PROFESSIONAL PATH – Claudio Giordano

Claudio Giordano's professional path can conceptually be broken up into four phases:

- ***Scientific education***
- ***Innovative processes***
- ***Strategic management***
- ***Marketing penetration***

Scientific education

In 1967 a 23-year-old Claudio Giordano, was awarded his Degree in Chemistry, at the University of Pisa (Italy) with a dissertation on "Asymmetric bromination of 4-methylciclohexene in the presence of dihydrocinchonine" – Supervisor Professor Giancarlo Berti. The work was then published:

- G.Bellucci, C.Giordano, A.Marsili, G.Berti, *Tetrahedron*, 25, 4515 (1969)

Between 1968 and 1979 he worked as a researcher at the Organic Chemistry Department of Guido Donegani Research Institute at Montedison - Novara (Italy). At the time this was one of the main research centers of Montedison, with 180 graduate researchers working in different departments ranging from Organic Chemistry, Homogeneous Catalysis and Physical Chemistry to Heterogeneous Catalysis and Structural Analysis. His research activity is documented by several patents and papers.

In 1973-1974 Giordano was appointed for the position of Associate Researcher at the Organic Chemistry Department of the Chicago University, Chicago (USA) by Professor Philip Eugene Eaton. The research results, dealing with the synthesis of cage molecules and precursors, were published in:

- P.E.Eaton, R.A.Hudson, C.Giordano, *J.C.S. Chem Comm.*, 978 (1974)
- P.E.Eaton, C.Giordano, G.Schloemer, U.Vogel, *J.Org.Chem.*, 2238 (1976)
- P.E.Eaton, C.Giordano, U.Vogel, *J.Org.Chem.*, 2236 (1976)

Subsequently thanks to Montedison leave of absence, Giordano joined Professor H. Hogeveen's R&D research team as Visiting Scientist at the Organic Chemistry Department of the University of Gröningen in the Netherlands. The team's research activity focused on the generation and isolation of mono-cationic and di-cationic species in a super-acidic medium. The results on Mono- and Dications appeared in:

- C.Giordano, R.F.Heldeweg, H. Hogeveen, *J.Am.Chem.Soc.*, 5181 (1977)
- H.Canardi, C.Giordano, R.F. Heldeweg, H.Hogeveen and E.M.G.A.van Kruchten, *Israel Journal of Chemistry* Vol.21, 229 (1981)

In this period Giordano developed an important long-standing professional cooperation with Professor Francesco Minisci of the Politecnico of Milan, world leader in the field of Radical Chemistry. As a result, new synthetic methodologies were developed, based on the polar character of radicals:

- REVIEW ARTICLE - Electron-transfer processes. Peroxydisulfate a useful and versatile reagent in organic chemistry – by F.Minisci, A.Citterio, C.Giordano, *Acc.Chem.Res.*, 27, 1983

He is co-author of more than 70 publications in international scientific journals. In addition, he is co-inventor of more than 100 patents, most of them extended abroad.

Innovative processes

In 1979, Giordano parted with the Guido Donegani Institute to dedicate himself to the R&D of innovative processes of Active Pharmaceutical Ingredients. He started out as Process R&D Director in a small company.

Soon after in 1981 he was appointed Director of Process R&D in Zambon Chimica (Zambon Group).

In this context, Giordano was involved in the creation of Gaetano Zambon Chemical Research Institute, dedicated to the innovation in industrial processes of bulk active pharmaceutical ingredients and their intermediates.

At Zambon Group, he was the co-inventor of the first industrial asymmetric synthesis of Naproxen, (S)-2-(6-methoxy-2-naphthyl) propanoic acid, a drug with anti-inflammatory, analgesic and anti-pyretic properties.

The elegant industrial process, where natural tartaric acid is used as a chiral auxiliary, differs from all other industrial processes in that it directly produces naproxen as a single enantiomer, thus avoiding the optical resolution and recycling.

- C.Giordano, C.Castaldi, G.Uggeri, S.Cavicchioli *U.S.Patents*: 4 810 819, 4 855 464 and 4 888 433 (1989)

Previously, Zambon had produced and accumulated an enantiomerically pure intermediate with wrong configuration in the course of several decades' production of thiamphenicol, (1R,2R)-2-(dichloroacetamido)-1-(4-methylsulphonyl)-phenylpropane-1,3-diol, an antibiotic for human and animal use. The Gaetano Zambon Chemical Research Institute then discovered an innovative practical method for the conversion of the product of this undesired configuration into thiamphenicol.

- *Eur.Pat.*, 423 705, 1989; C.Giordano, S.Cavicchioli, S.Levi, M.Villa, *J.Org. Chem.* 56, 114 (1991)

At Zambon, the process R&D team was also involved in the investigation of diltiazem, an enantiomerically pure drug belonging to the class of calcium antagonists with the aim of finding an early resolution. Because a key intermediate crystallizes as a conglomerate, an entrainment resolution was investigated successfully and developed up to the industrial production phase.

- *U.S. Patent* 5 097 059 (17.3.1992) C.Giordano, D.Tentorio, T.Casagrande, P.Bertin, V.Merli, G.Sagramora

Later on Giordano was involved in the innovation of cross coupling processes involving homogeneous catalysis by transition metal complexes.

He was appointed as a member of Federchimica (the Italian federation of the chemical industry) and of the Scientific Committee of CNR (Consiglio Nazionale Ricerche, the Italian National Research Council) for "Progetti Finalizzati di Chimica Fine e Secondaria" (Applied projects for fine and secondary chemicals).

In 1990 Giordano was awarded the *Federchimica National Prize* for his work on the innovative industrial processes of Active Pharmaceuticals Ingredients and their intermediates.

In 1994-1996 he acted as Italian representative for the IUPAC Company Associates in the Committee of chemistry and Industry.

Strategic management

Based on his experience in process chemistry management, in 1991 he was nominated Director of Fine Chemical Division in Zambon and placed in charge of the strategy, budgeting and activity planning for Active Pharmaceutical Ingredients for the Generic and Innovative market.

Giordano's solid knowledge of Process Chemistry along with his technical, commercial and economic knowledge spurred the development of Custom Synthesis in Zambon.

After leaving Zambon, in 1997 he began to collaborate as a self-employed consultant with several chemical producers, pharma companies and agents.

Then in 1999 he joined a small chemical Company as Vice President to establish the Custom Synthesis Division. New chemical and analytical laboratories as well as a pilot plant were set up.

In a short time, the reliability and positive image conveyed to potential customers by this new division led to numerous projects being brought to the company.

Marketing penetration

In 2002 Giordano founded APIS Chem S.r.l. (APIS), with the aim of providing technical and commercial support to Companies operating in the area of new Active Pharmaceutical Ingredients (APIs), that is to say Pharmaceutical Companies ("Customers") and Chemical Manufacturers ("Producers"). APIS is a company that operates mainly in the Custom Synthesis area with expertise in market strategies, evaluation and design of chemical processes and the appraisal of chemical Producers.

In the course of the last 16 years, APIS has developed a growing business volume. The company has appraised hundreds of projects related to different therapeutic areas, developed contacts with a vast number of pharmaceutical companies with very different needs. APIS works as a consultant with national and international pharmaceutical companies, and has thus developed a peculiar awareness of Custom Synthesis thanks to its long-standing cooperation with customers.

Thanks to its extensive experience, APIS offers consulting in the field of Custom Synthesis for scouting, market penetration, project negotiation, budgeting and planning activities, developing process chemistry, evaluation of production costs, along with selection and audit of contract manufactures.

As a natural consequence of the academic experience as Adjunct Professor and Lecturer (Politecnico of Milan and University of Milan respectively) accumulated during all these years, Giordano felt the need to share his approach and experience with colleagues in the field of process chemistry, leading to the development of a specific training program entitled *Understanding Chemistry To Make Chemicals*.