutionized. A new team of young, skilled managers was identified and fully committed; a clever selection of R&D projects was promoted and dynamically pushed ahead.*

*One proof for all that: on the base of the existing culture and the potential existing in the small team of Prof. Galli a project that had been sleeping, if not boycott, in the past years was soon rediscovered and re-launched; at the end of 1976 the new, revolutionary high-yield catalyst for Polypropylene was a reality; at the end of 1976 a first commercial plant started-up in Ferrara, in 1978 two brand new,*

*large scale plants started up in Feluy (Belgium) and Houston (TX). The extraordinary new and revolutionary era of the Polypropylene and Polyolefin, in general, life had successfully been initiated.*

*In 1980 the Ferrara Center had risen to a novel scientific and technology prestige, already recognized as the world-wide leader in the Heterogeneous Catalysis and Polyolefin Process Technology was dedicated to Professor Giulio Natta in a ceremony where the key Italian Industry Managers and the most famous scientists from all over the world were invited, among them Prof. Otto Vogl.*

*The foundation was laid for the techno-scientific and managerial development of the entire way of working of the Ferrara R&D, which were based on the work of a selected, special group of people, that understood how to impose the results, the respect and recognition that the Montedison-Himont- Montell-Basell Technology and the “Giulio Natta” Ferrara R&D Center has gained in the world today.*

*We may conclude that the destiny of the Ferrara Center has been: FROM THE MARHES TO THE MATTERHORN“. Quotation of Galli’s evaluation ends.*

Now a few words about my office and the office of the Divisione Materie Plastiche, located on Largo Donegani. On the 6<sup>th</sup> floor was the office of Trapasso, the President with his secretary Brunella Tommiso (from Parma). Opposite was a double office of Dr. Diaz, the Vice President of Marketing (it was called so in English) and me. We were separated by a secretarial office, which was occupied by Liliana Tosini. Diaz and I shared her as secretary but because I was rarely there, she was his secretary.

Liliana was wonderful; it was easy to work with her and - she made (at least 3 times in the morning) espresso, excellent espresso. You should have seen the amount of coffee grinds that she produced for the entire floor in a morning. It was carefully hidden, but once I saw it!! She was also most helpful when I had to do some shopping in some of the famous shops in via Monte Napoleone. After all, I had a wife that needed to know what I was doing and accomplishing. Liliana knew where everything was, that I needed and knew the price! And warned me, when it was excessive. Liliana translated (when it was needed) from my English script into Italian and it went to Trapasso.

In order to get to our office we did not use stairs or elevators but “pater nosters”, a kind of continuous elevators. You had to learn how to get on and how to get off. I had never seen them before but it worked similarly to escalators except it was a different technology, but - one had to learn to step on and off in a certain rhythm. Amazing what you can learn.

## **D. Life in Milan**

When I was in Milan I usually stayed at the Albergo Touring, a four plus star Hotel on via Ugo Tarchetti; it is about 2 blocks from the office. On the way to the Largo Donegani, I had my breakfast in my favored coffee house, a stand up bar where buns and coffee were served. Like everybody else I entered and asked for “un cappuccio e un brioche”. This was the standard for the regulars. We, the regulars, talked to each other – not more than “buon giorno e come va” but we knew each other and knew where they worked and if they were married. Dozens of early customers came at the same time. The cups came directly and hot from the dishwasher and everybody knew everybody – of sorts. The short way through the via Filippo Turati took me to the Largo Donegani. I took the “pater noster” a mobile elevator, to my office on the 6th floor.

When the Albergo Touring was full, I sometimes stayed at the Hotel Manin, at the Giardino Publico, or in the Hotel Cavour, via Fatebenefratelli. The price of the room at the Manin was about 190,000 L, now it is 172 Euro at discount prices. The Hotel where I usually stay in Vienna, the Hotel Atlanta, equivalent to the Manin, charges me 110 Euros – because I am a regular and devoted customer.

As you remember my good friend Prof. Giuseppe Bianchetti lived across from the gardens in the via Rossini, He originally had his Patent office in the via Senato, but now it is called Studio Consulenza Brevettuale and is located in the via Rossini 8. Like everything successful in life, it requires “net working” to have a home or a home connection. This was Pippo Bianchetti for me in Milan. To finish the story, Brunella Tommiso, Trapasso,s secretary was also from Parma, like Pippo’s father. Again the connection was immediately established with the city of Parma as the center.

As my interaction started seriously with Montedison (I actually should be specific by saying with the DMP of Montedison) I was located as Full Professor at the University of Strasbourg and had to go to Milan (the old Mediolanum) regularly. Initially the best way was by train. There was a train, with sleeping cars from Strasbourg to Milan. It left Strasbourg at 22:00 but in the first class sleeping car. You could take your place at 21:00 in the unconnected railroad car. Before train departure it was attached to the train and you arrived at Milan at about 5:00. It only required the appropriate ticket and the appropriate tip. You gave the conductor the passport and he handled the border requirements. Remember at this time, European countries had clearly defined and strictly enforced borders.

When arriving early morning at the railroad station in Milan, it was only necessary to take a taxi to the back entrance of the building in Largo Donegani. I knew the guard, he was very careful because at that time terrorist attacks had started in this part of Europe and were targeting “unusual visitors”. I was required to take the service elevator to take me to my office (the regular front entrance was still locked). Trapasso, the President, was an early riser and was usually in the office at 6:00 and the day began – now in Italian!



The return trip was more satisfying and exciting. It was a day trip with lunch in the dining car and the beautiful trip through the Swiss Alps! My wife met me in the evening at the Strasbourg railroad station.

Later my obligations in Strasbourg became more demanding and I required a different schedule. I gave a 4 hr per week course at 4 rue Boussingault, the University arm of the CNRS. The course was divided into two sessions because part of the course participants were from industry. This course consisted of a 2 hr session on Monday morning at 8:30 and a two hr lecture on Friday afternoon at 3:00. How did we do it? I had to speak English with my wife on the way to Entzheim. The two courses on “Degradation, Stabilization and Aging of Polymers” were, naturally, given in French. As I finished the lecture my wife took me (with all the weekly necessities packed) to the Airport of Strasbourg, Entzheim. I took the plane to Linate- Milan, the domestic airport of Milan ~ 5 km from City Center. It was most of the time a gorgeous flight, but sometimes scary because – after the beautiful view over the Swiss Alps, the Bernese Oberland, the Matterhorn (Cervinia), the region Lombardia, the northern part of Italy, was often covered with fog, so typical for this part of Italy. Sometimes we had to circle over the region seeing again the beauty of the Alps. As I arrived in Milan, and was expected at our meeting in Largo Donegani and I had to speak and understand Italian fluently (after the two-hour lecture in French in Strasbourg). No wonder that Brunella (Tommiso), not infrequently said: But "professore" (notice the word has not caps in Italian) your Italian is terrible.

Only then could I check into the Hotel “Touring”. I did not have to go to Milan every week, but there were many weeks of this exciting experience. Sometimes I also stayed at the Hotel Manin opposite the "giardino pubblico" or, the Hotel Cavour on the via Senato. The breakfast was eating, standing up and we “business people” discussed weather, how terrible the government was being conducted and the soccer results and forecasts. Milan had two teams Inter and Milano as they have today. It was important to know details, scores and scorers. Because, just like in this country for baseball, to be accepted meant to know the sport, but soccer !

Later it became important when one used taxis. The fare depended very much on one's knowledge and the personal behavior or conduct of the players. The teams were still local teams or at least Italian teams, only 3 players from abroad were allowed per team.

On arrival at Largo Donegani, people were now streaming to work, 8 o'clock, 8:30 at the latest. I took, like everybody else, the pater noster, a continuous elevator, stepped in on the ground floor, everybody was pushing in and trying to push out to depart at the right floor. The pater noster did not stop. If you missed your stop you had to continue. The pater noster turned above the top floor (the 12<sup>th</sup>) and came down on the other side. Now one had a second chance to get out. This time it was easier, because the cabin of the pater noster was now nearly empty. I arrived on the 6<sup>th</sup> floor where my office was. It was on the opposite side but near the pater noster. My secretary Liliana Tosini spoke English well, which was not very common in the mid 70's in Europe. She was important for me because I used to write my proposal analyses and letters in English, and she translated them for my signature.

The formalization of the appointment of DiDrusco as Research director was complicated, but the appointment of Galli of the Director of the Research in Ferrara was more than complicated. DiDrusco had a degree from Torino and was an Assistant of the plant in Ferrara, and generally acceptable. It was not completely simple. The Plant Director Dr. Lorenzo was a Christian Democrat, the Union was strong and the Mayor of Ferrara was a communist. Neither DiDrusco nor Galli had a political record. But...

Galli was a semi-supervisor and the position of a Research Director in Ferrara was 2 ½ levels above Galli's position. But I insisted. I was told be patient. Everything has to be done a certain way and it would work out. Consequently Galli was promoted to some "side" position, a substantial promotion. Then he was eligible to be promoted to the right position. I waited, but it took some months.

By then my tenure in Strasburg had expired, and we had moved to Berlin, where I was teaching a one-hour credit course at the Free University of Berlin in Dahlem. It was then the time to establish clearly who would hold of the key position of research at DMP.

We all went for dinner (not Lucca) to the Ristorante Savini, Galleria Vittorio Emanuele II, Piazza di Duomo, one of the fanciest restaurants in Milan. We celebrated what I did not know at that time, was one of my best decisions of I my life. I did not pay the bill. Aloisio had a rather free expense account.

There is a sideline. To celebrate my success I thought I should have a tailor made Milanese suit made. Aloisio advised me that a famous tailor in the Galleria Vittorio Emanuele II should do it. It was a beautiful suit. I could wear it only for certain occasions in New York. I even had a matching shirt made. It costed me 160,000 Lire, almost twice as much as I would have paid to a regular tailor in Milan at that time. But when finished, the tailor said: “professore, one of my customers is Mr. Cefis, the President of Montedison”. That was my once in a lifetime glory in Milan.

First, I would like to comment briefly on the structure of the company, more precisely the DMP. It had at this time sales of about 1.5 billion dollars. It had a number of divisions, not all of them of equal size and factories (stabilimenti) in various places in Italy mostly in the north.

In what part of Milan did I function? Between the Railroad Station and the Fair Grounds and between the Cimiterio Monumentale and the Corso Venetia. We worked long hours and there was not much time for entertainment. For lunch I had a panino (sandwich). Sometimes I ate cold cuts in the Hotel. I liked to pick my own meals. Coming out of Largo Donegani was the via Moscova, where there was little street with a salumeria (cold cut and ham shop), a bakery and a wine store, next to each other. First the ham, then the panino (the buns), and then the wine.

Regularly I went for a meal in a Trattoria in the via Filzi, a small side street on the way to the railroad station. It had been recommended by a friend. Only locals

frequented this place. It had a white paper tablecloth and linen napkins. The napkin (with a wooden ring) for each customer and the bottle with the rest of the wine were left in our personal cubbyhole. The napkin was changed twice a week. The wine was almost exclusively a red wine from Piedmont, or the Asti region. Each regular customer had his own cubbyhole. People there, all seemed to be regulars. Normally the people, took the menu or a special dish that the waiter whispered as especially good for this day. At the end of the room there was a spectacular display of local (rural) sausages and cheeses and bottles of red Piedmont's wine, hanging from the ceiling. You had the feeling of being welcome.. Occasionally I had to discuss the sports results, making sure to figure out what your new friend wanted to hear! Once in a while I had dinner with Pippo. The family also ate late, which was complicated because I had a lot to do and both Trapasso and I were early risers.

People will ask: What did he do in Milan for entertainment. First of all, I worked intensely in Milan and had little extra time for myself. Yes, I did have some time in between workdays, on some weekends. And Yes, I had my favored places in Milan. First those outside of Milan I had seen before: I did visit again the Certosa di Chiaravalle and the Certosa di Pavia. I visited the Castello Sforzesco, now a museum and its park. It was very close to the headquarters of the administration of Montedison, Montedison SpA not DMP. I walked frequently rather than taking public transportation to the center of town. The Center City of Milan is not that large and walking was more efficient.

My favored walk was along the via Manzoni, via Monte Napoleone, Piazza San Babila, Chiesa San Babila, Corso Vittorio Emanuele, Piazza del Duomo. San Babila was one of my favored churches in Milan. My really favorite was the Basilica di San Ambrogio, I believe, the oldest, well functioning church in Milan. I also visited Santa Maria delle Gracie located near San Ambrigio. Leonardo da Vinci had painted "The Last Supper" in the late 15<sup>th</sup> Century

I was fascinated with the famous historic cemetery, Cimiterio Monumentale, where all the famous people of Milan were buried, like Verdi and Toscanini (also Pippo's

parents).

I also went to the Politecnico of Milan on the Piazza Leonardo da Vinci, where Giulio Natta was Professor and where his research group discovered isotactic PP almost 60 years ago. When I was in Milan on a Sunday, I went to church, usually to Chiesa San Marco at the end of via Fatebenefratelli and via San Marco

I went once to the General Hospital in Milan. Fortunately, I did not have any medical problems, but Enrica, Pippo's sister, the direttoressa, had broken her ankle and I visited her.

I went several times to the Pinacoteca di Brera, the art museum and picture gallery, of Milan. I was always interested in paintings especially oil paintings. I had been instructed on the art of this region by the Bianchetti family years ago. My friend Pippo had bought some paintings by the then famous artist Brioschi, a member of the Brera and Pippo had recommended his paintings to me. In the late 50's, I bought three paintings of landscapes by Brioschi at an auction near the Duomo in Milan, which I still have prominently displayed in my home. I still enjoy them. My interest is also music and the opera. There is no better place to enjoy the opera than in Milan and at the Teatro della Scala, "the Scala". This is where Verdi triumphed and where Toscanini excelled. From where I lived at the Albargo Touring it was easy to walk along via Alessandro Manzoni ending in the Piazza della Scala. I saw three performances there: La Boheme, Lucia di Lammermoor and the premiere of Wozzek. I never bought tickets in advance usually bought a ticket for a Saturday afternoon performance before the performance and paid whatever was requested.

A little story about the Boheme: The performance had been sold out. I arrived 5 Minutes after the beginning of the performance, paid 15,000 Lire (a small portion of the regular price for a scalper, who had been unable to sell the ticket) and went in. Naturally, the performance had just started and I was discreetly directed to the "bleachers", the standing room only. I was told to go to my regular seat, after the first section of the performance had been completed. I was well received by the

audience, older, middle age and middle class people. It was hot and everybody was perspiring. You could see only part of the performance. We all had to hold together, were locked arm in arm and had to lean over together, when the scene moved to the near corner. It was wonderful. When the intermission came, I was ushered to my regular, fairly expensive seat and the people were disappointed and said "but professore how could you leave us". I had a similar experience at the Teatro Fenice in Venice but not as dramatic. I saw also the premiere of Wozzek at the "Scala", the theater was half empty and it was easy to purchase a good seat.

Even though I was and am a soccer fan and had followed "Inter" for years, I never made it to the Meazza Stadium, officially the Stadio Calcistico San Siro, where both Inter and Milan played and still play.

## **E. Production Centers of DMP of Montedison**

DMP had different plant locations in several areas in Northern Italy. The smaller plants, represented well established products needed not much support-research. The three large plants produced products with growing markets, required research support and required more of my attention.

### ***a. Near Milan – Linate, Rho, Castellanza***

Poly(methyl methacrylate) [PMMA] production and PMMA sheet molding was done in [Rho](#), north of Milan. [Castellanza](#) near Como and the border to Switzerland produced formaldehyde and its follow-up products, especially melamine. I will discuss the Castellanza facility, the plant and how it functioned functioning later in this book. Fluorocarbons and fluoro-polymers were produced in [Linate Peschiera Borromeo](#), not too far from the [Linate Air Port of Milan](#). The fiber plant produced polyolefin fibers and was located near Rome in Terni. The Terni factory belonged only in part to DMP and functioned somewhat independently.

The cities of Rho, Castellanza, and Busto Arsizio (not a Montedison facility) are on the Autostrada to Malpensa International Airport, the transatlantic Air Port Northwest of Milan. Rho is about 20 km, Castellanza about 35 km, Busto Arsizio over 40 km and Malpensa 50 km from Milan. Rho, in the county of Milano, Lombardia, is north of Milan and has ~50,000 inhabitants. Castellanza, in Varese, Lombardia was smaller, as was Linate Peschiera Borromeo, Terni, in Terni, Umbria was ~100 km north of Rome and had about 100,000 inhabitants. I visited Terni only once while I was working for Montedison, but later again, because Central Umbria had become designated by the government as “Industrial Park”. Years later, when I consulted for Enichimica, I visited the Terni facilities (which had been transferred from Montedison to Enichemica) again several times.

The refinery complex from which we received our basic materials at DMP was in the South Italian City of Brindisi, Puglia, it had a population ~90,000. The area of Brindisi had first been settled over 2,000 years ago by the Phoenicians and Greeks over 2 millennia’s ago because it had excellent harbor facilities.

#### ***a. Mantova - Polystyrene and Dichloroethane***

Mantova, as a city and as a region, had a very peaceful atmosphere., not too hustling and bustling. One could well imagine, it had been an independent principality for some time. The stabilimento of DMP was set in a feeling of independency and reliability as far as the production of the plant was concerned. The facilities in Mantova produced polystyrene and dichloroethane. Dichloromethane was made by chlorination of ethylene and shipped to Porto Marghera. There, it was thermally cracked to HCl and vinyl chloride and the vinyl chloride was used for the polymerization to PVC at the plant in Marghera.

Mantova, on the eastern end of the region of Lombardia is a City of ~50,000 inhabitants. For sometime, it was part of the Papal States, and then it came under the Hapsburg rules. Mantova had a prosperous period in the late middle ages, especially in the renaissance period under the Gonzaga dynasty. The Gonzaga complex of Palazzo’s is extensive and I spent quite a bit of time visiting the

Gonzaga Palaces.

Mantova is a magnificent town of tradition and culture. I enjoyed staying there at the Albergo San Lorenzo, Piazza Concordia. The center of town is dominated by the Piazza degli Erbe. At this piazza, there were three trattorie, which I frequented for dinner. For meals, the cooks in these restaurants were experts in veal specialties. When I had a special wish, the lady cook, took care for me and prepared the meals to my liking. A little outside of town was the more famous restaurant “il Cigno”, the swan.

But back to reality: I place P.C. Barbé, a very promising scientist from Ferrara, in charge of the research group for the plant support in Mantova. I did not realize the problem it caused. I was accustomed to our system in the U.S.: When a person was promoted to a higher position in a different location, he would move and his family would move as well. Not so in Italy (or Europe in general). Mantova was a little bit too far for a daily commute from Ferrara. Consequently Barbé rented a room in Mantova, worked 10-12 hrs a day, arrived from Ferrara on Monday morning and left on Friday to join his family. In other words he worked four days, but 12 hrs a day.

I knew the director of the plant very well, because we had, at the plant, labor (union) problems, My wife and I went to dinner once to his elegant villa and had a magnificent meal, in spite of the delicious “bird” aperitif, which, for my wife, as a bird lover, found difficult to take . The Director of the Mantova factory, Amleto Cirocco, was later promoted to the much more demanding and influential position, as the Director of the much larger plant facility in Ferrara. But in his case, the spacious house in Ferrara came with the promotion.

### ***b. Porto Marghera - Polyurethanes and PVC***

The City of Venice, was once the Capital of the Republic of Venice headed by the doge. Now it is the Capital of the Region of Venetia. Venice, a medieval town on the Adriatic coast is now a major tourist attraction in Europe, and a marvel of history



and architecture. In the late middle ages, the Venetian Republic was an independent State, a Center of culture, and commercial and naval power. Venice kept the Ottoman navy under control in the eastern Mediterranean for centuries. Now Venice is a sentimental city of tradition, located on a group of islands. But what is Venice really like? When Venice was a major naval and commercial power, it competed with the might of Genoa, After the Napoleonic wars, it became part of the Hapsburg Empire and finally, after Garibaldi's revolution, and the unification of Italy, a region of Italy, It is now the province of Veneto.

The commune of Venice has over 200,000 inhabitants. Not more than 1/3 live in the City of Venice, on the islands themselves. The surroundings include Mestre (a commune that includes ~ 170,000 inhabitants) and other suburban cities including Porto Marghera. Our plant, the plant of DMP, was in Porto Marghera, which had excellent access to port facilities. When I had responsibilities for our plant facilities, I usually stayed in convenient hotels near the railroad station in Mestre, the Hotel Mestre or the Hotel Plaza. For all the Montedison activities, our focus was placed in Porto Marghera, which had a harbor and an industrial "park". There, our facilities for producing PVC and polyurethanes were located.

Let me first start with the plants of DMP and their facilities. When I came into my position at Montedison, the person in charge of the plant in Porto Marghera was Erbo Sellan, a true Venetian. He let me know it from the beginning of our relation and I accepted it. The beginning of our relationship was a casual visit. Remember, I had to carve, from the personnel of the Porto Marghera plant facilities, a small research organization, out of his "empire". His empire had been functioning rather well, but had no research focus. I had to become friends with Sellan, the plant Director and had to have his consent for my proposals (decisions) of a research organization in Porto Marghera. I also had the responsibility of trying to maintain expenses of that research organization limited, which still was a part of the plant operation in Porto Marghera. The expenses had become excessive but had to fit within the framework.

I still remember my first true encounter with the Director Erbo Sellan: I mentioned that the cost of my coming to Venice from Milan by car with a driver was 11.000 Lire and we could do it for 6,000 Lire by using the first class facilities of the train “Rapido”, the common train from Milan to Venice. Erbo recalculated and showed that my time and effort and the need to have transportation within the company was less. I cautiously agreed.

I asked Sellan (notice the name Sellan is thoroughly Venetian, there is no i or o at the end of the name, only -an) to help me with the reorganization of the research part of the “stabilimento”. He said: We have to discuss the matter in detail to make sure that it ultimately works. And I said how?

He said further: In order to understand each other, we should have lunch together. He proposed to go to a famous restaurant, which used to be the half way station in the canal that went from Venice to Padova, when there was still canal traffic between Venice and Padova. It turned out to be an excellent restaurant near the town of Dolo. Erbo and I went with 8 other favored members of the technical organization for lunch. Erbo drove his Lamborghini and we settled for lunch at 12:00. We discussed all matters, including extensive meal expenses and productivity. The restaurant was near Soave, consequently the walls or the restaurant were filled with the famous Soave wines of exquisite quality at the right temperature. The meal included all the specialties of the Venetian seafood cuisine including “bianchettis” the tiny shrimps of the Adriatic. We finished at 4:30, after the espresso and the (after dinner) Grappa. I asked Sellan: How can we justify this extensive and expensive meal with all the people of the research organization. The answer was simple. He said: “professore, we Venetian deal only with friends. It took us, for you and me, remember I am a Venetian, and all the leaders of the organization who are also Venetians, 4 hrs to become friends, we know each other, we trust you, you can now have everything you want in 5 minutes. Erbo was right. When I started to rearrange the organization in Porto Marghera, I never had any problems with him, because he considered me his friend and we had the complete trust of the senior members of the organization.

Montedison in Porto Marghera had two sections: PVC and polyurethanes. I tackled my reorganization of the PVC research first, because it was easier. We had a person in the organization, Dr. Vidotto, who had graduated from the University of Padova and was very competent. He knew PVC the structural problems and the processes to produce the desired products. We placed him in charge of the research activities for PVC. The plant in Porto Marghera received dichloroethane from Mantova and cracked it to vinyl chloride. The vinyl chloride was used for two processes, the polymerization in emulsion and the polymerization in suspension. Each process produced slightly different types of PVC as far as polymer composition and molecular weight and molecular weight distribution was concerned. Even when I was later at Enichimica, we could not really solve the problem of satisfying the customers. Some wanted one kind, while others were determined to accept only the other variety of PVC. Vidotto became "responsabile" for handling research; he turned out to be very competent and capable.

While I was never too close to Vidotto, the research leader for polyurethane group, Talamini, and I soon became friends. Talamini was the obvious choice to lead the research effort for polyurethanes in Porto Marghera. As with Sellan we had an early understanding. This was of a more cultural nature. Talamini's brother played the first violin in the Teatro Fenice, the Venice Opera. Once my wife and I went together, with Mrs. and Dr Talamini to the Teatro Felice in Venice. I still remember it well; they played Donizetti's "L'elisire d'amore". The Talamini's picked us up from the Plaza Hotel in Mestre, where I often stayed; we drove to the Piazza Roma in Venice and parked the car; then we took the valporetto to the Fenice. I still see Mrs. Talamini with her mink coat (visone) in the valporetto, the normal valporetto, which is in Venice like a taxi in New York would be – not matching the elegance of the visone. In the intermission we met Talamini's brother and the conductor. What a pleasure.

The polyurethane group ultimately sent me one of their coworkers, Gianflavio Lunardon (what a Venetian name) to spend a year with me in Amherst. I think Gianflavio liked it in Amherst. He had grown up, and gone to school in Padova, and was really not that enthusiastic about spending a year in America. The polyurethane group was very interested in some fine points of the polyurethane

properties, especially of the polyester part. DMP prepared polyurethanes based on polyester glycol units. Ultimately, the plant of DMP provided us in Amherst with 200 and 400 molecular weight polyester glycols of various molecular weight distributions and with the help of Sumida, my other post doc from Kao Soap in Japan we solved the problems of the peculiar question of structure/structure relationship for polyester type polyurethanes based on toluene-diisocyanate (TDI).

### ***c. Ferrara – Polypropylene***

Ferrara is a town of nearly 150, 000 inhabitants in the commune (district) of Ferrara in the Province of Emilia Romagna. It is 50 km from the famous town of [Bologna](#), on a branch channel of the main stream of the [Po River](#), located 5 km north. The town is still surrounded by almost untouched ancient defensive town walls, mainly built in the 15th and 16th centuries. The most important building in town is the [Castello Estense](#) located in the town center, The town has also a number of important palaces dating from the 14th and 15th centuries, when it was the home the court of the [House of Este](#). Ferrara has many important cultural edifices including the Palazzo degli Diamanti. There is even an unproved relationship of Ferrara with Lucretia Borgia. For 2 hundred years, Ferrara was part of the Papal States, (16-19<sup>th</sup> century).

From the point of view of industrial activity, Ferrara was the plant site that was selected by, what was then Montecatini, to commercialize PP in 1957. I am not completely sure of the accuracy of the historical events, but... When PP was discovered in the laboratory of Professor Natta at the Politecnico of Milan as an interesting polymer for a possible commercialization, he had friends in industry who supported his proposal to explore the possible commercialization of isotactic PP. Industry also had the facility to select and locate the production site: It was the “stabilimento” Ferrara. By 1957 PP went into commercial production and in the next 50 years with all the continual improvements in product properties and processes, the development of PP as one of the most prominent polymers was a phenomenal success. It was not always Montecatini, it was not always the Natta school, who

led the forward thrust, but PP today is one of the most successful enterprises in polymer science and commands about 15% of the world's plastics market.

How did it all start and how was I involved. Remember I was given the responsibility by Trapasso to set up the research organization of his organization. Ferrara was the key point but also the most sensitive point of the relationship of Industry and University in Italy. The Natta chair in Milan and the discoveries in his laboratories had created isotactic PP and had inspired its commercialization. Consequently, PP (and even its production) was, in a sense, in the hands of the Natta school. The first industrial process for isotactic PP produced 10,000 g of PP per catalyst. PP became very soon a highly regarded polymer as far as its properties were concerned.

In the meantime Montecatini was bought by Edison and incorporated into Montedison. The requirements for increasing markets and improving performance; cost cutting in efficiency of production was essential. For a polymer with relatively simple and cheap starting monomers, the production was a relatively expensive process.

What I did not know, when I became involved in the reorganization of research in DMP, was, - and I was relatively naïve in the business aspect, - that decisions for the future of research in DMP, especially in Ferrara, had significant influence on the PP business and, in fact on the future of Ferrara and DMP.

I took the chance and decided to find the best and most competent man to lead the research organization in Ferrara. As I mentioned earlier it was not easy and it was a question of judgment and luck. With Trapasso, I made the tough decision to make. I proposed to select Galli (against all the regular rules of Montedison, and I would say of most companies at this time) as the “responsabile”. This was the official title for the Director of Research in Ferrara. He was to be responsible for research and controlled 550 people (scientists, technicians and workers) to make the future of PP a success. I still cannot believe it after 35 years. It was a success and what a success. And I was only the catalyst.

To say it in a few words, words that were told to me, Galli put 34 scientists on the project to find the super catalyst, a super catalyst for the production of PP. Galli had been involved with catalysts to produce linear polyethylene before, transition metal supported on magnesium chloride.

Within 6 months as I saw it, Galli claimed the key discoveries within one year of the time he was installed as Director. The super catalyst was found – not too soon because Norio Kashiwa in Iwakuni, Matsui Petrochemicals also led successful research and reached similar result. I had known about the efforts of Kashiwa and in fact I never knew that Mitsui Petrochemicals were working on a super-catalyst for PP in their Mitsui Petrochemicals Iwakuni facilities. In all my visits to Iwakuni I had never met Norio nor was I privileged to know about his research – fortunately. But on the other hand, Montedison and Mitsui Petrochemicals never chose to fight their inventions, which were so close time wise, but decided to cross license them. I did not know all about this because by then I had retired from Montedison I had fulfilled their request to “reorganize” their research organization, but not to conduct their research. That was in the hands of Galli.

I have talked about the commercial and scientific part of the reorganization in Ferrara. But what was my personal relationship with the town of Ferrara. I loved it. I liked the relationship of Ferrara with Verdi's opera Rigoletto, visited the location from which the opera was copied. I stayed always at the Hotel Astra on via Cavour 55, and had my favorite restaurant, "Ristorante Vecchia Chitarra". I will talk about the top restaurant “The Giovanni” later. I went to side streets, the Ristorante Grotto Azzura, another one on Piazza Secreti and one on the other side of town.

As I mentioned in my commentary about Porto Marghera and Erbo Sellan the plant director in Venice. I had an additional interesting story for Ferrara, maybe two. When I arrived at Malpensa, the international Milan Air Port and had to go directly to Ferrara, “my” driver used to meet me at the Airport in the morning. He had come from Ferrara the night before, slept somewhere and was ready for me at 6 in the morning for the 4 hr drive to Ferrara. I always apologized for the inconvenience I caused him and he assured me that was his job (in fact a well paid job). We

always had lunch 2/3 of the way; he knew a nice roadside restaurant. We always ate together, which was, as company policy, not allowed, that a driver sat at the same table as the Director of the Montedison.

In my attempts for cost cutting efforts, I questioned why we had leased 12 Fiat 132 cars with 12 (and several substitute drivers). The answer was very simple: Fiat buys all the rubber components from us and we have agreed to lease a certain number of their cars for our use. If we do not use this agreement and do not use their 12 Fiat 132 models, Fiat will find other suppliers for their rubber components in their cars.

On the other hand, the only time, my wife accompanied me on my trip to Ferrara, my favored driver was available (had nothing to do) and showed her the town of Ferrara and helped her shopping. It was not stealing, because most of the other drivers just pretended to tend for the cars and were washing and doing some polishing on the cars. Such was Italy 35 years ago.

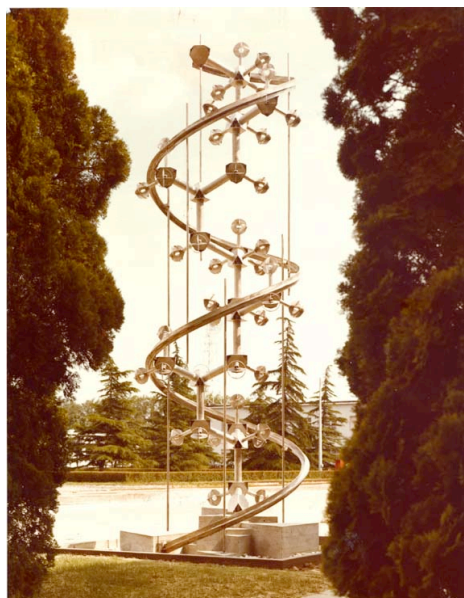
On a higher level: Our friend Lorenzo, the plant Director of the “stabilimento” in Ferrara, was being retiring or was to be retired. And the question of his successor was discussed. Here my former European background made me useful. Because I was asked for my opinion since the union was involved, both for the research director appointment as well as for the appointment for the next “responsabile” for the Montedison plant in Ferrara. It was obvious but had to be handled carefully: The best candidate was the head of the plant in Mantova, but he was of a different political party, what a problem.

With my assignment and my contract at Montedison at an end, the objective was accomplished in 1978. With the new and most efficient process to produce PP efficiently and cheaper, Galli and Trapasso reached higher levels in their career and went different ways. The entire PP business of Montedison was sold for about 650 mill \$ in the early 80's and combined with the PP activities of the Hercules Co. in Wilmington DE to form the new firm Himont, a company in which DiDrusco, Trapasso and Galli had successively leading positions and lived on some

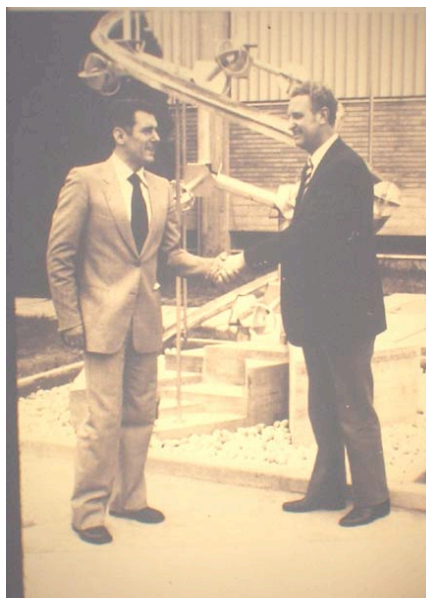
occasion in Wilmington, DE. I had started in Wilmington my industrial career at Du Pont 25 years before. Himont was later sold to Shell and this company to BASF and called Basell. Galli eventually retired as President of Basell Technology and Trapasso became the President of the rejuvenated company Montecatini; he is now also retired and lives in Monaco.

I was under the impression that my interaction with Montedison was at an end by 1978. But –

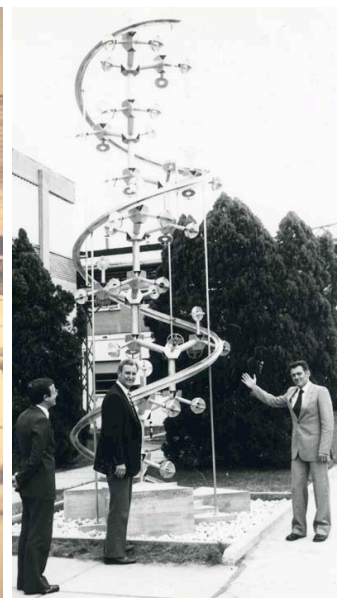
Now with a big success story behind him and in full control of research in Ferrara and with PP highly regarded and financially highly profitable, Galli properly decided to recognize the accomplishments of his high yield catalyst research and accomplishments. He engaged an artist/architect to construct an isotactic PP stainless steel structure to celebrate the 20<sup>th</sup> anniversary of the commercialization of PP and honor Natta for the discovery in his research group.(for which Natta received the Nobel Prize in 1963). The research center was named “Giulio Natta Research Center”.



Polypropylene Helix, Ferrara



with Paolo Galli



with Galli at the Opening of  
the Giulio Natta Research Center in Ferrara



The opening was scheduled in 1978 in Ferrara and the whole of the leadership of Montedison and most of the people of Natta's group was present, and also Professor Mark, an early friend of Natta and myself. The evening before the ceremony we all stayed at the Hotel Astra and went to "Il Giovanni" for an elaborate dinner. Afterwards I spent another hour with Mark to sharpen his talk, which he had to give in Italian. Remember, Herman F. Mark (Natta was 8 years younger) was Natta's host in Vienna, when Natta spent his honeymoon there in 1934.

The ceremony, that Galli had arranged went very well. As you can see in the picture I was sitting next to my friend Pino. He and I had rooms on a narrow passage of the dead end corridor, which led to the suites of the leadership of Montedison. This was the time, when in Europe attacks on industrial leaders of industry had started. I told Piero, we are in the worst location, if anybody wants to do something. But we had a relaxed and good laugh.

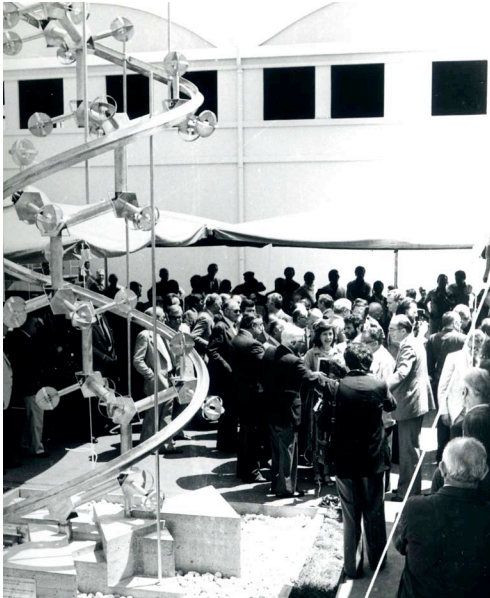
In the successful ceremony, Mark gave his usually brilliant talk in Italian, short as it was. We had also present Natta's daughter Franca Natta, now Mrs. Pesenti. As we were joking with Franca Natta (Mrs. Pesenti), I invited her daughter Giulia to come to America and spent 3 or 4 weeks with us. Surprisingly, Mrs. Pesenti accepted and Giulia came next year to stay with us in Amherst for about three weeks, she was then 19 years old. Our home in Amherst was the modest home



The 1978 Opening Celebration, Ferrara:

Left: Diaz, Mark, DiDrusco, OV, Mrs. Schimberni; Right: Cefis, Pino, OV, DiDrusco, Gatti

of a University Professor with 2 children her age in the countryside. It must have been quite a different atmosphere for Giulia to come from that in Bergamo, the home



Opening of G. Natta Research



Franca Natta, Herman Mark, Schimberni  
Opening, Giulio Natta Research Center in Ferrara 1978

of the Pesenti's, the baron of concrete manufacture of Italy to the country town of Amherst. But she seems to have enjoyed herself and her grandfather Pesenti called almost every day to check how happy she was in America. This was our connection with the Natta's.

After the celebration of the creation of the "monument " of PP and the naming of the research Center in Ferrara, the "Giulio Natta Research Center", my direct contact and responsibilities with Montedison came to an end.

### ***e. With the Family through Italy***

It was now the summer of 1978. Our son Eric had finished his B.S. at the University of New Hampshire and was getting ready for graduate school, Our daughter Yvonne had finished her first year at Williams College. We still had our

active personal Italian connection and decided, as a family, to have a nice one month “driving vacation” through the Italy we loved, especially the Italy, we did not know. The World Soccer Cup this year was being played in Italy and everybody there was excited. We were able to spend all the money that was left in the account of the Banca Laboro. The exchange rate of the Lire was questionable and one could not always exchange the Lira into some “hard” currency, like the dollar.

We rented a car at Malpensa Airport, a red Fiat 132, and drove throughout Italy, the Italy we all wanted to see. We spent some time in Milan, went to Genoa, the Ligurian Riviera, Porto Venere, Pisa, Florence and Fiesole,. We then succeeded to drive on the exciting Amalfi Drive. I, who drove most of the time, found the narrow road along the steep cliff without a guard rail, very dangerous. At Maloia, a town in the middle of the drive, where we stayed for two nights, we saw (my enthusiastic son and soccer fan and I) part of the finals of the Soccer World Championships. We went on to Siena and San Gemeniano for the next part of our journey. How exciting it was. I always liked the wine in San Gemeniano. The girls of the household, my wife and daughter must have found something more interesting; as they claimed to have been very happy.

Then, we spent some time in Rome, the Vatican and St Peters. We stayed in a Hotel in the via Sardinia, across from the Borghese gardens. As always there were some funny stories. We did not want to see particularly the famous tourist attraction, the via Venetia, which was nearby, yes, but only briefly. We wandered the street up and down.

As we were driving to the Vatican one day, we urgently had to fill up the tank in our car and we did in this section of town. As we continued to drive to the Vatican, we found an excessive gasoline odor. We stopped and checked, the attendant had forgotten to put the cap back on the gas tank. Back we went (with a wad of old cloth in the gas tank outlet) and, sure enough, the gas attendant smilingly said: We forgot to put the cap on -- here it is, you were in such a hurry. We had to give him a tip !!! All this shows the honesty of the Eternal City. Why should I bother you with the Vatican, the Pieta, and the Borghese Gardens? It is all well written in any

Travel Guide for Rome. We also went to see Ostia, the former port of ancient Rome, now 20 km inland. I do not remember the reason why we went to see Ostia, except that I wanted to see it.

On we went to the Naples area, to Vesuvius and Pompeii. Eric had just graduated from the University of New Hampshire with major in geology. He was fascinated when we drove up Mt. Vesuvius and he saw all the crystals that were left on the top of Vesuvius from the last volcanic eruption. And we all enjoyed the excavation of Pompeii with all the exciting remains of a City destroyed in minutes - and we saw the half excavated Herculaneum.

We actually stayed in Sorrento, the site of the Allies landing in Italy in 1944 and stayed in a small hotel strangely called Hotel Vienna. We decided to have a glass of Spumante something and I asked Eric to open the bottle (his first bottle of carbonated wine that I knew – it was too warm). The cork popped out through the open window over the street and past all the traffic. We spilled half of the bottle, but what was left, was delicious. Later we went for a Pizza to a local Pizza place with an old-fashioned stone furnace; Eric and I had a "carafe" of the chilled local white wine - delicious.

By now my direct association with Montedison had come to an end and I was involved in other important issues at the University and in professional societies. I started (and ultimately finished successfully) the creation of CUMIPP, the creative association at UMass of a University/Industry relationship and the first in the in the U.S. at least on polymers. I was also working on bringing the IUPAC Macromolecular Symposium (now called the World Conference on Polymers) to Amherst. We actually succeeded and had this World IUPAC Conference of Macromolecular Chemistry in Amherst in 1982 with over 1,000 participants. Now what happened in my own life and that of my family at that time ? I had received an invitation to accept the first endowed name chair in Polymer Chemistry from

the Polytechnic University in Brooklyn, NY – the Herman F. Mark Professorship; I accepted and my wife and I moved to New York.

## **F. Enichimica – Polyethylene and PVC**

Two years after we had moved to New York City, I received a phone call, asking me, if I would be willing and able to accept a special arrangement of cooperation with the Italian chemical company Enichemica in Milan. By now, I had much more teaching and administrative responsibilities, but I believed I could handle it. Dr. Italo Trapasso had become the President of Enichemica, and he wanted me to advise him, similar to what he had requested when he was in the key position of President of DMP at Montedison. Enichemica, the other important chemical company of Italy, was equivalent in size to Montedison. It had become responsible for the production of polyethylene and PVC and polycarbonates in Italy by putting together several smaller companies, especially for the production of PVC.

Again, after proper consideration, I accepted. I liked Trapasso personally; we had a personal mutual respect and even admiration. I liked his management style and we had worked together in the past, at Montedison, perfectly. Italian politics, Italian professional politics and Italian industrial politics were very delicate and complicated. He felt that I knew much of it by now and was capable of handling industrial circumstances in a major Italian industry.

When Trapasso had asked me to assist in his various reorganization plans of certain business ventures at DMP, he wanted a respected outsider. The problem

with Enichimica was simpler but more complicated. Enichimica S.A. was established as a company by acquisition and coordination of several smaller companies. It was responsible for industrial production and marketing of polyethylene (both high and low density) and PVC in Italy. (Enichimica also had a polycarbonate venture in Umbria, near Terni).

For the production of polyethylene, Enichimica had a plant near Calgari, the southern tip of island Sardinia and one in the northern part of Sardinia. Once I had to inspect both of the locations, So I traveled (with my “companion” from Enichemica, who was a scientist, but also like a “body guard” and he drove) to Calgari and from Calgari we drove to the north of Sardinia, to the Industrial Park. I checked and recognized, that everything was working satisfactorily.

Low density, polyethylene was produced by Enichemica by a high-pressure process, using a loop reactor in the Industrial Park, called "cimiterio industriale". In the same industrial complex there was also a factory for linear high density polyethylene, using a titanium based coordination polymerization catalyst. For the process of producing linear polyethylene, the catalyst was made near Milan and shipped in barrels (I saw it, when I was at the shipping platform in Genoa).

Different was the story with PVC. In all these coordination's and acquisitions of smaller chemical companies that produced PVC in Italy, Enichemica, ended up with possessing 5 processes for PVC production in 5 factories and 4 locations. They were now all operated by Enichimica. Trapasso had decided to try to simplify the production and use preferably only one process to cut costs and simplify the distribution of PVC.

Enichimica had the processes of emulsion polymerization, suspension polymerization and its variations, and the loop process of polymerizing vinyl chloride in liquid vinyl chloride (with some pressure), fundamentally the St. Gobain process. Remember, vinyl chloride was made by thermal cracking of dichloroethane. Dichloroethene was provided by chlorination of ethylene in the factory in Mantua, shipped to Porto Marghera and there cracked to HCl and vinyl chloride.

I had the idea of eliminating all the processes except the loop process, the St. Gobain process. Back came the analysis of the needs of the various customers from the marketing experts. They told us immediately and decisively. We have a market for each type of product, made by the different processes, we have our costumers who like the products that we provide. To adjust to a product slightly differently means trying to modify the marketing situation or losing a part of the market.

PVC is an unusual product, I made the analysis and indeed each process produced a different PCV based on molecular weight, molecular weight distribution, distribution of tacticity and even differences of head to tail and head to head placements of the vinyl chloride monomer units in ther polymer chains. As a consequence the product having polar chlorine substituents, a chlorine atom in each monomer unit, causes distinctly different changes of properties, and consequently different specification for the final product for specific uses. It would also require changes in the type of plasticizers that are being used for PVC for various applications.

We caved in and decided that if Marketing wished and could sell products prepared by one specific process, let them have it. The molecular weight of the

PVC, the molecular weight distribution and the overall tacticity of the polymer - what does it matter – as long as the customer was willing to buy it and pay for it.

That was my end at Enichimica. Trapasso was replaced as the President of Enichimica, he had obtained an offer for a position of higher responsibility, which he took. But for me, my career at Enichemica came to an end. Trapasso and I remained good friends and in close contact with each other for many years in his increasingly successful career.

### **G. Castellanza, via Linz Austria**

My career and my interaction with Italian industry was not quite over yet. It took a peculiar turn, which I did not quite foresee or anticipate. I became involved in interacting with Austrian industry. This happened in a peculiar way. One evening I received a phone call in New Rochelle, where I was living at that time, from a person from Zuerich, Switzerland. It was a Dr. Gruenwald; he turned out to be the CEO of OelAG, the Austrian industrial giant, which was the Chemistry arm of the Austrian Oil Company OMV. (which by itself had an operating budget of about 10 Billion \$/year).

Gruenwald asked me, if I would be willing to serve on the Supervisory Board of Directors of the Austrian Company, Chemie Linz. After a short consideration and, carefully checking the situation and conditions, I said yes.

If I recall correctly, I served reasonably well for 5 years. But this booklet, that I am writing here, is concerned with my Italian Connections. Consequently I am only mentioning what my responsibilities at Chemie Linz had to do with Italy. One



issue in my responsibility with Chemie Linz was the production of melamine. Chemie Linz, now AgroLinz, was a major producer of urea and other fertilizers in Europe and an important side product of urea is melamine. Melamine is produced by thermally cracking urea. The production of melamine is a relatively delicate process. However, how urea is cracked and the technical cracking conditions determine the melamine yield and the kind and amounts of useful and higher priced by-products. Melamine ultimately is also an intermediate for high-class plastic dinnerware.

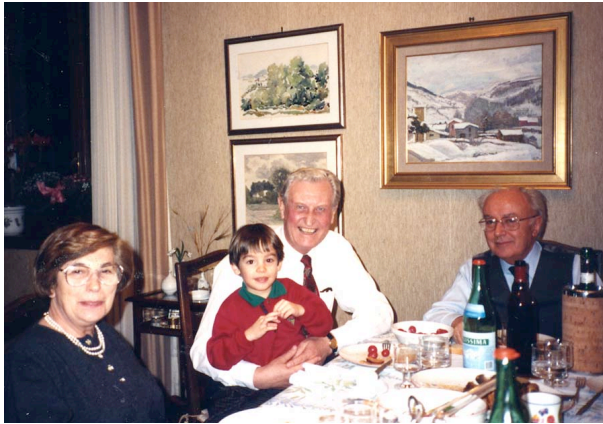
Chemie Linz decided to buy the Montedison part of the melamine business. Montedison also produced melamine but by a different process. At that time there were two working processes for the production of melamine from urea, one called the low temperature process used by Chemie Linz and the other the high temperature process used by Montedison in Castellanza (the same place I knew so well from my association with DMP).

I still remember when Chemie Linz bought the Montedison process and their facilities to produce melamine in Italy for 220 mill \$, way too much, but still a good buy, as it turned out ultimately. I still recall how concerned I was, when I signed the acquisition (25 years ago) – This sale would now be worth at least one billion \$!

Again, since I spoke Italian I had to go there, to inspect what we had bought. Castellanza is located halfway between Milan and Switzerland, near Lago Maggiore, the major tourist attractions of this region. Since I usually came from Linz or Vienna I used the Milan Airport Linate and stayed one night in Milan. Next day I took a limousine to Castellanza and stayed over night in the Hotel Tre Re, the Three Kings, on Lago Maggiore. Dr. Pieh from Chemie Linz was now in

charge of the Italian operations; he had learned Italian and I was satisfied with his performance; he did a remarkable job, leading the plant facilities for Chemie Linz in Castellanza, in Italy.

To give you one example: We had troubles with the laborers (all heavily unionized and politically active). The union workers had the right by union contract, to have a small (1/2 Liter) bottle of wine for lunch, in addition to the lunch provided by the factory, they had a choice of white or red wine for their lunch. Of course, for a worker in a chemical factory I thought it was outrageous. I am not sure I won.



Mrs. (Giusi) B, OV with Francesco Bianchetti      Mrs, G.Bianchetti, Cecilia B., Francesco  
Dinner at the Bianchetti's ~ 1985

Once, when I went to Castellanza I stayed at the Hotel Manin in Milan. This time I visited again my friend Pippo, in the via Rossini for dinner. Pippo and I were then 40 years older had had successful careers behind us, excellent families and were now grandparents, as you can see in the pictures. I have been in close contact with Pippo's family ever since.

I still remember another amusing story: On the way by limousine to Castellanza, a good relationship with the driver was quickly established, because I demonstrated that I spoke sufficiently well Italian and was a soccer fan, a fan of

Italian soccer, a follower of F.C. Internazionale Milan. When I paid the fare, it was probably half of what he would have charged to a newcomer.

Italy is a wonderful country, I had many successes there; I actually gave a few lectures in Italian. I miss Italy and I miss all the places that I wanted to see, professionally and personally, but did not do. I did not see Brindisi where our refinery (Montedison) was located, I did not see Gela and Taormina (Enichimica) in Sicily, other facilities of Enichemica, but I did see our PVC facilities in Ravenna, the old capital of the Western Roman Empire with its church from the 5<sup>th</sup> century.

I always wanted to see the “spine” of northern Italy, Parma, Piacenza, Cremona, or even Torino. I did not see it. I saw Bologna only from the railroad station, which saddens me, because Bologna has the oldest University in the world. I did not make it to downtown Naples, barely saw Genoa and Verona. I did not see Orvieto, although my wife and I drink regularly the wine grown in the Orvieto region regularly.

I regret that I probably cannot visit Italy on a regular basis any more.

I still have my dear friend Pippo (Prof. Giuseppe Bianchetti) in the via Rossini, his wife Giusi (Giuseppina) and his daughters Marina and Cecilia, as well as his sister Enrica (living now in via C. Goldoni).

I remain very attached to Italy. With my education, I had to take (and liked it) Latin in the Realgymnasium and the history of Rome and the Roman Empire. I lived in Vienna close to the outlying regions of the former Roman empire, what is now Austria, especially the locations in Carnuntum, Vindobona (Vienna), and

Tulln, the Roman naval base on the Danube. Because of my closeness with Linz (the Roman Lentium) I visited several times Loricum, the present Lorch in Upper Austria, the location of one of the Roman Legions. The Roman town where the Legion resided is still not excavated, but it is from there that the legion (6,700 men) packed up and went home to Rome in 488 A.D); this departure from the Danube ended the Roman Empire.

**Foot Note:** *Latin was the language the Roman Empire. It was spoken by the learned people, by the monks in monasteries and in the courts, for a millennium and several centuries. I learned some Latin for the mass in church and later for 6 years in the Realgymnasium from the third class on (which means, the 7th grade). We learned the vocabularies and read Caesar “De bello Gallico”, and were able to quote: Gallia est divisa in partes tres. We learned Cicero and could cite “Quousque tandem abutere, Catilina, patientia nostra” and we learned Ovid. We learned the accusative cum infinitivq, but did not learn to speak much Latin. The teacher could teach us how to translate Latin into German, he really did not speak Latin and we did not learn to speak Latin either.*



*Years went by and I had gone to the University, had finished my education in Chemistry, had obtained my doctoral degree and had become an Instructor at the II Chemical Institute of the University of Vienna. I was still attached and worked with Prof. Friedrich Galinovsky, my thesis advisor, which was the common tradition.*

## H. Further Connections in Italy

My early contact with Italy, when I worked with Pippo on alkaloids in Vienna, and when I became acquainted with Italian life and culture had only been the beginning of my scientific connection with Italy and with Milan. My work for

Montedison, especially the reorganization of research in DMP and the PP production, and the attempted rearrangement at Enichimica where my exposures showed me the way Italian industry and business functioned. My activity for Chemie Linz and the interaction with their branch operation in Italy rounded up my interesting activities in Italy and with Italians.

But this is not all. In all these years I had also a long and enduring connections with Italy, with Milan and their academic community on a scientific and professional basis. When I came to Du Pont in 1956, linear polyethylene and polypropylene had been, independently from other laboratories, discovered a few years before in the exploratory group of the Polychemicals Department of Du Pont. But this discovery was based on inorganic co-crystallization of aluminum and ferric chlorides, work that had been used in Germany as potential catalysts for other processes in the late 40's.

I had become very friendly with Bill Truett, who worked in the exploratory group but had a different assignment. I worked on a new synthesis of methyl methacrylate, but he was part of the group that had discovered and recognized polypropylene. He was also the inventor of the metathesis polymerization by polymerizing norbornene.

Back to PP and the discoveries of PP in Italy and how it was done there. Professor Natta, the head of the chemical engineering department at the Politecnico, had assembled a magnificent group of young people. His "lieutenant" was Associate Professor Piero Pino, born in Trieste and educated in Florence; he was the fatherly leading figure of the group (at that time 32 years old) with the "old" elegance and charm, next to the Patriarch Natta, who was at that time about 50. They had assembled an enthusiastic and highly competent team. Paolo

Corradini, 23) and Giorgio Mazzanti in his later 20's. When PP was first synthesized in Milan in 1953 by the late Chini in Natta's laboratory, excitement was aroused that led (with Natta's guidance and connections) to the commercialization of PP by Montecatini in Ferrara in 1957. Danubia of Austria (PCD), now called Borealis licensed it in 1959. Mrs. Natta, a scholar of linguistics had given this crystalline PP the name "isotactic" polymer in recognition of the structure that Corradini had established by x-ray analysis.

The question is now: How did the PP discovery and its commercialization fit into my interest? Well, first my connection with Bill Truett, who was an IR expert and we were both in Gresham's group, the Exploratory Group of the Polychemicals Department, which had discovered the Du Pont version (rumored 4 months after Natta) of crystalline isotactic PP.

Subsequently, when I arrived at DuPont in November 1956, McGrew, the Research Director of the Polychemicals Department called me in and told me: You are now in the "Delrin" group, the group that was responsible for the commercialization of polyformaldehyde. McGrew said: We made a mistake; as we were concentrating on the commercialization of polyformaldehyde, we had forgotten to look at the polymerization of higher aliphatic aldehydes. There had been some attempts before, but little was known about how the polymer of acetaldehyde to polyacetaldehyde had formed. I took my assignment seriously, because I realized that a major breakthrough might change my scientific life and my future reputation. Working with determination, within 6 months (from June 1957 to January 1958), I had discovered the polymerization of higher aliphatic polyaldehydes and more importantly, I had recognized that the stereochemistry could and was following the same principle as that of the polyolefins, particularly

PP, and that stereospecific polymerization of acetaldehyde led to the discovery of isotactic polyaldehydes.

What we did not know at that time, was that other people (the Natta group) and the Japanese (the Furukawa's group) had similar ideas. Our patent application record shows that we were first by 18 months in the synthesis of acetaldehyde by cationic and anionic catalysts. We also established that by using this basic principle and the catalysts we also were able to prepare polymers of higher aliphatic aldehydes and the synthesis of their isotactic polymers. What we did not know (all of us) and found out the hard way was, that the aldehyde polymers were not stable enough, thermally and auto-oxidatively and could not be commercialized. Price-wise for the production, polyacetaldehyde would have been superior to PP – it had similar fundamental properties.

But since we (the three groups) were all “losers” on this project of isotactic polyacetaldehyde, which could not be commercialized, we became friends. For my lifetime I had always-close personal relations with the Furukawa group and also with the Natta group.

Our first direct encounter with the Natta group was at the Moretonhampstead meeting a famous International meeting in England in 1961 that had attracted most famous polymer chemists of world renown. The fate and future of the discovery of isotactic polyacetaldehyde was still uncertain. Natta gave the invited lecture based on PP and its commercialization. His lecture was, as people had known, a little slow, since it was in English, and in the middle, he asked Mazzanti to continue and finish his talk. Giorgio, with his gold teeth shining, gave a brilliant performance. As we all know now, he ultimately became President of ENI, the Italian oil company.

After Natta's talk, we had lunch. I was invited by the Italian group to join them, Natta, Mrs. Natta, Giorgio Mazzanti, and Professor Nasini from Torino to celebrate the birth of Nasini's first grand child. It was done in style with Champaign and festive congratulations. I was accepted in this established Italian society and I was happy.

Nasini was famous for his work on the polymerization of diazoethylidene to polyethylidene by thermal decomposition of diazoethylidene. This procedure had been known for the polymerization of diazomethylene to (linear) polyethylene. (In actual fact it was not a "pure" polymerization, because there was also a real amount of nitrogen left in the polymer). I do not remember that the structure of pure polyethylidene from diazomethane was ever proven. But Nasini, a most elegant gentleman, was also the center of a joke, a funny joke at that time.

Let me bring you up-to date. Professor Mark (who was my mentor in many ways) had been appointed in Vienna in 1934 as the Director of the I. Chemical Institute, He had known Natta from his Vienna days; Natta was married (in 1934) and spent his honeymoon, on Mark's encouragement in Vienna. (now comes the networking). Mark, on one famous occasion wanted to please Nasini (who claimed to be of ducal ancestry), he wanted to address Nasini as the "Duke of Polymer Science" (il duca delgi polymeri) (the count of polymer science - a play of words) but Mark slipped and called him the Duce (il duce degli polymeri), which meant the Mussolini of polymers.

I was well acquainted with the "first" generation of the Natta school. Piero Pino (April 9, 1921-July 9. 1989), A.M. Liquori, Paolo Corradini, and Giorgio Mazzanti. Liquori was not actually a member of the Natta school. He was at the University



in Rome and really more interested in art. He painted; he loved the Rome society that was accessible to him. and he was an x-ray/structure expert. When Natta (so I was told) approached Liquori to join his group, actually his research effort on PP, and to come to Milan and establish the structure of PP. Liquori refused but he said: I have this brilliant young co-worker, highly competent, Paolo Corradini. He can do everything. Natta accepted him, Corradini went to Milan and within a few months he had established the correct crystal structure of crystalline isotactic PP. Not only did he determine the 3/1 helix for isotactic PP, but also the 4/1 helix of isotactic and crystalline polyacetaldehyde. Paolo Corradini and his wife Bixi from Munich, and I, became good friends.

The next encounter with Natta was during the IUPAC Symposium of Macromolecules in Prague. I was seated with Natta and Mrs. Natta at one of the banquets that was given and sponsored by one of the ministries of Czechoslovakia.

As Pino was advancing in his profession, first a promotion to a Full Professor at the University of Pisa in 1967 and 12 years later as Professor and Head of the Institute at the ETH, we became friends and cooperated scientifically. First he corrected in a gentleman's way one serious error which we had made in one of our NMR interpretations. I never knew how he found out, how he did it. He asked me one day for one of our samples of head to head polystyrene and the next thing I knew, a paper was published by Pino with the corrections and my name included as co-author. This was Piero Pino, this was the gentleman Pino. We also published later with Pino on the measurements of optical activity of solids in a similar fashion as before. This time I corrected and promoted his earlier work.

The last time that Jane and I saw Piero, was in Zurich. I gave a talk at the ETH; we went to dinner and then we had an after dinner drink in his luxurious home. Mrs. Pino never left Milan permanently and he commuted to Milan at least once a month. He died of a heart attack when he was only 68. His passing so early was a loss to all of us, the global scientific polymer community. Since he was an active member of the Board of Editors of the Journal Progress of Polymer Science, I arranged for a special issue to be dedicated to him, edited by Lido Porri.

When I was in Milan in connection with a visit and consultation at the Castellanza factory of Chemie Linz, Lido and I presented Mrs. Pino with a leather bound copy of a special issue of Progress in Polymer Science that I had arranged for his memory. We had dinner with her and her daughter Francesca in an elegant restaurant near the Piazza della Scala



Dinner in Milan, ~1994: Francesca Pino, OV, Mrs. Pino, Lido Porri.

After Natta's death, Lido Porri had become Professor and the official successor of Natta at the Politecnico some years before.

As you can see, I knew the first, second and third generation of the Natta school personally and respected them for their technical competence and dedication to polymer science and technology. It is not uncommon that a strong school changes as time passes. The next generation of young and competent people become established and create their own empires. There is usually only one successor for the chair of a famous Professor, the rest of the coworkers are dispersed to other important positions. In our case Pino went to the ETH.



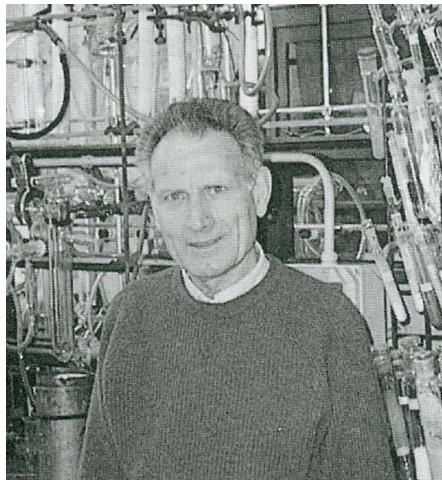
Professor Giulio Natta

Ciardelli to Pisa and Porri succeeded to Natta's chair at the University. Mario Farina, died unexpectedly.

The early Natta school had a number of other highly respected scholars: E. Mantica, G. Pregaglia who went to the G. Donegani Research Institute in Novara, as did A. Valvassori. Others had highly successful careers: Luciano Luciani, Dall'Asta, A. Zambelli. F. Danusso, I. Pasquon, T. Simonazzi, F. Ciardelli, G. Allagra, E. Chiellini



Paolo Corradini



Lido Porri



Piero Pino

The oldest generation of the Natta school: Piero Pino (April 9, 1921-July 9, 1989), A.M. Liquori (actually from Rome, brought Corradini to the Politecnico), Paolo Corradini, Giorgio Mazzanti, and Natta's successor Lido Porri were closest to me.

We all have joined in writing the story of Polymer Science in Milan, the Politecnico, as it was almost 20 years ago in Polymer News.

[http://works.bepress.com/otto\\_vogl/212/](http://works.bepress.com/otto_vogl/212/)

Lido Porri, Mario Farina, Guido Audisio and Otto Vogl, Polymer Science in Milano - ITALY, Polymer News, 18(4), 116-124 (1993)



**Lido Porri, Mario Farina, Guido Audisio and Otto Vogl,**  
*Polymer Science in Milano – ITALY*  
**Polymer News, 18(4), 116-124 (1993)**

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Centers of Polymer Research

## Polymer Science in Milan, Italy

Lido Porri<sup>a</sup>, Mario Farina<sup>b</sup>, Guido Audisio<sup>c</sup> and  
 Otto Vogl<sup>d</sup>

<sup>a</sup> Department of Industrial Engineering Chemistry, Politecnico di Milano, Milan, Italy;

<sup>b</sup> Department of Organic and Industrial Chemistry, University of Milan, Italy;

<sup>c</sup> National Council of Research, Institute of the Chemistry of Macromolecules, Milan, Italy;

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*Otto Vogl*



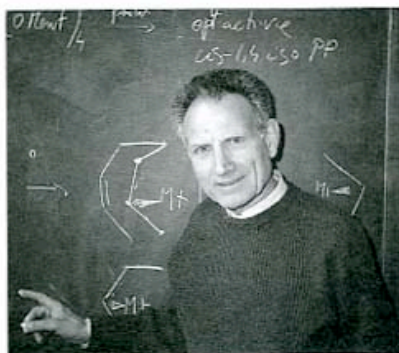
*Guido Audisio*

Italy is in the center of the Mediterranean. Milan, the second largest city of Italy, with a population of nearly 2 million, is the hub of the Italian industrial north. The city has also been, for nearly two millennia, an important center for culture, for the arts and for science.

Polymer chemistry in Milan developed rapidly after World War II. It was one of the most vigorously growing scientific disciplines in Italy. Polymer science in Milan is concentrated in three important centers of research: at the Politecnico di Milano, at the University of Milan and at the Institute of Macromolecular Chemistry of the National Council Research of Italy. About 15 senior professors and their students are active in research in polymer science in Milan; in addition, almost 50 scientists are active and permanently employed by the University or by the National Research Center. The highest concentration of the research activity is at the Politecnico, which has 10 professors.

At this time, it is probably appropriate to remember that after World War II when the research activities started at the Politecnico, there was only one professor's chair and this chair was in the Institute of Industrial Chemistry; Giulio Natta was the holder. Work in his group was primarily in catalysis and on carbonylation reactions. He was joined in the late '40s by a young graduate from Professor Quilico's group in Florence, Piero Pino. Pino brought organic chemistry, heterocyclic chemistry and isoxazole chemistry to the Politecnico, and another assistant, Dr. Ercoli, also joined the group. In 1952, Natta recognized the potential impact of Ziegler's "Aufbaureaktion" of ethylene with triethylaluminum and the subsequent discovery of linear polyethylene and coordination polymerization with transition metal complexes.

Natta recognized that the polymerization of propylene had a



*Lido Porri*



*Mario Farina (with picture of Giulio Natta)*





Center City Milano, Italy

tremendous potential. Under his leadership and with Pino's assistance, work on the polymerization of propylene started at the Politecnico and the first polypropylene was made by Paolo Chini in March of 1954. After this discovery, explosive developments in polymer science followed at the Politecnico in close cooperation with Montecatini. A highly competent group of very young, vigorous, enthusiastic and highly competent students assembled around Natta

and Pino and within a few years the entire field of olefin polymerization with coordination catalysts was opened up and worked out. In 1958 polypropylene was commercialized by Montecatini in Ferrara and in 1963 Professor Natta received the Nobel Prize.

The "Natta" school flourished; Italy and Milan became a center of polymer chemistry and polymer science.



## Centers of Polymer Research



Milano, Skyline I



Milano, Skyline II

### Politecnico di Milano

#### A. Department of Industrial Chemistry and Chemical Engineering

Today 10 professors are engaged in this department in polymer chemistry, polymer characterization, theoretical aspects in polymer chemistry, polymer engineering and material science.

Lido Porri is Professor of Industrial Organic Chemistry in the Department of Industrial Chemistry and Chemical Engineering. His work involves the polymerization of hydrocarbon monomers with transition metal catalysts, particularly with Ziegler-Natta systems. Work now in progress covers the following topics: a) Polymerization of ethylene with soluble catalysts based on group 4 metals. These studies include the influence of the catalyst structure on the activity and on the molecular weight distribution of the polyolefins. b) Evaluation of new catalyst systems for ethylene/propylene copolymerization. c) Polymerization of conjugated diolefins; work in this field is mainly aimed at the identification of new catalyst systems and at the elucidation of the factors that determine stereospecificity.

Febo Severini is Professor of Applied Chemistry and Materials. His field of research involves the degradation of olefins by the environment, the modification of polyolefins with polar monomers, especially the preparation of graft copolymers useful as compatibilizers in polymer blends. Additional interests of Febo Severini involve the surface modification of high technology fibers and the improvement of interfacial adhesion in composites. The structure of humic acids and interactions of these materials with metals is also being studied. New polymers are being synthesized which can be used for the preparation of membranes suitable for use in gas separation.

The instrumentation and facilities available to Dr. Severini's research group are excellent and include facilities for differential thermal analysis, FT-IR spectroscopy, Brabender mixer, Instron dynamometer, instrumentation for potentiometric titrations and polarographic measurements.

Maria Carla Gallazzi Malcovati is Professor of Industrial Chemical Technologies. Her interest is in Ziegler-Natta catalysis for diolefin polymerization, the metathesis reaction on cycloolefins and linear olefins, metallorganic complexes of transition metals and lanthanides.

Additional interests lie in phosphazene chemistry, cyclic and polymeric phosphazenes substituted with functional groups  $[-N=P(R)(R+)-]$ , where  $R+$  is alkyl or aryl. The applications of these materials are spread over different fields: fire retardants, membranes for gas separation or for ionic transport, carriers for biological active substances and ligands for transition metals in catalysis. Conducting polymers and non-linear optical materials are also areas of research which include the chemical synthesis of polythiophenes with alkyl or alkoxy substituents, studies on the relation between the regiospecificity of synthesis processes, determined by NMR, IR and UV spectra of the polymers and the electro-optical properties of these materials.

Ferdinando Danusso, Professor of Macromolecular Chemistry for Engineers in the same department, works in a field of research which involves the synthesis of new specialty polymers or copolymers by step reaction polymerization and their characterization. Special areas of research involve the synthesis or functionalization of macromonomers with particular chain stiffness or flexibility, the selection and development of new base reactions, able to link macromonomers with bridging atomic groups of particular stability and step synthesis of triblock and multiblock copolymers, combining soft-soft or hard-soft segments with different mutual affinity. Molecular, supermolecular, physico-chemical and physico-mechanical characterization of related oligomeric and polymeric products is also being investigated. Of particular emphasis is also the study of structure-properties relationship of polymers.

Excellent facilities and possibilities are also available for structural characterization to the group of Giuseppe Zerbi, Professor of Material Science. Professor Zerbi is also the Director of the School of Polymer Specialization "G. Natta" which is involved in education of young scientists in polymer science. Dr. Zerbi's field of research



involves the main research themes of material science; it is focussed on the understanding of the relationship between molecular structure and macroscopic properties of polymers. The physical tools used are mostly optical vibrational spectroscopies (infrared absorption and reflection, Raman and neutron scattering) in their experimental, theoretical and computational aspects.

Particular themes of Professor Zerbi's research are the dynamics and spectra of structurally ordered and/or disordered classical organic polymers (and of corresponding models). Phase transitions and molecular mobility in polymers are also being investigated as are the structures of polymers at interfaces. Generally speaking, structure-properties relations and phase transitions of fatty acids, soaps, phospholipids and biological membranes are being studied. Additional investigations involve atomic charges, charge mobilities from vibrational intensities and specific intermolecular interactions in polymer blends. The structure and electrical conductivity of polyconjugated polymers and oligomers for applications in photonics, telecommunications, optical memories and molecular electronics are also investigated. "Molecular Engineering" via Quantum Chemical or Molecular Mechanics calculations for the predictions of structures with improved electrical and non-linear optical properties are particularly emphasized.

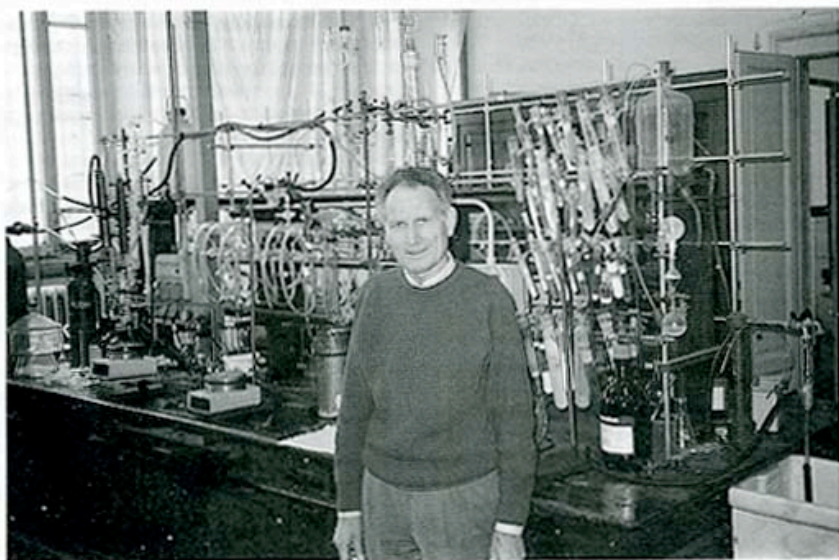
The laboratory is equipped with modern infrared interferometers and with a multichannel Raman scattering spectrometer equipped with a microscope. Fourier Transform Raman scattering interferometers with infrared excitation can be used. Several IBM personal computers and computer terminals for IBM, VAX, UNIVAC, CONVEX are available.

Every year the laboratory offers an internal course on the introduction to molecular dynamics and spectroscopy to Ph.D. students and guests.



*Institute Giulio Natta: Porri, Vogl*

Giuseppe Tieghi is the Professor of Structure of Macromolecular Materials whose interest is in the development of new methodologies for the characterization of non-linear viscoelastic behavior of polymeric materials. The investigation of non-linear effects is carried out by analyzing the experimental results obtained from stress



*Lido Porri at the former Natta Laboratory*



## Centers of Polymer Research



**Politecnico di Milano**

relaxation measurements in simple extension. In this way, methods for the measurements of mechanical properties on specimens of very small sizes are studied by microdynamometry. Also studied are the structure, morphology, physical and mechanical properties of new materials with segmented macromolecular structure, which can be obtained by polymerization of functionalized macromonomers.

The instrument in this research group involved an automated microdynamometer for mechanical instrument measurements, automated X-ray powder diffractometer and an instrument for molecular weight measurements of polymers.

Mario Pegoraro, Professor of Polymer Science and Technology, is involved in polymer compatibilization, the preparation of grafted polymers as a means of glassy or semicrystalline polymer toughening. Mechanical properties of these blends are being studied and compared with the mechanical theoretical viscoelastic models. Also being investigated are polymer surface energy measurements and theoretical previsions, including the interface properties and interphase adhesion, their theoretical and practical evaluation. Special attention is given to the composite polyimides/carbon fibers.

Gas and liquids transport properties of polymeric membranes are also being studied which involves the investigation of permeability and diffusivity measurements. Theoretical previsions of transport properties in rubberlike and in glassy polymers includes the preparation of special polymers for selective gas separation. Different classes of polyurethanes are being tailor-made for this purpose. Entropic elasticity in rubberlike networks, network crosslinks densities from mechanical properties and viscosity properties of high temperature resisting composite materials is also being investigated.

The instrument facilities of the group include dynamometers with tools to measure moduli and dilation, thermal analysis D.S.C., an instrumented impact tester, optical and electron microscopes, FT-IR analysis, a compression molding apparatus, a Brabender mixer, mechanical-dynamic property analyzers (Rheovibron and Rheometrics), and a Lyssys gas permeameter.

In the department are also two professors responsible for teaching and research in polymer engineering: Andrea Pavan, Professor of Polymer Engineering and Marta Rink, who is a Professor of Polymer

Materials. The research activities of this group include research in physical and mechanical properties of polymer blends and of rubber-modified glassy polymers. Theoretical modeling and experimental characterization of yielding and fracture of polymers and composites showing viscoelastic behavior. A further field of interest of this group is the development of engineering designs of polymeric materials.

Facilities in this group include instruments for physical and molecular characterization of polymers, machines for processing and preparation of solid test specimens, instruments for rheological and mechanical testing including creep and creep fracture, yield and fracture under different test configurations, fatigue and impact fracture. Ancillary optical microscopes and videorecording systems are used to analyze the mechanical phenomena.

Associated with the activities in Milan is Paolo Ferruti, Professor of Applied Chemistry at the Department of Mechanical Engineering at the University of Brescia. Dr. Ferruti has two special fields of research. The first is the synthesis of ionic polymers and macromonomers by Michael-type stepwise polyaddition processes; he uses intermediates for: a) obtaining crosslinked resins capable of complexing heavy ion metals to be used in industrial catalysts; b) surface modification of inorganic materials to render them suitable for the same purpose; c) preparation of surface-modified polymeric materials, as well as block and graft copolymers for biomedical use; and d) preparation of heparin complexing resins for achieving regional heparinization in extracorporeal circuits, especially during hemodialysis.

Another area of interest of Dr. Ferruti's group is the synthesis of end-functionalized oligomers to be used for preparing oligomeric derivatives of drugs and enzymes. In particular the following main lines of research are being followed: a) the introduction of original methods of reactive functions of already available oligomers, such as poly(ethylene glycols); and b) preparation of new end-functionalized oligomers of N-vinylpyrrolidinone and substituted acrylamides by radical polymerization in the presence of functional chain transfer agents. This chemical laboratory headed by Dr. Ferruti is equipped for polymer, as well as for organic synthesis, and has an FT-IR spectrometer, a U.V. spectrometer, viscosimetry measuring devices, a <sup>1</sup>H NMR spectrometer and a differential scanning calorimeter.



**Students at the Politecnico**





**Advanced School of Polymer Science Politecnico di Milano**

#### **B. Department of Chemistry**

Giuseppe Allegra is a Professor of Chemistry. His field of interest includes statistical conformational studies on macromolecules; macromolecules in solution adsorbed onto surfaces and confined within tubular cavities. Branched polymers are studied in good and bad solvents as are macromolecular collapse with micellar aggregation. The evaluation of the persistence length and of the isotropic-nematic transition temperature of aromatic polyesters and polyamides is also being investigated.

In Allegra's research group, macromolecular structure determination of crystalline polymers is being carried out. The main techniques of investigation consist of X-ray diffraction from oriented fibers and from crystallized powders applying the Rietvelds method; polyolefins, polydiolefins, and polyphosphazenes are currently under study. Dynamical studies involve branched and rigid-linear polymer chains in solution at different concentrations. Other fields of interest are: a) the theoretical evaluation of  $T_g$  and of the monomeric friction coefficient of different macromolecules; and b) the diffraction studies on incipient crystallization of polymers including iso- and syndiotactic polypropylene, iso- and syndiotactic polystyrene, polypivalolactone.

The instruments and facilities of this group include single-crystal X-ray diffractometer of the Consorzio Diffrattometrico Milanese; a single-crystal diffractometer of the Istituto di Chimica delle Macromolecole, C.N.R.; photographic, wide angle X-ray diffraction cameras; a small-angle X-ray diffraction camera; a powder X-ray-diffractometer with a recording device; a graphic station for conformational energy calculation and three-dimensional display of molecular systems; several personal computers and a computer terminal for IBM, UNIVAC, and DIGITAL computing facilities.

#### **University of Milan**

##### **Department of Organic and Industrial Chemistry**

At the University of Milan there is one major group involved in the study of the stereochemistry and of organic chemistry of polymers. Mario Farina is the Professor of Macromolecular Chemistry and Giuseppe Di Silverto is Professor of Industrial Chemistry. Another member of this research group is Piero Sozzani.

The research interest of this group involves stereochemistry, radical polymerization, the determination of kinetic parameters in homo- and copolymerization by GC-MS, the control of the molecular mass distribution as well as the synthesis of block and star copolymers.

Solid state polymerization in inclusion compounds is also being studied. It not only involves the analysis of the structure of clathrates containing monomers or polymers, but also their stability and reactivity. Another field of interest in Farina's research group is anionic polymerization, where linear and branched homo- and copolymers containing functional groups are being synthesized.

Polymers are subjected to molecular characterization by SEC and LLS and by structural characterization in solution and in the solid state by NMR. Thermal characterization of amorphous and crystalline polymers is being carried out by DSC, the solid state characterizations by CP MAS NMR.

The facilities in the department include high-vacuum and inert-gas polymerization set-ups for regular and for high pressure reactions. Instruments include size exclusion chromatographs equipped with RI and W detectors, laser light scattering instruments (Wyatt Technology, type DAWN F) with batch and flow cells for simultaneous measurement at 15 different angles. A Mettler TA 3000 thermal analyzer is also available; 200, 300 and 500 MHz NMR spectrometers for solution studies are accessible as are 300 NMR spectrometer equipped with a solid sample probe.

##### **The School of Specialization in Polymer Science "Giulio Natta"**

The research groups involved in polymer science in Milan cooperate in a School for Specialization in Polymer Science, named after Giulio Natta. It is an advanced school of education which is based at the Politecnico.

Polymer science developed after Natta and his collaborators contributed very significantly to its vigorous growth over a period of many years. Continuing the tradition, the Specializations School was started at the the Polytechnico of Milano in 1978 for the purpose of preparing new young specialists in various branches of polymer science to be employed by industries, by universities or by national laboratories.

The preparation of the young specialist develops in two main directions. It begins first with tutorial courses on different subjects in polymer science and provides a general, more comprehensive knowledge of polymer science, which normally cannot be given during the university curriculum. Secondly, the student has to spend two full years working in a laboratory on an original scientific research project in a field of specialization of his choosing. During these two years of research, the student is exposed to various aspects of modern polymer science, thus testing and practicing what he has learned during the tutorial courses.

The structure of the school's two year curriculum is organized in the following way: During the first year, four introductory general courses are offered to all students in an attempt to provide a common



## Centers of Polymer Research

background for all of them coming from different fields and from different universities. For the second year the student must do research under the direction and in one of the professors' laboratories. At the end of the two years, the results of the research are collected in a thesis which is then presented and discussed by a committee of the professors of the school.

A final diploma of specialization is given by the Politecnico after the final thesis has been discussed and accepted by the committee. The diploma has legal value in Italy. Some fellowships (for the duration of two years) are available to students chosen by the school through a selection which will be made in Milano before the start of the academic year.

Titles of the regular courses of the School of Specialization in Polymer Science "Giulio Natta" are: First year: Principles of Polymer Chemistry, Structure of Polymers, Characterization of Polymers. The second year consists of the following curriculum divided into the three major disciplines:

1. Polymer Chemistry Curriculum: Methods of Polymer Synthesis; Ziegler-Natta Catalysts and Polymerization; Modification of Polymers; Advanced Methods of Polymer Characterization; Functional Polymers.

2. Polymer Physics Curriculum: Statistical Thermodynamics of Polymers (Solutions, Melts, Rubbery State, Crystallization); Scattering Methods in Polymer Physics; Molecular Dynamics, Mobilities and Phase Transition in Chain Molecules; Dielectric, Electric and Optical Properties of Polymers. Special seminars are conducted in: Polymer Surfaces and Interfaces; Numerical Simulations of Structural and Physical Properties of Polymers; Advanced Methods of Characterization of Polymers.

3. Polymer Engineering Curriculum: Processes of Industrial Polymer Production; Fundamentals of Polymer Processing; Principles of Polymer Engineering, Technology and Properties of Polymer Composites; Recycling and Recovery of Industrial Polymers.

A series of seminars on special topics are presented every year; the subjects are continually updated.

## National Council for Research

### Institute for the Chemistry of Macromolecules

After the discovery of isotactic polypropylene by G. Natta and his group, the subsequent vigorous progress in the polymer research led, in 1961, the Italian National Council of Research to create a Center of "Chemistry of Macromolecules." The Center was located in the Politecnico di Milano; in 1968, this center was enlarged into an Institute with its own autonomy and a new location.

Guido Audisio is the director of the Institute. At the present time, 20 scientists and 12 technicians work in the Institute. The scientific research of the Institute has four major themes: a) Ziegler-Natta polymerization; b) Speciality polymers; c) Biopolymers; and d) Development of new methodologies for the characterization of macromolecules.

Paolo Locatelli, Maria Carmela Sacchi, Incoronata Tritto and Fabrizio Forlini are involved in the study of the stereochemistry of Ziegler-Natta catalysis. This is done by NMR analysis of the microstructure of the polymers obtained by these investigations. The group has contributed significantly to the understanding of the mechanism of isospecific polymerization with traditional and supported high yield Ziegler-Natta catalysts. Their studies include: a) NMR analysis of isolated steric defects and of isolated ethylene units in propene-ethylene copolymers; b) Determination of the stereochemical structure of selectively labeled chain end groups; and c) Synthesis of model compounds, selectively labeled monomers and co-catalysts in order to interpret the NMR spectra. Recently, reactions between catalyst components and successive polymerization steps have been directly followed by NMR.

Giovanni Ricci is interested in the polymerization of diolefins with Ziegler-Natta catalysts based on transition metals and lanthanides. His current research involves the following topics: a) Synthesis of new catalysts and characterization of the polymers obtained from these polymerizations; b) Study of the mechanism of the formation of stereoregular polydiolefins; c) Studies of the organometallic compounds of the synthesis of lanthanides and their use as catalyst components.

Silvia Destri, Marinella Catellani and Alberto Bolognesi are members of a research group which studies polymers for electronics applications. Their interest is focused on the synthesis of macromolecules having an extended  $\pi$ -system. They are mainly interested in the characterization of their structure and their electrical and spectroscopical properties. This group is also involved in the synthesis of different thiophene derivatives: oligomers, structures with condensed thiophene rings, poly(3-alkylthiophenes). Both traditional and electrochemical polymerizations are carried out. Some of these materials have shown interesting electrooptical properties and are now under investigation for possible applications in information transmissions and for optical switches. Interesting phenomena, such as electrochromism or thermochromism, are also being studied. The polymers are also being spin coated into thin films with improved order or are being investigated for their behavior when fabricated by Langmuir-Blodgett techniques. William Porzio is responsible for the X-ray diffraction studies of these polymers in powder form, or in the form of spin coated or LB films. This study is carried out at varying temperatures with a computer controlled Siemens D-500 diffractometer.

Silvia Luzzati is in charge of the Vibrational Spectroscopy Laboratory. The laboratory is equipped with a Bruker FT-IR instrument with a Raman attachment for the analysis in the near IR. Raman



Opera of Milan, La Scala





Milan, Il Duomo

facilities with different laser sources and a Cary 2400 spectrometer are also available. Photo-induced absorption measurements are also carried out; the laboratory is especially equipped to study the resonant Raman scattering of conjugated system.

Guido Audisio, the director of the Institute, is responsible for the laboratory of characterization of macromolecules. The facilities available in the laboratory include instruments for Gel Permeation Chromatography operating up to 150°C with UV, diffraction index and viscosity detectors. High Performance Liquid Chromatography, Differential Scanning Calorimetry and Thermogravimetry for thermal analysis, Gas-Chromatography coupled with Mass Spectrometry, and FTIR Spectroscopy are also available. Polymer characterization in solution is the responsibility of Raniero Mendichi, and thermal characterization, of Fabio Bertini. The laboratory functions as analytical support for all the problems of the research groups of the Institute. It is also responsible for research in the following areas: a) Characterization of polymers by means of pyrolysis GC-MS. This work is presently concentrated on the distribution of the pyrolysis products as a function of the molecular weight of the polymer. b) Catalytic degradation of the polymers, as a possible future tool for recycling of the polymers, is carried out with the objective of finding some selectivity to produce some interesting new compounds. c) Synthesis and characterization of polymers with a flame retardant incorporated in its structure. These polymers, synthesized by polycondensation reaction or by grafting copolymerization, can be blended with polyolefins. It gives them high flame retardancy while retaining good mechanical properties. d) Study of the degradation of some biological material by radicals which might be involved in the aging process of humans (hyaluronic acid). The influence of some "radical scavengers" to retard the aging process is being studied in attempts to stabilize some of the material.

The group of conformational analysis (Dino R. Ferro, Massimo

Ragazzi and Augusto Provasoli) is interested in the development and in the application of computational techniques to elucidate the conformation of synthetic and biological polymers. This activity, mainly based on molecular mechanics, quantum chemistry and molecular graphics, provides the theoretical interpretation of different physico-chemical properties. One of the current research lines concerns the refinement of the structure of microcrystalline polymers by combining energetic criteria (simultaneous minimization of intra- and inter-molecular energy) with crystallographic techniques (Rietveld's whole profile method). This work allows for a deeper understanding of polymorphism and of the impact of lattice forces on the polymer chain conformation for several important polymer systems: *trans*-1,4-poly(penta-1,3-diene), polypivalolactone, *cis*-1,4-poly(2-methyl-penta-1,3-diene) and last, but not least polypropylene.

A second major research objective is involved in the elucidation of the structure of sulfated polysaccharides (mainly heparin and related glycosaminoglycans). Their properties are related to the understanding of the origin of their biological properties. This work is substantially based on the interpretation of the NMR data of these compounds (vicinal coupling constants and nuclear Overhauser effects) by means of molecular mechanics calculations. The calibration of a refined force-field for carbohydrates is another current effort of the group.

Lucia Zetta is responsible for the NMR laboratory; her closest coworker is Roberto Consonni. Their field of interest involves the structural characterization of macromolecules in solution and in the solid state by means of high resolution, photo-CIDNP, MAS and microimaging NMR spectroscopy.

The main themes of their research in the biological field are: protein folding, peptide-protein and protein-protein interaction, and structure-activity relationships. Structural information is derived from a variety of multidimensional homo and heteronuclear NMR experiments, using paramagnetic or transient radical probes. NMR parameter constrain techniques are also used in the generation of molecular dynamics and chemical structures. Studies "in vivo" on the muscle physiology are also carried out by microimaging.

In the area of synthetic polymers, the defects known to be present in stereoregular polyolefins are studied. The structures of conducting polymers are also investigated in the solid state by magic angle spinning techniques.

The instruments available to the laboratory are: a Bruker AM-500 NMR spectrometer for all nuclei, also suitable for reverse detection; a Bruker AM-270 for high resolution proton and carbon NMR spectroscopy, equipped with an argon laser for photo-CIDNP spectroscopy; a Bruker AM-200 WB for all nuclei, equipped with MAS and microimaging accessories; a Silicon Graphics computer system.

The laboratory also offers internal courses on the "Introduction to NMR Spectroscopy" for young scientists of the School of Polymer Specialization "G. Natta," and generally, for Ph.D. students and for guests.



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Columns

## Personalities in Polymer Science



*Paolo Galli*

Few personalities have influenced polymer technology and science to the extent as has Paolo Galli. He is one of the most successful scientists and businessmen in polyolefins, and, he is, in addition, the acknowledged leader in polypropylene. Under his guidance and imagination entirely new processes and products were invented, developed and produced.

Paolo Galli was born on August 29, 1936 as the first of three sons of Carlo Galli and Vittoria née Nanni in the province of Vicenza in Bassano del Grappa, which is located in the Alps of Northern Italy. Carlo Galli, his father, was a colonel in the Italian Army and later became an Industrial Manager. Vittoria was a teacher of French and German literature. The Galli family has deep roots to Florence in Tuscany, Italy that go back to the year 1200, to Doctor Giulio Galli, the "Magnificent". Paolo went to Elementary School (from 1942-1947), Middle School (from 1947-1950) and the Scientific Lyceum in Bassano del Grappa from which he graduated in 1955.

In 1956 Paolo Galli enrolled in the University of Padova; he studied Industrial Chemistry at the Faculty of Science. In 1961, he received his doctoral degree in Industrial Chemistry under the guidance of Professor Giovanni Semeraro with a thesis entitled "Polymerization of Vinyl Chloride at Low Temperatures".

He subsequently won the Italian Employer's Federation competition award which allowed him to study in the laboratory of a major Italian company. He chose Montecatini and joined the Hydrocarbon Research Institute. Galli received a degree in Polymer Technology working on the "Development of New Polymerization Technologies based the Ziegler-Natta Catalysis" under the guidance of Professor Natta.

Since first joining Montecatini, Paolo Galli pursued his industrial career with great success but always kept in touch with academic life in Italian Universities and foreign scientific institutions. For the next 35 years he was, in part, associated with academia. From 1962 to 1965 he was an Adjunct Professor at the University of Bologna, teaching physical chemistry, chemical kinetics and Industrial chemistry. Since 1965 Paolo Galli has been closely associated with the Faculty of Science of the University of Ferrara where he held an Adjunct Professorship in Industrial Physical Chemistry from 1965-1973. From 1973-1983 he was Associate Professor and since 1984 he has held the Chair of Macromolecular Chemistry at the University of Ferrara.

In the late 1980's, Paolo Galli conceived the idea of creating the International School of Advanced Studies in Polymer Science in Ferrara, a unique mechanism of cooperation between Industry and Academia. Paolo Galli was the Director for three years after its creation in 1989.

From 1968 to 1975 Paolo Galli supervised basic research and process development for catalysts, ethylene-propylene rubber, high density polyethylene, polypropylene and crystalline ethylene-propylene copolymers. He made major contributions to the discovery of the revolutionary use of magnesium chloride based catalysts for polyethylene. He also was a major contributor for the "reactor granule technology".

In 1975, the Division of Petrochemicals, of Montedison, the successor company of Montecatini was divided and the Division of Plastics Materials was created with Italo Trapasso as its President. This development necessitated a complete reorganization of the Division and, in 1976, Paolo Galli was appointed Director of Research in Ferrara with a team of 550 including scientists and supporting staff. This allowed him to streamline the research organization and completely redirect its operation. Galli

assigned a large task force one third of his working team to concentrate on the development of better, more efficient and ultimately, more cost efficient catalysts, catalysts that could be used in such minute amounts that they could be left in the polymers without any detrimental effects.

Within one year of Galli's appointment, the "High Yield Catalysts" (*alta resa*) for polypropylene were discovered which gave Montedison a dominant role in the production and sales of polypropylene. In joint activities with Mitsui Petrochemicals in Japan the polyolefin business was revolutionized and made polypropylene the polyolefin with the highest growth rate and the polymer that challenged engineering plastics in most applications. In his capacity, Paolo Galli initiated and directed basic research into new processes and products. Most prominent was the discovery and development of the world dominant position for Montedison in the polymerization processes Spheripol, Spherylene, Catalloy and Hivalloy, which were based on breakthroughs in "Reactor Granule Technology".

In 1980, Paolo Galli was responsible for naming the Research Center in Ferrara in honor of Giulio Natta under whose direction at the Politecnico in Milan, polypropylene had been discovered. A monument depicting the structure of isotactic polypropylene is now located in Ferrara in front of the Research Center.

From 1983 to 1984 Paolo Galli spent one year in Milan and managed the Special Product and Polymer Division of Montedison and the next year he became the Managing Director of Dutral SpA, the newly established company within Montedison responsible for specialized elastomers, engineering thermoplastics, high performance materials and high yield Ziegler-Natta catalysts.

During this time, the polypropylene part of Montedison was joined with the polypropylene activities of Hercules under the name of Himont. In 1985, Paolo Galli assumed the position of Executive Vice President of Technology, located in Wilmington, DE. In 1989, he became Managing Director of Montedison Research while continuing as Vice President at Himont. From 1991 to 1995 Paolo Galli held the following positions: Corporate Director of Montedison Research, President of Montecatini Technology S.R.L./Spherylene, President of CSI-Montedison Applied Research,



## Columns

President of Orion Advanced Chemical Research SpA, a Member of the Board of Directors, Himont SpA, and a Member of the Board of Directors, Tecnimont SpA.

In 1995, a new company, Montell, was created by the fusion of Montedison, Himont Montecatini Technology/Spherylene and Shell companies. Paolo Galli was appointed President of Montell Technology.

During his scientific career, Galli has published over 200 scientific papers, several books and is the holder of 35 patents. Paolo Galli was and is also in high demand as a plenary and main speaker in major International conferences.

In 1995, he received the "Outstanding 1995 Achievements Award" of the Plastic Materials, Division of the American Plastic Engineers Society. In 1996 he was cited for "outstanding contribution in development and commercialization of New Polyolefins". In 1996, he received the special award "Federico Bernagozzi" and the Free Honorary Lectureship at the "International University" Studiorum Superiorum PRODEO. In 1997, he was awarded the "Knight of Sacro Romano Impero" and the "Knight of Tau of San Giacomo di Altopascio". In 1998, he was elected "Member of the Academy of the Georgofili" and in 1998, he received the Herman F. Mark Medal.

Since Paolo was a child he has been deeply involved with nature and is a lover of the outdoors. He has been an active skier, jogger and, most importantly, scuba diver.

While pursuing these interests and his diving in the North Adriatic sea off-shore of Aquileia, he found many Roman amphoras and found eventually an entire Roman ship of the 2nd century filled with amphoras. He also has found many Roman Imperial coins "Sesterzi" in Ostia Antica.

Paolo Galli has also been interested in natural forms of many descriptions, from minerals, to stones and to fossils. He was and is particularly fascinated by the "perfect spherical shapes". This interest led him ultimately to significant inventions in the polymerization of propylene. He recognized that it was important that the catalysts for

propylene polymerization have a spherical shape. In addition the catalyst particles must break up under polymerization conditions and the entire polymer granule retains the shape of the original parent catalyst particle and the final polymer particles maintain the desired high bulk density of polypropylene. This invention and innovation needed the full understanding of polymer generation and growth on the heterogeneous catalyst and ultimately led to the creation of the classification "Catalyst Architecture".

Not only is Paolo Galli interested in antiquity and antiquities such as his interest in old maps, old clocks, watches and numismatics, but he is also an expert in gourmet delicacies. In Summer and Fall he can be seen, with his wife, looking for "delicious porcini mushrooms". Coming from Bassana del Grappa, he is also a world expert of *Grappas*, the distillate from the fermentation of the residues of grapes.

In 1964, Paolo Galli married Anna Maria Marcon. They share their interests in archeology, arts, classical music and nature especially their enthusiasm of mountaineering in the Dolomiti mountains.

The Galli's have one daughter Giulia and two sons: Stefano and Massimo. Giulia has a M.S. in classic literature with specialization in ancient numismatics and archeology. Stefano received a B.E. from the University of Delaware in Industrial Engineering and an M.B.A. from the Wharton School of Philadelphia. He is now working with Merrill-Lynch in New York. Massimo graduated in International Economics from Georgetown University of Washington; he then earned a law degree from Columbia University and is now working for Toger and Welts, an American Law Firm, located in New York and London.

This article was prepared by **Otto Vogl**, Herman F. Mark Professor, Emeritus, Department of Polymer Science and Engineering, University of Massachusetts, Amherst, MA, 01003, USA and **Anna Maria Marcon-Galli** of Viale Po 106, I-44 100 Ferrara, Italy.

\*A column co-ordinated by Charles A. Wilkie, Marquette University.



**Otto Vogl and Brigitte Griesbeck Corradini, Paolo Corradini**  
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Columns

## Personalities in Polymers Science



Paolo Corradini

### Honoring Professor Paolo Corradini on his 70th Birthday

Paolo Corradini was the pioneer in the establishment of the correct structures of stereoregular polymers. He determined the structure of polypropylene, a helical structure, prominently seen in the most important natural polymers, poly ( $\alpha$ -amino acids), and nucleic acids. He also was instrumental in preparing and establishing the structures of many stereoregular polymers and copolymers. He is a renowned International scientist and a leader in polymer science in Europe.

Paolo Corradini was born in Rome, Italy, on October 19, 1930 as the second son (of three) of Corrado Corradini (headmaster and teacher of the local High School) and Bianca Pennacchi (teacher of the Elementary School). Young Paolo grew up in the district of San Giovanni di Laterano in Rome, where he went to Elementary, Middle and High School. He graduated in June 1946, three years earlier than the regular time. During the war, Paolo spent the school year, 1943-1944, away from Rome in a small village, Bellforte del Chienti, in the region Marche.

After graduation, he immediately enrolled in the University of Rome, studied chemistry and received the degree of Doctor of Chemistry in July 1951, *summa cum laude*. His thesis advisor was Professor Giordano Giacomello (who had as his Assistant Alfonso Liguori). The title of his thesis was "The X-Ray Structure of 1,1'-Cyclobutane-dicarboxylate".

In 1952, Liguori recommended Paolo Corradini to Professor Giulio Natta at the Politecnico in Milan. Paolo accepted the invitation and he joined Natta's research group.

The work was sponsored by the "Società Chimica Montecatini", at the Institute of Industrial Chemistry, Politecnico di Milano. Corradini's assignment was to perform X-ray studies on heterogeneous catalysts (ZnO based, for the synthesis of methanol) and solid semicrystalline polymers (free radical low density polyethylenes).

At this same year a collaboration started between Natta and Ziegler on linear ethylene oligomers, which could be obtained with aluminum alkyl catalysts, called the "Aufbaureaktion". The aim was to obtain higher molecular weight ethylene oligomers and the corresponding linear carboxylic acids which were used to produce soaps. High molecular weight polymers were discovered by the group of Ziegler at the end of 1953, through the catalytic combination of aluminum alkyls with titanium tetrachloride.

Soon thereafter, titanium catalysts for propylene polymerization were tried in the laboratories of Professor Natta. This was the start of a research project to produce elastomeric polymers through the copolymerization of ethylene and propylene. On March 11, 1954 Paolo Chini obtained a solid material in an autoclave polymerization trial with propylene alone and brought it upstairs to Paolo Corradini to examine it by X-ray diffraction. This was the starting point of the discovery and structural investigations of an entirely new class of crystalline polymers, stereoregular polymers of which polypropylene is the most important example.

Within a few months from the time this investigation started, Paolo Corradini solved the structure of polypropylene and established the chain conformation of crystalline isotactic polypropylene as a  $3_1$  helix with a repeat unit of 6.50 Å. This was the third major determination of polymer structures, which resulted in a helical structure, after the  $\alpha$ -helix of the poly ( $\alpha$ -amino acids) and the double helix of nucleic acids, and the first of helical synthetic polymer. This foresighted discovery was the basis of the structure evaluation of many synthetic crystalline polymers.

Corradini stayed in Natta's group until 1960 and evaluated the structure of many stereoregular polyolefins and polydiolefins. Natta received the Nobel Prize for polypropylene in 1963, in recognition of the fact that the monopoly of nature, to build macromolecules with ordered steric helical units, had been broken, but Corradini played a decisive part in his work.

In 1958, Corradini was awarded the "Libera Docenza", which is the equivalent of the title of an Associate Professor for his work on Structural Chemistry. In 1960 he

was appointed Full Professor of General and Inorganic Chemistry at the University of Cagliari. The University of Cagliari has been the stepping stone for many important appointments for Professors before they received a call to key Universities. Already in 1961, Corradini was called to the University Federico II of Naples as Professor of General and Inorganic Chemistry. He has been at the University of Naples since that time and now, since 1991, has held the Chair of Industrial Chemistry.

In 1968, Paolo Corradini spent one year abroad as Visiting Professor at the Polytechnic Institute of Brooklyn (Brooklyn Poly). In 1985 he spent half a year in Somalia, cooperating to the Italian effort to start a University in Mogadishu. Over the years, Paolo Corradini served also in key Professional Societies. For many years, from 1968 to 1979, he was a Member of the Macromolecular Division of IUPAC, and from 1989-1990 he was the President of the European Polymer Federation.

The contributions of Corradini were acknowledged in his home country.

In 1982 he received the recognition of "Benemerito della Scuola, della Cultura e dell'Arte" (*well deserving Citizen in the fields of School, Culture and Arts*) from the Italian "Ministero della Pubblica Istruzione". He also received the important annual Prize for outstanding Italian Scientists of the "Ministero dei Beni Culturali ed Ambientali" (1985), and a number of other prizes and medals from various institutions, among them the Giulio Natta medal of the Italian Chemical Society.

In 1987, he was elected a Corresponding Member of the "Accademia Nazionale dei Lincei" (the most important Italian Academy, of which Galileo Galilei was a founding member) and, since 1993, Corradini is a Full Member.

Paolo Corradini has served as Director of the Chemical Institute in Naples and as President of the Scientific Council of the CNR Laboratory for the Technology of Polymers in Naples for many years.

As mentioned above, the contributions provided by Paolo Corradini to the Science of Macromolecules started with the fundamental studies on the synthesis and structural characterization of stereoregular crystalline polymers of vinyl and diene monomers. Classical is the threefold helix conformation found for the chain of isotactic polypropylene. Numerous polymers have achieved a very large industrial importance, for instance isotactic polypropylene in the field of plastic materials, with a world production in 2000 of more than 30 million tons per year, and *cis*-tactic polybutadiene in the field of elastomers.

The studies on the structure and chain conformation of crystalline polymers have been extended subsequently by Paolo Corradini to the study of the compatibility of various types of statistical disorder (in the constitution, configuration and conformation of the polymeric chains or in the mode of packing of the chains among themselves) with the maintenance of some kind of three dimensional order and, thence, of crystallinity.

They have been extended also in the last fifteen years to a number of new stereoregular polymers which can be obtained with the newly discovered stereoselective homogeneous catalysts. They include syndiotactic and isotactic polymers of olefins, syndiotactic polymers of styrene and styrene derivatives, and tactic copolymers of carbon oxide and styrene both isotactic and syndiotactic.

More recently, a systematic analysis of models for the explanation of the stereoselectivity of Ziegler-Natta polymerizations has been undertaken, based on the evaluation of the energetic interactions between non-bonded atoms at the catalytic sites. General results have been obtained, which explain very well the stereoselectivity of the polymerization reaction on  $TiCl_3$  based and on high yield  $MgCl_2$  supported heterogeneous catalysts as well as on the homogeneous catalysts, based on metallocenes which have become popular.

The extensive scientific research of Paolo Corradini has resulted in more than 400 scientific papers and reviews. He has also written a number of text-books for High School and University students. He has served as a member of various Editorial Boards of Scientific Journals, including *The European Polymer Journal* and *Advances in Polymer Science*. He has been invited to give plenary and main lectures at several International Congresses and Symposia and at various Institutions in various places around the world. He has also acted as a member of several Organizing Scientific Committees.

Paolo is not only a scientist par excellence but he has several most interesting and satisfying hobbies. Together with his wife Brixia, he likes to play cards, in particular bridge on a high level and enters frequently bridge tournaments. He likes to listen to music, especially the opera, but also concerts, and holds season tickets at the "Teatro S. Carlo" in Naples. He collects minerals, and enjoys a walk every day and has to travel to Rome (on the occasion of meetings of the *Accademia dei Lincei*) every month.

In 1956 Paolo Corradini married Brixia Griesbeck; they have two daughters, Patrizia

(43) and Maria Grazia (39) and two grandchildren, Simona (21) and Dario (18). Patrizia, together with her husband Mario and their children Simona and Dario, live in Rome. Maria Grazia obtained a doctorate in Chemistry, and lives with her husband Giorgio in Naples. They both are enthusiastic sailors.

This article was prepared by **Otto Vogl**, Herman F. Mark, Professor Emeritus, Department of Polymer Science and Engineering, University of Massachusetts, Amherst, MA, 01003-4350, U. S. A. and **Brigitta Griesbeck Corradini**, the wife of Paolo Corradini, via Caravaggio 70/R, 80126 Naples, Italy.



