

## EMANUELA LICANDRO CURRICULUM VITAE

### PERSONAL DATA

Born in Milan on August 11th, 1952.

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### SCIENTIFIC CARRER

- 1977** Italian Laurea at the University of Milan, Institute of Industrial Chemistry. supervisor Prof. Piero Dalla Croce, title of the thesis: "*Synthesis, structure and reactivity of spiro cyclopropane derivatives of indolinones, isoxazolones and pyrazolones*".
- 1977-79** Fellowship of the Chemical Industry EUTECO(ENICHEM) in the field of new synthesis of pigments of iron oxides.
- 1979-81** Fellowship of the University of Milan, work done at the Institute of Organic Chemistry, on a research project for the synthesis of 12-azasteroids model compounds with potential pharmacological activity related to morphine
- 1980** Permanent position as Researcher in Organic Chemistry at the University of Milan.
- 1988-89** Two months at the Imperial College of Science, Medecine and Tecnology of London, laboratory of prof. Steven Ley, preparing a review lecture and a written review for the XIV "A. Corbella" Summer School of the Organic Division of the Italian Chemical Society.
- 1992** Associate Professor in organic chemistry at the Department of Organic and Industrial Chemistry of the University of Milan.
- 2000 and 2010** Visiting professor at Université Pierre et Marie Curie, Paris VI.
- 2000** Appointed as Full Professor in Organic Chemistry at the University of Milan.
- 2000** Member of the Excellence Centre of the University of Milan "*Centre for Bio-molecular Interdisciplinary Studies and industrial Applications [CISI]*"
- 2005-present** Member of the Excellence Centre of the University of Milan "*C.I.MA.I.NA. "Centro Interdisciplinare Materiali e Interfacce Nanostrutturati"*".
- 2011-present** Member of the Scientific board of Organometallic Interdivisional Group of Italian Chemical Society.
- 2010-present** Membro of the editorial board of International Journal of Organic Chemistry .
- 2008-present** Coordinator of the tutorial activity for Lauree in Chemistry at Università degli Studi di Milano.
- 2012-2013** Coordinator of the Doctorate course in Chemical Sciences of the Università degli Studi di Milano.
- 2013-present** Coordinator of the Doctorate course in Chemistry at Università degli Studi di Milano.

### HONORS and AWARDS

- Some results on helicenes studies have been mentioned in *Aldrichimica Acta*, ACTA Forum, Vol. 38, No. 2, 2005; in *Synfacts*, 2007, 1, 0038-0038; in *Cheminform*, 2007, vol. 38, issue 10.
  - Invited Cover Picture of *Eur. J.O.C.*, 2008, issue 27 and *Eur. J.O.C.*, 2013, 7489
- 2014** Premio alla Ricerca of the Organic Chemistry Division of the Italian Chemical Society "Chimica organica nei suoi aspetti sintetici (metodologie e prodotti)"
- 2017** As the coordinator of the PhD course in Chemistry at the University of Milan is Member of the Paul Ehrlich European Medicinal Chemistry PhD Network.

## ORGANIZATION OF SCIENTIFIC MEETINGS AND SCHOOLS

- 1993-present** Member of the scientific board for the Ph.D. School in Chemical Science, of the University of Milan, charged in particular of the organization of courses held by foreign distinguished visiting professors.
- 1995-98** Secretary of the Organizing Committee of the Summer School "A: Corbella, Seminar in Organic Synthesis", a course of the Organic chemistry Division of the Italian Chemical Society, for Ph.D students and young researchers both from Industry and University. In quality of direct collaborator of the Director of the School, she organized all the lectures of speakers, the logistics and all activities of the course, included the preparation of the book collecting reviews from the speakers.
- 1996** Member of the organizing committee of ***RSCI-Joint Meeting on Heterocyclic Chemistry***, Numana (Italy).
- 2005** Member of the organizing committee of ***ICOS 12, 12<sup>th</sup> International Conference on Organic Synthesis***, Venezia.
- 2005-2007** Chairman of the "A. Corbella" Summer School: "*Seminars in Organic Synthesis*", organized every year, on behalf of the Organic Chemistry Division of Italian Chemical Society, for Ph.D. students and young researchers working in the Organic Chemistry field.
- 2006** Member of the organizing committee of ***ISBOMC'06, 3<sup>rd</sup> International Symposium on Bioorganometallic Chemistry***, Milan.
- 2011-2015** As member of the scientific board of the Interdivisional Group of Organometallic Chemistry of the Italian Chemical Society, organization of: i) X Co.G.I.C.O., Congresso Interdivisionale del gruppo di Chimica Organometallica, Padova, 5-8-giugno 2012; ii) VIII, IX and X editions of International School of Organometallic Chemistry (ISOC 8, 2011; ISOC 9, 2013; ISOC 10, 2015), Camerino (MC).
- 2014** Chairman of the XI Congress of the Interdivisional Group of Organometallic Chemistry (Co.G.I.C.O.), Milan, June 24-27, 2014.
- 2018** Member of the organizing committee of XXXVIII Convegno Nazionale della Divisione di Chimica Organica della Società Chimica Italiana (CDCO, Milano, 9-13 settembre 2018)

## FUNDED RESEARCH PROJECTS

- 1991** Progetto Finalizzato Chimica Fine II, title: "New synthesis of products with biological activity"
- 1994** Participation, as a member of the coordinator group, at the European Research Programme "Human Capital and Mobility, Network", title of the project "Multiple Metal-Carbon Bond Species in Selective Processes", a network of seven Universities.
- 1995** European programme COST D14.  
Action title: "Functional Molecular Materials", Title of the project: "Photorefraction with organometallic dipoles in helical environments"
- 1995-2001** Participation at the European Programme COST D1/D8, title of the project "New Applications of Organometallic Compounds in Bioinorganic and Organic Chemistry".
- 1996** Participation to the national project FIRB 2003 – RBNE033KMA, title: "Molecular compounds and hybrid nanostructured materials with resonant and non resonant optical properties for photonic devices", coordinator Prof. Renato Ugo
- 1999-2001** Scientific responsible of a collaboration between the University of Milan and the GlaxoWellcome Company of Verona, title of the research: "Arenechromiumtricarbonyl derivatives supported on solid phase: preparations and reactivity", tutor of a fellowship holderand. Participation to another contract between the University of Milan and the GlaxoWellcome Company of Verona, title of the research: "Metal-mediated synthesis on solid phase: preparation of supported new Fischer-type 3arbine complexes and their utilization for the solid phase synthesis".
- 2001** National Project COFIN co-funded by the Ministry of Research (MURST) and the University of Milan  
Title: "Stereoselection in Organic Synthesis. Methodologies and Applications"
- 2002** National Project FIRB funded by MURST  
Title: "Innovative molecules with antiflogistic and antitumoral activity synthesised with advanced methodologies "
- 2005-2007** Scientific responsible of the Milan research groups within the national project PRIN 2005, Prot. 2005038704\_002, title: "Design, synthesis and biomolecular properties of peptide nucleic acids (PNA) and their analogs for diagnostic and therapeutic applications", coordinator Prof.ssa Rosangela Marchelli.
- 2005-2008** Participation to the national project FIRB 2003 – RBNE033KMA, title: "Molecular compounds and hybrid nanostructured materials with resonant and non resonant optical properties for photonic devices", coordinator Prof. Renato Ugo
- 2008** Participation to the project PRISMA 2007, title: "Porfirine simmetricamente e asimmetricamente sostituite per applicazioni nelle celle solari e nella limitazione ottica, coordinator Dr. Claudia Dragonetti.
- 2009** Scientific responsible of the research group of the Department of Organic and Industrial Chemistry within the national project FONDAZIONE CARIPILO: Ricerca Scientifica e Tecnologica sui Materiali Avanzati-2008, title: "Studio del ruolo dei metalli nella progettazione e utilizzo di nuovi materiali per celle solari organiche di terza generazione", coordinator Prof.ssa Maddalena Pizzotti.
- 2011-2013** Scientific responsible of the Milan research groups within the national project PRIN 2009, prot. 20093N774P title: "Molecular recognition of micro-RNA (miR) by modified PNA: from structure to activity. national coordinator Prof.ssa Rosangela Marchelli.

- 2011-2013** Scientific responsible of a collaboration between the University of Milan and the ENI Donegani Company of Novara, financed by ENI S.p.A, title of the research: "*Materiali organici, molecolari e polimerici per l'impiego in celle solari ibride (DSSCs), in celle organiche (BHJ) e in concentratori solari*".
- 2012-2015** Scientific responsible of the Milan research groups within the national project of Fondazione CARIPL0 "Bando 2011 - Promuovere progetti di ricerca finalizzati allo studio dell'impatto del particolato ultrafine e delle nanoparticelle ingegnerizzate sulla salute dell'uomo, title: "Inter-cellular delivery, trafficking, and toxicity of engineered magnetic nanoparticles in macrophages and CNS cells".
- 2014-2016** Coordinator of the national project of Fondazione CARIPL0 "Bando 2013 - Ricerca Scientifica e Tecnologica sui Materiali Avanzati", title: "New biomimetic tools for miRNA targeting (BaTMAN)".
- 2017-2019** Scientific responsible of the UNIMI research group within the project " Sviluppo di nuove molecole candidate alla cura di HBV" - ID 229452", Call "ACCORDI PER LA RICERCA E L'INNOVAZIONE" approvata con D.g.r. n. X/5245 del 31/05/2016. PROGRAMMA OPERATIVO REGIONALE 2014-2020, obiettivo "INVESTIMENTI IN FAVORE DELLA CRESCITA E DELL'OCCUPAZIONE", Asse prioritario I - Rafforzare la ricerca, lo sviluppo e l'innovazione. Azione I.1.b.1.3 - Sostegno alle attività collaborative di R&S per lo sviluppo di nuove tecnologie sostenibili, di nuovi prodotti e servizi.

#### INVITED CONFERENCES

- 1989** Lesson at the XIV "A. Corbella" Summer School in Organic Synthesis, Gargnano, (Brescia). Title: "*Utilization of organometallic compounds in organic synthesis*"
- 1990** Pharmaceutical Company Roussel-Uclaf, Romainville, Dr. Jacques Perronnet Title: "*Chromium carbene complexes in organic chemistry*"
- 1998** 2<sup>nd</sup> Italian-Spanish Symposium on Organic Chemistry (ISSOC-2), Lecce Title: "*C<sub>2</sub> symmetry amines as chiral auxiliaries in stereoselective reactions of Fischer-type carbene complexes*"
- 2000** Université Pierre et Marie Curie, Paris VI, Séminaires de Chimie Organique Title: "*Hydrazines as new stabilizing substituents in Fischer-type carbene structures; a promising new class of organometallics for stereoselective organic synthesis*"
- 2000** Université Pierre et Marie Curie, Paris VI, Séminaires de Chimie Organique Title: "*Fischer-type carbene chemistry for the formation of new carbon-carbon bonds: stereochemistry, scope and potential*"
- 2000** Institut de Chimie Moléculaire d'Orsay, Université Paris-Sud, Orsay Title: "*Hydrazines as new stabilizing substituents in Fischer-type carbene structures; a promising new class of organometallics for stereoselective organic synthesis*"
- 2000** Université Pierre et Marie Curie, Paris VI, Prof. Gérard Jaouen Title: "*Hydrazines as new stabilizing substituents in Fischer-type carbene structures; a promising new class of organometallics for stereoselective organic synthesis*"
- 2000** Institut de Chimie Moléculaire d'Orsay, Université de Bourgogne, Dijon Title: "*Hydrazines as new stabilizing substituents in Fischer-type carbene structures; a promising new class of organometallics for stereoselective organic synthesis*"
- 2001** Concord Gecom 2002, 4arbine4tà Pierre et Marie Curie, Paris VI,

Title: *"Fischer-type Carbene complexes: still efficient and versatile organometallic tools for organic synthesis"*

- 2002** University of Amsterdam, Prof. Dr. C. J. Elsevier  
Title: *"The hydrazine-stabilized metalcarbonyl carbenes: a new class of Fischer-type carbene complexes and their potential for organic synthesis"*
- 2004** 4<sup>th</sup> French-Italian Meeting on Organic Chemistry (FIMOC IV), Annecy  
Title: *"Novel functionalized heterohelicenes: new synthetic routes and applications"*
- 2007** Università degli Studi di Milano, title: *"Helix: the importance of this structural motif in biology and material science"*.
- 2008** Università degli Studi di Milano, Incontro con l'Università, il CNR e l'Industria. Title: *"Acidi peptido nucleici: un ampio, stimolante ed innovativo campo di ricerca"*
- 2008** University of Oviedo, SISOC VII. Title: *"Novel functionalized heterohelicenes: new synthetic routes and applications"*.
- 2010** Université Pierre et Marie Curie, Paris VI, Séminaires de Chimie Organique  
Title: *"Modified peptide nucleic acids (PNA) for DNA targeting"*.
- 2010** XXXIII Convegno Nazionale Chimica Organica, San Benedetto del Tronto. Title: *"Peptide nucleic acids as nucleic acid mimics: innovative modifications for improved properties"*
- 2013** University of Zürich, February 2013. Title: *"Synergistic cooperation of organic and inorganic fragments: the case of metal-modified peptide nucleic acids"*
- 2014** 14th Anglo-Italian Meeting on Heterocyclic Chemistry, Cumberland Lodge (UK), 29 giugno-1 luglio 2014. Title: *"Tetrathiahelicenes: eclectic chiral helical tools in chemistry and biology"*
- 2014** XXV Congresso Nazionale della SCI, September 7-12, 2014  
Title: *"The many aspects of Peptide Nucleic Acids as tools for diagnostics and therapy"*
- 2015** Rino Michelin Lecture, Padova July, 3<sup>rd</sup> 2015  
Title: *"Tetrathiahelicenes: eclectic chiral helical tools in chemistry and biology"*
- 2018** Plenary lecture at the "European Colloquium on Heterocyclic Chemistry (EHC)", Lecce, September 2-5, 2018.

## CONFERENCES

- 1991** 2<sup>nd</sup> Symposium on "Cycloadditions and related reactions", Milan.  
Title: *"Inter and intramolecular cycloadditions of arylazomethylenetriphenylphosphoranes"*
- 1985** XV National Congress of the Organic Division of the Italian Chemical Society, Sirmione, Lake Garda.  
Title: *"Electrophilic reactions in arylazomethylenetriphenylphosphorane: alkylation and acylation"*
- 1987** Scientific Meeting of the Lombardia Section of the Italian Chemical Society  
Title: *"Opening of oxiranes and oxetanes with the chromium pentacarbonyl(methoxymethyl)carbene: synthesis of  $\gamma$ - and  $\delta$ -lactones"*

- 1989** OMCOS V, 5<sup>th</sup> IUPAC Symposium on Organometallic Chemistry directed towards Organic Synthesis, Florence  
Title: *"New reactions on pentacarbonyl carbene chromium complexes"*
- 1995** XIth FECHEM Conference on Organometallic Chemistry, Parma, Italy.  
Title. *" The use of Organometallic Fischer-type amino carbene complexes in stereoselective synthesis"*
- 1997** XIIth FECHEM Conference on Organometallic Chemistry, Prague  
Title: *"Fischer-type amino complexes in stereoselective synthesis"*
- 2006** COST D35 Scientific Kick-Off Meeting "From molecules to molecular devices", Prague, Czech Republic. Title: *"Novel and efficient approach to tetrathia[7]helicenes"*
- 2009** XXIII Congresso Nazionale Società Chimica Italiana, Sorrento. Title: *"Anchoring Peptide Nucleic Acids (PNAs) to Ferrimagnetic Iron Oxide Nanoparticles for DNA targeting"*.
- 2010** International Symposium on Bioorganometallic Chemistry, Bochum, Germany. Title: *Fluorescent Conjugates Between Dinuclear Rhenium(I) Complexes and Peptide Nucleic Acids (PNA) for Cell imaging and DNA Targeting*
- 2016** XII Congresso del Gruppo Interdivisionale di Chimica Organometallica (Co.G.I.C.O.) della Società Chimica Italiana, Genoa June, 5 – 8, 2016.

#### LECTURES AT SPECIALIZATION SCHOOLS

- 2001** First laboratory of Synthetic Methodologies in Pharmaceutical Chemistry, University of Siena  
Title: *"The concept of linker in solid phase organic synthesis"*.  
Organization and coordination of laboratory practice: *"Introduction to practical methods for the solid phase synthesis and analysis of organic compounds"*
- 2003 -present** Series of lessons for the II Level Master course: *"Design and development of drugs"*, University of Pavia. Title of seminar: *"Principles and chemistry in the protection of functional groups"*
- 2006 -2010** Series of lessons for the Master course: *"Processes and management aspects in pharmaceutical fine chemistry"*, University of Milan.  
Titles: *"Concepts and applications of bioorganometallic chemistry"*; *"New strategies in the protection of functional groups"*
- 2007** Series of lessons within a training course organized by the University of Milan for young chemists of the Pharmaceutical Company Nerviano Medical Science.  
Title: *"New strategies in the protection of functional groups"*.
- 2010** Lesson for Ph.D. students at the Université Pierre et Marie Curie, Paris VI, title of the seminars: *"Fluorous protecting groups: a new tool for organic synthesis"*.
- 2010** Series of lessons within the Doctorate School in Chemical Science of the University of Milan, title of the seminars: *"Magnetic nanoparticles (NP) for applications in diagnostics and therapy"*
- 2016** Series of lessons within the Doctorate course in Chemistry of the University of Milan, title of the seminars: *"Transition metal catalyzed C-H activation for the synthesis of (hetero)polyaromatic synthesis: from basic knowledge to recent applications."*

## TEACHING ACTIVITY

**1999-2002** Responsible of the management of teaching laboratories of the Department of Organic and Industrial Chemistry, utilized for all of the Organic Chemistry practical courses (about 800 students per year).

As an Associate Professor (1992-2000) and then as a full Professor (2000-today) she has been teacher in the following courses (3-4 courses per year)

*Laurea in Biology:*

- Organic Chemistry

*Laurea in Industrial Chemistry:*

- Laboratory of Organic Chemistry II
- Laboratory of Applied Organic Chemistry
- Organic Chemistry II
- Concepts and methodologies of organic synthesis

*Laurea in Chemistry:*

- Laboratory of Organic Chemistry I
- Introduction to Nanotechnology
- Chemistry of heterocyclic compounds
- 

*Laurea in Chemical Sciences*

- Organic Chemistry A

Tutor and/or co-tutor of several Ph.D. undergraduate students, and post-doc fellowships.

## SCIENTIFIC INTERESTS

**SHE IS AUTHOR OF MORE THAN 150 PUBLICATIONS ON INTERNATIONAL JOURNALS WITH REFEREES , 12 PATENTS AND 3 BOOK CHAPTERS.**

In the beginning of her career the scientific interests were focused on the synthesis and reactivity of heterocyclic compounds. Later on and till today main research topics are in the field of organometallic chemistry directed towards organic synthesis: Namely, the use of arenechromium tricarbonyl complexes and Fischer-type carbene complexes for the stereoselective formation of new carbon-carbon bonds and, more recently, polymer-bound organometallics for solid phase synthesis and application of transition metal complexes chemistry to biomolecules. Recently, new scientific interests are in the field of peptide nucleic acids (PNAs, which are DNA mimetics). In particular, the design and synthesis of new PNAs with new structural characteristics, in order to obtain modified PNAs useful both in diagnostic and as anti-sense agents. To do this, PNAs are conjugated with specific organometallic moieties as new spectroscopic and electrochemical probes (PNAs in diagnostics) or their backbone structure modified with respect to the classical *N*-aminoethylglycine based PNA, in order to improve their properties.

A further recent research interest is in the field of heterohelicenes, molecules with potential in non linear optics (NLO). New functionalized thia-[7]-heterohelicenes have already been prepared by innovative methodologies and submitted to NLO measurements. Some recent results related to the set up of new methodologies for the synthesis and functionalization of tetrathiahelicenes have been mentioned in *Aldrichimica Acta*, ACTA Forum, Vol. 38, No. 2, 2005; in *Synfacts*, **2007**, 1, 0038-0038; in *Cheminform*, **2007**, vol. 38, issue 10.

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