Società Chimica Italiana

Atti del
XXVI Congresso Nazionale della Società Chimica Italiana

Centro Congressi Hotel Ariston
Paestum (SA), 10-14 settembre 2017

Vol I

- Sessioni Plenarie

Società Chimica Italiana
Roma, Italia
www.soc.chim.it

ISBN 9788886208802
ISBN 9788886208819

SPONSOR ISTITUZIONALI
Università degli Studi di Salerno

DIFARMA

Dipartimento di Farmacia

dCB
Dipartimento di Chimica e Biologia

Dipartimento di Chimica e Biologia A. Zambelli

GOLD SPONSOR

BRUKER

ELSEVIER

MAPEI® 80 years 1937-2017

MERCK

BRONZE SPONSOR

Biotage

BUCHI
SWITZERLAND

DASITGROUP | CARLO ERBA
REAGENTS

ChemPubSoc Europe

deltek DX

SCIEX

TCI EUROPE N.V.
Division of TOKYO CHEMICAL INDUSTRY

VACUUM SERVICE
Tecnologie del Vuoto - Assistenza Tecnica

ThermoFisher
SCIENTIFIC

SUPPORTERS

Waters
THE SCIENCE OF WHAT'S POSSIBLE.®

SHIMADZU
Excellence in Science

phenomenex®
...breaking with tradition℠

Patrocinio

FEDERCHIMICA
CONFINDUSTRIA

SOMMARIO

XXVI CONGRESSO NAZIONALE DELLA SOCIETÀ CHIMICA ITALIANA

Comitato Scientifico

Angela Agostiano	Presidente SCI
Giorgio Cevasco	Vice Presidente SCI
Gaetano Guerra	Vice Presidente SCI
Raffaele Riccio	Past President SCI
Vincenzo Barone	Presidente Divisione di Chimica Teorica e Computazionale
Donatella Caruso	Presidente Divisione di Spettrometria di Massa
Gabriele Costantino	Presidente Divisione di Chimica Farmaceutica
Gianluca M. Farinola	Presidente Divisione di Chimica Organica
Carla Isernia	Presidente Divisione di Chimica dei Sistemi Biologici
Aldo Laganà	Presidente Divisione di Chimica Analitica
Francesco Paolucci	Presidente Divisione di Elettrochimica
Francesco Pignataro	Presidente Divisione di Chimica Industriale
Adriana Saccone	Presidente Divisione di Chimica Inorganica
Elena Selli	Presidente Divisione di Chimica Fisica
Lucia Toniolo	Presidente Divisione di Chimica dell’Ambiente e dei Beni Culturali
Giovanni Villani	Presidente Divisione di Didattica Chimica

Comitato Organizzatore

Raffaele Riccio *Chair*	Dipartimento di Farmacia UNISA
Rita Patrizia Aquino	Direttore Dipartimento di Farmacia UNISA
Placido Neri	Direttore Dipartimento di Chimica e Biologia UNISA
Pietro Campiglia	Dipartimento di Farmacia UNISA

Delegati di Divisione

Antonio Proto	Divisione di Chimica dell’Ambiente e dei Beni Culturali
Carlo Crescenzi	Divisione di Chimica Analitica
Gianluca Sbardella	Divisione di Chimica Farmaceutica
Riccardo Zanasi	Divisione di Chimica Fisica
Vincenzo Venditto	Divisione di Chimica Industriale
Chiara Costabile	Divisione di Chimica Inorganica
Giuseppe Bifulco	Divisione di Chimica Organica
Luigi Russo	Divisione di Chimica dei Sistemi Biologici
Nadia Rega	Divisione di Chimica Teorica e Computazionale
Silvana Saiello	Divisione di Didattica Chimica
Amalia Velardo	Divisione di Elettrochimica
Paola Montoro	Divisione di Spettrometria di Massa

Segreteria Organizzativa

Personale e Servizi della Società Chimica Italiana

Manuela Mostacci	Ufficio Congressi SCI
Simone Fanfoni	Ufficio Ragioneria SCI
Paola Cerrini	Ufficio Segreteria SCI
Barbara Spadoni	Ufficio Segreteria SCI
Carla Ricci	Ufficio Soci SCI
Gianni Morelli	Webmaster SCI

Segreteria Organizzativa Locale

Cristina Pastore	Logistica e organizzazione locale
ZON Service sas	Sito Web SCI 2017

Programma Scientifico

Domenica 10 Settembre 2017

Centro Congressi dell'Hotel Ariston - Paestum	
10:00-14:00	*Registrazione*
Auditorium Giove	
14:30-15:00	*Cerimonia di Apertura del XXVI Congresso Nazionale SCI*
15:00-15:30	*Cerimonia di Conferimento delle Medaglie SCI*
Sessione Plenaria - Plenary Session ***Chimica per la tutela dell'ambiente e del patrimonio culturale*** ***Chemistry for environmental protection and for preservation of cultural heritage***	
Auditorium Giove	
Chairperson: Fabrizio Passarini	
15:30-16:10	GEN PL01 - Martin Scheringer *Environmental Chemistry: Quo Vadis?*
16:10-16:30	GEN IL01 - Maria Cristina Facchini *Marine organic aerosol in Marine Boundary Layer*
16:30-16:50	GEN MD01 - Tiezzi SCI Medal Lecture - Nicola Armaroli *Light, chemistry and energy: a 20-year journey across sustainable concepts and approaches*
16:50-17:20	Coffee Break
Chairperson: Lucia Toniolo	
17:20-18:00	GEN PL02 - Koen Janssens *The chemistry of Pigment Degradation: Investigations at different Length Scales*
18:00-18:30	GEN MD02 - Cannizzaro SCI Medal Lecture - Gabriele Centi *Solar-driven chemistry and solar fuels: the next revolution*
18:30-18:50	GEN MD03 - Marotta SCI Medal Lecture - Matteo Guidotti *There are no evil molecules. Education and dissemination for a mitigation of "bad" Chemistry*
18:50-19:10	GEN MD04 - Marotta SCI Medal Lecture - Domenico Misiti *From the Marotta's Institute to Sapienza University passing through Camerino: Sixty years spent working in the field of chemistry*
19:10-19:30	GEN MD05 - Illuminati SCI Medal Lecture by Fabio Olmi *Far comprendere la chimica per fare amare la chimica-Elogio della didattica*

Sala Giunone	
20:30-22:30	***Evento sociale: Party di benvenuto – Social event: Welcome party***

Lunedì 11 Settembre 2017

Sale delle Divisioni presso Centro Congressi Hotel Ariston e Hotel Savoy	
9:00-10:30	*Lavori delle Divisioni (consultare i programmi delle Divisioni)*
10:30-11:00	Coffee Break
11:00-13:00	*Lavori delle Divisioni (consultare i programmi delle Divisioni)*
13:00-14:00	Intervallo Pranzo – Lunch Break
Sala Paestum B Centro Congressi Hotel Ariston	
14:00-15:00	***Sessione Poster 1*** *(consultare i programmi delle Divisioni)*
Sale delle Divisioni presso Centro Congressi Hotel Ariston e Hotel Savoy	
15:00-16.30	*Lavori delle Divisioni (consultare i programmi delle Divisioni)*
16:30-17:00	Coffee Break
17:00-18:30	*Lavori delle Divisioni (consultare i programmi delle Divisioni)*
18:30-20:00	***Assemblee generali delle Divisioni presso sale Hotel Ariston***

	Giardini e Terrazze Hotel Ariston
20:00-21:00	***Evento sociale: Aperitivo serale***

	Auditorium Giove
21:00-21:30	GEN IL02 Conferenza serale su Etica e Scienza - Enrico Bucci *Lies, damned lies: detecting forgeries and manipulations in published scientific images*

Martedì 12 Settembre 2017

	Sale delle Divisioni presso Centro Congressi Hotel Ariston e Hotel Savoy
9:00-10:30	*Lavori delle Divisioni (consultare i programmi delle Divisioni)*
10:30-11:00	Coffee Break
11:00-13:00	*Lavori delle Divisioni (consultare i programmi delle Divisioni)*
13:00-14:00	Intervallo Pranzo – Lunch Break
	Sala Paestum B Centro Congressi Hotel Ariston
14:00-15:00	***Sessione Poster 2*** *(consultare i programmi delle Divisioni)*
	Auditorium Giove
	Sessione Plenaria-Plenary Session: ***Chimica per l'economia circolare - Chemistry for circular economy***
	Chairperson: Vincenzo Barone
15:00-15:30	GEN KN01 Vincenzo Balzani *From a Linear to a Circular Economy. The Role of Energy*
15:30-16.10	GEN PL03 **ChemPubSoc Europe Lecture** - Ryu Abe *Mixed-Anion Semiconductor Photocatalysts for Visible Light Induced Water Splitting*
16:10-16:30	GEN MD06 Pisani SCI Medal Lecture - Gianfranco Pacchioni *Solid state quantum chemistry: towards the rational design of nano- and photo-catalysts*
16:30-17:00	Coffee Break
	Chairperson: Alessandro Abbotto
17:00-17:30	GEN KN02 Anders Hagfeldt *The Versatility of Mesoscopic Solar Cells*
17:30-18:00	GEN KN03 David Peck *Critical materials and the circular economy. European actions and opportunities*
18:00-18.30	GEN MD07 Natta SCI Medal Lecture - Antonio Facchetti *Polymers and Polymeric Composites for Flexible Opto-Electronic Devices*

	Auditorium Giove
18.30-20.00	***Assemblea Generale dei Soci della Società Chimica Italiana***

	Sala Giunone
20.30	***Evento sociale – Social event: Cena Cilentana - Tipical local dinner***
	"Cerimonia di consegna del Premio SCI-Reaxys" Elsevier

Mercoledì 13 Settembre 2017

Auditorium Giove	
Sessione Plenaria - Plenary Session: ***Chimica per la salute - Chemistry for health***	
Chairperson: Roberto Fattorusso	
9:00-9:40	GEN PL04 *Paola Arimondo* *Towards the reprogramming of cancer cells with chemical tools targeting DNA methylation*
9:40-10:10	GEN KN04 *Giuseppe Legname* *Of Prions and Other Tales*
10:10-10:30	*GEN MD08* *Bertini SCI Medal Lecture by Chiara Gabbiani* *Exploring the cytotoxic, apoptotic and antitumoral effects of two new gold N-heterocyclic carbene–gold(I) complexes on A2780 human ovarian cancer cells*
10:30-11:00	Coffee Break
Chairperson: Francesco Paolucci	
11:00-11:40	*GEN PL05* *Aldo Roda* *Advanced instrumentation for the astronaut health monitoring and diagnostics during long-term space exploration*
11:40-12:10	GEN KN05 *Christian Amatore* *Seeing, Measuring and Understanding Vesicular Exocytosis of Neurotransmitters with Micro- and Nanoelectrodes*
12:10-12:30	*GEN MD09* *Piria SCI Medal Lecture by Cesare Gennari* *Tumor Targeting with Integrin Ligand - Drug Conjugates*
12:30-13:00	*GEN MD10* *Avogadro SCI Medal Lecture by Nino Russo* *Can chemistry replace the scalpel? The case of photodynamic therapy*
13:00-14:00	Intervallo Pranzo – Lunch Break
Sala Paestum B Centro Congressi Hotel Ariston	
14:00-15:00	***Sessione Poster 3*** *(consultare i programmi delle Divisioni)*
Sale delle Divisioni presso Centro Congressi Hotel Ariston e Hotel Savoy	
15:00-16.30	*Lavori delle Divisioni (consultare i programmi delle Divisioni)*
16:30-17:00	Coffee Break
17.00-18.30	*Lavori delle Divisioni*

Sessione del Gruppo Senior: Chimica e Sport ***Senior Group Session: Chemistry and Sport***	
Sala Diana	
Chairperson: Domenico Misiti	
15:00-15:30	GRS IL01 Santo Davide Ferrara *Doping-Antidoping e ruolo delle Scienze Biomedicolegali*
15:30-16:00	GRS IL02 Luigi Nicolais *I grandi cambiamenti nella 4° rivoluzione industriale*
16:30-17:00	Coffee Break
Chairperson: Rosario Nicoletti	
17.00-17.30	Aracne Editrice – Comitato Editoriale SCI *Presentazione della Collana "Molecole in primo piano"*
	Assemblea Gruppo Senior SCI

Sala Giunone	
20:30	***Cena Sociale – Social Dinner***

Giovedì 14 Settembre 2017

Auditorium Giove	
Sessione Plenaria - Plenary Session: Produzione sostenibile e sviluppo economico Sustainable production and economic development	
Chairperson: Vittorio Maglia	
9:00-9.20	*Introduction by Chairperson*
	"Mario Giacomo Levi Award" ceremony, a prize of the Division of Industrial Chemistry sponsored by Federchimica in recognition of a public-private joint research project developed at industrial level
9.20-10:00	GEN PL06 Johannes A. Lercher *Lessons from enzymes - On the role of steric constraints and chemical environments for catalysis*
10:00-10:30	GEN KN06 Oliver Kappe *Organic Synthesis Goes Flow - The Use of Continuous Flow Technology for the Synthesis of Active Pharmaceutical Ingredients*
10:30-11:00	Coffee Break
Chairperson: Adriana Saccone	
11:00-11:30	GEN KN07 Paul T. Anastas *How will Green Chemistry Influence the Future?*
	"Primo Levi Award" ceremony, a prize of the SCI Junior Group
11:30-11.50	GEN IL03 Francesca Ferrazza *Overview of the R&D program at Eni*
11:50-12:10	GEN MD11 Paternò SCI Medal Lecture by Giorgio Strukul *Towards the Greening of Oxidation Reactions*
12:10-12:50	GEN PL07 David Cole-Hamilton *The catalytic production of chemicals from waste bio-oils*
12:50-13:10	*Cerimonia di Chiusura – Closing Ceremony*
13:10-14:30	Intervallo Pranzo-Lunch Break

Eventi satellite di interesse industriale Satellite events of industrial interest	
Auditorium Giove	
14:30-18:00	***Grafene e sue possibili applicazioni industriali Graphene and its possible industrial applications***
Chairperson: Vincenzo Palermo	
14:30-14:45	ESG IL01 Gaetano Granozzi *Second and third generation graphenes for energy conversion*
14:45-15:00	ESG IL02 Giovanni Bruno *CVD graphene: trasparency, conductivity and flexibility, three inseparable properties to develop innovative applications*
15:00-15:15	ESG IL06 Maurizio Peruzzini *Black Phosphorus: from Ugly Duckling to Black Swan*
15:15-15:30	ESG IL04 Michele Maggini *Continuous flow synthesis of functionalized graphene*
15:30-15:45	ESG IL05 Zhenyuan Xia *Functionalization and applications of graphene-based materials*
15:45-16:00	ESG IL03 Maurizio Galimberti *Facile and sustainable functionalization method for preparing graphene layers with different solubility parameters*
16:00-16:30	Coffee Break
Chairperson: Gaetano Guerra	

16:30-16:45	ESG IL07 Manuela Melucci *Tailored polysulfone-graphene oxide adsorbers for water remediation*
16:45-17:00	ESG IL08 Maria Rosaria Acocella *New Application of Oxidized Nanocarbons: from Catalysis to Nanocomposites*
17:00-17:15	ESG IL09 Pellegrino Musto *Vibrational spectroscopy investigations on graphene/Poly(lactic acid) composites*
17:15-17:30	ESG IL10 Marino Lavorgna *Porous graphene-based polyurethane foams-aerogel composites prepared via unidirectional freeze-drying process*
17:30-17:45	ESG IL11 Michele Giordano *Multifunctional properties of Graphene Nanoplatelets based nanolaminates*

	Sala Mercurio
14:30-18.00	***Formulazioni nell'industria chimica e farmaceutica*** ***Formulations in the Chemical and Pharmaceutical Industry***
Chairperson: Gerardino D'Errico, Martino Di Serio	
14:30-14:35	*Introduction by Chairperson*
14:35-14:50	ESF IL01 Vittorio Maglia *Chimica delle formulazioni e chimica delle specialità: le esigenze dell'industria*
14.50-15:05	ESF IL02 Marco Adami *Formulation challenges and emerging technologies in the pharmaceutical industry: an overview*
15:05-15:20	ESF IL03 Sesto Viticoli *I formulati, nuova frontiera della chimica italiana*
15:20-15:35	ESF IL04 Enrico Zambelli *Trimbow® a new extrafine triple combination in a single inhaler for COPD treatment*
15:35-15:50	ESF IL05 Giorgio Ferrari *Studio della struttura alla scala nanometrica di formulati cementizi*
15:50-16:05	ESF IL06 Salvatore Mercuri *Innovative approches to tailor a particle size distribution*
16:05-16:30	Coffee Break
Chairperson: Rita Patrizia Aquino, Gianluca Sbardella	
16:30-16:45	ESF IL07 Franco Gasparri *I cosmetici per pelli sensibili: strategie formulative per la modulazione dell'attività lenitiva ed anti-infiammatoria*
16:45-17:00	ESF IL08 Stefano Resta *Challenges in formulating Ace Bleach products*
17:00-17:15	ESF IL09 Antonino Bagnulo *Formulazioni nel settore della nutraceutica: stato dell'arte e prospettive future*
17:15-17:30	ESF IL10 Massimo Bonini *Colloidi e Nanoscienze: Formulazioni e nuove sfide*
17:30-17:45	ESF IL11 Pasquale Del Gaudio *Polysaccharides based in situ gelling powders as promising wound healing medical devices*
17:45-18:00	ESF IL12 Martino Di Serio *Formulazioni industriali, un nuovo indirizzo di laurea*

Medaglie della Società Chimica Italiana

Medaglia Amedeo Avogadro 2017

Nino Russo **Università della Calabria**

"come riconoscimento ad una carriera spesa a favore dell'avanzamento di conoscenze metodologiche della chimica computazionale e della formazione di nuove generazioni di giovani ricercatori nello stesso ambito disciplinare"

Medaglia Stanislao Cannizzaro 2017

Gabriele Centi **Università di Messina**

"per il grande contributo allo sviluppo di processi chimici nella prospettiva di un utilizzo efficiente e sostenibile delle risorse materiali ed energetiche"

Medaglia Giulio Natta 2017

Antonio Facchetti **Northwestern University and Flexterra Inc.**

"per l'eccezionale valore scientifico e l'innovatività della ricerca su temi di grande attualità, quale lo sviluppo di dispositivi macromolecolari per applicazioni elettroniche, condotta in Italia ed all'estero"

Medaglia Ivano Bertini 2017

Chiara Gabbiani **Università di Pisa**

"per i brillanti e innovativi risultati ottenuti nella ricerca in chimica farmaceutica e bioinorganica"

Medaglia Gabriello Illuminati 2017

Fabio Olmi

"per il continuo e qualificato impegno, sia scientifico che istituzionale, nel campo della Didattica della Chimica"

Medaglie Domenico Marotta 2017

Matteo Guidotti **CNR-Istituto di Scienze e Tecnologie Molecolari**

"per la sua attività di divulgazione e di impegno civile, condotta con generosità ed entusiasmo"

Domenico Misiti **"Sapienza" Università di Roma**

"per l'incessante lavoro svolto a favore della comunità chimica tutta in importanti istituzioni nazionali ed organizzazioni internazionali"

Medaglia Emanuele Paternò 2017

Giorgio Strukul **Università di Venezia**

"per la capacità di indirizzare la sua ricerca su sistemi catalitici omogenei ed eterogenei alla sostenibilità ed allo sviluppo di nuove metodologie"

Medaglia Raffaele Piria 2017

Cesare Gennari **Università di Milano**

"per il fondamentale e innovativo contributo dato alla chimica organica con le sue ricerche nel campo della catalisi omogenea e della bioorganica"

Medaglia Cesare Pisani 2017

Gianfranco Pacchioni **Università di Milano Bicocca**

"per i suoi straordinari risultati ottenuti nell'applicazione del calcolo ad una molteplicità di studi su materiali nanostrutturati e loro superfici"

Medaglia Enzo Tiezzi 2017

Nicola Armaroli **CNR Istituto per la Sintesi Organica e la Fotoreattività,**

"per la grande visibilità e autorevolezza scientifica conquistato a livello nazionale e internazionale sui complessi temi della sostenibilità energetica e ambientale nella loro più vasta accezione"

Conferenze delle Medaglie SCI

Light, chemistry and energy: a 20-year journey across sustainable concepts and approaches

Nicola Armaroli

Istituto per la Sintesi Organica e la Fotoreattività, Consiglio Nazionale delle Ricerche (ISOF-CNR)
Via P. Gobetti 1010, 40129 Bologna; nicola.armaroli@isof.cnr.it

The investigation of fundamental phenomena in photochemistry and photophysics (*e.g.*, energy transfer, electron transfer, luminescence) is a privileged path to explore a variety of molecules, supermolecules and materials of wide (and sometimes unexpected) interest in the area of sustainable chemistry. In this lecture, I will give an overview of some key findings of my research over 20 years, outlining future perspectives. I will focus in particular on carbon nanomaterials for solar energy conversion (1-3), luminescent complexes and materials for lighting devices (4,5) and photocatalysis (6), copper complexes as alternatives to related materials based on rare and expensive elements (7). Key bottlenecks on the path of the energy transition from fossil fuels to renewables will also be highlighted (8).

References

1. T. Miletić, E. Pavoni, V. Trifiletti, A. Rizzo, A. Listorti, S. Colella, N. Armaroli, D. Bonifazi *ACS Appl. Mater. Inter.*, 2016, **8**, 27966.
2. K. Yoosaf, J. Iehl, I. Nierengarten, M. Hmadeh, A. M. Albrecht-Gary, J. F. Nierengarten, N. Armaroli *Chem.-Eur. J.*, 2014, **20**, 223.
3. G. Accorsi, N. Armaroli *J. Phys. Chem. C*, 2010, **114**, 1385.
4. F. Monti, A. Baschieri, E. Matteucci, A. Mazzanti, L. Sambri, A. Barbieri, N. Armaroli *Faraday Discuss.*, 2015, **185**, 233.
5. R. D. Costa, E. Orti, H. J. Bolink, F. Monti, G. Accorsi, N. Armaroli *Angew. Chem. Int. Ed.*, 2012, **51**, 8178.
6. A. Gualandi, E. Matteucci, F. Monti, A. Baschieri, N. Armaroli, L. Sambri, P. G. Cozzi *Chem. Sci.*, 2017, **8**, 1613.
7. N. Armaroli *Chem. Soc. Rev.*, 2001, **30**, 113.
8. N. Armaroli, V. Balzani *Chem.-Eur. J.*, 2016, **22**, 32.

Solar-driven chemistry and solar fuels: the next revolution

Gabriele Centi and Siglinda Perathoner

[a] *Univ. Messina, ERIC aisbl and INSTM/CASPE, Industrial Chemistry (Dept.s MIFT & ChimBioFarAm), V.le F. Stagno D'Alcontres 31 – 98166 Messina, Italy*

Driven from competitiveness in a changing economic world with an increasing transition to renewable energy, chemical and refinery production are in a major transition phase to go beyond fossil fuels (as main raw materials and energy source) and to increase sustainability. It is thus necessary to rethink chemical and refinery production methodologies from this perspective, with consequent need of new approaches to chemical industrial production (1). Between the emerging hot areas are those generally indicated as solar-driven chemistry and solar fuels (2).

Solar-driven chemistry indicates the general effort to develop the sustainable chemistry of the future based on the progressive decrease of the massive use of fossil fuels and the introduction of renewable energy in the value chain. It is thus a new vision for sustainable chemical (and energy vectors) production, and has a major impact on catalysis and process engineering. In fact, moving from the use of thermal energy (as currently in most of chemical processes) to the use of photon, electrons, radiations, etc., as necessary for addressing the challenge of solar-driven chemistry, requires to conceptually redesign catalysis and industrial processes. Solar fuel is the parallel concept of energy vectors which are able to convert renewable energy sources (with all the associated problems of discontinuity, transport, etc.) to chemical energy vectors which allow to trade on a world scale energy, as actually made for fossil fuels, but base on renewable energy sources (3).

The key issue is to use renewable energy (photons, electrons, radiations) rather than thermal energy (deriving from fossil fuels, as currently in over 98% of industrial cases) to drive chemical production (4). While there is still large skepticism or at least seen as a very-long-term objective, this lecture will try to evidence how the transition is instead on a relatively short-term, with identification of the possibilities, and challenges to address, and the identification of a new possible chemical production tree to create the future low-carbon chemical production, with a minimized use of fossil fuels and the progressive introduction of new routes for the production of large-volume chemicals or intermediates.

This lecture will include in the discussion also some of the areas on which we are working, like the electrochemical conversion of CO_2 to acetic acid (5) or to produce ethylene glycol, or of N_2 conversion to NH_3 (6).

References

1. M Beller, G Centi, L Sun, Chemistry Future: Priorities and Opportunities from the Sustainability Perspective, *ChemSusChem* **2017**, 10 (1), 6-13.
2. S Perathoner, S Gross, EJM Hensen, H Wessel, H Chraye, G Centi, Looking at the Future of Chemical Production through *the* European Roadmap on Science and Technology of Catalysis the EU Effort for a Long-term Vision, *ChemCatChem* **2017**, 9 (6), 904-909.
3. S Abate, G Centi, S Perathoner, Chemical Energy Conversion as Enabling Factor to Move to a Renewable Energy Economy, *Green* **2015**, 5 (1-6), 43–54
4. S Perathoner, G Centi, CO_2 recycling: A key strategy to introduce green energy in the chemical production chain, *ChemSusChem* **2014**, 7 (5), 1274-1282
5. C Genovese, C Ampelli, S Perathoner, G Centi, Mechanism of C–C bond formation in the electrocatalytic reduction of CO_2 to acetic acid. A challenging reaction to use renewable energy with chemistry, *Green Chemistry* **2017**, 19, 2406-2415
6. S Chen, S Perathoner, C Ampelli, C Mebrahtu, D Su, G Centi, Electrocatalytic Synthesis of Ammonia at Room Temperature and Atmospheric Pressure from Water and Nitrogen on a Carbon-Nanotube-Based Electrocatalyst, *Angewandte Chemie Int. Ed.* **2017**, 129 (10), 2743-2747

"There are no evil molecules"
Education and dissemination for a mitigation of "bad" Chemistry

Matteo Guidotti

CNR-Istituto di Scienze e Tecnologie Molecolari, via C. Golgi 19, Milano
Accademia delle Scienze dell'Istituto di Bologna, via Zamboni 33, Bologna
m.guidotti@istm.cnr.it

"There are no bad molecules, only evil human beings" is a famous sentence by Roald Hoffmann (1), Nobel laureate in Chemistry, who is devoting a large part of his recent efforts to the investigation of the relationships between Chemistry and ethical choices of scientists.

This expression has been the leitmotiv of a series of initiatives carried out in Italy, in Europe and in Asia (2) aiming at enhancing broad public's awareness on the potential risks and threats linked to the *dual use* (for either malicious or peaceful purposes) of chemical know-how and compounds.

Hazardous industrial chemicals, explosives, chemical weapons and polluting industrial materials are well known examples generating fear and increasing the general sensation of vulnerability in non-expert population. Technogenic incidents, either deliberate (terrorist attacks) or unintentional (industrial accidents), are indeed felt as a major source of concern by the public opinion. However, a poor risk assessment when facing emergency situations and/or incidents with hazardous chemicals can induce a sense of impotence and inability in tackling the non-conventional event in expert professionals too, if they are not properly trained and skilled.

In this scenario, only a better knowledge can minimise fear and only adequate awareness-raising actions addressed to wide audiences can enhance people's preparedness and resilience against chemical disasters and threats.

Education, dissemination and training activities organised in schools, universities, governmental agencies and professional bodies are a powerful tool to discredit wrong common places, rectify false myths and, in general, to help people to be more familiar with "good" Chemistry and its concepts.

Figure 1. (from left to right). "Chemistry for Safety and Security" at the 9th Edition of the European Night of the Research, in Alessandria; training courses for governmental first responders in South-East Asia: hand-over of certificates in Lao and table-top exercises with Cambodian delegates.

M. G. gratefully acknowledges F. Trifirò, A. Breccia Fratadocchi, R. Psaro, L. Campanella and A. Katsev for their constant support in raising-awareness initiatives on Chemistry and Ethics.

References:
1. Cardellini, L. Chemistry International, 29 (2007) 4.
2. Enhancement of CBRN capacities of South-East Asia in addressing CBRN risk mitigation concerning CBRN first response, biosafety and biosecurity awareness raising and legal framework. *http://www.cbrn-coe46.eu*

From the Marotta's Institute to Sapienza University passing through Camerino: Sixty years spent working in the field of chemistry.

Domenico Misiti

Sapienza, University of Rome
domenico.misiti@uniroma1.it

The occasion of awarding to Professor Domenico Misiti this prestigious medal bearing the name of Domenico Marotta represents a favorable occasion to remind and honor the figure and personality of an open minded chemist who even had the privilege of knowing Marotta personally and gained his friendship and esteem for long time since the beginning of his scientific career in 1956.

The various and different aspects of Misiti's scientific activity will be briefly and schematically reviewed, starting from his researches in the field of medicinal and natural substances chemistry under the guidance of Daniele Bovet and G.B.Marini Bettolo.

His research activity concerned mainly the synthesis of biologically active heterocyclic compounds, structure elucidation of natural compounds, asymmetric synthesis, separation science, synthesis of new chemio- and stereo-selective chiral stationary phases, studies on the mechanisms of stereoselective molecular recognition, development of new analytical methods in the field of biosciences, biotransformations and biocatalysis, chemistry of calixarene and fullerene derivatives as biological models. In parallel to the research and teaching activity and in addition to the numerous institutional assignments, an intensive organizational and dissemination activity has been developed mainly in relation to drugs and to chemical risk to health and the environment in National and International Institutions such as CNR in "Fine Chemistry I°-II° Projects", OCDE, EEC, EMEA, European Pharmacopoeia and MiUR, MSE, Ministry of Health, Ministry of Environment and several National Regions as Expert in the evaluation of numerous industrial research projects. Moreover an industrial consulting position was held mainly for a Pharmaceutical Industry. He promoted also the series of Symposia in Chiral Discrimination (ISCD) and he created the prestigious "Chirality Medal" in Rome in 1991. Finally he also had an editorial activity editing various textbooks for university as well for secondary school students.

D.M would like to thank his Colleagues B. Botta, L. Caglioti, F. Gasparrini, M. Pierini, C. Villani, G. Zappia for their active contribution to his research activity and R. Ballini, S. Cacchi and F. De Angelis for the numerous occasions of scientific interactions with them.

Far comprendere la chimica per fare amare la chimica
Elogio della didattica

Fabio Olmi

fabio.olmi@gmail.com

La relazione, redatta in occasione del conferimento al sottoscritto della Medaglia Illuminati per la didattica 2017, partendo da un quadro della situazione in cui l'autore si è venuto a trovare nel momento della scelta degli studi universitari, espone le difficoltà incontrate che sono state però di stimolo per il successivo percorso professionale. Consapevole della grande inadeguatezza della scuola frequentata in rapporto alle discipline scientifiche sperimentali, non appena intrapresa la strada dell'insegnamento ha fatto avanzare insieme una sua necessaria autoformazione (in mancanza di qualsiasi sistema di formazione allora esistente nel Paese) e la messa a punto di un percorso didattico innovativo per le scienze sperimentali, in particolare per la chimica, che fosse realmente efficace oltre che sostenibile. Attingendo a tipi di nuovi curricoli che venivano messi a punto in alcuni Paesi anglosassoni (USA e Gran Bretagna) e alle riflessioni sull'esigenza di una nuova didattica sostenuta da vari ricercatori soprattutto europei, l'autore ha messo a punto gli elementi caratterizzanti del proprio nuovo paradigma didattico messo in atto all'interno di una sperimentazione realizzata nella propria scuola. Si è passati cioè da una didattica verbalistica, astratta e tale da rendere l'allievo ascoltatore sostanzialmente passivo di fronte alle spiegazioni del docente, all'adozione di una didattica caratterizzata da alcuni elementi costitutivi che guidano lo studente, a partire da una situazione problematica iniziale opportunamente progettata, alla concreta costruzione dei concetti da acquisire con un confronto generale in classe per una loro condivisione e una conclusiva verbalizzazione del processo effettuato.

Il percorso di insegnamento si è alimentato con una costante attività di ricerca e sperimentazione didattica che nel corso di molti anni ha toccato diversi settori di cui i più significativi sono stati: indagini sull'insegnabilità a determinati livelli scolari di alcuni concetti-chiave della chimica, didattica del laboratorio e rapporti tra teoria ed esperienza, problem solving, verifica e valutazione degli apprendimenti in chimica e controllo delle competenze acquisite. Accanto a queste ricerche e sperimentazioni sono stati sviluppati altri due settori di interesse: da un lato l'esigenza di opportune riflessioni sugli aspetti epistemologici e metodologico-didattici dell'insegnamento della chimica e dall'altro l'esigenza di creare e far funzionare strutture e competenze per una nuova formazione primaria e in servizio dei docenti. Ad un primo livello di organizzazione l'autore si è mosso come membro della Divisione Didattica della SCI di concerto con le altre Associazioni di insegnanti di scienze sperimentali (Fisica, Biologia e Scienze della Terra). La vincita del concorso a Supervisore lo ha poi portato all'interno delle nascenti Scuole di Specializzazione degli Insegnanti di Scuola secondaria (SSIS) a collaborare con colleghi dell'Università di Firenze e a svolgere anche l'incarico del corso di Laboratorio di didattica e didattica del laboratorio. Attualmente fa parte del Comitato scientifico del gruppo di lavoro creato dalla Regione Toscana per la formazione di docenti di discipline scientifiche in servizio "Laboratori del sapere scientifico" (LSS) in funzione da ormai 10 anni e svolge attività di formazione.

Conclude la relazione un appello alla comunità dei chimici sullo stato della ricerca didattica, la necessità di sostenere una nuova formazione primaria dei docenti e infine l'esigenza di omogeneizzare l'insegnamento della chimica a livello di scuola secondaria superiore mediante la creazione di un'abilitazione bidisciplinare, come emerge da un puntuale documento messo punto tre anni fa da una qualificata commissione della Divisione Didattica della SCI e presente sul nostro sito.

Solid state quantum chemistry: towards the rational design of nano- and photo-catalysts

Gianfranco Pacchioni[a]

[a] *Dipartimento di Scienza dei Materiali, Università di Milano-Bicocca, via R. Cozzi, 55 – 20125 Milano*
E-mail Gianfranco.pacchioni@unimib.it

The rational design of advanced materials is an ambitious target of modern chemical research. Thanks to the advances of quantum theory methods to determine the electronic structure of solids and to describe complex chemical systems and reactions, nowadays not only it is possible to rationalize experimental observations, but also to predict novel systems with potential interest in practical applications. Two fields where progress has been particularly relevant are nanocatalysis and photocatalysis.

Nanocatalysis deals with components of a solid catalysts at the nanoscale. A way to exploit nanodimensionality in heterogeneous catalysis is to use oxide nanostructures. Graphene is the prototype of two-dimensional (2D) materials, but also oxides can be prepared in this form. When 2D oxides are grown on a metal, new physical properties and chemical reactivity appear, opening the way towards new catalytic systems. A relevant example is that of gold nanoclusters on MgO, FeO, and other oxide ultrathin films, and of the spontaneous charging effects that they induce.

Photocatalysis deals with the use of materials able to efficiently transform solar energy into chemical energy. A lot of efforts have been dedicated to this topic in the last decades, with alternating success. Introducing dopants, defects, heterojunctions, etc. opens a great number of possibilities to engineer new semiconducting oxides. This can be efficiently explored with the help of quantum chemistry which can provide new insight, concepts, and ideas.

In this talk we will discuss selected successful examples of nano- and photo-catalysts derived from theoretical models, showing the potential that solid state quantum chemistry has to solve problems in material science in general, and in heterogeneous catalysis in particular.

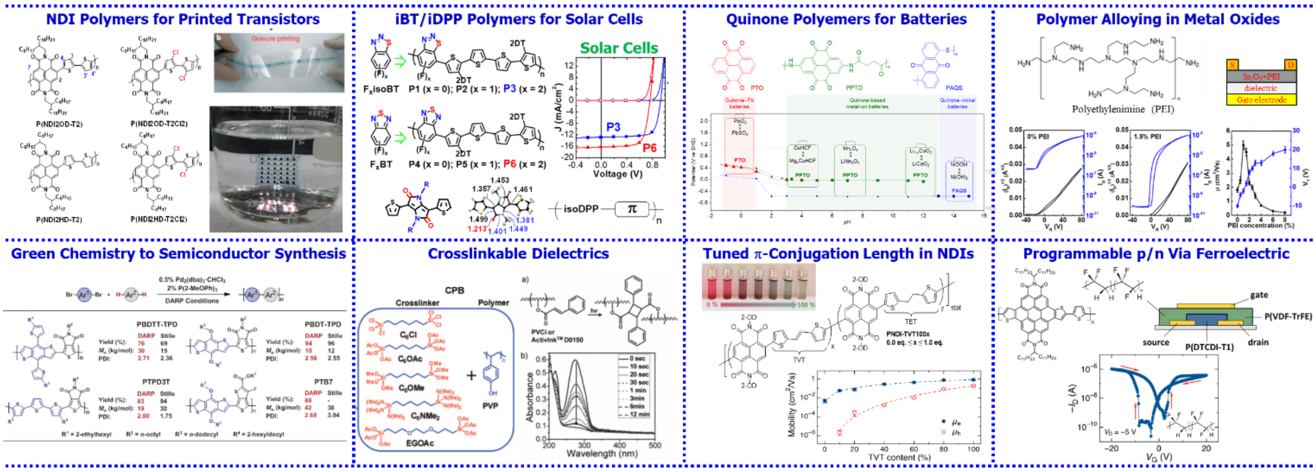
This work has been supported by the Italian MIUR through the PRIN Project 2015K7FZLH SMARTNESS "Solar driven chemistry: new materials for photo– and electro–catalysis", and by the European Community's Seventh Program FP7/2007–2013 under Grant Agreement nº 607417 – European Marie Curie Network CATSENSE, and Grant Agreement n° 604307 CASCATBEL.

Polymers and Polymeric Composites for Flexible Opto-Electronic Devices

Antonio Facchetti[a,b]

[a] Flexterra Inc., 8025 Lamon Ave., Skokie, IL, 60077 (USA); [b] Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208 (USA) - afacchetti@flexterracorp.com

In this presentation we will describe the design rationale, synthesis, characterization of several organic semiconducting and dielectric materials for printed/flexible thin-film transistors (TFTs),(1-5) circuits,(4) photovoltaic cells (PVs),(6,7) and batteries(8) as well as to understand their charge-transport/performance characteristics as a function of the device architecture and interface modifications (Fig. 1). Furthermore, new hybrid materials comprising polymers and metal oxide semiconductors will be presented.(9,10) We will also briefly summarize our recent synthetic efforts for the sustainable synthesis of semiconducting polymers.(11,12) Finally, new approaches to understand how the degree of π-conjugation in semiconducting polymers affect charge transport will be reported.(13) Our materials enable the realization of printed TFTs with mobilities > 3-40 cm^2/Vs, OPV cell with efficiencies >12%, and aqueous batteries with specific capacities > 395 mAh g^{-1}.



1) Yan, H.; Chen, Z.; Zheng, Y.; Newman, C. E.; Quin, J. Dolz, F.; Kastler, M.; Facchetti, A. *Nature* **2009**, *457*, 679.
2) Usta, H.; Newman, C.; Chen, Z.H.; Facchetti, A. *Adv. Mater.* **2012**, *24*, 3678.
3) Fabiano, S.; Usta, H.; Forchheimer, R.; Crispin, X.; Facchetti, A.; Berggren, M. *Adv. Mater.* **2014**, *26*, 7438.
4) Bucella, S. G.; Luzio, A.; Gann, E.; Thomsen, L.; McNeill, C. R.; Pace, G.; Perinot, A.; Chen, Z.; Facchetti, A.; Caironi, M. *Nat. Commun.* **2015**, *6*, 8394.
5) Ryu, G.-S.; Chen, Z.; Fabiano, S.; Usta, H.; Noh, Y.-Y.; Facchetti, *MRS Commun.* **2016**, *6*, 47.
6) Guo, X.; Zhou, N.; Lou, S. J.; Smith, J.; Tice, D. B.; Hennek, J. W.; Ortiz, R. P.; López Navarrete, J. T.; Chen, L. X.; Chang, R. P. H.; Facchetti, A.; Marks T. J. *Nature Photonics* **2013**, *7*(10), 825.
7) Chen, Z.; Brown, J.; Drees, M.; Seger, M.; Hu, Y.; Xia, Y.; Boudinet, D.; McCray, M.; Delferro, M.; Marks, T. J.; Liao, C.-Y.; Ko, C.-W.; Chang, Y.-M.; Facchetti, A. *Chem. Mater.* **2016**, *28*(17), 6390.
8) Liang, Y.; Jing, Y.; Gheytani, S.; Lee, K.-Y.; Liu, P.; Facchetti, A.; Yao, Y. A. *Nat. Mater.* **2017**, *16, in press*.
9) Yu, X.; Marks, T. J.; Facchetti, A. *Nat. Mater.* **2016**, *15*, 383.
10) Yu, X.; Zhou, N.; Lin, H.; Guo, P.; Smith, J.; Yu, J.; Chang, R. P. H.; Marks, T. J.; Facchetti, A. *Proc. Natl. Acad. Sci. U. S. A.* **2015**, *112*(11), 3217-3222.
11) Strappaveccia, G.; Ismalaj, E.; Petrucci, C.; Lanari, D.; Marrocchi, A.; Drees, M.; Facchetti, A.; Vaccaro, L. *Green Chem.* **2015**, *17*, 365.
12) Dudnik, A. S.; Aldrich, T. J.; Eastham, N. D.; Chang, R. P. H.; Facchetti, A.; Marks, T. J. *J. Am. Chem. Soc.* **2016**, *138*, 15699.
13) Erdmann, T.; Fabiano, S.; Milián-Medina, B.; Hanifi, D.; Chen, Z.; Berggren, M.; Gierschner, J.; Salleo, A.; Kiriy, A.; Voit, B.; Facchetti, A. *Adv. Mater.* **2016**, *28*, 9169.

Exploring the cytotoxic, apoptotic and antitumoral effects of two new gold N-heterocyclic carbene–gold(I) complexes on A2780 human ovarian cancer cells

Chiara Gabbiani[a], *Lorella Marchetti*[a], *Tiziano Marzo*[a,b], *Tania Gamberi*[b], *Alessandra Modesti*[b],
Luigi Messori[c]

[a] *Department of Chemistry and Industrial Chemistry (DCCI), University of Pisa, Via Moruzzi, 13, 56124 Pisa, Italy;*[b] *Department of Biochemical, Experimental and Clinical Sciences "Mario Serio", University of Florence, Viale GB Morgagni 50, 50134, Firenze, Italy;*[c] *Laboratory of Metals in Medicine (MetMed), Department of Chemistry "U. Schiff", University of Florence, Via della Lastruccia 3, 50019, Sesto Fiorentino, Italy.*
chiara.gabbiani@ unipi.it

Following the introduction of auranofin in the clinics for the oral treatment of rheumatoid arthritis and the discovery of its remarkable antiproliferative properties *in vitro*, gold compounds were increasingly considered and evaluated as a possible source of new and more effective metal-based anticancer agents (1). This interest was also fueled by the observation that gold compounds usually manifest a very different pharmacological profile compared to established anticancer platinum drugs, implying the occurrence of original and innovative modes of action. Among the various families of gold compounds tested for their anticancer effects in the last decade, a variety of organometallic gold(I) N-heterocyclic carbene (NHC) complexes were designed, featuring anticancer activity in the micromolar or sub-micromolar range in vitro (2,3). In this frame, we show here two gold carbene compounds, Au(NHC) and $Au(NHC)_2$, endowed with potent cytotoxic properties *in vitro* toward various cancer cell lines. We explored the cellular and molecular mechanisms that are at the basis of their antiproliferative properties. Both carbene complexes affected proteins belonging to protein synthesis, metabolism, cytoskeleton and stress response and chaperones. To obtain a more detailed view of these metabolic differences we evaluated the ability of carbenes to affect glycolytic and mitochondrial activity.

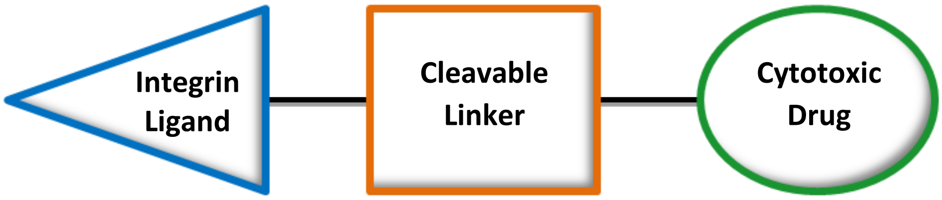
References:
1. Nobili, S.; Mini, E.; Landini, I.; Gabbiani, C.; Casini, A.; Messori, L. Med. Res. Rev. 2010, 30, 550−580.
2. L. Oehninger, R. Rubbiani, I. Ott, Dalton Trans. Camb. Engl. 2003 2013, 42, 3269–3284.
3. W. Liu, R. Gust, Coord. Chem. Rev. 2016, 329, 191–213.

Tumor Targeting with Integrin Ligand - Drug Conjugates

Cesare Gennari

Università degli Studi di Milano, Dipartimento di Chimica, via C. Golgi 19 – Milano 20133;
cesare.gennari@unimi.it

Integrins are a large family of heterodimeric transmembrane glycoprotein receptors, composed by two non-covalently-associated subunits (α and β). Integrins $\alpha_V\beta_3$ and $\alpha_V\beta_5$ have been found to be overexpressed on blood vessels in tumors, but not on vessels in normal tissues. For this reason, these integrins have become attractive targets for pharmacological studies mainly in the oncology area. We have recently investigated the synthesis and biological properties of a new class of cyclic peptidomimetics containing a bifunctional diketopiperazine (DKP) scaffold and the tripeptide sequence Arg-Gly-Asp (RGD) (1,2) or *iso*Asp-Gly-Arg (*iso*DGR) (3) as potent integrin ligands. Competitive binding assays for the displacement of biotinylated vitronectin bound to purified $\alpha_V\beta_3$ and $\alpha_V\beta_5$ integrins displayed excellent IC_{50} values, in the low nanomolar range. The interaction of *cyclo*[DKP-RGD] ligands with intact cancer cells was investigated by NMR and computational studies, allowing the determination of the binding epitope and the bioactive conformation of the ligands (4). *Cyclo*[DKP-RGD] and *cyclo*[DKP-*iso*DGR] ligands proved to be potent angiogenesis inhibitors and genuine integrin antagonists (5). Since α_V integrins are overexpressed on the surface of cancer cells, integrin ligand-Paclitaxel conjugates were synthesized with the aim of using the tumor-homing *cyclo*[DKP-RGD] or *cyclo*[DKP-*iso*DGR] peptidomimetics for site-directed delivery of the cytotoxic drug (6,7,8).



References:
1. Ressurreição, A. S. M.; Vidu, A.; Civera, M.; Belvisi, L.; Potenza, D.; Manzoni, L.; Ongeri, S.; Gennari, C.; Piarulli, U. *Chem. Eur. J.* **2009**, *15*, 12184-12188.
2. Marchini, M.; Mingozzi, M.; Colombo, R.; Guzzetti, I.; Belvisi, L.; Vasile, F.; Potenza, D.; Piarulli, U.; Arosio, D.; Gennari C. *Chem. Eur. J.* **2012**, *18*, 6195 – 6207.
3. Mingozzi, M.; Dal Corso, A.; Marchini, M.; Guzzetti, I.; Civera, M.; Piarulli, U.; Arosio, D.; Belvisi, L.; Potenza, D.; Pignataro, L.; Gennari C. *Chem. Eur. J.* **2013**, *19*, 3563–3567.
4. (a) Guzzetti, I.; Civera, M.; Vasile, F.; Araldi, E. M.; Belvisi, L.; Gennari C.; Potenza, D.; Fanelli, R.; Piarulli, U. *Org. Biomol. Chem.* **2013**, *11*, 3886-3893. (b) Guzzetti, I.; Civera, M.; Vasile, F.; Arosio, D.; Tringali, C.; Piarulli, U.; Gennari, C.; Pignataro, L.; Belvisi, L.; Potenza, D. *ChemistryOpen* **2017**, *6*, 128-136.
5. Panzeri, S.; Zanella, S.; Arosio, D.; Vahdati, L.; Dal Corso, A.; Pignataro, L.; Paolillo, M.; Schinelli, S.; Belvisi, L.; Gennari, C.; Piarulli, U. *Chem. Eur. J.* **2015**, *21*, 6265-6271.
6. Colombo, R.; Mingozzi, M.; Belvisi, L.; Arosio, D.; Piarulli, U.; Carenini, N.; Perego, P.; Zaffaroni, N.; De Cesare, M.; Castiglioni, V.; Scanziani, E.; Gennari C. *J. Med. Chem.* **2012**, *55*, 10460-10474.
7. Dal Corso, A.; Caruso, M.; Belvisi, L.; Arosio, D.; Piarulli, U.; Albanese, C.; Gasparri, F.; Marsiglio, A.; Sola, F.; Troiani, S.; Valsasina, B.; Pignataro, L.; Donati D.; Gennari, C. *Chem. Eur. J.* **2015**, *21*, 6921 – 6929.
8. Zanella, S.; Angerani, S.; Pina, A.; López Rivas, P.; Giannini, C.; Panzeri, S.; Arosio, D.; Caruso, M.; Gasparri, F.; Fraietta, I.; Albanese, C.; Marsiglio, A.; Pignataro, L.; Belvisi, L.; Piarulli, U.; Gennari, C. *Chem. Eur. J.* **2017**, *23*, 7910-7914.

Acknowledgements: I gratefully acknowledge MIUR (PRIN project 20157WW5EH "Tumor-targeting peptidomimetics: synthesis and bio-medical applications") and the European Commission (Marie Skłodowska-Curie ITN MAGICBULLET 642004 "Peptide-Drug Conjugates for Targeted Delivery in Tumor Therapy") for financial support.

Can chemistry replace the scalpel? The case of photodynamic therapy

Nino Russo[a]

Dipartimento di Chimica e Tecnologie Chimiche, Università della Calabria, I-87036 Rende, Italy, Email: nrusso@unical.it

Photodynamic therapy (PDT) is a non-invasive medical therapy nowadays used for the treatment of different kinds of tumors (e.g. esophagus, bladder, early lung, breast and prostate cancers), age-related macular degeneration, skin diseases and its clinical efficiency is currently explored for other diseases such as infections, cardiovascular and environmental application (e.g. water treatment and disinfection processes). For the origins of phototherapy, the roots can be found in the Egyptian and Greek culture many thousand years ago. In the 1892-3 years Sciascia in Palermo and Finsen in Stockholm demonstrated the possible use of the light in medicine. The therapeutic use of light began in 1900 when Raab reported that the combination of acridine orange and light could destroy living organisms. Nowadays, it is used in oncology and ophthalmology in United States, Japan, Canada, France, Netherlands and other 8 countries. A series of drugs including Levulan (D-5-aminolevulinic acid), photofrin (sodium porphyrin), SnET2 (Sn-ethyl-porphyrin), MV9411 (In), Lutrin (lutetium texaphyrin) and others are commercially available for cancer therapy. PDT requires the combination of a light source of adequate wavelengths with an appropriate photosensitizer. In given physico-chemical conditions, this mix can produce excited singlet molecular oxygen that is the cytotoxic agent. Then, we can define PDT as a “surgery without scalpel” or a surgery with a chemical scalpel (O_2, $^1\Delta_g$).

In this talk, I will briefly review our works (1) in this filed underlying as theoretical and computational chemistry should be a potent tool in designing and proposing new efficient drugs for photodynamic therapy.

References

(1) A. Quartarolo, N. Russo, E. Sicilia, J. Chem. Theory Comput. 2007, 3, 860; A. D. Quartarolo, N. Russo, E. Sicilia, F. Lelj, J. Chem. Theory Comput. 3 (2007) 860; Lanzo, I.; Russo, N.; Sicilia, E., J. Phys. Chem. B., 112 (2008) 4123; I. Lanzo, A. Quartarolo, N. Russo, E. Sicilia, Photochem. Photobiol. Sci., 2009, 8, 386; A. Quartarolo, E. Sicilia, N. Russo, Phys. Chem. Chem. Phys., 11, (2009) 4586; A. Quartarolo, E. Sicilia, N. Russo, J. Chem. Theor. Comput., 5 (2009) 1849; A. Quartarolo, N. Russo, J. Chem. Theory Comput., 7 (2011) 1073; G. Mazzone, N. Russo, E. Sicilia, Can. J. Chem. 91 (2013) 902; M. E. Alberto, C. Iuga, A. Quartarolo, N, Russo, J. Chem. Inf. Model., 53 (2013) 2334; M. E. Alberto, T. Marino, A. Quartarolo, N. Russo, Phys. Chem. Chem. Phys., 15 (2013) 16167; A. Quartarolo, D. Pérusse, F. Dumoulin, N. Russo, E. Sicilia, J. Porphyrins Phthalocyanines, 17 (2013) 980; M. E. Alberto, B. C. De Simone, G. Mazzone, A. Quartarolo, N. Russo, J. Chem. Theory Comput, 10 (2014) 4006; M. E. Alberto, G. Mazzone, A. Quartarolo, F. F. Ramos Sousa, E. Sicilia, N. Russo, J. Comput. Chemistry 35 (2014) 2107; M. E. Alberto, B. C. De Simone, G. Mazzone, T. Marino, N. Russo, Dyes and Pigments, 120 (2015), 335; M, E. Alberto, B, C. De Simone, G, Mazzone, E, Sicilia, N. Russo, Phys. Chem. Chem. Phys., 17 (2015), 23595; J. Pirillo, B. C. De Simone, N. Russo, Theor Chem Acc 135 (2016) 8; G. Mazzone, M. E. Alberto, B. C. De Simone, T, Marino, N. Russo, Molecules, 21 (2016) 288; G. Mazzone, A. D. Quartarolo, N. Russo, Dyes and Pigments, 130 (2016) 9; Marta E. Alberto, Nino Russo, Carlo Adamo, Chem. Eur. J., 22 (2016) 9162; M. Erminia Alberto, J. Pirillo, N. Russo, C. Adamo, Inorg. Chem., 55 (2016), 11185; B. C. De Simone, G. Mazzone, J. Pirillo, N. Russo, E. Sicilia, Phys. Chem. Chem. Phys., 19 (2017), 2530; J. Pirillo, G. Mazzone, N. Russo, L. Bertini, J. Chem. Inf. Model, 57 (2017) 234.

Towards the Greening of Oxidation Reactions

Giorgio Strukul[a]

[a] Dipartimento di Scienze Molecolari e Nanosistemi, Università Ca' Foscari Venezia

Catalytic oxidation is intrinsically a poorly selective reaction because in general the reaction product is more easily oxidizable than the starting substrate, this leading very often to a number of unwanted by-products. Since the early 1980's hydrogen peroxide has been successfully employed as an environmentally acceptable oxidant, replacing a variety of less benign mono-oxygen donors, in a range of synthetically useful organic chemistry reactions such as sulfoxidation, alkene epoxidation, the hydroxylation of aromatics, the Baeyer-Villiger oxidation of ketones (1). These processes were made possible by the use of transition metal catalysts possessing soft Lewis acidity properties thus opening the way to nucleophilic oxidation (2) proving very profitable in terms of selectivity in all its declinations: chemo- regio-, stereo-, enantio-.

More recently these systems were further improved in terms of sustainability by carrying out the above reactions in water with the aid of self-assembling additives like surfactants, opening the way to other synthetically useful reactions like hydration, hydroformylation, C-C bond formation (3) all characterized by sometimes large selectivity improvements. This practical approach allowed to expand their application potential because not only they represent examples of Green Chemistry, but they can also shorten costs and working times mainly in multi-step processes employed in the pharmaceutical sector as has been recently demonstrated (4).

References:
1. G. Strukul (ed), *Catalytic Oxidations with Hydrogen Peroxide as Oxidant*, Kluwer, Dordrecht, 1992.
2. R.A. Michelin, P. Sgarbossa, A. Scarso, G. Strukul, *Coord. Chem. Rev.*, **2010**, *254*, 646.
3. G. La Sorella, G. Strukul, A. Scarso, *Green Chem.*, **2015**, *17*, 644.
4. F. Gallou, N. A. Isley, A. Ganic, U. Onken, M. Parmentier, *Green Chem.* **2016**, *18*, 14

Speaker Invitati

Chimica per la tutela dell'ambiente e del patrimonio culturale
Chemistry for environmental protection and for preservation of cultural heritage

Martin Scheringer	ETH Zürich, Department of Environmental Systems Science
Koen Janssens	University of Antwerp, Campus Groenenborger
Maria Cristina Facchini	CNR, Istituto di Scienze dell'Atmosfera e del Clima (CNR-ISAC)

Etica e Scienza

Enrico Bucci	Resis Srl, Italy; Sbarro Health Research Organization, USA

Chimica per l'economia circolare - Chemistry for circular economy

Vincenzo Balzani	Alma Mater Studiorum - Università di Bologna, Dipartimento di Chimica "Giacomo Ciamician"
Ryu Abe	Department of Energy and Hydrocarbon Chemistry, Graduate School of Engineering, Kyoto University,
Anders Hagfeldt	Ecole polytechnique fédérale de Lausanne, Institut des sciences et ingénierie chimiques
David Peck	Delft University of Technology, Faculty of Architecture and the Built Environment

Chimica per la salute - Chemistry for health

Paola Arimondo	CNRS - Centre Pierre Fabre Laboratories - Research & Development
Aldo Roda	Università di Bologna, Dipartimento di Chimica "Giacomo Ciamician"
Giuseppe Legname	Scuola Internazionale Superiore di Studi Avanzati - Neurobiology Sector
Christian Amatore	Ecole Normale Supérieure Département de chimie

Produzione sostenibile e sviluppo economico
Sustainable production and economic development

Vittorio Maglia	Federchimica
Johannes A. Lercher	Technische Universität München, Department Chemie
David Cole Hamilton	School of Chemistry, University of St. Andrews
Oliver Kappe	Kerl-Franzens-Universitat Graz, Institut fur Chemie
Paul T. Anastas	Department of Chemistry, Yale University
Francesca Ferrazza	Eni S.p.A. - Research & Innovation

Chimica e Sport - Chemistry and Sport

Santo Davide Ferrara	Università di Padova
Luigi Nicolais	Università di Napoli Federico II

Eventi satellite di interesse industriale - Satellite events of industrial interest

Grafene e sue possibili applicazioni industriali

Gaetano Granozzi	Dipartimento di Scienze Chimiche-Università di Padova
Giovanni Bruno	Istituto di Nanotecnologie-CNR Nanotec Bari
Maurizio Galimberti	Dipartimento di Chimica, Materiali e Ingegneria Chimica "Giulio Natta"-Politecnico di Milano
Michele Maggini	Dipartimento di Scienze Chimiche-Università di Padova
Zhenyuan Xia	Istituto per la Sintesi Organica e la Fotoreattività -CNR-Bologna
Maurizio Peruzzini	Istituto di Chimica dei Composti Organo Metallici-CNR-Firenze
Manuela Melucci	Istituto per la Sintesi Organica e la Fotoreattività-CNR-Bologna
Maria Rosaria Acocella	Dipartimento di Chimica e Biologia, Università degli Studi di Salerno
Pellegrino Musto	Istituto per i Polimeri,Compositi e Biomateriali -CNR Pozzuoli
Marino Lavorgna	Istituto per i Polimeri,Compositi e Biomateriali-CNR Portici
Michele Giordano	Istituto per i Materiali Compositi e Biomedici-Portici

Formulazioni nell'industria chimica e farmaceutica

Vittorio Maglia	Federchimica
Marco Adami	Pharmaceutical Consultant, Milano
Sesto Viticoli	Italian Association for Industrial Research
Enrico Zambelli	Chiesi Farmaceutici S.pA.,
Giorgio Ferrari	Mapei S.p.A.,
Salvatore Mercuri	Micro-Macinazione SA
Franco Gasparri	MedaPharma S.p.A.,
Stefano Resta	Fater S.p.A
Antonino Bagnulo	Fater S.p.A
Massimo Bonini	Consorzio per lo Sviluppo dei Sistemi a Grande Interfase (CSGI)
Pasquale Del Gaudio	Università di Salerno
Martino Di Serio	Università di Napoli Federico II

Conferenze Plenarie

Environmental Chemistry: Quo Vadis?

Martin Scheringer[a,b]

[a] *Swiss Federal Institute of Technology (ETH) Zürich, 8093 Zürich, Switzerland;*
[b] *RECETOX, Masaryk University Brno, 625 00 Brno, Czech Republic;*
scheringer@chem.ethz.ch

Environmental chemistry deals with the fate (i.e., the transformation and degradation, phase partitioning, and transport) of anthropogenic chemicals in the environment. This field of research combines original scientific research (elucidation of processes governing the fate of chemicals in all environmental media; development of sampling techniques and measurement methods, etc.) with decision making processes (chemical risk assessment, input to development of chemical policies) at the national and international level, for example for the European chemicals regulation, REACH, and the Stockholm Convention on Persistent Organic Pollutants (POPs), an international agreement. Over the last 50 years, environmental chemistry has made important contributions to the scientific understanding of how chemicals circulate in, and interact with, the environment (1), including the elucidation of the mechanisms leading to stratospheric ozone depletion (Nobel Prize in chemistry in 1995); detection of anthropogenic chemicals in remote areas, including the bottom of the Mariana Trench, snow of the Himalayas, and waters around Antarctica; and development of highly sensitive analytical methods applicable to many different chemicals present and complicated matrices. Another genuine contribution of environmental chemistry is the education of scientists who play a crucial role in industry and governments in the process of chemical risk assessment. Whereas the role and relevance of environmental chemistry (and the related field of ecotoxicology) is clearly recognized in industry and governments, environmental chemistry and ecotoxicology have been losing support, resources and recognition at universities for many years (2). What are possible causes of this process? A first problem may be that the need for research and teaching in environmental chemistry and ecotoxicology is no longer seen at universities because chemical pollution problems are considered as largely solved. Secondly, environmental chemistry and ecotoxicology may be seen as fields dominated by routine work and where there are not many interesting research questions left. A third part of the problem may be that other environmental impacts such as climate change are given higher priority than chemical pollution problems. Here, all three possible causes of the loss of recognition of environmental chemistry are discussed and several cases are presented that illustrate the great demand for innovative research and teaching in environmental chemistry and ecotoxicology. It is crucial that environmental chemistry and ecotoxicology are firmly rooted in academic science and are provided with sufficient equipment, resources and prospects for development (3).

References: 1. R.P. Schwarzenbach, P.M. Gschwend, D.M. Imboden (2017) Environmental Organic Chemistry. 3rd Edition John Wiley & Sons. 2. A. Schäffer, H. Hollert, H.T. Ratte, M. Roß-Nickoll, J. Filser, M. Matthies et al. (2009) An Indispensable Asset at Risk: Merits and Needs of Chemicals-Related Environmental Sciences, Environmental Science & Pollution Research 16, 410–413. 3. M. Scheringer (2017) Environmental Chemistry and Ecotoxicology: in Greater Demand than Ever, Environmental Sciences Europe 29:3, http://dx.doi.org/10.1186/s12302-016-0101-x

The chemistry of Pigment Degradation: Investigations at different Length Scales

Koen Janssens

Department of Chemistry, University Of Antwerp, Antwerp, Belgium
koen.janssens@uantwerpen.be

Many painting materials employed by artists in different historical periods, ranging from the Antique period to the modern era, are subject to spontaneous degradation [1]. Usually, a combination of physical and chemical factors in the environment of the works of art exert an influence on the durability of the pigments originally employed. This can lead to a loss of mechanical strength of the paint as a whole but can also take milder forms such as a discoloration. Often discoloration phenomena are caused by redox transformation of original pigments. In the recent past, we have examined the degradation of various sulfide-based pigments such as vermillion red (HgS), cadmium yellow (CdS) and orpiment (As_2S_3) used in well-known works of art by Van Eyck, Rubens, Rembrandt, Van Gogh and Munch.

Many of these substances are semi-conductor materials that upon illumination with light of sufficient energy can release electron-hole pairs that in their turn can promote oxidation and reduction reactions, either of the semi-conductor material itself or of materials in its immediate vicinity. In this presentation, the attention will be focussed on the degradation of lead and arsenic based pigments employed by artists and craftsmen in different period. Minium (also known as as *red lead*, Pb_3O_4) is a mixed-valence oxide of lead that can be converted to various lead carbonates, hereby losing its characteristic red-orange color [2]. Some forms of chrome yellow, a class of pigments frequently used by artists at the end of the 19th century are prone to photo-reduction while others are much more stable under exposure to light [3]. An unstable class of pigments used in many historical periods are arsenic sulfides (in general As_xS_y) that may first convert into arsenolite (As_2O_3) and upon further oxidation to very mobile arsenate compounds [4].

The degradation pathways of these pigments can be elucidated as a function of environmental conditions by means of a combination of (X-ray based) analytical imaging methods such as X-ray fluorescence, X-ray diffraction and X-ray absorption spectroscopy. Macroscopic forms of these methods [5] are employed to characterize and explore the affected works of art in their totality while microscopic variants are useful for more detailed (speciation) analysis of minute paint samples taken from these artworks [1,2]. A number of case studies will be discussed as concrete illustrations.

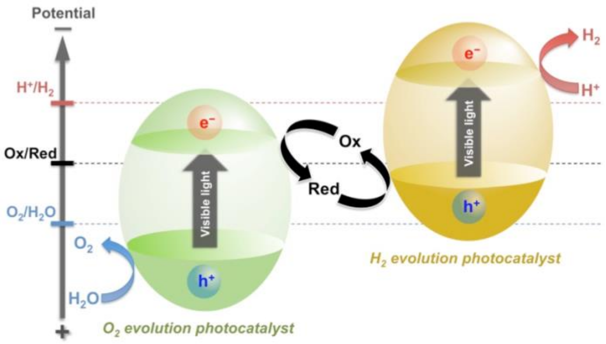
References: 1. Janssens K., Van der Snickt G., Vanmeert F. et al., Topics in Current Chemistry, 374 (2016) 1-52.
2. Vanmeert F., Van der Snickt G., Janssens K., Angewandte Chemie – Int. Ed., 54 (2015) 3607-3610.
3. Monico L., Janssens K., Hendriks E., et al., Angewandte Chemie – Int. Ed., 54 (2015) 13923–13927
4. Vermeulen M., Nuyts G., Saynova J. et al., J. of Analytical Atomic Spectrometry, 31 (2016) 1913-1921.
5. Janssens K., Legrand S., Van der Snickt G., Vanmeert F., Elements, 12 (2016) 39-44.
6. Van der Snickt G., Dubois H., et al., Angewandte Chemie – Int. Ed., 129 (2017) 4797-4801

Mixed-Anion Semiconductor Photocatalysts for Visible Light Induced Water Splitting

Ryu Abe

Graduate School of Engineering, Kyoto University, Katsura, Nishikyo-ku, Kyoto 615-8510, Japan
ryu-abe@scl.kyoto-u.ac.jp

Photocatalytic water splitting into H_2 and O_2 using semiconductor photocatalysts has received much attention recently due to the potential for the clean production of H_2 from water utilizing solar energy (1). Because almost half of all incident solar energy at the Earth's surface falls in the visible region, the efficient utilization of visible light remains indispensable for realizing practical H_2 production. We have recently developed a new type of photocatalytic water splitting system, mimicking the mechanism of photosynthesis in green plants (2). In this system, the water splitting reaction is broken up into two stages: one for H_2 evolution and the other for O_2 evolution; these are combined by using a shuttle redox couple (Red/Ox) in the solution. Over a H_2 evolution photocatalyst, the photoexcited electrons reduce water to H_2 and holes oxidize a reductant (Red) to an oxidant (Ox). The Ox is reduced back to the Red by photoexcited electrons generated over an O_2 evolution photocatalyst, where the holes oxidize water to O_2. This system reduces the energy required to drive each photocatalysis process, allowing visible light to be utilized more efficiently than in conventional water splitting system. We have achieved overall water splitting using various visible light responsive photocatalysts, such as $SrTiO_3$ doped with Cr (2), tantalum oxynitrides (TaON or $BaTaO_2N$) (4), and organic dyes (5), which work as a H_2 evolution photocatalyst, combined with tungsten oxide (WO_3) for O_2 evolution in the presence of a shuttle redox mediator such as iodate/iodide (IO_3^-/I^-). We have recently demonstrated that some oxyhalides such as Bi_4NbO_8Cl, with single layer Sillen-Aurivillius perovskite structure, are stable and efficient O_2-evolving photocatalysts under visible light, enabling a Z-scheme overall water splitting with Fe^{3+}/Fe^{2+} redox (6). It was revealed that the valence band maximum of Bi_4NbO_8Cl is unusually high owing to highly dispersive O-2*p* orbitals (not Cl-3*p* orbitals), affording the narrow band gap and the stability against self-oxidative deactivation. We have also demonstrated that the porous tantalum oxynitrides (TaON or $BaTaO_2N$) film electrode prepared on conducting substrates showed stable O_2 evolution with significantly high quantum efficiency in an aqueous solution, after loading of IrO_2 or CoO_x nanoparticles as a cocatalyst for water oxidation; enabling water splitting into H_2 and O_2 under visible light with a Pt electrode under an externally applied bias (7).



References:

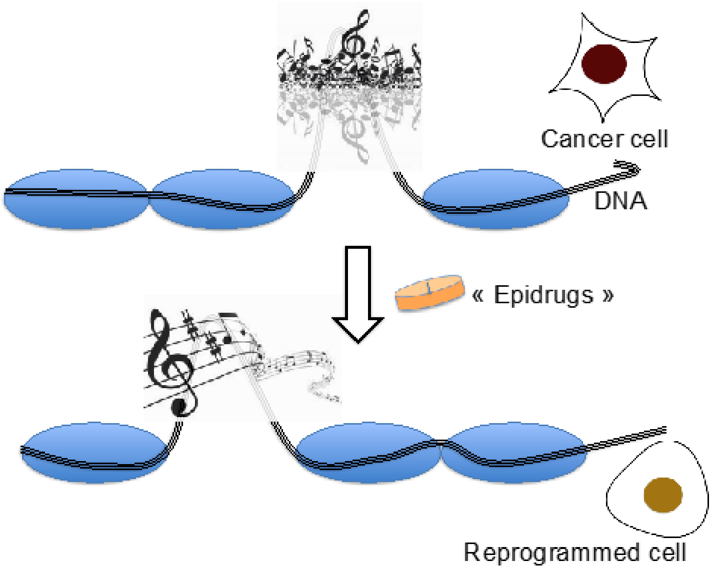
1. R. Abe, *J. Photochem. Photobiol. C: Photochemistry Reviews* **2011**, *11*, 179.
2. R. Abe, *Bull. Chem. Soc. Jpn. (Award account)* **2011**, *84*, 1000.
3. R. Abe, K. Sayama, and H. Sugihara, *J. Phys. Chem. B* **2005**, *109*, 16052.
4. a) R. Abe, T. Takata, H. Sugihara, and K. Domen, *Chem. Commun.* **2005**, 3829; b) M. Higashi, R. Abe, T. Takata, and K. Domen, *Chem. Mater*. **2009**, *21*, 1543; c) K. Maeda, M. Higashi, D. Lu, R. Abe, and K. Domen, *J. Am. Chem. Soc.* **2010,** *132*, 5858; d) R. Abe, M. Higashi, and K. Domen, *ChemSusChem* **2011**, *4*, 228.
5. R. Abe, K. Shinmei, N. Koumura, K. Hara, and B. Ohtani, *J. Am. Chem. Soc.* **2013**, *135*, 16872.
6. H. Fujito, H. Kunioku, D. Kato, H. Suzuki, M. Higashi, H. Kageyama, and R. Abe, *J. Am. Chem. Soc.* **2016**, *38*, 2082.
7. a) R. Abe, M. Higashi, and K. Domen, *J. Am. Chem. Soc.* **2010**, *132*, 11828; b) M. Higashi, K. Domen, and R. Abe, *Energy Environ. Sci.* **2011**, *4*, 4138; c) M. Higashi, K. Domen, and R. Abe, *J. Am. Chem. Soc.* **2012**, *134*, 6968; d) M. Higashi, K. Domen, and R. Abe, *J. Am. Chem. Soc.* **2013**, *135*, 10238.

Towards the reprogramming of cancer cells with chemical tools targeting DNA methylation

Paola B. Arimondo[a]

[a] ETaC FRE3600 CNRS, Toulouse, France

DNA methylation is involved in the regulation of gene expression and plays an important role in normal developmental processes and disease. In particular, the epigenetic landscape is altered in cancers where abnormal hypermethylation leads to silencing of certain genes such as tumor suppressor genes. In mammals, DNA methyltransferases are the enzymes responsible for DNA methylation on the position 5 of cytidine in a CpG context. Few direct enzyme inhibitors are known and those have several drawbacks. In order to identify novel inhibitors, we developed three chemical strategies. First a fluorescent High-Throughput Screening for the inhibition of the murine catalytic Dnmt3a/3L complex. Second, based on molecular modeling studies of quinoline inhibitor SGI1027 and *N*-Phthaloyl-L-tryptophan RG108, we four compounds induced the reexpression of a reporter gene, controlled by a methylated CMV promoter, in leukemia KG-1 cells. Third, we design bisubstrat analogues of the DNMTs and found potent quinazoline-based compounds active in cancer cells.. Finally, docking studies were conducted in order to understand their binding mode. The biological activity of the compounds was also addressed in solid and hematological cancer cells. Altogether, these studies provide insights for the design of the next-generation of DNMT inhibitors.



References: 1/ Ceccaldi et al.. *Identification of Novel Inhibitors of DNA Methylation by Screening of a Chemical Library.* ACS Chem Biol. 2013 8(3):543-8. 2/Rilova et al. *Design, synthesis and biological evaluation of 4-amino-N-(4-aminophenyl)- benzamides analogues of quinoline-based SGI-1027 as inhibitors of DNA methylation.* Chem.Med.Chem 2014 9, 590-601. 3/ Asgatay et al. *Synthesis and Evaluation of Analogues of N-Phthaloyl-l-tryptophan (RG108) as Inhibitors of DNA Methyltransferase 1.* J Med Chem. 2014 57(2):421-34. 4/ Erdmann et al. *Targeting DNA Methylation with Small Molecules: What's Next?* J Med Chem. **2015** 58(6):2569-83. 5/ Gros et al. *New Insights on the Mechanism of Quinoline-based DNA Methyltransferase Inhibitors* J Biol Chem **2015** 290(10):6293- 302. 6/ Halby et al. *Rational Design of Bisubstrate-Type Analogues as Inhibitors of DNA Methyltransferases in Cancer Cells.* J Med Chem. **2017**. 7/ Castillo-Aguilera et al. *DNA Methylation Targeting: The DNMT/HMT Crosstalk Challenge.* Biomolecules. **2017** 7(1). pii: E3. 8/ Pechalrieu et al. *DNA methyltransferase inhibitors in cancer: From pharmacology to translational studies.* Biochem Pharmacol. **2017**;129:1-13.

Advanced instrumentation for the astronaut health monitoring and diagnostics during long-term space exploration

Aldo Roda

Department of Chemistry "Giacomo Ciamician"-Alma Mater Studiorum University of Bologna-
aldo.roda@unibo.it

Life evolved on Earth, while the force of gravity has been constant for billion years and there is no genetic memory of life responding to gravitational force changes. Space microgravity is therefore an unnatural place to live. But what happens to humans in space? Many physical properties of solids and liquids are different in microgravity, including capillarity, hydrostatic pressure, surface tension, wettability, buoyancy and thermal convection. We therefore expect that this new environment greatly affects the human physiology even at a cellular level, which becomes even more relevant and critical in extended duration missions. The main microgravity negative effects on astronaut's health and performances result from fluids and organs shift-up causing edema and optical nerve distortion and the vision grows worse. Furthermore, without the constant tug of gravity skeleton doesn't work nearly as hard, which causes it to weaken and decalcify.

Additionally to microgravity, the major biological risks of space travel derive from cosmic rays, loss of atmosphere, exposure to toxins, mechanical trauma, acceleration and deceleration, extreme temperatures, meteoroids and space debris, circadian rhythms and sleep alterations and psychological distress. The safety and success of extended space missions require efficient management of astronauts' health by monitoring a range of physiological parameters that are indicators of the health status and by setting up a real autonomous clinical care in the space station. The chemistry of smart materials and nanostructures is a key point, not only for the spacecraft structure, but for health: radiation shielding using quantum dots, for example, which can tolerate hundreds of times more radiation than their macroscale counterparts can; isotopically-enriched boron nanotubes might be able to effectively shield radiation and store energy as they form the hull of a spacecraft. Nanotechnology makes "lab-on-a-chip" solutions with instant results possible, thus boosting biosensor applications, which are crucial to space exploration for monitoring astronaut health and water quality, and for seeking out life on other planets. The medical equipment toward and independent clinical care should perform diagnostics tests, body imaging (ultrasound, X ray) and even surgery in case of emergency by a non-medical personal. The use of tele-robotic and telemedicine will allow approaching part of these problems.

The main avenues using nanotechnology and nanomaterials for scaling down a gravitational independence diagnostic system's footprint are: 1) reduce the scale at which the device operates at nanoliter volume levels. 2) Include on board biosensors based on optical and electrochemical detection which are nowadays mature, driven by micropumps and valving integrated with electronics to achieve the needed robustness and ruggedness. 3) Exploit shared resources such as PC, CCD for data analysis and processing. 4) Scale back the disposables. 5) Incorporate modularity via dynamic programmability by using quick disconnects or swiping out chip. 6) Use a device that can perform massive multiplexing, i.e. process many tests from a single sample with high sensitivity and non-invasiveness.

Our experience in space medicine diagnostics, dealing with the development of portable devices and biosensors to non-invasively measure health biomarkers in astronauts' breath and saliva, respectively from MARS 500 Mars simulation mission and on board International Space station ISS experiments, will be reported and discussed, as examples of the role of chemistry in space medicine. The most appropriate methodological approaches in term of analytical principle, format, instrumentation will be critically discussed, anticipating the new advanced emerging technology.

Lessons from enzymes - On the role of steric constraints and chemical environments for catalysis

Johannes A. Lercher

Department of Chemistry Technische Universität München, Garching, Germany
Institute for Integrated Catalysis, Pacific Northwest National Laboratory, Richland, WA
johannes.lercher@tum.de

Elementary organic transformations are catalyzed by enzymes at large unmatched rate and selectivity. The local constraints at active sites of enzymes and the local chemical environment are two key properties to achieve such extraordinary catalytic vectors. We use the sites in crystalline nanoporous materials to mimic such well-defined reaction space. Molecules experience constraints that can be subtly adjusted via direct synthesis, as well as via the addition of cations, oxidic clusters or organic fragments. The role of water and other solvents in such environments changes drastically the reaction pathways compared with the catalytic pathways in a homogeneous environment of chemistry in solution. The lecture will compare reactions such as elimination reactions of alcohols, alkylation of aromatic molecules and the role of acid sites for hydrogenation and hydrogenolysis. Experimental methods to define the state of the reacting molecules combined with detailed kinetic analysis and theory will be used to explain the principal contributions of the interactions and the confinement to determine reaction rates. It will be discussed how reaction rates and pathways can be tailored using the space available for a transition state and the chemical constituents around the active site.

The catalytic production of chemicals from waste bio-oils

David J. Cole-Hamilton,[a*] *Ruben Duque Garcia,*[a] *Ronan le Goff,*[a] *Marc Furst,*[a]*Yiping Shi* [a] *Juma Mmongoyo,*[b] *James Mgaya,*[b] *Jennifer Julis*[a] *Stuart Bartlett*[a] *Sabrina Baader*[c] *and Quintino Mgani*[b]

[a] *EaStCHEM, School of Chemistry, University of St. Andrews, St. Andrews, Fife, KY16 9ST, Scotland, UK*
[b] *University of Dar es Salaam, Chemistry Department, P.O.Box 35061, Dar es Salaam, Tanzania*
[c] *Fachbereich Chemie, Organische Chemie, TU Kaiserslautern, Erwin-Schrödinger-Straße 54, 67663 Kaiserslautern, Germany*
** E-mail: djc@st-and.ac.uk*

As oil supplies dwindle and the price increases, it is essential to find new ways of making the many chemicals on which the quality of our lives depends. One possible solution is to use waste products for the manufacture of chemicals. We shall discuss the conversion of fatty acids from *Tall Oil,* a waste from wood processing, into polymer precursors. We shall also discuss the synthesis of a range of important chemicals from cashew nut shell liquid (CNSL), a waste from cashew nut processing.

We shall show how homogeneous carbonylation,(1, 2) metathesis,(3) and reductive amination(4) can be used to make difunctional esters acids, alcohols and amines(1, 5, 6) for polymer formation(7, 8) from unpurified natural oils containing oleate residues. We shall also describe a direct route to *N*-heterocycles from diacid esters and amines.

Cashew nut shell liquid contains interesting phenols *meta* substituted with an unsaturated C_{15} chain. We shall describe how it can be used to synthesise tse-tse fly attractants, potentially safe detergents, polymer additives, monomers for polymerisation and large ring macrocyclic lactones.(9-13) (Figure 1).

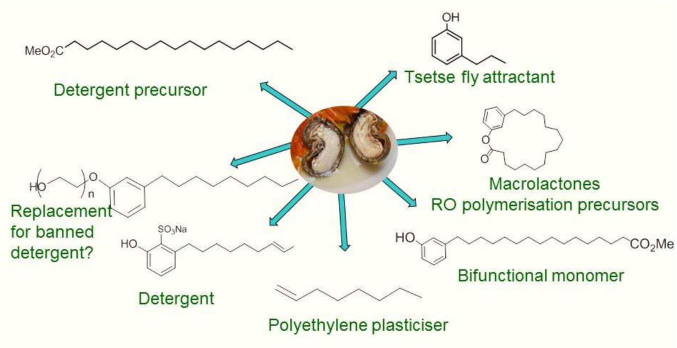


Fig. 1 Chemicals from cashew nut shell liquid

References

1. C. Jiménez-Rodriguez, G. R. Eastham and D. J. Cole-Hamilton, *Inorg. Chem. Commun.*, 2005, **8**, 878. 2. C. J. Rodriguez, D. F. Foster, G. R. Eastham and D. J. Cole-Hamilton, *Chem. Commun.*, 2004, 1720. 3. R. Duque, E. Ochsner, H. Clavier, F. Caijo, S. P. Nolan, M. Mauduit and D. J. Cole-Hamilton, *Green Chem.*, 2011, **13**, 1187. 4. A. A. Nunez Magro, G. R. Eastham and D. J. Cole-Hamilton, *Chem. Commun.*, 2007, 3154. 5. M. R. L. Furst, R. le Goff, D. Quinzler, S. Mecking and D. J. Cole-Hamilton, *Green Chem.*, 2011, **14**, 472. 6.M. R. L. Furst, T. Seidensticker and D. J. Cole-Hamilton, *Green Chem.*, 2013, **15**, 1218 7. D. Quinzler and S. Mecking, *Angew. Chem. Int. Ed.*, 2010, **49**, 4306. 8. F. Stempfle, D. Quinzler, I. Heckler and S. Mecking, *Macromolecules*, 2011, **44**, 4159. 9. J. A. Mmongoyo, Q. A. Mgani, J. M. Mdachi, P. J. Pogorzelec and D. J. Cole-Hamilton, *Eur. J. Lipid. Sci. Technol.*, 2012, **114**, 1183. 10. S. Baader, P. E. Podsiadly, D. J. Cole-Hamilton and L. J. Goossen, *Green Chem.*, **16**, 4885. 11. J. Julis, S. A. Bartlett, S. Baader, N. Beresford, E. J. Routledge, C. S. J. Cazin and D. J. Cole-Hamilton, *Green Chem.*, 2014, **16**, 2846. 12. J. E. Mgaya, E. B. Mubofu, Q. A. Mgani, D. B. Cordes, A. M. Slawin and D. J. Cole-Hamilton, *Eur. J. Lipid. Sci. Technol.*, 2015, **117**, 190. 13. J. E. Mgaya, S. A. Bartlett, E. B. Mubofu, Q. A. Mgani, A. M. Z. Slawin, P. J. Pogorzelec and D. J. Cole-Hamilton, *ChemCatChem*, 2016, **8**, 751.

Keynote e Conferenze su Invito

From a Linear to a Circular Economy
The Role of Energy

Vincenzo Balzani

Dipartimento di Chimica Giacomo Ciamician, Università di Bologna, vincenzo.balzani@unibo.it

Thanks to science, technology and fossil fuel energy, in the last 50 years there has been an increasing human activity that has caused enormous changes in the Earth's system. We are living in the so-called linear economy, an economic model based on the assumptions that resources are infinite and infinite is also the space for disposing waste. The linear economy, which is powered by a non-renewable and dangerous energy source like fossil fuels, causes an irreversible degradation of the planet.

We need to get out of the linear economy and adopt a circular economic model where raw materials are used in the smallest possible quantity and with the highest efficiency to fabricate things designed not only for use, but also for being repaired, reused, collected, and recycled to provide new useful materials. To run a circular economy we need renewable energies that can be obtained from sun, wind, water.

Renewable energies are abundant and, in principle, fossil fuels could be completely replaced by 2050. In practice, however, there are problems because renewable energies must be converted into the forms of energy that we need in everyday life: electricity, heat and fuels. Such a conversion is performed by devices (e.g., PV cells and wind turbines) that must be constructed starting from the elements of the Periodic Table. While some elements are abundant, others are scarce. So the bottleneck for energy production is not the number of photons arriving from the sun or the availability of wind, but the accessibility of the elements needed for constructing devices for energy conversion and storage. Chemistry can play a fundamental role in solving this problem, by: (i) replacing critical elements with other more abundant; (ii) redesigning chemical processes; (iii) reducing the amount of materials used; (iv) increasing efficiency of devices for energy conversion and storage; (v) improving recycling processes.

Energy availability is a very important factor to reach a good level of human development, but above a certain amount of energy consumption any further increase has no effect or it is even damaging. In developed countries there is a need of reducing energy consumption. In principle, this result can be reached by increasing efficiency. Experience shows, however, that increasing efficiency most often does not reduce energy consumption (rebound effects). Effective reduction of energy consumption can only be obtained by focusing on sufficiency, which means reducing use of products or devices.

- N. Armaroli, V. Balzani: *Energy for a Sustainable World – From the Oil Age to a Sun-Powered Futur*e, Wiley-VCH, 2011.
- N. Armaroli, V. Balzani: *Energia per l'astronave Terra. Terza edizione. L'era delle rinnovabili,* Zanichelli, 2017.

The Versatility of Mesoscopic Solar Cells

Anders Hagfeldt

Laboratory of Photomolecular Science, Swiss Federal Institute of Technology Lausanne (EPFL)
CH-1015, Lausanne, Switzerland
Anders.hagfeldt@epfl.ch

In our work on solid-state dye-sensitized solar cells (ssDSSC) we have recently [1] shown that copper phenanthroline complexes can act as an efficient hole transporting material. We prepared ssDSCs with the organic dye LEG4 and copper(I/II)-phenantroline as redox system and achieved power conversion efficiencies of more than 11%. Our follow up work on electron transfer studies and device optimization will be presented at the meeting.

In our work on perovskite solar cells (PSC) we have achieved efficiencies above 20% with a mixed composition of iodide/bromide and methyl ammonium/formamidinium [2]. For cells larger than 1 cm^2 we recently certified a record efficiency of 19.6% [3], replacing the anti-solvent step in the perovskite film formation with a vacuum flash treatment. With the use of SnO_2 compact underlayers as electron acceptor contacts we have constructed planar perovskite solar cells with a hysteresis free efficiency above 20% [4]. Recently, we have taken the cation mixing of the perovskite film further by including the Cs^+ in a so-called ‘triple cation’ composition, i.e. Cs/FA/Ma. Larger grains grown in a monolithic manner are observed and for example reproducibility and device stability are improved [5]. At the meeting we will discuss our follow up works [6] and present our champion data; up to 22% efficiency with an external electroluminescence of 4%, and an outstanding open-circuit voltage of 1.24 V at a band gap of 1.63 eV entailing one of the smallest loss-in-potential of 0.39 V ever measured for any solar cell material. Furthermore, we will report a breakthrough in stability at 85 ^{o}C for 500 h under full solar illumination and maximum power point tracking (during which 95% of the initial performance was retained).

References

[1] Freitag et al., Energy & Envir. Sci., DOI: 10.1039/C5EE1204J
[2] Bi et al., Science Advance, DOI: 10.1126/sciadv.1501170
[3] X. Li et al., Science, DOI:10.1126/science.aaf8060
[4] Correa et al., Energy & Envir. Sci., DOI:10.1039/C5EE02608C
[5] M. Saliba et al., Energy & Envir. Sci., 2016, DOI: 10.1039/C5EE03874J
[6] M. Saliba et al., Science 10.1126/science.aah5557 (2016)

Critical materials and the circular economy
European actions and opportunities

David Peck

Senior Research Fellow, Critical Materials and Circular Cities, Faculty of Architecture and the Built Environment, Delft University of Technology (TU Delft), The Netherlands
E-mail of presenting author: d.p.peck@tudelft.nl

Rarely in history do we get the opportunity to rethink the entire economic system. The "take-make-waste" way of doing things is coming to an end and Europe is leading the change. Everyone has a role to play in the circular economy which is emerging. In this new world we will reuse, repair, refurbish, remanufacture and recycle products and in doing so value will be created for the benefit of everyone. In the circular economy materials which used to be regarded as 'waste' can be turned into the things we all need. It is this significant change that this presentation will cover

Leading universities, businesses, and governments, are currently exploring how to make the circular economy happen. This lecture will give an introduction on what is currently happening and in particular will highlight the problem of critical materials. The opportunities and barriers in the transition towards a more circular system will be explored, and funded programmes and case studies will be shown.

Of Prions and Other Tales

Giuseppe Legname [a]

[a] *Scuola Internazionale Superiore di Studi Avanzati (SISSA), via Bonomea 265, 34136 Trieste, Italy*

Prions are unique protein molecules able to replicate in mammal hosts leading to devastating diseases known as prion diseases.

The molecular mechanism underlying prion protein conversion to the infectious form of prion is still quite obscure. Many studies have focused on the structure of the physiological molecule and/or the identity of the pathological form. While the structure of the former is well established, information about the latter is just emerging. In this lecture, I will focus on our knowledge (and mainly our ignorance) about the structural events leading to the formation of a nascent prion molecule.

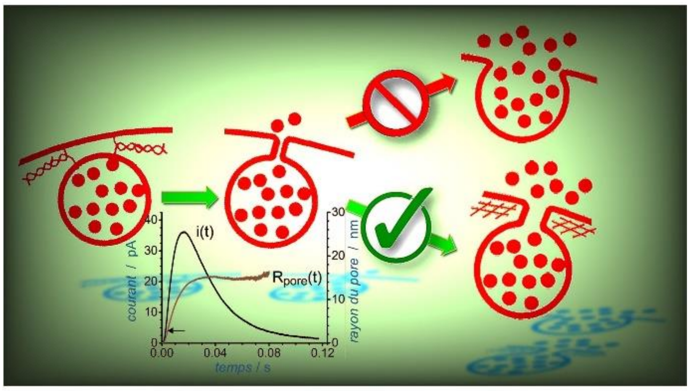
In addition, the relevance of prion conversion and replication mechanisms will be discussed for other proteins involved in neurodegenerative diseases.

Seeing, Measuring and Understanding Vesicular Exocytosis of Neurotransmitters with Micro- and Nanoelectrodes

Christian Amatore

Ecole Normale Supérieure-PSL Research University, Sorbonne Universités-UPMC Univ. Paris 06, CNRS UMR 8640 PASTEUR and LIA CNRS NanoBioCatEchem, 24 rue Lhomond, 75005 Paris, France
christian.amatore@ens.fr

Vesicular exocytosis is a biological nanoscale process of crucial importance for cells and tissues communication in humans as well as in most animals. This involves a connection between nanometric vesicles contained inside a cell with the cell membrane occurring by creation of a fusion nanopore across the two membranes through which biologically active molecules stored inside the vesicle are released into the extracellular environment (synaptic cleft, circulating fluids, *etc*.). Despite the minute released amounts (from thousands or millions of molecules), single exocytotic events can be studied by means of the 'artificial synapse' amperometric method (1), in which a cell is interrogated by a carbon fiber microelectrode collecting and oxidizing released molecules so that the finely-structured electrochemical current measured with micro- and nanoelectrodes quantitatively tracks the exocytotic flux. Our purpose in this lecture is to show and explain how this information can be used to derive dynamic information about these phenomena to obtain the time-dependent radius of the fusion nanopore (2). However, the feasibility of such reconstruction requires that one of the characteristic dimensions is known as an independent entry. To this end, we resorted to initial fusion nanopore radius values (*viz*., 1.2±0.35 nm), which are well established by patch-clamp measurements. This allowed determining the average neurotransmitter diffusion rate within the vesicle, which in turn permitted reconstructing the fusion nanopore dynamics during neurotransmitter release in endocrine cells (3,4,5). The same approach was used to investigate neurotransmitter release from single functional neuronal synapses, using nanoelectrodes sufficiently small to be inserted inside neuro-muscular synapses (6,7,8).



Owing to the large number of spikes available in amperometric traces this afforded statistically significant distributions of initial and final fusion pore sizes (5,6,7,8). This established unambiguously for the first time that the "full fusion" stage does not end into full fusion but stops after less than ca. 1% of the vesicle membrane surface area is integrated in that of the cell. These results indicate that the fusion mechanism is more complex than thought up to now and is most certainly regulated by an active participation of the actin cytoskeleton or of proteins complexes.
This is an essential finding that rules out a classical paradigm of neurobiology (5,9,10) and may stimulate new medical approaches to treat neurological disorders.

References: **1.** C. Amatore *et al.*, *Chem. Rev.*, 108, 2585-2621 (2008). **2.** C. Amatore *et al.*, *ChemPhysChem*, 11, 149-158 (2010); *ChemPhysChem*, 11, 159-174 (2010). **3.** A. Oleinick *et al.*, *Faraday Discuss.*, 164, 33–55 (2013). **4.** A. Oleinick *et al.*, *J. Electrochem. Soc.*, 163, H3014-H3024 (2016). **5.** A. Oleinick *et al.*, *Proc. Royal Soc. A*, 473, 20160684 (12 p.) (2017). **6.** Y.T. Li *et al.*, *Angew. Chem.*, 53, 12456-12460 (2013). **7.** Y.T. Li *et al.*, *Angew. Chem.*, 54, 9313–9318 (2015). **8.** S. Majdi *et al.*, *Angew. Chem.*, 7, 13609-13612 (2015). **9.** J. Lovric *et al.*, *Faraday Discuss.*, 193, 65-79 (2016). **10.** L. Ren *et al.*, *Quarter. Rev. Biol.*, 49, 1-27 (2016).

Organic Synthesis Goes Flow - The Use of Continuous Flow Technology for the Synthesis of Active Pharmaceutical Ingredients

C. Oliver Kappe

Institute of Chemistry, University of Graz, and Research Center Pharmaceutical Engineering
8010 Graz, Austria

oliver.kappe@uni-graz.at

Continuous flow processes form the basis of the petrochemical and bulk chemicals industry where strong competition, stringent environmental and safety regulations, and low profit margins drive the need for highly performing, cost effective, safe and atom efficient chemical operations. In contrast to the commodity chemical industry, however, the fine chemical industry primarily relies on its existing infrastructure of multipurpose batch or semi-batch reactors. Fine chemicals, such as drug substances and active pharmaceutical ingredients (APIs), are generally considerably more complex than commodity chemicals and usually require numerous, widely diverse reaction steps for their synthesis. These requirements generally make versatile and reconfigurable multipurpose batch reactors the technology of choice for their preparation. However, the advantages of continuous flow processing are increasingly being appreciated also by the pharmaceutical industry and, thus, a growing number of scientists, from research chemists in academia to process chemists and chemical engineers in pharmaceutical companies, are now starting to employ continuous flow technologies on a more routine basis (1).

In this lecture, contributions from our research group in the field of continuous flow processing will be highlighted. Emphasis will be given to highly atom efficient and process intensified chemical transformations useful for the synthesis of APIs or key intermediates that are often too hazardous to be executed in a batch reactor. These involve azide (2), diazomethane (3) and nitration (4) chemistry, selective precious metal-free olefin (5) and nitrogroup (6) reductions, oxidation reactions involving pure oxygen (7) and flow photochemistry applications (8).

References: 1. Review: Gutmann, B.; Cantillo, D.; Kappe, C. O. *Angew. Chem. Int. Ed*. **2015**, *54*, 6688. 2. Gutmann, B.; Roduit, J.-P.; Roberge, D.; Kappe, C. O. *Angew. Chem. Int. Ed.* **2010**, 49, 7101. 3. Mastronardi, F.; Gutmann, B.; Kappe, C. O. *Org. Lett.* **2013**, *16*, 5590. 4 Cantillo, D.; Damm, M.; Dallinger, D.; Bauser, M.; Berger, M.; Kappe, C. O. *Org. Process Res. Develop.* **2014**, *18*, 1360. 5. Pieber, B.; Martinez, S. T.; Cantillo, D.; Kappe, C. O. *Angew. Chem. Int. Ed*. **2013**, *52*, 10241. 6. Cantillo, D.; Baghbanzadeh, M.; Kappe, C. O. *Angew. Chem. Int. Ed*. **2012**, *51*, 10190. 7 Gutmann, B.; Weigl, U.; Cox, D. P.; Kappe, C. O. *Chem. Eur. J.* **2016**, *22*, 10393. 8 Cantillo, D.; de Frutos, O.; Rincon, J. A.; Mateos, C.; Kappe, C. O. *Org. Lett.* **2014**, *17*, 5590.

How will Green Chemistry Influence the Future?

Paul T. Anastas

Yale University

The future will look like largely what we design it to look like. We have spent the past 200 years as a society inventing new technologies that have focused on a very narrow definition of performance and function. While we have revolutionized everything from energy to agriculture to materials, we have also inflicted tremendous harm on the plant and its occupants during the same time period. Green Chemistry supplied the tools and frameworks to allow for designing for sustainability such that new advances can be made while making positive impact for humans and the environment.
This talk will focus on the future and the role green chemistry must play.

Marine organic aerosol in Marine Boundary Layer

Maria Cristina Facchini[a], *Colin O'Dowd*[b], *Roberto Danovaro*[c,d]

[a] *Institute of Atmospheric Science and Climate Bologna, Italy;* [b] *School of Physics, National University of Ireland Galway, Ireland;* [c] *Department of Life and Environmental Sciences , Polytechnic University of Marche, Ancona, Italy; Stazione Geologica Anton Dohrn, Napoli*
mc.facchini@isac.cnr.it

Studies performed during the past years suggest that biogenic organic compounds play an important role in submicron marine aerosol chemical composition over biologically productive, high latitude, marine regions, in both hemispheres and new biogenic oceanic sources of primary and secondary origin of OA were revealed. We discuss on the global importance of biogenic OA marine sources, their high spatial and temporal variability and the complex interaction with gaseous biogenic precursors and oceanic biotic components (phytoplankton, viruses and bacteria). Submicron marine organic aerosol are a complex mixture of biogenic materials transferred from the ocean surface by the sea spray or by oxidative gas to particle conversion of volatile organics emitted by decomposition processes of oceanic dissolved organic carbon. The role of marine biota on the evolution of plankton bloom and on the partitioning of oceanic organic carbon in POC and DOC reservoirs and transfer mechanisms into MBL will be presented.

Lies, damned lies: detecting forgeries and manipulations in published scientific images

Enrico Bucci[a,b]

[a] *Resis Srl Resis Srl, Via Ivrea, 8/1, 10010 Samone (TO), Italy;* [b] *Sbarro Health Research Organization, c/o Temple University, 1900 N 12th St - 19122 Philadelphia, PA - USA; E-mail: enrico.bucci@resis-srl.com*

Since the commercial introduction of digital imaging software in the ’80s, the preparation of high quality images for publication in scientific papers became virtually unlimited. Image production and enhancement, including contrast, luminance and more complex filtering operations, greatly enhanced the clarity of published images, without the need to involve highly skilled artists as it used to be in the past. While this process enhanced the way results are communicated to the public, it also allows several possible forms of misconduct, which range from different types of data falsification to full fabrication of experimental images from scratch. Luckily at the very same time the digitalization of scientific publishing and the emergence of Internet as the main dissemination medium of papers led to the development of tools apt to look for tale-telling signatures in images, so to flag potential manipulations. Some of these tools and the results obtained by large-scale screening experiments will be presented; a general scheme for a standard definition of image manipulation misconduct will eventually be discussed.

Overview of the R&D program at Eni

Francesca Ferrazza

Eni S.p.A. Research and Technology Innovation, VP;
francesca.ferrazza@eni.com

In the context of the worldwide growth of the demand for low carbon energy supply, renewable resources will represent an increasingly important part of the energy mix. Nowadays this sector is expanding, particularly in areas where incentives are granted by local and national institutions, with the expectation of developing self-sustaining technologies from the economic, environmental and social aspects. Eni has a broad research and development program focused mainly but not solely on solar energy and advanced biofuels, with the objective of developing clean, sustainable sources of energy for the future energy mix.

Concentrating solar power (CSP) is the oldest and conceptually simplest solar energy technology. The solar radiation is concentrated using lenses or mirrors on a high thermal capacity fluid, heating it to high temperatures for the production of steam. CSP can be integrated in natural gas fueled power stations, and can be equipped with thermal storage to increase its flexibility in steam applications. It is estimated (Roadmap IEA 2010) that CSP will produce 5% of electricity by 2020 in the more favorable areas (12% by 2050 on a worldwide scale). Eni research focuses on the development of advanced parabolic collector prototypes developed in collaboration with MIT and the PoliMi, the identification of innovative low-cost heat-carrying fluids and the development of advanced coatings for receiving pipes, while evaluating the potential for integration with O&G operations.

Organic solar cells (OPV) are a class of emerging photovoltaic devices with interesting potential because they use non-toxic and abundant materials and can be produced using low-cost roll to roll printing technology. The devices currently have lower performances than commercially available modules, in terms of efficiency and lifetime, although steadily progressing thanks to research and development efforts. Eni program on OPV includes the development of innovative patented materials for device fabrication, and of a specific know-how for the fabrication of full modules.

Luminescent solar concentrators (LSC) are made up of sheets of transparent material, either plastic or glass, doped with fluorescent dyes which absorb a part of the sun radiation, re-emitting it a greater wavelength. The light is guided by internal reflection towards the thin edges of the sheet, where it is concentrated on small-sized conventional photovoltaic cells. The performance of this device is closely related to the properties of the fluorescent dyes used Unlike most traditional photovoltaic modules, these systems also work well at low intensity anon direct light, thanks to the fact that the dyes are able to absorb sunlight from every direction. Eni has developed patented LSC dyes of various colors, and built a solid proprietary know-how for the realization of working prototypes and demo systems.

Eni's research in the field of advanced bio-oils for transformation in green diesel is engaged in the conversion of ***cellulosic waste into microbial oils*** with very similar characteristics to vegetable oils. The process uses oleaginous microorganisms (yeasts) able to accumulate a large quantity of lipids inside the cells, which can be extracted and transformed in biofuel for example through the Eni-UOP Ecofining process. The Green Diesel produced in this way can easily be blended with traditional diesel and is completely compatible with present day engines.

Waste-to-Fuel technology thermally converts solid organic waste into bio-oil that can be used for producing electricity or upgraded to diesel fuel. The process is based on a liquefaction process thanks to the water contained in the original biomass. This technology uses raw materials for which an established collection system already exists, and offers an alternative solution to the problem of dealing with waste/sewage sludge from urban areas while respecting the environment.

Sessione del Gruppo Senior:
Chimica e Sport

Doping-Antidoping and the Role of the Bio-medicolegal Sciences

Santo Davide Ferrara

Department of Legal Medicine and Toxicology, University Hospital of Padova

The idea that a substance, a product, a magic potion, or a practice can somehow relieve the fatigue and suffering of human life has always been part of cultures in general and perhaps concerns the collective unconscious. Healing and survival have always been transformed in sport into the need to excel and win, even through the use of "potions", "practices" or "doping", experienced without negative values, and applied with shifting strategies, adapted to the evolution of available products, to become "systematic care" that accompanies the athlete throughout their competitive life.

Anti-doping, so far a simulacrum of opposition to the complex and exponential "socio-cultural and sporting" inevitability of the doping phenomenon, has only found positive indications in the recent and rapid evolution of science in the “post-modern society of risk”, at once globalized and glocalized.

The development of scientific research and the reduction of “black biomedical holes” will benefit from the platforms of the future constituted by imaging, omics and bio-analytical sciences. *Imaging* will evolve at the same pace both in the field of the living and that of the dead, and in the *omics* and *bio-analytical sciences* as well as the clinical and forensic fields.

In the current state of omic maturity, recent innovations in the development of mass spectrometry, cutting-edge technology and computational tools, have considerably increased the power and the potential application of the multi-omic approach, and in spite of the still ongoing progress in the methodologies, their application can already provide informative results leading to more accurate interpretations and evidence.

The integration of omic strategies in the bioanalytical research pipeline has created new opportunities for better understanding the molecular mechanism involved in physiological and pathophysiological states. The methodology has been successfully applied in numerous areas (cancer, cardiovascular disease, obesity, etc.), creating the *Integrative Personal Omics Profile.* Because of its capability to detect slight changes in large datasets, *metabolomics* is also impacting the field of medico-legal disciplines, particularly toxicology, to determine signatures of exposition, susceptibility or toxicity and identify new direct or indirect biomarkers of doping or drug abuse.

Quantitative *Imaging techniques* such as functional MRI, molecular imaging, photoacoustic tomography/endoscopy or the integration of the two, as well as x-ray CT fluorescence molecular tomography, will be the second key platforms of biomedical research in the future. Ptychographic–CT, Optical Frequency Domain, Spectral Optical Tomography and Fluorescence Molecular Tomography will enable the development of algorithms, for the time being based on population data which, if adopted uniformly and applied methodically by the international scientific community, will be able to increase the accuracy of the single discipline.

In the current post-modern society, where Holistic – Personalized and Humanistic Biomedicine is axiomatic, the Evidence can be revealed and understood in full as *Accuracy,* namely, *Truth* equivalent to *Reality*. Moreover, the growing need for certainty in the realm of justice is reflected in the demand for biomedical-molecular, as opposed to opinion-based, evidence.

To be effective and entirely suited to the needs and requirements of the Judicial System, *the future should therefore be* oriented towards the elaboration of a *Mathematical Algorithm* of Evidence, founded on the increased accuracy of the various disciplines. In the meantime, it will be the task of the scientific community and, markedly, of the International Scientific Societies, to sustain an effort of collaboration in the realization of a *Master Plan* on *Evidence* and *Accuracy*, so as to be able to definitively declare to the *Justice System* the real capacity of the sciences to furnish truth and proof in doping-antidoping system cases.

References: Ferrara SD, P5 Medicine and Justice; the future is now. Int J Legal Med (2017) 131: 897-899

The great changes in the 4th industrial revolution

Luigi Nicolais

Università degli Studi di Napoli Federico II

The application of Information and Communication Technologies to business processes, the more and more automated and interconnected production processes, and the advent of Internet of Things have anticipated the fourth industrial revolution from which derives the term industry 4.0.

Industry 4.0 is "the comprehensive transformation of the whole sphere of industrial production through the merging of digital technology and the internet with conventional industry" (*Angela Merkel, German Chancellor - Organization for Economic Co-operation and Development, 19 February 2014*).

The fourth industrial revolution is a technological and social change. In fact, the new technologies (I.o.T., cloud, additive manufacturing, big data, advanced robotics and smart materials) often re-structures socio-cultural, political and economic conditions, which in turn change the employment landscape. For example, these technologies (connectivity, computing power, and automation) have given rise to new business models: customer centricity, circular economy, sharing economy, market strategies ICT-based and maker economy.

Grafene e Sue Possibili Applicazioni Industriali

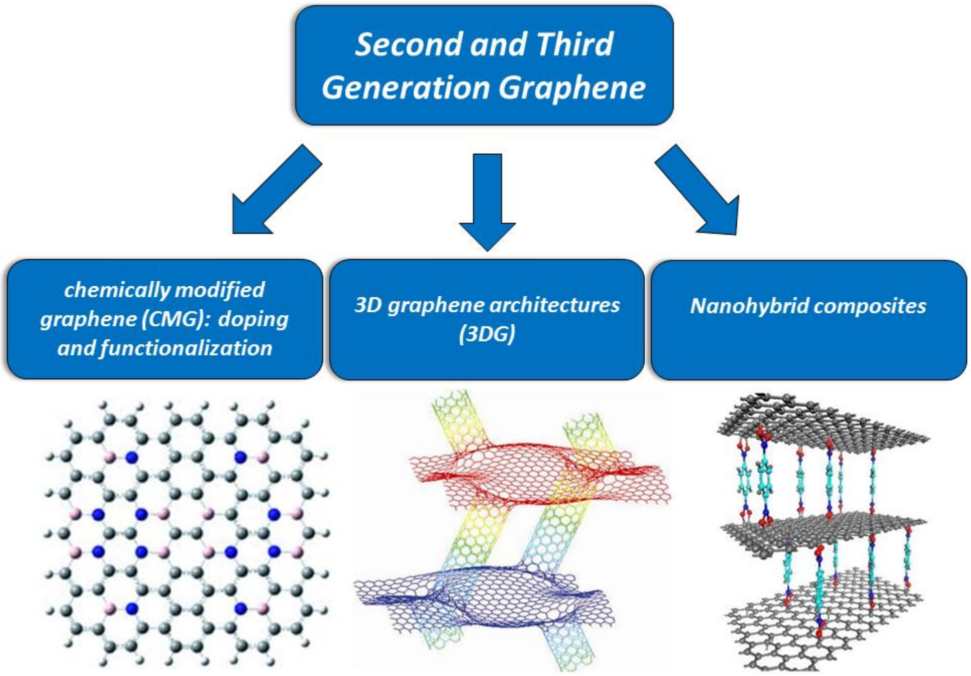
Graphene and Its Possible Industrial Applications

Second and third generation graphenes for energy conversion

Stefano Agnoli and Gaetano Granozzi

Surface Science and Catalysis Group (SSCG), Dipartimento di Scienze Chimiche,
Università di Padova, via Marzolo 1, 35131, Padova
E-mail gaetano.granozzi@unipd.it

Graphene (G) is an extremely intriguing material that is arousing a formidable interest in many different fields since it was first produced in a conscious manner in a lab in 2003. So many words have already been spent to emphasize its peculiar properties that it is needless to add more efforts to convince scientists on the actual breakthroughs that graphene can provide. Nowadays, the forefront of G research has progressed from the simple preparation and characterization of G toward second generation G-based materials, i.e. chemically-modified graphene (CMGs), and third generation 3D systems based on the assembly CMG sheets (3DGs) or nanohybrids composites with other nanostructures (e.g. nanoparticles or molecules).



The potential of such materials in the field of sustainable energetics (photovoltaics, fuel cells, batteries, supercaps…) has been clearly outlined in recent review articles (1-3). In the present communication the author will briefly summarize the state of the art and will present some recent results from the SSCG of the University of Padova in the field of electrochemical conversion (4-5).

References:
1. R. Raccichini, A. Varzi, S. Passerini and B. Scrosati, Nat. Mat. 2015, 14, 271
2. N. Mahmood, C. Zhang, H. Yin and Y. Hou, J. Mater. Chem. A 2014, 2,15
3. F. Bonaccorso, L. Colombo, G. Yu, M. Stoller, V. Tozzini, A.C. Ferrari, R.S. Ruoff, V. Pellegrini, Science 2015, 347 41
4. M. Favaro, L. Ferrighi, G. Fazio, L. Colazzo, C. Di Valentin, C. Durante, F. Sedona, A. Gennaro, S. Agnoli and G. Granozzi, ACS Catal. 2015, 5, 129
5. F. Carraro, L. Calvillo, M. Cattelan, M. Favaro, M. Righetto, S. Nappini, I. Pís V. Celorrio, D. J. Fermín, A. Martucci, S. Agnoli and G. Granozzi, ACS Appl. Mater. Interfaces 2015, 7, 25685

CVD graphene: transparency, conductivity and flexibility, three inseparable properties to develop innovative applications

Giovanni Bruno

Institute of Nanotechnology, CNR-NANOTEC, Dept of Chemistry, University of Bari, Via Orabona 4 70125 Bari

Over the last decade, there has been an intense activity aimed at the development of a synthetic technique capable of producing the "best" graphene, i.e., a graphene that *"clearly reveals itself in a pronounced ambipolar electric field effect"* (1). Nowadays, the most widely used production methods, depending on the specific applications, are the CVD for the growth of large-area graphene films and the graphite exfoliation for the production of large quantities of graphene flakes. However, there is no doubt that the success of the "wonder" graphene is due to three inseparable physical properties that can be considered "graphene values": transparency, conductivity and flexibility. There have been many efforts to utilize these outstanding properties of graphene in existing and "new" devices for a variety of applications, such as transparent conducting layers in optoelectronics (OLED, photodetectors, photovoltaic cells, touch panel displays,….) (2-7). Although there are many applications demonstrated at lab scale, the development of "best-graphene" technologies is slower than the graphene community expected. The reasons are many and varied, but we have to agree that demonstrating even more the potentialities of the "best graphene" is of primary concern.

The talk will touch on topics that are explored in our lab: CVD graphene growth and transfer on substrates, graphene doping and functionalization. Also, I will share my thoughts on some aspects that require a greater insight into the research for the definitive affirmation of CVD-graphene technology

References:

1. A. K. Geim, K. S. Novoselov. Nature Materials, **6**, 183 - 191 (2007)
2. S. Ba et al, Nature nanotechnology **5**,574 (2010)
3. F. Bonaccorso t al, Nature Photonics, **4**, 611 - 622 (2010)
4. D.Pile, Nature Photonics, **1**, 506 (2016).
5. 2. M. Grande, et al, Scientific Reports, , **5**, 17083 (2015)
6. 3. M. Grande, et al, OPTICS EXPRESS, , **24**, 22788 (2016)
7. 4. L. La Notte, et al, Nanoscale, , **9**, 62 (2017)

Facile and sustainable functionalization method for preparing graphene layers with different solubility parameters

Maurizio Galimberti, Vincenzina Barbera, Andrea Bernardi, Alessandro Rosengart

Politecnico di Milano, Department of Chemistry, Materials and Chemical Engineering ʻG. Natta'
Via Mancinelli 7, 20131 Milano, Italy;
maurizio.galimberti@polimi.it

Graphene has exceptional properties: high charge-carrier mobilities, in-plane thermal conductivity, very high elastic modulus. Such properties essentially arise from the six atoms aromatic ring repeating unit of graphene layers. Hence, objective of graphene synthesis and functionalization should be to obtain and preserve such structure. Graphene functionalization has indeed great importance: electronic and solubility properties, self-assembly and phaseforming behaviour are affected by functional groups.

In this work, a functionalization method was developed (1,2), able to introduce functional groups in peripheral positions of graphene layers, without appreciably altering graphene structure. Functionalization was performed by using molecules whose basic structure is shown in Figure 1. A pyrrole ring with different substituents on the nitrogen atom was used.

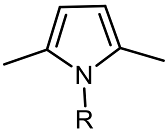


Figure 1

Synthesis of these molecules was performed with high atom economy (larger than 80%), high yield (up to 99%) and thus high atom efficiency, the only byproduct being water, in the absence of solvent and catalyst (3).

Reaction between such molecules and nanosized high surface area graphites was performed by simply mixing them, donating either mechanical or thermal energy. Functionalization occurred with almost quantitative yield. This process has a low environmental impact.

Thanks to such functionalization method, solubility parameter of graphene layer was changed in a broad range, obtaining stable layers' suspension in water, hexane, toluene. Form such suspensions, few layers graphenes were isolated. Moreover, even dispersions of graphene layers were prepared in polymer matrices such as poly(1,4-*cis*-isoprene), poly(styrene-co-butadiene), poly(urethane).

This work presents a facile, sustainable, economically viable functionalization method of graphene layers, suitable for preparing few layers graphene from nanosized graphite and for matching the solubility parameters of polymer matrices, achieving even dispersions and intimate interactions.

References: 1. Galimberti M. S., Barbera V., Sebastiano R., Valerio A. M., Leonardi G., Citterio A.: Adducts between carbon allotropes and serinol derivatives. Word Patent WO2016050887 (2016). 2. Galimberti M., Barbera V., Guerra S., Conzatti L., Castiglioni C., Brambilla L., Serafini A.: Biobased Janus molecule for the facile preparation of water solutions of few layer graphene sheets. RSC Advances, 5, 81142–81152 (2015). 3. Barbera V., Citterio A., Galimberti M. S., Leonardi G., Sebastiano R., Shisodia S. U., Valerio A. M.: Process for the synthesis of 2-(2,5-dimethyl-1*H*-pyrrol-1-yl)-1,3-propanediol and its substituted derivatives. Word Patent WO/2015/189411 (2015).

Continuous flow synthesis of functionalized graphene

Michele Maggini[a], *Meng Zheng*[a], *Simone Silvestrini*[b]

[a] *University of Padova, Department of Chemical Sciences, Via Marzolo 1 35131 Padova;* [b] *Institut de Science et d'Ingénierie Supramoléculaires, 8 allée Gaspard Monge, 67083 Strasbourg Cedex, France*
michele.maggini@unipd.it

Microfluidics is a powerful tool for the smart management of chemical reactions. It has been shown that the flow chemistry approach allows for precise control over process parameters, ease of optimization and simplified scale-up from lab-scale to production modules. These features are useful when dealing with complex systems, where reactants are not molecular in nature, as in the case of carbon nanostructures whose chemical functionalization gives nano-sized functional components for a wide range of applications. We focused on the addition to graphene materials of aryl radicals, generated in situ by treatment of aryl amines with alkyl nitrites. This approach has been widely employed for the functionalization of carbon nanostructures. It has been observed that the addition of aryl radicals can result in different layers of the functional molecules being added, therefore a control of both formation and density of oligomers on the graphene surface is needed to prepare derivatives with tailored properties. With this long-term goal, the presentation will outline our results on the covalent linking of different organic molecular structures on graphene and our chemical approach for its non-symmetrical functionalization.

Functionalization and applications of graphene-based materials

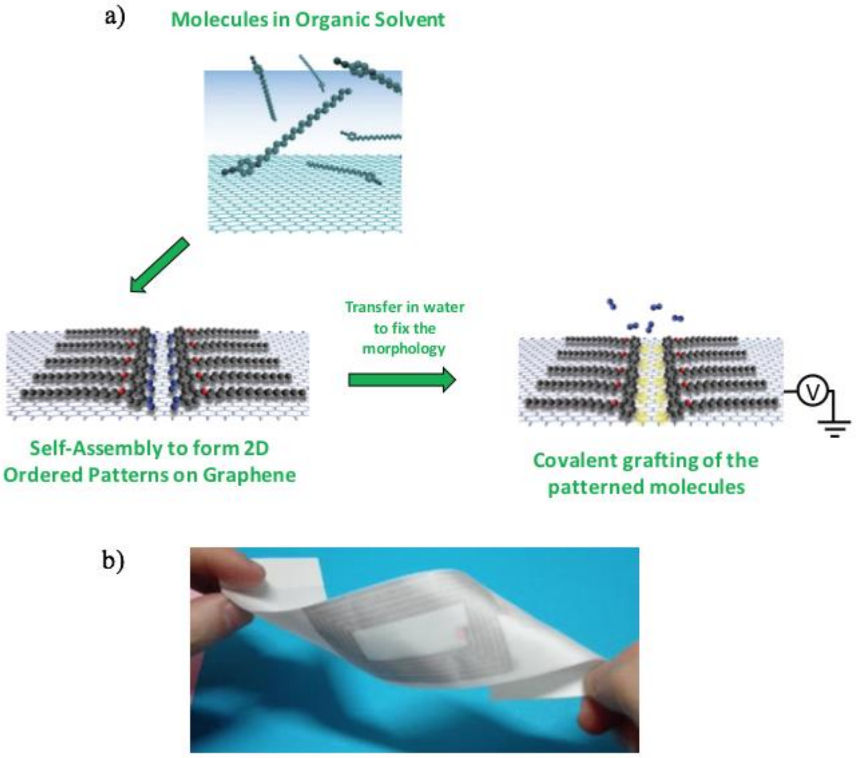
Emanuele Treossi[a], *Alessandra Scidà*[a], *Zhenyuan Xia*[a], *Vincenzo Palermo*[a]

[a] *CNR-ISOF, Via P.Gobetti 101, Bologna, Italy; emanuele.treossi@isof.cnr.it*

In this talk, we present some recent results obtained in our group on the chemical functionalization of graphene and a new application of graphene-based materials in flexible electronics.

In particular, we describe a fast and versatile method to functionalize high-quality graphene with organic molecules by exploiting the synergistic effect of supramolecular and covalent chemistry. The approach used is characterized by the independent control over the processes of immobilization of molecules on the substrate and their covalent tethering, enabling fast covalent functionalization of graphene (1).

Moreover, we present a highly flexible Near-Field Communication (NFC) antenna composed of layered materials obtained from re-stacking of graphene nanoplatelets. By combining material characterization, computer modelling and engineering of the device, the antenna could exchange information with NFC readers, such as a mobile phone, matching the performance of standard, commercial metallic antennas. The antennas are chemically inert, highly resistant to thousands of bending cycles and can be deposited on different standard polymeric substrates or silk tissues (2).



a) Scheme of the procedure used for chemical functionalization of graphene. b) Picture of a wearable NFC bracelet in silk with a graphene-based antenna.

References: 1. Electrochemical Functionalization of Graphene at the Nanoscale with Self-Assembling Diazonium Salts. Z. Xia, F. Leonardi, M. Gobbi, Y. Liu, V. Bellani, A. Liscio, A. Kovtun, R. Li, X. Feng, E. Orgiu, P. Samorì, E. Treossi, V. Palermo. ACS Nano, 10 (2016) 7125. 2. Flexible Graphene based NFC devices. E. Treossi, A. Scidà, S. Haque, A. Robinson, S. Smerzi , S. Ravesi, S. Borini, V. Palermo. In preparation.

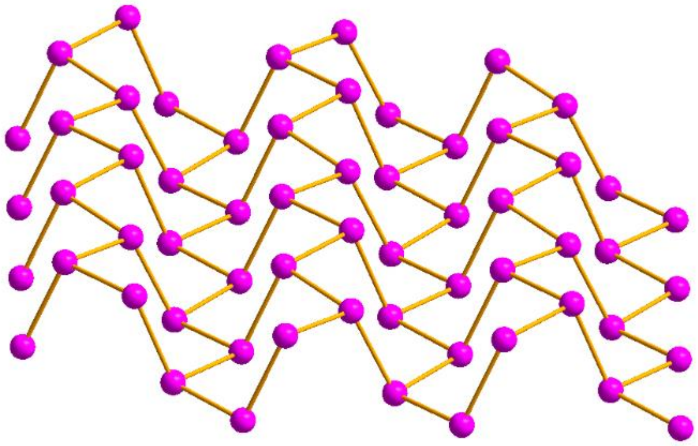
Black Phosphorus: from Ugly Duckling to Black Swan

Maurizio Peruzzini[a]

[a] *CNR-ICCOM Via Madonna del Piano 10, 50019 Sesto Fiorentino (FI)*
E-mail: maurizio.peruzzini@iccom.cnr.it

Black phosphorus was first synthesized more than one hundred years ago, but until recently it was considered only a scientific curiosity. In 2014 everything changed after the isolation of a new 2D material, the phosphorene, by both mechanical and wet exfoliation of black phosphorus. [1] Just as an example of the huge interest of the scientific community for black phosphorus is the number of papers that was grown exponentially from less than 10 in 2013 to more than 500 in 2016.

Phosphorene is a semiconductor and the value of its direct band gap depends on number of layers between 0.8 to 2.0 eV. This characteristic makes the material very attracting for a large number of applications in optoelectronics such as detectors for near and mid infrared radiation, light-emitting diodes or laser. Also several proofs of concept demonstrated the possibility of building black P-based detectors, modulators, RF transistors, sensors, etc. [2]



On the other side, the material is still in his infancy. Several issues have to be resolved before its full exploitation. In particular, with the aim of wide the material properties as well as to improve its stability and processability in air, we are working in optimizing protocols of reproducible and with high yield synthesis using the wet exfoliation route, the intercalation in different polymeric materials, the construction of devices and the chemical functionalization of this intriguing material. [3-5].

Acknowledgements: The authors thank the European Research Council for funding the project PHOSFUN "*Phosphorene functionalization: a new platform for advanced multifunctional materials*" (Grant Agreement No. 670173) through an ERC Advanced Grant to MP.

Thanks are expressed to all my colleagues participating in the PHOSFUN ERC project whose names are listed in refs 3 - 5

References: 1. X. Ling, H. Wang, S. Huang, F. Xia, M. S. Dresselhaus *PNAS* **2015**, *112*, 4523–4530; 2. A. Carvalho, M. Wang, X. Zhu, A. S. Rodin, H. Su, A. H. Castro Neto *Nature Reviews Materials*, **2016**, *1*, 16061; 3. M. Serrano-Ruiz, M. Caporali, A. Ienco, V. Piazza, S. Heun, M. Peruzzini, *Adv. Mater. Interfaces*, **2016**, *3*, 15000441; 4. E. Passaglia, F. Cicogna, G. Lorenzetti, S. Legnaioli, M. Caporali, M. Serrano-Ruiz, A. Ienco, M. Peruzzini *RSC Adv.*, **2016**, *6*, 53777–

53783; 5. N. Hemsworth, V. Tayari, F. Telesio, S. Xiang, S. Roddaro, M. Caporali, A. Ienco, M. Serrano-Ruiz, M. Peruzzini, G. Gervais, T. Szkopek, and S. Heun *Phys. Rev. B*, **2016**, *94*, 245404

Tailored polysulfone-graphene oxide adsorbers for water remediation

Manuela Melucci [a], *Cristian Bettini* [a], *Massimo Zambianchi* [a], *Emanuele Treossi* [a], *Andrea Liscio* [b], *Maria Luisa Navacchia* [a], *Vincenzo Palermo*[a]

[a] Consiglio Nazionale delle Ricerche, Istituto per la Sintesi Organica e la Fotoreattività,(CNR-ISOF), via P. Gobetti 101, 40129 Bologna, Italy; [b] Consiglio Nazionale delle Ricerche, Istituto dei Sistemi Complessi, (CNR-ISC), via del Fosso del Cavaliere 100, 00133 Roma, Italy.
manuela.melucci@isof.cnr.it

Growing worldwide attention has been paid to the increased occurrence of a vast array of organic contaminants of emerging concerns (EOCs) in urban wastewater system (1). Most of these compounds are recalcitrant to conventional wastewater treatments; consequently they are able to enter ground and even drinking water calling for new treatment technologies. Due to its high surface area, interactions capability with organic molecules and to surface chemical modification possibility, graphene oxide (GO) and GO-based materials are attracting increasing interest for environmental applications (2). In this presentation we summarize our work on the design, tailoring and synthesis of new GO based composites to be used as absorbers of organic contaminants from water. In particular the synergy of GO and polysulfone (PS), an hydrophobic polymer widely exploited for the fabrication of ultrafiltration membranes, for the removal of seven selected EOCs including pharmaceuticals and personal healthcare products is highlighted. Starting from tailored mixtures of PS and GO (5% w/w) we exploited phase inversion method to fabricate nano/microporous PS-GO composite adsorbers (Fig. 1) that were able to remove ofloxacin (antibiotic), benzophenone-3 (UV filter), rhodamine b (xanthenic dye), diclofenac (antiflammatory) and triton X-100 (surfactant) with efficiency higher than 90% with capacity in the range of tens of mg per g of adsorber, in a few hours treatment times (1-4 h). The mechanism of adsorption in relation to the molecular structure of the organic contaminant was rationalized in terms of hydrophobicity and dipole moment. PS-GO membrane adsorbers outperformed a commercial granular activated carbon (GAC) at low contact times and compared well at longer contact time for the majority of the targeted contaminants, suggesting the suitability of PS-GO composites for advanced water treatment.

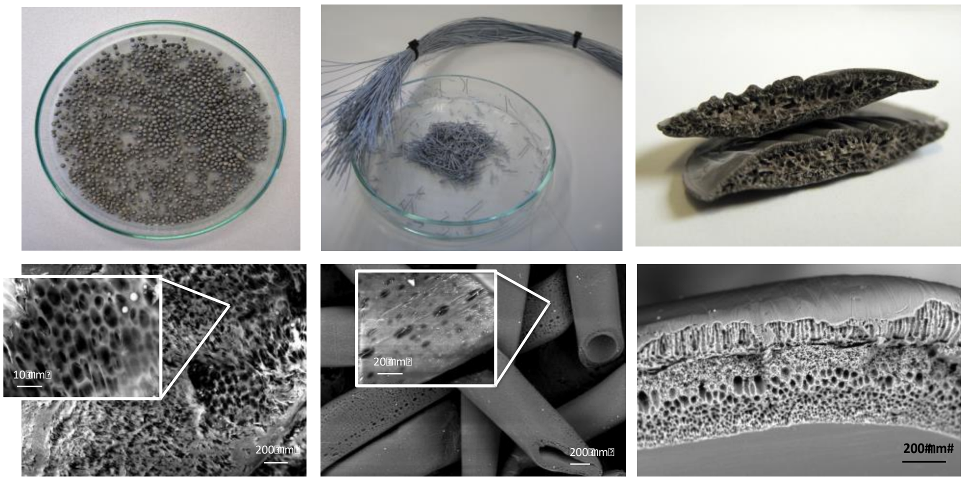


Fig. 1. PS-GO porous composites (top) and morphologies (scanning electron microscopy images).

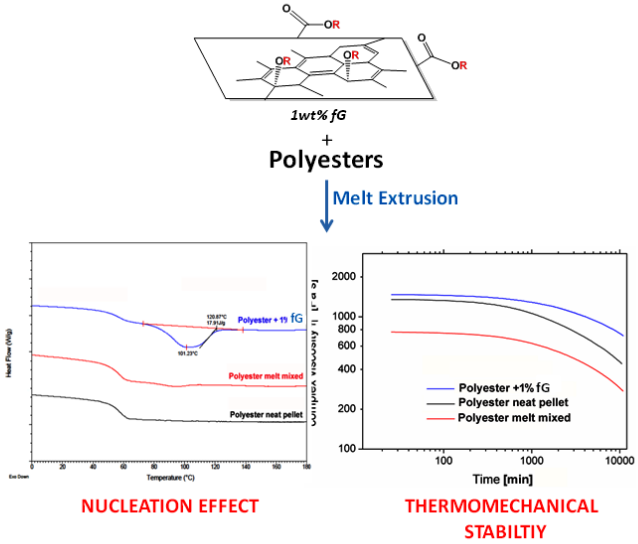
References: 1) B. Petrie, R. Barden, B. Kasprzyk-Hordern, Water Res. 2015, 72, 3-27; 2) F. Perreault, A. Fonseca de Faria and M. Elimelech, Chem. Soc. Rev., 2015, 44, 5861-5896.

New Applications of Oxidized Nanocarbons: from Catalysis to Nanocomposites

Maria Rosaria Acocella,[a] *Luciana D'Urso*, [a] *Felice De Santis*,[b] *Roberto Pantani*,[b] *Gaetano Guerra*[a]

[a] *Dipartimento di Chimica e Biologia, Università di Salerno, Via Giovanni Paolo II, 132- 84084-Fisciano(SA);* [b] *Dipartimento di Ingegneria Chimica, Università di Salerno, Via Giovanni Paolo II, 132- 84084-Fisciano(SA).*
E-mail: macocella@unisa.it

Oxidized Nanocarbons, mainly regarding Graphite Oxide (GO) and Oxidized Carbon Black (oCB) are 2D carbon nanostructures containing many hydrophilic groups, making them promising in many potential applications. In particular, GO and oCB has recently been used both as catalyst for important organic reactions (1-4) and as filler of polymers (5-7).
The first part of the contributes will describe preparation and use of oxidized nanocarbons, their ability to catalyze some important reactions and how this catalytic activity can be technologically relevant for polymeric matrices, mainly regarding epoxide and phenolic resins.
The second part of the contribution will be devoted to the incorporation of carbon nanofillers in several commercial biodegradable polyesters. In particular in this study we will show that the incorporation of oxidized nanocarbons induce polymer degradation during melt processing. On the contrary, their covalent functionalization minimizes polymer degradation in melt processing, thus allowing the production of polyesters/graphite-based nanocomposites. Furthermore, a nucleation effect was observed able to increase the crystallization kinetic ten times more than the usual filler.
We carried out functionalization of GO (fG) and oCB (fG) by introduction of alkyl groups by a well-known methodology (8) and acetyl groups by a new green procedure (9).With both functionalizations, improved melt stability and faster crystallization kinetic were achieved.



Nucleation effect and thermomechanical stability in biodegradable polyester/fG nanocomposites

References:
1) Acocella, M.R.; Mauro, M.; Falivene, L.; Cavallo, L.;Guerra, G. *ACS Catalysis* **2014**,4,492
2) Acocella, M.R.; Mauro, M.; Guerra, G. *ChemSusChem* **2014**,7,3279.3;
3). Acocella, M.R.; D Pascale, M.; Maggio, M; Guerra, G. *J. Mol. Catal.*, **2015**, *408*, 237;
4) Acocella, M.R.; D'Urso L., Maggio, M. Guerra, G.. *ChemCatChem* **2016**, 8,1915
5) Mauro, M.; Acocella,M.R.; Esposito Corcione, C.; Maffezzoli, A.; Guerra, G. *Polymer* **2014**,*55*,5612
6) Acocella,M.R.; Esposito Corcione, C.; Giuri, A., Maggio, M.,Maffezzoli, A.; Guerra, G. *RSC Adv.* **2016**, 6, 23858.
7) Acocella, M.R., Corcione C.e., Giuri, A.; Maggio, M. Guerra, G., Maffezzoli,A. *Polymers*,**2017,** 9, 133
8) Shim,S. H.; Kim, K.T.; Lee, J. U.; Won, W. H. *Appl. Mater. Interfaces* **2012**, 4, 4184.
9) Acocella, M.R., D'Urso, L., Maggio, M., Avolio, R., Errico M.E., Guerra, G *submitted* **2017.**

Vibrational spectroscopy investigations on graphene/Poly (lactic acid) composites

P. Musto[a], P. La Manna[a], M. Pannico[a], P. Russo[a], F. Cimino[a], G. Mensitieri[b]

[a1]Institute of Polymers, Composites and Biomaterials, National Research Council of Italy, via Campi Flegrei 34, 80078, Pozzuoli, Italy
[b]Department of Chemical, Materials and Production Engineering, University of Naples Federico II, P.le V.Tecchio 80, 80125, Napoli, Italy

Poly (lactic acid) (PLA), a biodegradable and biocompatible polymer, is suitable for food packaging, medical applications and implant devices. However, its applications are limited by intrinsic drawbacks including slow crystallization rate, low thermal stability, relatively poor mechanical and barrier properties. Adding nano-sized fillers provides a way to improve the performances of PLA and to expand the its applications. (1) To this aim, PLA based films containing low amounts (up to 0.75 wt %) of graphene nanoplatelets (GnPs) were prepared by a solvent casting procedure and characterized by vibrational spectroscopy. (2) Confocal Raman Imaging provided information on the distribution of GnPs taking advantage of the high spectroscopic contrast, the appropriate space resolution and sensitivity. In fact, the experiments carried out by this technique highlighted the presence of well-defined domains (≈ 15 µm) for PLA loaded at 0.25% wt (figure 1); while, at higher GNPs content (0.75 % wt) a co-continuous phase is distinguishable in the whole sample.

In-situ FTIR spectroscopy was used to study the diffusion of water vapor in pristine and in GnP modified films. It was demonstrated that the solubility and the diffusivity of H_2O vapor decrease appreciably by increasing the GnP content in the composite. The *time-resolved* spectra, analyzed by different techniques (difference spectroscopy, DS, least-squared curve fitting, LSCF and 2D correlation spectroscopy, 2D-COS) provided relevant and complementary information on the diffusion mechanism and the molecular interactions occurring between the penetrant and the polymeric host.

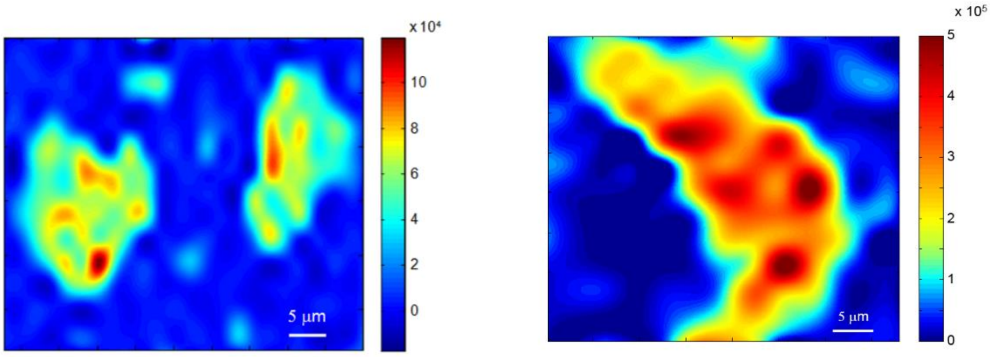


Figure 1. Confocal Raman Imaging of PLA/GnPs 0.25 wt % (left) and PLA/GnPs 0.75 wt % (right)

References

1. C. Goncalves, A. Pinto, A.V. Machado, J. Moreira, I. C. Goncalves, F. Magalhaes, *Polymer Composites* DOI 10.1002/pc.24050 (2016).
2. A. M. Pinto, J. Cabral, D. A. Pacheco Tanaka, A. M. Mendes and F. D. Magalhaes, *Polymer International*, 1, 33 (2013).

Porous graphene-based polyurethane foams-aerogel composites prepared via unidirectional freeze-drying process

T. Zhai [a,b], *P. Cerruti* [b], *L. Verdolotti* [b], *GG. Buonocore* [b], *M. Lavorgna* [b], *H.Xia* [c], *L. Ambrosio* [b]

[a] *Guizhou Building Material Quality Supervision Testing Center, Guiyang, China*
[b] *Institute of Polymers, Composites and Biomaterials (IPCB-CNR), Portici, Italy*
[c] *State Key Laboratory of Polymers Engineering Materials, Sichuan University, Chengdu, China*
Email: marino.lavorgna@cnr.it

Carbon based aerogels exhibit excellent properties, such as low density, high conductivity, outstanding adsorptive property. However, in most cases carbon aerogels are mechanically fragile and show poor resilience, which limit their applications. In this work, a novel complex structure with high electrical conductivity was designed based on open cell polyurethane foams (PUF) and reduced graphene oxide (rGO)/chitosan (CS) aerogel. The lightweight, highly porous, electrically conductive rGO/CS aerogel was formed in-situ within the PUF porous structure via unidirectional freeze-drying technique. The resulting structure is illustrated in Figure 1. As an integrated structure the aerogel was mechanically supported by the elastic PUF scaffold. However the conductive 3D network constructed by aerogel offered a robust conductive network throughout the whole material. Therefore this structure possess many unique features, such as good mechanical properties, excellent electrical conductivity and outstanding piezoresistive properties. To enhance the interface bonding, the PUF surface was coated by an rGO coating layer through liquid phase deposition process. The influence of rGO coating layer on the mechanical and electrical properties was investigated. The electrical properties in the parallel and transverse directions of aerogel growth are reported. This study provides a novel alternative approach to preparing high performance polymer nanocomposites with potential application prospects in many fields, including wearable sensors, catalyst carriers and adsorbent materials.

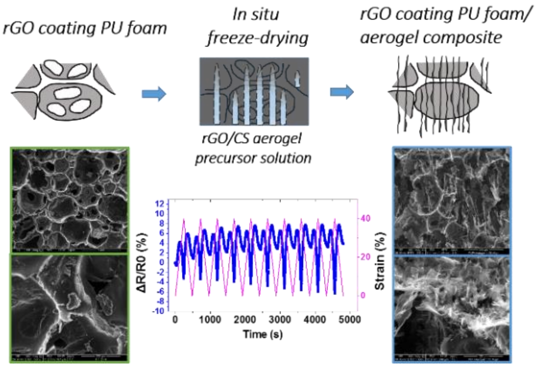


Figure 1: SEM images and stable piezoresistive property of the novel structure resulting from the *in-situ* formation of reduced graphene oxide/chitosan aerogel in the open cell polyurethane foam.

References:

1. Zhai, T., Zheng, Q., Cai Z., Turng L., Xia, H., Shao, Q. (2015) Poly(vinyl alcohol)/cellulose nanofibril hybrid aerogels with an aligned microtubular porous structure and their composites with polydimethylsiloxane, *ACS Appl. Mater. Interfaces*, 7, 7436-7444.
2. Yao, H., Ge, J., Wang, C., Wang, X., Hu, W., Zheng, Z., Ni, Y., Yu, S. (2013) A flexible and highly pressure-sensitive graphene-polyurethane sponge based on fractured microstructure design, *Adv. Mater*., 25, 6692-6698

Multifunctional properties of Graphene Nanoplatelets based nanolaminates

A. Martone[a]*, M. R. Ricciardi*[a]*, F. Cristiano*[b]*, F. Bertocchi*[b,c]*, M. Giordano*[a]

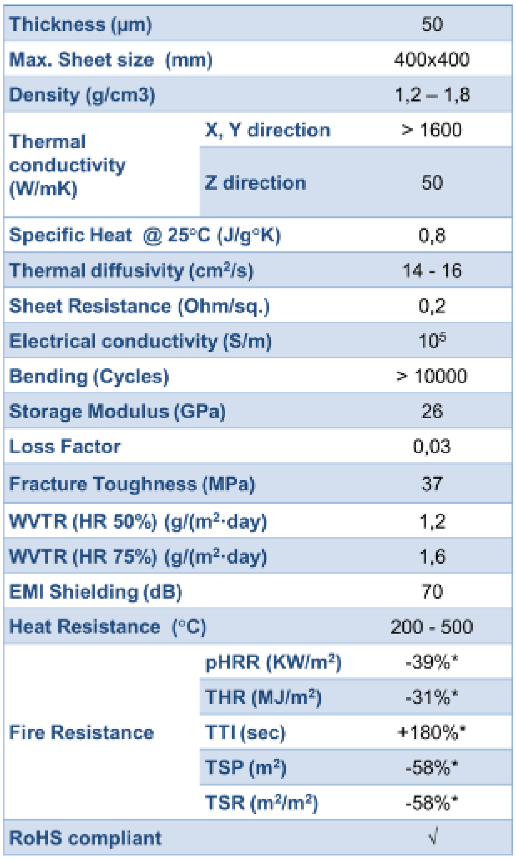
[a] *CNR-IPCB Institute for Composites, Polymers and Biomaterials, National Research Council of Italy, P.le E. Fermi, 1 80055 Portici, NA, Italy;* [b] *Nanesa S.r.l. Via del Gavardello 52c 52100 Arezzo, Italy,* [c] *Punto Quantico S.r.l. Viale Ferrovia, 30/A, Capua (CE), Italy 81043*

Among the different composite architectures, nanolaminates are emerging as interesting materials for structural and functional applications. Nanolaminates is a biomimetic architecture copying the structure of nacre consisting of the assemblies of well-oriented nanolaminae held together by an extremely low content of matrix. Nanolaminates consists of a stiff constituent phases bonded together by the soft constituent phases resulting in the so-called 'brick-and- mortar' ('B-and- M') structure. The combination of a small fraction of polymeric phase along with the nanolaminate three-dimensional architecture leads to exceptional mechanical properties, including high toughness, high strength and high stiffness. (1, 2, 3, 4)

We have developed nanolaminates containing very high content (>80% w/w) of graphene nanoplatelets, GNP, within an uncured epoxy matrix (prepregs) that are suitable for the conventional prepregs manufacturing technologies: film stacking and consolidation under temperature under pressure. Such kind of materials shows exceptionally rich multifunctional properties. See Table 1. Such as high and anisotropic thermal and electrical conductivities, low density, high Young modulus and damping capacity, very low Water Vapor Transmission Rate, fire resistance (in terms of flame retardation and reduction of the peak emission), high electromagnetic shielding and IR mirroring. In addition, the flexible manufacturing route enables an easy interchange of the polymeric matrix: GNP nanolaminated sheets (A3 dimensions) have been manufactured with both thermoset and thermoplastic polymer matrices.

Several industrial applications are in the development stage that take advantages from the multi functionality of the GNP nanolaminates, among the others: flexible batteries, fire protection systems and bulk graphite substitution in high temperature ovens.

Work is in progress to further dope the nanolaminate composition to access new functional properties, for example the addition of metallic nanoparticles to increase the peak electrical current before material break down.



Thickness (µm)		50
Max. Sheet size (mm)		400x400
Density (g/cm3)		1,2 – 1,8
Thermal conductivity (W/mK)	**X, Y direction**	> 1600
	Z direction	50
Specific Heat @ 25°C (J/g°K)		0,8
Thermal diffusivity (cm^2/s)		14 - 16
Sheet Resistance (Ohm/sq.)		0,2
Electrical conductivity (S/m)		10^5
Bending (Cycles)		> 10000
Storage Modulus (GPa)		26
Loss Factor		0,03
Fracture Toughness (MPa)		37
WVTR (HR 50%) (g/(m^2·day)		1,2
WVTR (HR 75%) (g/(m^2·day)		1,6
EMI Shielding (dB)		70
Heat Resistance (°C)		200 - 500
Fire Resistance	**pHRR (KW/m^2)**	-39%*
	THR (MJ/m^2)	-31%*
	TTI (sec)	+180%*
	TSP (m^2)	-58%*
	TSR (m^2/m^2)	-58%*
RoHS compliant		√

*Percentage improvement respect to CFRP

Table 1
Properties of GNP nanolaminates

References:
(1) Schmidt, D. F. Nanolaminates - Bioinspired and beyond. *Mater. Lett.* **2013**, *108*, 328–335.
(2) Espinosa, H. D.; Rim, J. E.; Barthelat, F.; Buehler, M. J. Merger of Structure and Material in Nacre and Bone - Perspectives on de Novo Biomimetic Materials. *Progress in Materials Science*. 2009, pp 1059–1100.
(3) Begley, M. R.; Philips, N. R.; Compton, B. G.; Wilbrink, D. V; Ritchie, R. O.; Utz, M. Micromechanical Models to Guide the Development of Synthetic "Brick and Mortar" Composites. *J. Mech. Phys. Solids* **2012**, *60* (8), 1545–1560.

(4) Wegst, U. G. K.; Bai, H.; Saiz, E.; Tomsia, A. P.; Ritchie, R. O.; Ortiz, C.; Boyce, M.; Wegst, U. G. K.; Bai, H.; Saiz, E.; Tomsia, A. P.; Ritchie, R. O. Bioinspired Structural Materials. *Nat. Mater.* **2014**, *14* (1), 23–36.

Formulazioni
nell'Industria Chimica e Farmaceutica

Formulations in the
Chemical and Pharmaceutical Industry

Formulation and Specialty Chemistry: the needs of Chemical Industries

Vittorio Maglia[a]

[a] Federchimica; v.maglia@federchimica.it

In the Specialty Chemistry, Italian industry has developed a true specialization that deriving from the characteristics of the companies, the interaction with the users of the Made in Italy and industrial districts.

The results of this specialization are evident in foreign trade data showing a growing active balance that has now exceeded € 3 billion.

Key success factors were: flexibility, creativity and innovation ready to offer quality solutions to the user.

Nowadays, the challenges of the global market lead the industry (not just the large companies) to an increase in terms of quality towards more and more structured research. To be able to contribute significantly to the competitiveness of downstream productions, the Specialty Chemistry has to offer not only fast responses but also anticipate needs with a design that must also produce patents.

The strong links between chemical industry and chemical science find in this context the need for chemistry of formulas to have a growing role in the university programs, in the forms that Universities can identify according to their characteristics and needs of the territory.

The drive towards research involves the need for well-prepared chemists in the areas of industrial specialization, bearing in mind that the size of the companies does not always allow the company to act in a proactive way. This action should be done by universities also by promoting Thesis of industrial interest.

Formulation challenges and emerging technologies in the pharmaceutical industry: an overview

Marco Adami[a], *Giuseppe Colombo*[b]

[a] *Pharmaceutical Consultant, Milano;* [b] *Italfarmaco SpA, Milano*
m_adami@alice.it; giuseppe.colombo@italfarmaco.com

Quality and innovation are two of the pharmaceutical industry's most defining characteristics. They are the driver for profitable revenue growth and long-term sustainability. Now more than ever, partnership and collaboration are essential to advance drug delivery innovation. This is due to several factors:

- Increasing complexity of both small- and large-molecule drugs;
- Increasing consumption of medicines in both emerging and mature markets;
- Growing number of biologic drugs in development;
- Entrance of several small startups into the market;
- Increasing generic competition.

As the pharmaceutical industry continues to move towards a quality-by-design (QbD) paradigm, the design and control of the Active Pharmaceutical Ingredients physico-chemical properties as well as the demonstration of greater understanding of the development of the Drug Product and its manufacturing process become an area of increasing interest.

Some of the key formulation challenges and emerging technologies in the pharmaceutical industry include:

- Delivery/oral delivery of biologics;
- Poor solubility;
- Patient-friendly drug delivery and packaging systems;
- Personalized medicines;
- Pediatric formulations;
- 3D printing;
- Nanotechnology;
- Drug discovery by design;
- Gene delivery;
- Advanced Therapy Medicinal Products (ATMP);
- Antibody-Drug Conjugates (ADC);
- QbD, Process Analytical Technology (PAT) and Manufacturing Excellence;
- Continuous Manufacturing (CM);
- Manufacturing Classification System (MCS) for oral dosage forms;
- Classification of Direct Compression (DC) excipients;
- Biopharmaceutics Classification System (BCS), Developability Classification System (DCS), Biopharmaceutics Drug Disposition Classification System (BDDCS), Extended Clearance Concept Classification System (ECCCS) in drug discovery and development settings.

This list (which is far from being exhaustive) groups both quality- and technology-related aspects. The former are indicating a trend towards the categorization of the formulation activities and manufacturing processes, possibly reflecting the high growth rates for contract manufacturing. The latter represent either emerging or relatively consolidated tools intended to provide solutions to ensure high bioavailability, efficacy and safety of today more complex candidate drugs.

A few selected examples of either group will be given in this presentation.

Formulation Chemistry: a new frontier of the Chemistry in Italy

Sesto Viticoli[a]

[a] *Italian Association for Industrial Research; viticoli@airi.it*

Chemistry has been largely identified over the years just with chemical products as individual chemical species characterized by their production processes and their use for specific chemical and physical properties. The ability to use individual chemicals can be significantly expanded and improved if they are physically combined to achieve otherwise unattainable properties or to achieve a desirable cost advantage. In this respect, Formulation Chemistry play an important role for several areas of particular interest National Companies such as, for example, Health, Agri-Food, Construction, and Industry's heterogeneous and photo-sensitive systems.

By way of example (1) we can cite, for heterogeneous systems, the case of tires where, by introducing polar functional groups on polymer chains into silica-containing compounds, an improved effect on the dissipative properties of the material, resistance to tire rolling and therefore fuel consumption of the vehicle. The same statement applies to Construction, where new Formulations are designed to follow and possibly anticipate the evolutionary trend of new market needs, such as new functionality and multifunctionality of materials, durability and sustainability, to control the structure of matter at nanometric scale and identify the material degradation mechanisms, to develop the market for new nano-structured products, eg. in the field of prefabricated elements.

Formulations play a central role also in modern Agriculture, especially in terms of modulating the release of active ingredients in a controlled way over time; reducing the level of assets in the environment, also controlling degradation; eliminating the exposure to toxic substances by operators; increasing the photostability of the active substances, thus reducing the amount of pesticides placed into the environment.

In the field of the drug, the Formulations strongly affect three parameters such as speed, time and place, which are essential to control and modify the drug release mechanisms. The Welness can become a very promising area in relation to the new needs of consumers, industrial needs, the advancement of scientific knowledge and the development of new analytical techniques, the evolving international standards increasingly vigilant Public health and consumer protection. These development parameters must be added to the extreme dynamism of a sector that has a very high turn-over in products, both in terms of new proposals and the average life expectancy of traditional products. Cosmetic ingredients also have a high index of innovation, with the annual input of over 300 new raw materials (mostly blends), both synthesis and extraction or natural derivation, to increase their nutraceutical properties and give rise to a nouca Area defined as Cosmeceutica (Cosmetics + Nutraceuticals).

Trimbow® a new extrafine triple combination in a single inhaler for COPD treatment

Enrico Zambelli

Chiesi Farmaceutici S.pA., Via Palermo, 26/A 43122 Parma

After 60 years from the first commercialization of a pressurized metered dose inhaler (pMDI) by Riker Laboratories in 1956 (later acquired by 3M Pharmaceuticals) this pharmaceutical form remains a common and extensively used method to treat lung diseases such asthma and Chronic Obstructive Pulmonary Disease (COPD). Medical treatment of lung disease has changed significantly over time pushing the drug maker to develop new treatments, which can better address the patient needs. In this scenario many patients with COPD are recommended to use combination therapy composed of bronchodilators such as β_2 agonists and long acting muscarinic antagonists (M_3 antagonist), and anti-inflammatory agents like inhaled corticosteroids (ICS).(1) Patients with COPD receiving such triple therapy currently use at least two inhalers, typically an ICS plus a long-acting β2-agonist combination in one inhaler and a long-acting muscarinic antagonist in a second, and often these inhalers are of different types and designs which may affect patient compliance(2). The therapeutic gap has been recently filled by Chiesi Farmaceutici which has developed a novel triple fixed dose combination (Trimbow®) in a single inhaler (pMDI) containing formoterol fumarate (B_2 agonist), glycopyrronium bromide (M_3 antagonist) and beclometasone dipropionate (ICS), which has recently been approved in Europe.

The development of multi-drug containing products is very challenging and involves a very high level of technical, clinical and regulatory requirements, which discourage the development of such pharmaceutical forms. The safety and efficacy of the fixed dose combination should be demonstrated against its single and double combination components, whilst technically the combination of the three active ingredients involves a significant effort in the design and formulation development in order to assure the quality of the final product in terms of delivery performance and chemical-physical stability. The Trimbow® development approach addressed all the hurdles by means of an extensive technical, pre-clinical and clinical program to assess the safety and efficacy by means of 12 different clinical studies involving more than 7000 patients. Trimbow® formulation was developed under the Chiesi Modulite® technology platform as a pMDI solution with the goal of having an extrafine product (i.e., mean mass aerodynamic diameter (MMAD) <2.0 μm)(3). The extrafine formulation enables efficient lung deposition allowing an optimal distribution of the active ingredients both in the central and peripheral lung(3). Despite achieving the typical dose reproducibility and the optimal low particle size of the emitted dose from a pMDI solution, it is known that the chemical stability of the active ingredients could be critical especially when more than one active ingredient is combined in the same inhaler. The concept of combining different bronchodilators with an ICS in a single inhaler is therefore an attractive opportunity to minimize the number of medications that the patient should take on a daily basis and thus may enhance patient compliance. Thus, few Triple fixed combination therapies are currently in late stage development/available in the world(4) and none of the them are pMDI solutions or can claim to be extrafine products. Despite of the technical challenges, Chiesi was able to develop a formulation capable of assuring the chemical stability of the three active ingredients with the desired product performance becoming the first company to gain approval for a Triple fixed combination therapy in Europe.

1. Brusselle G, Price D, Gruff ydd-Jones K, et al. The inevitable drift to triple therapy in COPD: an analysis of prescribing pathways in the UK. Int J Chron Obstruct Pulmon Dis 2015; 10: 2207–17.
2. Dave Singh, Alberto Papi, Massimo Corradi, Ilona Pavlišová, Isabella Montagna, Catherine Francisco, Géraldine Cohuet, Stefano Vezzoli, Mario Scuri, Jørgen Vestbo. Single inhaler triple therapy versus inhaled corticosteroid plus long-acting β2-agonist therapy for chronic obstructive pulmonary disease (TRILOGY): a double-blind, parallel group, randomised controlled trial. Lancet. 2016 Sep 3;388(10048):963-73.
3. Dave Singh, Massimo Corradi, Monica Spinola, Stefano Petruzzelli and Alberto Papi. Extrafine beclometasone diproprionate/formoterol fumarate: a review of its effects in chronic obstructive pulmonary disease. NPJ Prim Care Respir Med. 2016 Jun 16;26:16030.
4. Montuschi P, Malerba M, Macis G, Mores N, Santini G. Triple inhaled therapy for chronic obstructive pulmonary disease. Drug Discov Today. 2016 Nov;21(11):1820-1827.

Study of the nanostructure of innovative formulations for cement mixtures

Giorgio Ferrari[a], *Vincenzo Russo*[a], *Gilberto Artioli*[b], *Luca Valentini*[b],*Mariachiara Dalconi*[b]

[a] *Mapei S.p.A., via Cafiero 22, 20158, Milano; Dipartimento di Geoscienze, Università di Padova, via Gradenigo 8, 35100, Padova*[b]

Water is the main source of the premature deterioration of concrete structures, by carrying dissolved aggressive chemicals such as chloride and sulfate ions into the concrete structure, which can cause the corrosion of steel rebars and the expansion of concrete paste due to delayed ettringite formation. The critical factors that contribute to the durability of concrete are a dense microstructure, a fine pore structure and low capillary porosity (1). The addition of supplementary cementing materials (SCMs) into concrete mixtures has been gaining acceptance with respect to improving durability and reducing permeability (2). In addition, a class of materials referred to as permeability-reducing admixtures (PRAs) have been developed to improve concrete durability by reducing the permeability of cement paste of concrete (3).

This paper describes a new concrete permeability reducing admixture capable to effectively reduce the movement of water under hydrostatic head pressure (PRAH). The new admixture is an aqueous suspension of nano-sized metal transition polymeric silicate hydrate that catalyzes the nucleation of CSH in the capillary pores of hydrating cement paste. The crystallization of CSH in the capillary pores refines the capillary porosity of cement paste and significantly increases the resistance to water penetration under pressure. The mechanism of homogeneous crystallization of CSH was demonstrated by Synchrotron XRD micro-Tomography (XRD-µT) and by Scanning Electron Microscope (SEM) investigations. The effectiveness of the new admixture was tested on concrete specimens by measuring the water permeability according to European Standard EN 12390-8. The results indicated that the new admixture is highly effective in reducing the penetration of water, compared to a reference concrete with the same W/C and to other PRAH admixtures, working with different mechanisms. The new admixture also increases the early strength development of concrete and can be used in conjunction with WR and HRWR to produce concrete with outstanding mechanical performances and durability.

References

1. Basheer, L. et al., Construction and Building Materials 2001, 15, (2-3), pp. 93-103.
2. Papadakis V.G., Cement and Concrete Research 2000, 30, (2), pp. 291-299.
3. Munn, R.L. e t al., ACI Special Publ. 217 2003, pp. 361-380

Innovative approaches to tailor a particle size distribution

S. Mercuri[a], *A. Murdocco*[a], *A. Della Bella*[a], *S. Lucariello*[a], *P. Iamartino*[a]

[a] *Micro-Macinazione SA, Zona Artigianale 19, Madonna del Piano (Svizzera);*
smercuri@micromacinazione.com

In the pharmaceutical industry, size reduction techniques are used to improve powder processing and to increase, when solubility is the limiting step, the bioavailability of an active pharmaceutical ingredient (API) to obtain the desired therapeutic effect or to aid in drug product formulation.

One common size reduction technique used by the pharmaceutical industry is jet milling. With this technique, comminution is based on a particle-to-particle collisions mechanism that avoids the use of moving parts and the consequent risk of foreign particles contamination.

Grinding nozzles allow the grinding gas to enter at supersonic speed into the grinding chamber creating a vortex of gas that accelerates the powder particles within a spiral flow path inside the grinding chamber.

Centrifugal force directs particles to the outside of the chamber, while an opposite drag force is created by the gas exiting the milling chamber and forces the particle through a central exit.

As centrifugal force is proportional to the particle diameter cubed and drag force is proportional to the particle diameter squared, as particles break into smaller fragments the centrifugal force decreases faster than the drag force. Once the drag force on the particle exceeds the centrifugal force, the particle is brought out of the milling chamber.

To influence the resulting particle size created during the process, the typical operating variables are: grinding pressure, feeding pressure, and feed rate.

When the modifications of the previously mentioned variables do not lead to the desired PSD it is possible to act on the geometrical parameters of the jet-mill as: grinding chamber dimensions and shape, nozzles diameter and angle, static classification system diameter and length etc…

Unfortunately, also applying all the possible geometrical variations, it is impossible to precisely control the amount of fine fraction leaving the milling chamber. This means that over a certain value, there will be a limited control of the PSD dispersion.

In this case, one of the available option is to couple the jet-mill with a dynamic classification system to separate the unwanted fraction from the PSD.

With this solution, the product exiting from the jet-mill is fed into a classification chamber where the powder is accelerated against a classifier wheel. At this stage, fines are separated from oversize and subsequently routed for collection. Feed rate, air flow and rotor speed can be adjusted to vary the “cut size” of the fractions that will be collected before and after the dynamic classifier.

I cosmetici per pelli sensibili: strategie formulative per la modulazione dell'attività lenitiva ed anti-infiammatoria

Franco Gasparri

MedaPharma S.p.A., Via Valosa di Sopra 9, 20900 Monza, Italy; Email: franco.gasparri@medapharma.it

La sensibilità cutanea e le manifestazioni infiammatorie sono problematiche con una incidenza epidemiologica molto elevata ed in progressivo aumento. I soggetti con pelle sensibile rappresentano in Europa e negli USA circa il 60% del mondo femminile ed il 40% del mondo maschile. Il claim "sensitive skin" coinvolge il 25% dei prodotti cosmetici sul mercato (Mintel's Global New Products Database 2017). In campo dermatologico i fenomeni infiammatori accompagnano le dermatiti (allergiche, irritative, atopiche, seborroiche, foto-indotte) e gli eczemi cutanei. La cute, infatti, è l'organo umano più esteso, in perenne contatto con l'ambiente esterno e svolge un ruolo primario nella difesa immunitaria dell'organismo. Le citochine dell'epidermide possono avere un ruolo importante nel mediare il processo infiammatorio e la risposta immunitaria della cute. Negli ultimi anni molti cosmetici specifici per le pelli sensibili e reattive sono stati sviluppati ed immessi sul mercato, privilegiando principi funzionali di origine naturale. Gli estratti dalle radici della Glycirrhiza glabra contengono composti storicamente utilizzati per le proprietà di modulazione dei fenomeni infiammatori cutanei (1). Le proprietà biologiche di questa pianta sono associate alla presenza della glicirrizina e del suo aglicone l'acido glicirretico. Alcuni derivati come il dipotassio glicirrizinato (DG) e lo stearil diglicirrizinato (SG) sono utilizzati in preparati per uso esterno: in preparati cosmetici per le proprietà lenitive anti-rossore (2) ed in preparati ad uso dermatologico per migliorare la sintomatologia delle dermatiti sia acute che croniche. DG e SG hanno una elevata stabilità chimica ma differenti proprietà chimico-fisiche e solubilità. Infatti mentre DG ha una buona solubilità in acqua, SG ha un pronunciato carattere lipofilo. Queste caratteristiche sembrerebbero rendere tali sostanze non facilmente biodisponibili in quanto le sostanze molto idrofile o lipofile sono normalmente non ben assorbite per via transcutanea (3). Lo scopo dello studio condotto è stato quello di valutare la capacità di veicoli differenti (emulsioni O/W e gel) e di penetration enhancers nel modulare l'assorbimento percutaneo di DG ed SG. Inoltre si è valutata in parallelo la capacità veicolante di sistemi micro-particellari (4) quali Solid Liquid Nanoparticles (SLN). L'assorbimento percutaneo è stato studiato in vitro (5) utilizzando membrane strato corneo-epidermide (SCE) in celle di Franz. In vivo è stata poi determinata la proprietà anti-infiammatoria (6). Dai risultati ottenuti si evidenzia, per quanto riguarda la forma tecnica del veicolo, come il gel promuova meglio l'assorbimento di DG e l'emulsione O/W l'assorbimento di SG. Dai risultati ottenuti, inoltre si evidenzia, come l'utilizzo di penetration enhancers o di SLN, rappresenti una tecnologia valida per l'ottimizzazione del rilascio topico di DG ed SG. In particolare, l'uso di lecitina di soia idrogenata consente un aumento dell'assorbimento percutaneo dei due attivi ed un effetto antiinfiammatorio che si esplica a tempi brevi post applicazione nei test in vivo. Le SLN cariche di SG hanno invece evidenziato una "sustained and delayed" attività infiammatoria.

References: 1. M.N. Asl, H. Hosseinzadeh, Review of Pharmacological effects of Glycyrrhiza sp. and its bioactive compounds. *Phytother Res*., 22, 709-724 (2008). 2. G.L. Capella, A.F. Finzi, Complementary therapy for psoriasis. *Dermatol Ther.*,16, 164-174 (2003). 3. J. Hadgraft, "Formulation of anti-inflammatory agents", in *Nonsteroidal anti-inflammatory drugs. Pharmacol Skin*, C. Hensby and N.J. Lowe Eds. (Karger, Basel, 1989), Vol. 2, pp 21-43. 4. R. H. Muller, M. Radtke, S. A. Wissing, Solid lipid nanoparticles (SLN) and nanostructured lipid carriers (NLC) in cosmetic and dermatological preparations. *Adv. Drug Deliv. Rev.*, 54, S131–S155 (2003). 5. M. Siewert, J. Dressman, C.K. Brown, V.P. Shah, FIP/AAPS guidelines to dissolution/*in vitro* release testing of novel/special dosage forms. *AAPS PharmSciTech*., 4, E7 (2003). 6. C. Puglia, P. Blasi, L. Rizza, A. Schoubben, M. Ricci, F. Bonina, C. Rossi, Lipid nanoparticles for prolonged topical delivery: an in vitro and in vivo investigation. Int.J.Pharm., 357, 295-304 (2008).

Challenges in formulating Ace Bleach products

Stefano Resta

Fater S.p.A; via Volta 10, Pescara. resta.s@fatergroup.com

Fater Research and Development department proudly defines its mission as “the magic behind the promise of our brands”. This magic consists in three activities that constitute the essence of R&D:

- “Translate” the Promise turning consumer needs and brand benefits into product/package measurable attributes
- Make the Promise “real” identifying enabling technologies, and designing products and packages which delight consumers at affordable costs
- Keep the Promise by designing and scaling up manufacturing process which can deliver quality products & packs, day in day out

With focus on formulation challenges and approaches to problem solving, the presentation will provide specific examples of:

- How Fater R&D designs a cleaning product based on consumer needs
- Approaches to formula design to maximize performance
- Formula stability studies for intrinsically unstable bleach-based products

Founded in 1958, since 1992 Fater is an equal share joint venture between the Angelini Group and Procter&Gamble.

For more than 50 years Fater has presence in Italian homes through its products: Pampers, LINES, TAMPAX, LINIDOR and DIGNITY. Since 2013, Fater acquired the ACE brand, expanding its line of brands.

A rare example of successful joint venture over a long period of time, Fater bases its growth on its in-depth knowledge of consumers and markets, combined with the application of multinational work methods.

Fater is a dynamic company that believes in continuous innovation and it invests 4% of its turnover in Research&Development.

Fater Headquarter is located in Pescara, we have several affiliates in Moscow, Bucharest, Istanbul and Mohammedia and manufacturing plants in Italy (Pescara and Campochiaro), in Portugal (Porto), in Turkey (Gebze) and Morocco (Mohammedia).

Fater counts globally 1,400 employees and 915 million Euros of turnover (ref. 2013/2014 financial statements).

Formulazioni nel settore della nutraceutica: stato dell'arte e prospettive future

Antonino Bagnulo

Shedir Pharma

Colloids and Nanosciences: Formulations and New Challenges

Massimo Bonini[a]

[a] *Consorzio per lo Sviluppo dei Sistemi a Grande Interfase (CSGI) & Dipartimento di Chimica "Ugo Schiff", Via della Lastruccia 3, 50019 Sesto F.no (FI)*

Colloidal systems are crucial to many materials broadly used in everyday life (such as plastics, pharmaceuticals, cosmetics, agrochemicals, paper, food, inks, paints, detergents, cements, and many others). The number and variety of potential applications clearly highlight the importance of colloids in the field of formulations, but also denotes its multidisciplinary nature, requiring the combination of multiple skills and the knowledge of chemistry, physics, biology, engineering and medicine. Furthermore, over the last couple of decades, the advances in the field of nanosciences have made available to both academic and industrial researchers a plethora of nanostructured materials and innovative technologies that could be integrated within commercial products to improve their quality and to optimize their production costs, as well as to design completely new products.

In such a crowded and challenging scenario, it is now obvious that the cooperative connection between academia and industry is a pre-requisite for excellence in the field of formulations. In this contribution, we will report on examples where the scientific collaboration between industrial partners and the CSGI consortium has taken to the formulation of commercially relevant materials based on colloids and nanostructured materials.

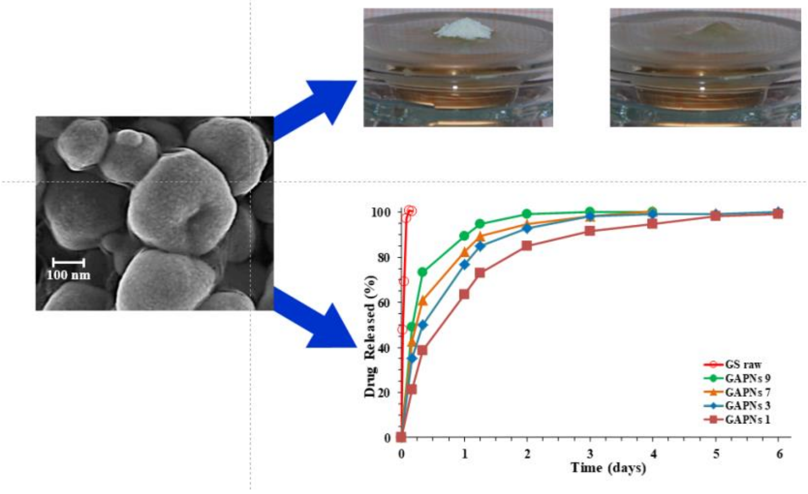
Polysaccharides based in situ gelling powders as promising wound healing medical devices

Pasquale Del Gaudio, Paola Russo, Rita Patrizia Aquino

Department of Pharmacy, University of Salerno, via Giovanni Paolo II, 132 – 84084 Fisciano (SA), Italy; pdelgaudio@unisa.it

Injury to the skin provides a unique challenge, as wound healing is a complex, sequential and intricate process. Acute wounds have the potential to move to chronic wounds, which are arrested in a specific phase of wound healing and unable to progress. There is tremendous pressure on the medical system to develop new and cost-effective therapies due to high cost of the treatments as well as associated health care system and social costs. Wound care as well as wound management products are essentially aimed at ensuring wound healing and infection control. Their effectiveness is can be measured by incidence of complete closure and quality of healing, by prevention or treatment of infection, reduced pain and reduced blood loss during debridement. A number of wound care products are available on the market and approved as over-the-counter (OTC), prescription topical products and medical devices. Still there is no device that can be configured as an optimal product due to the many technical challenges associated to the development of the ideal device. In fact, an ideal device should avoid local irritation and contact sensitization as well as immune reactions, dehydration of the wound site and removal trauma. Moreover, it should be cheap in order to reduce treatment costs. Therefore, the need of innovative products is very high, owing the unsatisfying clinical outcomes and low effectiveness of many conventional products.

In order to overcome such problems an innovative product consisting of polysaccharides blend submicrometric powder, able to form in situ a soft gel dressing when in contact with exudates, have been designed in our lab. Alginate, pectin and chitosan with specific molecular weight and moieties have been used as excipients to prepare the powder that have been used as carrier for different active ingredients (i.e. antibiotics, NSAIDs, and peptides). Nanospray drying technique has been chosen as encapsulation technology to produce the drug loaded powder due to the possibility to run the atomization process at low temperature (50-60 °C) and high processes yield (> 85%). Submicrometric particles show narrow size distribution, spherical morphology, smooth surface and good flowability. The proper polysaccharide blend used to make the particles is able to move the powder from solid to gel state very quickly (5-15 min) when in contact with wound fluids, producing a gel barrier able to fill completely the wound cavity. Moreover, the polysaccharide blend gel has demonstrated high fluid uptake ability (between 10 and 15-fold its dry weight) resulting in high exudate absorbance from wound bed and proper adhesiveness to the wound due to the formation of highly entangled gel texture during the submicrometric particles swelling. The entanglement of the *in situ* formed gel is also able to control the release of the loaded drug prolonging its release (between 1 – 12 days) depending on drug/polymer blend ratio and physico-chemical properties of the loaded active ingredient.



Industrial Formulation: a new curriculum in Industrial Chemistry Master’s degree

Martino Di Serio[a]

[a] *Università di Napoli Federico II, Dipartimento di Scienze Chimiche; diserio@unina.it*

The Department of Chemical Sciences of University of Naples Federico II has made a careful analysis of the evolution of the Italian chemical industry, to improve and increase the attractiveness of the Master's Degree in Industrial Chemistry.

Particularly interesting were data reported in the Report of the Italian Association for Industrial Research (AIRI) on Priority Technologies of Industry (1). In the chapter dedicated to the chemical industry, it is emphasized that that formulation technologies involve about 70% of Italian chemical and pharmaceutical industry, and as a consequence there are a strong need for research and training in the formulation sector.

It is clear from the above that activating a curriculum devoted to the formulation would surely find a strong interest in Italian industrial sector. However, to have a high quality training, it is necessary to have the skills.

An analysis was then carried out to evaluate the activities that the Department of Chemical Sciences has done over the past 10 years, identifying activities related to the formulation sector. The analysis showed that an intense activity has been done in the field of formulation and in many cases these activity has been done in collaboration with Industry.

A new curriculum has been designed by activating 4 courses devoted to the formulation science and technology for a total of 24 CFU. Then, the formation of the students will be deepened during the thesis (38 CFU) that will be dedicated to the formulation sector.

References

4. AIRI, Le innovazioni del prossimo futuro: tecnologie prioritarie per l’industria- IX Edizione, 2016

Elenco degli Autori

*Autore presentatore

Abe Ryu*	GEN PL03
Acocella Maria Rosaria*	ESG IL08
Adami Marco*	ESF IL02
Agnoli Stefano	ESG IL01
Amatore Christian*	GEN KN05
Ambrosio Luigi	ESG IL10
Anastas Paul T.*	GEN KN07
Aquino Rita Patrizia	ESF IL11
Arimondo Paola B.*	GEN PL04
Armaroli Nicola*	GEN MD01
Artioli Gilberto	ESF IL05
Baader Sabrina	GEN PL07
Bagnulo Antonino*	ESF IL09
Balzani Vincenzo*	GEN KN01
Barbera Vincenzina	ESG IL03
Bartlett Stuart	GEN PL07
Bernardi Andrea	ESG IL03
Bertocchi F.	ESG IL11
Bettini Cristian	ESG IL07
Bonini Massimo*	ESF IL10
Bruno Giovanni*	ESG IL02
Bucci Enrico*	GEN IL02
Buonocore G. G.	ESG IL10
Centi Gabriele*	GEN MD02
Cerruti P.	ESG IL10
Cimino F.	ESG IL09
Cole-Hamilton David J.*	GEN PL07
Colombo Giuseppe	ESF IL02
Cristiano F.	ESG IL11
Dalconi Mariachiara	ESF IL05
Danovaro Roberto	GEN IL01
De Santis Felice	ESG IL08
Del Gaudio Pasquale *	ESF IL11
Della Bella A.	ESF IL06
Di Serio Martino*	ESF IL12
Duque Garcia Ruben	GEN PL07
D'Urso Luciana	ESG IL08
Facchetti Antonio*	GEN MD07
Facchini Maria Cristina*	GEN IL01
Ferrara Santo Davide*	GRS IL01
Ferrari Giorgio*	ESF IL05
Ferrazza Francesca*	GEN IL03
Furst Marc	GEN PL07
Gabbiani Chiara*	GEN MD08
Galimberti Maurizio*	ESG IL03
Gamberi Tania	GEN MD08
Gasparri Franco*	ESF IL07

Gennari Cesare*	GEN MD09
Giordano Michele*	ESG IL11
Granozzi Gaetano*	ESG IL01
Guerra Gaetano	ESG IL08
Guidotti Matteo*	GEN MD03
Hagfeldt Angers*	GEN KN02
Iamartino P.	ESF IL06
Janssens Koen*	GEN PL02
Julis Jennifer	GEN PL07
Kappe C. Oliver*	GEN KN06
La Manna P.	ESG IL09
Lavorgna Marino*	ESG IL10
le Goff Ronan	GEN PL07
Legname Giuseppe*	GEN KN04
Lercher Joannes*	GEN PL06
Liscio Andrea	ESG IL07
Lucariello S.	ESF IL06
Maggini Michele*	ESG IL04
Maglia Vittorio*	ESF IL01
Marchetti Lorella	GEN MD08
Martone A.	ESG IL11
Marzo Tiziano	GEN MD08
Melucci Manuela*	ESG IL07
Mensitieri G.	ESG IL09
Mercuri Salvatore*	ESF IL06
Messori Luigi	GEN MD08
Mgani Quintino	GEN PL07
Mgaya James	GEN PL07
Misiti Domenico*	GEN MD04
Mmongoyo Juma	GEN PL07
Modesti Alessandra	GEN MD08
Murdocco A.	ESF IL06
Musto Pellegrino*	ESG IL09
Navacchia Maria Luisa	ESG IL07
Nicolais Luigi *	GRS IL02
O'Dowd Colin	GEN IL01
Olmi Fabio*	GEN MD05
Pacchioni Gianfranco*	GEN MD06
Palermo Vincenzo	ESG IL05
Pannico M.	ESG IL09
Pantani Roberto	ESG IL08
Peck David*	GEN KN03
Perathoner Siglinda	GEN MD02
Peruzzini Maurizio*	ESG IL06
Resta Stefano*	ESF IL08
Ricciardi M. R.	ESG IL11
Roda Aldo*	GEN PL05

Elenco dei Partecipanti

Antonio Abbadessa	Università di Catania	abbadessa.antonio@unict.it
Giorgio Abbiati	Università di Milano	giorgio.abbiati@unimi.it
Alessandro Abbotto	Università di Milano Bicocca	alessandro.abbotto@unimib.it
Ryu Abe	Kyoto University	
Ornella Abollino	Università di Torino	ornella.abollino@unito.it
Gianpiero Adami	Università di Trieste	gadami@units.it
Gabriele Agonigi	Università di Pisa	g.ago2@hotmail.it
Alessandro Agosti	Olon Spa	aagosti@olonspa.it
Angela Agostiano	Università di Bari "Aldo Moro"	angela.agostiano@uniba.it
Anna Agovino	Università di Salerno	aagovino@unisa.it
Gianluigi Albano	Università di Pisa	gianluigi.albano@dcci.unipi.it
Stefano Alberti	Università di Genova	stefanofilippo.alberti@gmail.com
Alberto Albinati	Università di Milano	alberto.albinati@unimi.it
Silvana Alfei	Università di Genova	alfei@difar.unige.it
Vincenzo Algieri	Università della Calabria	vincenzo.algieri@unical.it
Franco Alhaique	Università di Roma "La Sapienza"	franco.alhaique@uniroma1.it
Anna Maria Almerico	Università di Palermo	annamaria.almerico@unipa.it
Maarten Altelaar	Utrecht University	m.altelaar@uu.nl
Cosimo D. Altomare	Università di Bari "Aldo Moro"	cosimodamiano.altomare@uniba.it
Emanuele Amata	Università di Catania	eamata@unict.it
Jussara Amato	Università di Napoli Federico II	jussara.amato@unina.it
Christian André Amatore	Ecole Normale Supérieure	
Luigi Ambrosini		
Angela Amoresano	Università di Napoli Federico II	
Paul Thomas Anastas	Yale University	
Vincenza Andrisano	Università di Bologna	vincenza.andrisano@unibo.it
Andrea Angeli	Università di Firenze	andrea.angeli@unifi.it
Ruggero Angelico	Università del Molise	
Maria Anghelone		ugo.cosentino@unimib.it
Giannamaria Annunziato	Università di Parma	giannamaria.annunziato@studenti.unipr.it
Riccarda Antiochia	Università di Roma "La Sapienza"	
Simonetta Antonaroli	Università di Roma "Tor Vergata"	simonetta.antonaroli@uniroma2.it
Azzurra Apriceno	Università di Roma "La Sapienza"	azzurra.apriceno@uniroma1.it
Eleonora Aquilini	MIUR	ele.aquilini6@gmail.com
Rita Patrizia Aquino	Università di Salerno	aquinorp@unisa.it
Francesca Arcudi	Università di Trieste	francescarcudi@gmail.com
Francisco Ardini	Università di Genova	ardini@chimica.unige.it
Fabiana Arduini	Università di Roma "Tor Vergata"	fabiana.arduini@uniroma2.it
Paola Barbara Arimondo	CNRS - Centre Pierre Fabre Laboratories	
Marco Arlorio	Università del Piemonte Orientale	
Nicola Armaroli	Consiglio Nazionale delle Ricerche	nicola.armaroli@cnr.it
Donatella Armentano	Università della Calabria	donatella.armentano@unical.it
Serena Arnaboldi	Università di Milano	

Giuseppe Arrabito	Università di Palermo	giuseppedomenico.arrabito@unipa.it
Massimiliano Aschi	Università de L'Aquila	massimiliano.aschi@univaq.it
Michael Assfalg	Università di Verona	
Orazio Antonio Attanasi	Università di Urbino "Carlo Bo"	orazio.attanasi@uniurb.it
Matteo Atzori	Università di Firenze	matteo.atzori@unifi.it
Sara Auriemma	Iti Galvani	saraauriemma@libero.it
Elisa Azzali	Università di Parma	elisa.azzali@studenti.unipr.it
Alessandro Bacaloni	Università di Roma "La Sapienza"	alessandro.bacaloni@uniroma1.it
Elena Badetti	Università Ca' Foscari Venezia	elena.badetti@unive.it
Denis Badocco	Università di Padova	denis.badocco@unipd.it
Maria Teresa Badolato	Università della Calabria	
Elnaz Bahadori	Università di Milano	elnaz.bahadori@unimi.it
Roberto Ballini	Università di Camerino	roberto.ballini@unicam.it
Vincenzo Balzani	Università di Bologna	
Amodio Luca Balzano	Università di Salerno	abalzano@unisa.it
Riccardo Balzarotti		
Tiziano Bandiera	Istituto Italiano di Tecnologia	tiziano.bandiera@iit.it
Marco Bandini	Università di Bologna	
Luca Banfi	Università di Genova	banfi@chimica.unige.it
Walter Baratta	Università di Udine	walter.baratta@uniud.it
Maria Camilla Baratto	Università di Siena	mariacamilla.baratto@unisi.it
Elettra Barberis	Università del Piemonte Orientale	elettra.barberis@uniupo.it
Nadia Barbero	Università di Torino	nadia.barbero@unito.it
Alessia Barbieri	Università di Roma "La Sapienza"	alessia.barbieri@uniroma1.it
Luisa Barbieri	Università di Modena e Reggio Emilia	luisa.barbieri@unimore.it
Marco Baron	Università di Padova	marco.baron@unipd.it
Vincenzo Barone	Scuola Normale Superiore	vincenzo.barone@sns.it
Carlo Giorgio Barracchia	Università di Verona	carlog.barra@gmail.com
Elisabetta Barresi	Università di Pisa	elisabetta.barresi@farm.unipi.it
Lucia Bartella	Università della Calabria	lucia.bartella@unical.it
Francesco Barzagli	Consiglio Nazionale delle Ricerche	francesco.barzagli@gmail.com
Oscar Baseggio	Università di Trieste	obaseggio@units.it
Manuela Giovanna Basilicata	Università di Salerno	mbasilicata@unisa.it
Riccardo Basosi	Università di Siena	riccardo.basosi@unisi.it
Elisa Basso	Bruker	
Simone Bastianoni	Università di Siena	simone.bastianoni@unisi.it
Alberto Battistel	École Polytechnique Fédérale de Lausanne	alberto.battistel@epfl.ch
Chiara Battocchio	Università Roma Tre	
Silvia Becagli	Università di Firenze	silvia.becagli@unifi.it
Stefano Becherini	Università di Pisa	stefano.becherini@farm.unipi.it
Federico Bella	Politecnico di Torino	federico.bella@polito.it
Gianfranco Bellachioma	Università di Perugia	gianfranco.bellachioma@unipg.it
Fabio Bellina	Università di Pisa	fabio.bellina@unipi.it
Marco Bellini	Consiglio Nazionale delle Ricerche	marco.bellini@iccom.cnr.it
Emilia Lucia Belsito	Università della Calabria	emilialucia.belsito@unical.it
Maurizio Benaglia	Università di Milano	maurizio.benaglia@unimi.it

Fabio Benedetti	Università di Trieste	benedett@units.it
Michele Benedetti	Università del Salento	michele.benedetti@unisalento.it
Amerigo Beneduci	Università della Calabria	amerigo.beneduci@unical.it
Tiziana Benincori	Università dell'Insubria	
Chiara Bergaglieri		
Roberta Bernini	Università della Tuscia	berninir@unitus.it
Emanuela Berrino	Università di Firenze	emanuela.berrino@unifi.it
Alessia Bertamino	Università di Salerno	abertamino@unisa.it
Francesco Berti	Istituto Italiano di Tecnologia	d3segreteria@iit.it
Giorgio Bertolini	Olon Spa	gbertolini@olonspa.it
Guy Bertrand	Universiy of California	guybertrand@ucsd.edu
Carlo Bertucci		bertucci46@gmail.com
Simona Bettini		
Denise Biagini	Università di Pisa	denisebiagini@virgilio.it
Michele Bianchi	Università del Piemonte Orientale	michele.bianchi@uniupo.it
Armandodoriano Bianco	Università di Roma "La Sapienza"	
Alessandra Biancolillo	Università di Roma "La Sapienza"	alessandra.biancolillo@uniroma1.it
Massimo Bietti	Università di Roma "Tor Vergata"	bietti@uniroma2.it
Giuseppe Bifulco	Università di Salerno	bifulco@unisa.it
Marco Biglietto	Sciex	
Gilberto Binda	Università dell'Insubria	g.binda2@uninsubria.it
Simona Olga Binetti	Università di Milano Bicocca	simona.binetti@unimib.it
Francesca Biscaglia	Università di Padova	francesca.biscaglia@phd.unipd.it
Tarita Biver	Università di Pisa	tarita.biver@unipi.it
Julien Bloino	Consiglio Nazionale delle Ricerche	julien.bloino@pi.iccom.cnr.it
Enrico Bodo	Università di Roma "La Sapienza"	enrico.bodo@uniroma1.it
Cristiano Bolchi	Università di Milano	cristiano.bolchi@unimi.it
Chiara Liliana Boldrini	Università di Milano Bicocca	c.boldrini@campus.unimib.it
Bianca Bolfi	Università del Piemonte Orientale	bianca.bolfi@uniupo.it
Paolo Bollella	Università di Roma "La Sapienza"	paolo.bollella@uniroma1.it
Maria Laura Bolognesi	Università di Bologna	marialaura.bolognesi@unibo.it
Stefania Bonaiti	Università di Milano Bicocca	s.bonaiti3@campus.unimib.it
Aurelio Bonasera	Humboldt Universität Zu Berlin	aurelio.bonasera@chemie.hu-berlin.de
Nicole Bonelli		
Andrea Bonetti	Indena Spa	andrea.bonetti@indena.com
David Bongo		
Massimo Bonini	Università di Firenze	massimo.bonini@unifi.it
Giuseppe Bonura		
Nicola Borbone	Università di Napoli Federico II	nicola.borbone@unina.it
Silvia Bordiga	Università di Torino	silvia.bordiga@unito.it
Alessandra Bordo		russo@chimica.unige.it
Olga Bortolini	Università di Ferrara	olga.bortolini@unife.it
Andrea Bortot	Università di Verona	andrea.bortot@univr.it
Alessandra Maria Bossi	Università di Verona	alessandramaria.bossi@univr.it
Filippo Bossola	Consiglio Nazionale delle Ricerche	filippo.bossola@gmail.com
Lorenzo Botta	Università della Tuscia	lor.botta83@gmail.com
Maurizio Botta	Università di Siena	botta.maurizio@gmail.com

Arianna Bracciali	Università di Firenze	ariannabracciali@alice.it
Alberto Brandi	Università di Firenze	alberto.brandi@unifi.it
Riccardo Brandiele	Università di Padova	riccardo.brandiele@studenti.unipd.it
Carlo Bravin	Università di Padova	carlo.bravin@studenti.unipd.it
Clemente Bretti	Università di Messina	cbretti@unime.it
Daniele Brignole	Università di Genova	danielebrignole@gmail.com
Irene Briguglio	Università di Sassari	ibriguglio@uniss.it
Nicoletta Brindani	Istituto Italiano di Tecnologia	nicoletta.brindani@iit.it
Agostino Bruno	Università di Parma	agostino.bruno@unipr.it
Giovanni Bruno		
Ines Bruno	Università di Salerno	brunoin@unisa.it
Maurizio Bruno	Università di Palermo	maurizio.bruno@unipa.it
Olga Bruno	Università di Genova	
Sergio Brutti	Università della Basilicata	sergio.brutti@unibas.it
M. Concetta Bruzzoniti	Università di Torino	mariaconcetta.bruzzoniti@unito.it
Enrico Bucci	Resis Srl & Sbarro Health Research Organization	
Roberta Budriesi	Università di Bologna	roberta.budriesi@unibo.it
Antonio Buonerba	Università di Salerno	
Simone Cailotto		simone.cailotto@unive.it
Elisa Cala		
Donato Calabria	Università di Bologna	donato.calabria2@unibo.it
Gabriella Caldini		ribasosi2@gmail.com
Cristiana Caliceti	Università di Bologna	cristiana.caliceti@unibo.it
Paolo Caliceti	Università di Padova	paolo.caliceti@unipd.it
Lorenzo Calugi	Università di Firenze	lorenzo.calugi@gmail.com
Cosima Damiana Calvano	Università di Bari "Aldo Moro"	cosimadamiana.calvano@uniba.it
Rachel Camerini	Università di Firenze	rachelelisabetta.camerini@unifi.it
Federica Camin	Fondazione Edmund Mach	federica.camin@fmach.it
Ruggero Caminiti	Università di Roma "La Sapienza"	ruggero.caminiti@uniroma1.it
Sabrina Campagna Zignani	Consiglio Nazionale delle Ricerche	zignani@itae.cnr.it
Beatrice Campanella	Consiglio Nazionale delle Ricerche	beatrice.campanella@pi.iccom.cnr.it
Pietro Campiglia	Università di Salerno	
Sebastiano Campisi	Università di Milano	sebastiano.campisi@libero.it
Rolando Cannalire	Università di Perugia	rolando.cannalire@hotmail.it
Patrizia Canton	Università Ca' Foscari Venezia	cantonpa@unive.it
Carmine Capacchione	Università di Salerno	ccapacchione@unisa.it
Vito Capaccio	Università di Salerno	vcapaccio@unisa.it
Domenica Capasso	Università di Napoli Federico II	domenica.capasso@unina.it
Sante Capasso	Università della Campania "Luigi Vanvitelli"	
Amedeo Capobianco	Università di Salerno	acapobianco@unisa.it
Loredana Cappellacci	Università di Camerino	loredana.cappellacci@unicam.it
David Cappelletti	Università di Perugia	david.cappelletti@unipg.it
Chiara Cappelli	Scuola Normale Superiore	
Massimo Cappi		
Achille Cappiello	Università di Urbino "Carlo Bo"	achille.cappiello@uniurb.it
Vito Capriati	Università di Bari "Aldo Moro"	vito.capriati@uniba.it
Anna Laura Capriotti	Università di Roma "La Sapienza"	annalaura.capriotti@uniroma1.it

Martina Capua		
Valentina Caratto	Università di Genova	caratto@chimica.unige.it
Mauro Carcelli	Università di Parma	mauro.carcelli@unipr.it
Nicola Cardellicchio	CNR - Ist. per l'Ambiente Marino Costiero	n.cardellicchio@iamc.cnr.it
Liberato Cardellini		
Antonio Carella	Università di Napoli Federico II	antonio.carella@unina.it
Luca Carena	Università di Torino	carena.luca@hotmail.it
Paolo Carloni	Institute for Advanced Simulations	p.carloni@fz-juelich.de
Giuseppe Carlucci	Università "G. D'Annunzio" Chieti-Pescara	giuseppe.carlucci@unich.it
Daniela Maria Carminati	Università di Milano	daniela.carminati@unimi.it
Antonio Caroli		
Anna Caronia	I.S. Ettore Majorana - Palermo	anna.caronia@tin.it
Alfonso Carotenuto	Università di Napoli Federico II	alfonso.carotenuto@unina.it
Andrea Carotti	Università di Perugia	andrea.carotti@unipg.it
Mauro Carraro	Università di Padova	mauro.carraro@unipd.it
Fabrizio Carta	Università di Firenze	fabrizio.carta@unifi.it
Gabriele Carullo	Università della Calabria	
Donatella Caruso	Università di Milano	donatella.caruso@unimi.it
Tonino Caruso	Università di Salerno	tcaruso@unisa.it
Viviana Caruso	Università di Catania	vivianact@hotmail.it
Agostino Casapullo	Università di Salerno	casapullo@unisa.it
Alessandro Caselli	Università di Milano	alessandro.caselli@unimi.it
Antonella Casoli	Università di Parma	antonella.casoli@unipr.it
Sabrina Castellano	Università di Salerno	scastellano@unisa.it
Tommaso Cataldi	Università di Bari "Aldo Moro"	tommaso.cataldi@uniba.it
Sebastiano Cataldo	Università di Palermo	sebastiano.cataldo@unipa.it
Martina Catani	Università di Ferrara	ctnmtn@unife.it
Michelina Catauro	Università della Campania "Luigi Vanvitelli"	michelina.catauro@unina2.it
Emilio Catelli		
Rosa Catucci		
Jacopo Cautela	Università di Roma "La Sapienza"	jacopo.cautela@uniroma1.it
Silvia Cauteruccio	Università di Milano	silvia.cauteruccio@unimi.it
Felicia Cavaleri	Università di Palermo	liciacavaleri@gmail.com
Chiara Cavaliere	Università di Roma "La Sapienza"	chiara.cavaliere@uniroma1.it
Giuseppe Cavallaro	Tu Berlin	peppe.log@hotmail.it
Fabrizio Cavani	Università di Bologna	fabrizio.cavani@unibo.it
Antonella Cavazza	Università di Parma	antonella.cavazza@unipr.it
Violetta Cecchetti	Università di Perugia	violetta.cecchetti@unipg.it
Teresa Cecchi		
Daniela Cecconi	Università di Verona	daniela.cecconi@univr.it
Giuseppe Cecere	Its Buonarroti Caserta	chim.cec@tin.it
Teresa Celestino	Liceo A. Manzoni (LT)	
Gabriele Centi	Università di Messina	centi@unime.it
Paolo Centomo	Università di Padova	paolo.centomo@unipd.it
Carmen Cerchia		
Bruno Cerra	Università di Perugia	bruno.cerra@chimfarm.unipg.it
Antonietta Cerulli	Università di Salerno	acerulli@unisa.it

Federico Cesano	Università di Torino	federico.cesano@unito.it
Giorgio Cevasco	Università di Genova	giorgio.cevasco@unige.it
Luca Cevenini	Università di Bologna	luca.cevenini5@unibo.it
Tatiana Chenet	Università di Ferrara	tatyc89@alice.it
Clara Chiappara	Università di Palermo	chiappara.clara@libero.it
Fausto Pietro Chiapparini	Biotage	
Cinzia Chiappe	Università di Pisa	cinzia.chiappe@unipi.it
Gian Luca Chiarello	Università di Milano	gianluca.chiarello@unimi.it
Marco Chiarini	Università di Teramo	mchiarini@unite.it
Isabella Chiarotto	Università di Roma "La Sapienza"	isabella.chiarotto@uniroma1.it
Giuseppe Chidichimo	Università della Calabria	giuseppe.chidichimo@unical.it
Mario Chiesa	Università di Torino	mario.chiesa@unito.it
Donatella Chille'	Università di Messina	dchille@unime.it
Maria Giovanna Chini	Università di Salerno	mchini@unisa.it
Marco Chino	Università di Napoli Federico II	marco.chino@unina.it
Tania Ciaglia	Università di Salerno	tciaglia@unisa.it
Gianluca Ciancaleoni	Università di Pisa	gianluca.ciancaleoni@unipi.it
Piergiorgio Cianciullo	IDAEA-CSIC	p.cianciu@gmail.com
Alessandro Ciccola	Università di Roma "La Sapienza"	alessandro.ciccola@uniroma1.it
Cristina Cidonio		
Rosalia Maria Cigala	Università di Messina	rmcigala@tiscali.it
Cristina Cimarelli	Università di Camerino	cristina.cimarelli@unicam.it
Giuseppe Cinelli		
Stefano Cinti	Università di Roma "Tor Vergata"	stefano.cinti@uniroma2.it
Nicola Cioffi	Università di Bari "Aldo Moro"	nicola.cioffi@uniba.it
Simone Ciofi Baffoni	Università di Firenze	ciofi@cerm.unifi.it
Laura Cipolla	Università di Milano Bicocca	laura.cipolla@unimib.it
Alessandra Cipriano	Università di Salerno	acipriano@unisa.it
Damiano Cirri	Università di Firenze	damiano.cirri@unifi.it
Girolamo Cirrincione	Università di Palermo	girolamo.cirrincione@unipa.it
Stefano Ciurli	Università di Bologna	stefano.ciurli@unibo.it
Bartolomeo Civalleri	Università di Torino	bartolomeo.civalleri@unito.it
Rosella Cocciaro		
Beatrice Cogliati	Università di Parma	beatrice.cogliati@studenti.unipr.it
Claudia Colabella		claudia.colabella@gmail.com
David Cole Hamilton	University of St. Andrews	
Marco Colella	Università di Bari "Aldo Moro"	marco.colella@uniba.it
Amilcare Collina	Mapei S.p.a.	amilcare.collina@alice.it
Elena Collina	Università di Milano Bicocca	
Francesca Colo'	Politecnico di Torino	d034329@polito.it
Noemi Colozza	Università di Roma "Tor Vergata"	noemi.colozza@uniroma2.it
Salvatore Coluccia	Università di Torino	salvatore.coluccia@unito.it
Maria Irene Coluzzi	Isiss Conti Aversa	irene.coluzzi@gmail.com
Alessandra Comandè	Università della Calabria	alessandra.comande@outlook.com
Mauro Comes Franchini	Università di Bologna	mauro.comesfranchini@unibo.it
Nicola Comisso	Consiglio Nazionale delle Ricerche	nicola.comisso@cnr.it
Valeria Comite		

Eleonora Conca	Università di Torino	econca@unito.it
Catia Contado	Università di Ferrara	catia.contado@unife.it
Giulio Maria Conte	Università di Salerno	gconte@unisa.it
Valeria Conte	Università di Roma "Tor Vergata"	valeria.conte@uniroma2.it
Luca Conti	Università di Firenze	lucacontichim@gmail.com
Federico Coppola	Università di Napoli Federico II	
Federico Corelli	Università di Siena	federico.corelli@unisi.it
Davide Corinti	Università di Roma "La Sapienza"	davide.corinti@uniroma1.it
Marta Corno	Università del Piemonte Orientale	marta.corno@uniupo.it
Silvia Corradi	Istituto Italiano di Tecnologia	silvia.corradi@iit.it
Roberto Corradini	Università di Parma	roberto.corradini@unipr.it
Giuseppina Anna Corrente	Università del Salento	giuseppinaanna.corrente@unisalento.it
Carlotta Cortelli		
Ugo Cosentino	Università di Milano Bicocca	ugo.cosentino@unimib.it
Chiara Costabile	Università di Salerno	ccostabile@unisa.it
Giulia Costamagna	Università di Torino	giulia.costamagna410@edu.unito.it
Gabriele Costantino	Università di Parma	gabriele.costantino@unipr.it
Valeria Costantino	Università di Napoli Federico II	valeria.costantino@unina.it
Maria Paola Costi	Università di Modena e Reggio Emilia	mariapaola.costi@unimore.it
Donatella Coviello	Università della Basilicata	coviello.donatella28@gmail.com
Antonietta Cozzolino	Università di Salerno	
Mariachiara Cozzolino	Università di Salerno	
Alberto Credi	Università di Bologna	alberto.credi@unibo.it
Giuseppina Crescente	Università della Campania "Luigi Vanvitelli"	giuseppina.crescente@unicampania.it
Carlo Crescenzi	Università di Salerno	carlo.crescenzi@unisa.it
Claudia Crestini	Università di Roma "Tor Vergata"	crestini@stc.uniroma2.it
Letizia Crocetti	Università di Firenze	letizia.crocetti@unifi.it
Matteo Crosera	Università di Trieste	mcrosera@units.it
Raffaele Cucciniello	Università di Salerno	rcucciniello@unisa.it
Claudio Curti	Università di Parma	claudio.curti@unipr.it
Michele Cutini	Università di Torino	michele.cutini@unito.com
Marinella Cutolo		marinellacutolo@gmail.com
Brigida D’Abrosca	Università della Campania "Luigi Vanvitelli"	brigida.dabrosca@unicampania.it
Gianluca D’Abrosca	Università della Campania "Luigi Vanvitelli"	
Gilda D’Urso	Università di Salerno	
Giuseppe Daidone	Università di Palermo	giuseppe.daidone@unipa.it
Enrico Dalcanale	Università di Parma	enrico.dalcanale@unipr.it
Antonella Dalla Cort	Università di Roma "La Sapienza"	antonella.dallacort@uniroma1.it
Clelia Dallanoce	Università di Milano	clelia.dallanoce@unimi.it
Federico Dallo	Consiglio Nazionale delle Ricerche	federico.dallo@unive.it
Daniele D'Alonzo	Università di Napoli Federico II	dandalonzo@unina.it
Massimo Christian D'Alterio	Università di Napoli Federico II	massimochristian.dalterio@unina.it
Assunta D'Amato	Università di Salerno	assunta.damato.92@gmail.com
Pier Giuseppe Daniele		piergiuseppe.daniele@unito.it
Salvatore Daniele		
Francesca D'Anna	Università di Palermo	francesca.danna@unipa.it
Angelo Antonio D'Archivio	Università de L'Aquila	angeloantonio.darchivio@univaq.it

Federica D'Aria		
Assunta Dario		assunta.dario@tin.it
Valeria D'Auria	Università di Napoli Federico II	madauria@unina.it
Marco De Amici	Università di Milano	marco.deamici@unimi.it
Francesco De Angelis	Università de L'Aquila	francesco.deangelis@univaq.it
Sonia De Angelis	Università di Bari "Aldo Moro"	soniadeangelis91@gmail.com
Giuseppe De Benedetto	Università del Salento	giuseppe.debenedetto@unisalento.it
Francesco De Bon	Università di Padova	francesco.debon@studenti.unipd.it
Modesto De Candia	Università di Bari "Aldo Moro"	modesto.decandia@uniba.it
Federica De Castro	Università del Salento	decastrofederica87@gmail.com
Maria De Fenza	Università di Napoli Federico II	maria.defenza@unina.it
Giovanni De Filpo	Università della Calabria	defilpo@unical.it
Ersilia De Lorenzi	Università di Pavia	ersidelo@unipv.it
Antonio De Luca	Università di Firenze	
Claudio De Luca		
Laura De Luca	Università di Messina	ldeluca@unime.it
Francesco de Luca di Roseto	Deltek	
Pietro de Luca di Roseto	Deltek	
Simona De Marino	Università di Napoli Federico II	sidemari@unina.it
Jacopo De Maron	Università di Bologna	jacopo.demaron2@unibo.it
De Montis		
Lorenzo De Napoli	Università di Napoli Federico II	lorenzo.denapoli@unina.it
Serena De Negri	Università di Genova	serena.denegri@unige.it
Antonio De Nino	Università della Calabria	denino@unical.it
Chiara De Rosa	Università di Verona	chiara.derosa@univr.it
Margherita De Rosa	Università di Salerno	maderosa@unisa.it
Augusta De Santis	Università di Napoli Federico II	augusta.desantis@unina.it
Francesco De Sarlo	Università di Firenze	
Nicola Alessandro De Simone	Università di Salerno	n.desimone89@gmail.com
Concetta De Stefano	Università di Messina	cdestefano@unime.it
Gaetano De Tommaso	Università di Napoli Federico II	gaetano.detommaso@unina.it
Simona De Vita	Università di Salerno	sdevita@unisa.it
Marta De Zotti	Università di Padova	marta.dezotti@unipd.it
Luigi Dei	Rettorato Università di Firenze	luigi.dei@unifi.it
Fabio Del Bello	Università di Camerino	fabio.delbello@unicam.it
Massimo Del Bubba	Università di Firenze	delbubba@unifi.it
Annarita Del Gatto	Consiglio Nazionale delle Ricerche	annarita.delgatto@unina.it
Federica Del Gaudio	Università di Salerno	fdelgaudio@unisa.it
Federica Del Gaudio	Università di Salerno	
Pasquale Del Gaudio	Università di Salerno	pdelgaudio@unisa.it
Alessandra Del Giudice	Università di Roma "La Sapienza"	alessandra.delgiudice@uniroma1.it
Francesca Del Vecchio	Vacuum Service	
Guido Del Vecchio	Vacuum Service	
Andrea D'Elia		andrea.delia@chimici.it
Francesco Della Monica	Università di Salerno	fdellamonica@unisa.it
Giorgio Della Sala	Università di Salerno	gdsala@unisa.it

Paolo Della Sala	Università di Salerno	pdellasala@unisa.it
Maria Michela Dell'Anna	Politecnico di Bari	mariamichela.dellanna@poliba.it
Franco Dell'Erba	Itis "Pacinotti" Taranto	franco.dellerba@alice.it
Simona Delsante	Università di Genova	simona.delsante@unige.it
Nunzio Denora	Università di Bari "Aldo Moro"	nunzio.denora@uniba.it
Gerardino D'Errico	Università di Napoli Federico II	gerardino.derrico@unina.it
Alessio Dessi'	Consiglio Nazionale delle Ricerche	a.dessi@iccom.cnr.it
Marina Di Carro	Università di Genova	marina.dicarro@unige.it
Anna Di Chiacchio	Istituto Tecnico " Buonarroti" Di Caserta	annadichiacchio@alice.it
Cristina Di Donato	Università della Campania "Luigi Vanvitelli"	
Giovanni Di Fabio	Università di Napoli Federico II	difabio@unina.it
Francesco Di Franco	Università di Palermo	francesco.difranco@unipa.it
Maria Luisa Di Gioia	Università della Calabria	ml.digioia@unical.it
Francesco Di Maiolo	Università di Parma	francesco.dimaiolo@studenti.unipr.it
Simone Di Micco	Università di Salerno	sdimicco@unisa.it
Benedetta Di Napoli	Università di Roma "Tor Vergata"	benedetta.di.napoli@uniroma2.it
Vito Di Noto		
Roberto Di Santo	Università di Roma "La Sapienza"	roberto.disanto@uniroma1.it
Veronica Di Sarno	Università di Salerno	vdisarno@unisa.it
Martino Di Serio	Università di Napoli Federico II	
Francesca Di Turo	Università di Roma "La Sapienza"	francesca.dituro@uniroma1.it
Patrizia Diana	Università di Palermo	patrizia.diana@unipa.it
Rosita Diana	Università di Napoli Federico II	rosita.diana@libero.it
Giuseppe Dilauro	Università di Bari "Aldo Moro"	giuseppe.dilauro@uniba.it
Danilo Dini	Università di Roma "La Sapienza"	danilo.dini@uniroma1.it
Marco d'Ischia	Università di Napoli Federico II	dischia@unina.it
Valentina Domenici	Università di Pisa	valentina.domenici@unipi.it
Greta Donati	University of Washington	greta.donati@unina.it
Paola Agata Eustochia Donato	Università di Messina	padonato@unime.it
Maria Pia Donzello	Università di Roma "La Sapienza"	mariapia.donzello@uniroma1.it
Luka Dordevic	Università di Firenze	luka.dordevic@phd.units.it
Filippo Doria	Università di Pavia	filippo.doria@unipv.it
Rosarita D'Orsi	Università della Basilicata	rosarita.dorsi@gmail.com
Davide Dova		davide-dova@libero.it
Roberto Dovesi		
Christian Durante	Università di Padova	christian.durante@unipd.it
Alessandro D'Urso	Università di Catania	adurso@unict.it
Gilda D'Urso	Università di Salerno	gidurso@unisa.it
Franco Egidi	Scuola Normale Superiore	franco.egidi@sns.it
Anna Esposito	Università di Napoli Federico II	anna-esposito@outlook.com
Tiziana Esposito	Università di Salerno	tesposito@unisa.it
Veronica Esposito	Università di Napoli Federico II	veronica.esposito@unina.it
Roberto Esposito	Università di Napoli Federico II	
Antonio Evidente	Università di Napoli Federico II	
Marco Fabbiani	Università dell'Insubria	marco.fabbiani88@gmail.com
Debora Fabbri	Università di Torino	debora.fabbri@unito.it

Laura Fabiani	Università di Roma "Tor Vergata"	laura.fabiani@uniroma2.it
Maria Aurora Fabiano	Università di Roma "La Sapienza"	maria.aurora.fabiano@gmail.com
Antonio Facchetti	Flexterra Inc.	afacchetti@flexterracorp.com
Maria Cristina Facchini	CNR, Istituto di Scienze dell'Atmosfera e del Clima	
Anna Maria Fadda	Università di Cagliari	mfadda@unica.it
Lucia Fagiolari	Università di Perugia	lucia.fagiolari@studenti.unipg.it
Maurizio Fagnoni	Università di Pavia	fagnoni@unipv.it
Andrea Patrizia Falanga	Università di Napoli Federico II	and.falanga@gmail.com
Laura Falivene	Kaust	laura.falivene@kaust.edu.sa
Claudio Faloni		kate-12@hotmail.it
Simone Fanfoni	Società Chimica Italiana	
Elisabetta Fanizza	Università di Bari "Aldo Moro"	elisabetta.fanizza@uniba.it
Francesco Paolo Fanizzi	Università del Salento	fp.fanizzi@unisalento.it
Marzia Fantauzzi	Università di Cagliari	fantauzzi@unica.it
Marco Fantin	Carnegie Mellon University	mfantin@andrew.cmu.edu
A. Faraci		
Gianluca Maria Farinola	Università di Bari "Aldo Moro"	gianlucamaria.farinola@uniba.it
Caterina Fattorusso	Università di Napoli Federico II	
Roberto Fattorusso	Università della Campania "Luigi Vanvitelli"	roberto.fattorusso@unicampania.it
Laura Favaretto		
Gabriele Favero	Università di Roma "La Sapienza"	gabriele.favero@uniroma1.it
Tommaso Felicetti	Università di Perugia	tommaso.felicetti90@gmail.com
Simona Felletti	Università di Ferrara	fllsmn1@unife.it
Fulvia Felluga	Università di Trieste	ffelluga@units.it
Cristina Femoni	Università di Bologna	cristina.femoni@unibo.it
Alessandra Feoli	Università di Salerno	afeoli@unisa.it
Paola Fermo	Università di Milano	paola.fermo@unimi.it
Santo Davide Ferrara		
Anna Maria Ferrari	Università di Modena e Reggio Emilia	annamaria.ferrari@unimore.it
Giorgio Ferrari	Mapei	
Luca Ferrari		luca.ferrari13@studenti.unimi.it
Pamela Ferrari	Università di Firenze	pamela.ferrari@unifi.it
Francesca Ferraris	Università di Roma "La Sapienza"	francesca.ferraris@uniroma1.it
Francesca Ferrazza	Eni S.p.A. - Research & Innovation	
Luca Ferrero	Università di Milano Bicocca	luca.ferrero@unimib.it
Maurizio Ferretti	Università di Genova	ferretti@chimica.unige.it
Guido Giovanni Ferro		
Stefania Ferro	Università di Messina	
Vincenzo Ferrone	Università "G. D'Annunzio" Chieti-Pescara	vinsferrone@gmail.com
Carmen Festa	Università di Napoli Federico II	carmen.festa@unina.it
Roberto Fiammengo	Istituto Italiano di Tecnologia	roberto.fiammengo@iit.it
Rosario Figliolia	Università di Udine	figliolia.rosario@spes.unina.it
Jonathan Filippi	Consiglio Nazionale delle Ricerche	jonathan.filippi@iccom.cnr.it
Giulia Fiorani	University of Oxford	giulia.fiorani@chem.ox.ac.uk
Antonio Fiorentino	Università della Campania "Luigi Vanvitelli"	antonio.fiorentino@unicampania.it
Rosa Fiorentino	Università di Bari "Aldo Moro"	r.fiorentino1@studenti.uniba.it

Patrizia Firmani	Università di Roma "La Sapienza"	patrizia.firmani@uniroma1.it
Vincenzo Firpo	Università di Napoli Federico II	vincenzo.firpo@gmail.com
Patrizia Foglia	Università di Roma "La Sapienza"	patrizia.foglia@uniroma1.it
Fabrizio Foiani	Aboca S.p.A.	fabrizio.foiani@gmail.com
Ettore Fois	Università dell'Insubria	ettore.fois@uninsubria.it
Antonella Fontana		
Patrizia Formoso	Università della Calabria	patrizia.formoso@unical.it
Simonetta Fornarini	Università di Roma "La Sapienza"	
Antonio Fornite	Thermo Fisher	
Raimondo Fornite	Thermo Fisher	
Cosimo G. Fortuna	Università di Catania	cg.fortuna@unict.it
Fabio Fossati	Università di Genova	fabio.fossati296@gmail.com
Gianluca Fossati	Italfarmaco Spa	g.calcopietro@italfarmaco.com
Claudia Foti		
Oscar Francesconi	Università di Firenze	
Carlo Franchini	Università di Bari "Aldo Moro"	carlo.franchini@uniba.it
Placido Franco	Università di Bologna	placido.franco2@unibo.it
Francesca Franco	Università di Salerno	
Ilaria Fratoddi	Università di Roma "La Sapienza"	ilaria.fratoddi@uniroma1.it
Laura Fumagalli	Università di Milano	laura.fumagalli@unimi.it
Emilia Furia	Università della Calabria	emilia.furia@unical.it
Giovanni Fusco	Università di Roma "La Sapienza"	giovanni.fusco@uniroma1.it
Marco Fuse'	Scuola Normale Superiore	fuse.marco@gmail.com
Elisabetta Gabano	Università del Piemonte Orientale	elisabetta.gabano@uniupo.it
Chiara Gabbiani	Università di Pisa	chiara.gabbiani@unipi.it
Bartolo Gabriele	Università della Calabria	bartolo.gabriele@unical.it
Serena Gabrielli	Università di Camerino	serena.gabrielli@unicam.it
Carmine Gaeta	Università di Salerno	cgaeta@unisa.it
Massimiliano Gaeta	Università di Catania	mgaeta@unict.it
Luciano Galantini	Università di Roma "La Sapienza"	luciano.galantini@uniroma1.it
Paola Galatello	Università di Salerno	pgalatello@unisa.it
Simone Galliano	Università di Torino	simone.galliano@unito.it
Emma Gallo	Università di Milano	emma.gallo@unimi.it
Pierluca Galloni	Università di Roma "Tor Vergata"	galloni@scienze.uniroma2.it
Andrea Gambaro		
Marta Gambucci	Università di Perugia	marta.gambucci@gmail.com
Lucia Gardossi	Università di Trieste	gardossi@univ.trieste.it
Claudio Garino	Università di Torino	claudio.garino@unito.it
Silvia Gaspa	Università di Sassari	silviettta_89@tiscali.it
Francesco Gasparrini	Università di Roma "La Sapienza"	francesco.gasparrini@uniroma1.it
Manuela Gatto		
Rita Gelli	Università di Firenze	gelli.rita@gmail.com
Alessandra Genga	Università del Salento	alessandra.genga@unisalento.it
Cesare Gennari	Università di Milano	cesare.gennari@unimi.it
Armando Gennaro	Università di Padova	armando.gennaro@unipd.it
Claudio Gerbaldi	Politecnico di Torino	claudio.gerbaldi@polito.it
Elena Ghedini	Università Ca' Foscari Venezia	gelena@unive.it

Silvia Ghimenti	Università di Pisa	silvia.ghimenti@unipi.it
Francesca Ghirga	Istituto Italiano di Tecnologia	francesca.ghirga@iit.it
Ilaria Giacchello	Università di Genova	giacchello@difar.unige.it
Fausta Giacobello	Università di Messina	fgiacobello@unime.it
Elio Giamello	Università di Torino	elio.giamello@unito.it
Concetta Giancola	Università di Napoli Federico II	giancola@unina.it
Marco Giannetto	Università di Parma	marco.giannetto@unipr.it
Clelia Giannini	Università di Milano	clelia.giannini@unimi.it
Arnaud Gigot	Politecnico di Torino	arnaud.gigot@polito.it
Marco Ginepro	Università di Torino	marco.ginepro@unito.it
Andrea Gini	University of Regensburg	and.g1@hotmail.it
Salvatore Vincenzo Giofre'	Università di Messina	sgiofre@unime.it
Fabrizio Giordanetto	D E Shaw Research Llc	fabrizio.giordanetto@deshawresearch.com
Lara Giordani	TCI Europe N.V.	
Claudia Giorgi	Università di Firenze	claudia.giorgi@unifi.it
Gianluca Giorgi	Università di Siena	gianluca.giorgi@unisi.it
Simone Giorgi	Università di Camerino	sim.giorgi@gmail.com
Eugenia Giorno	Università della Calabria	giornoeugenia@gmail.com
Chiara Giovannini		chiara.giovannini@gmail.com
Alberto Girlando	Università di Parma	girlando@unipr.it
Rosaria Gitto	Università di Messina	rgitto@unime.it
Ottavia Giuffrè		
Alessandro Giuffrida	Università di Catania	agiuffri@unict.it
Arianna Giuliani		
Walter Giurlani	Università di Firenze	walter.giurlani@unifi.it
Marina Gobbo	Università di Padova	marina.gobbo@unipd.it
Roberto Gobetto	Università di Torino	roberto.gobetto@unito.it
Gianfranco Goi	Isis F. Solari	goigianfranco@alice.it
Lorenzo Gontrani	Università di Roma "La Sapienza"	lorenzo.gontrani@uniroma1.it
Laura Goracci	Università di Perugia	laura@chemiome.chm.unipg.it
Fabio Gosetti	Università del Piemonte Orientale	fabio.gosetti@uniupo.it
Claudia Graiff	Università di Parma	claudia.graiff@unipr.it
Gaetano Granozzi	Università di Padova	gaetano.granozzi@unipd.it
Alfonso Grassi	Università di Salerno	agrassi@unisa.it
Giuliana Grasso	Università di Salerno	
Vittoria Graziani	Università della Campania "Luigi Vanvitelli"	vittoria.graziani@unicampania.it
Claudio Greco	Università di Milano Bicocca	claudio.greco@unimib.it
Alessia Griglio	Università del Piemonte Orientale	alessia.griglio@uniupo.it
Fabia Grisi	Università di Salerno	fgrisi@unisa.it
Roberto Grisorio	Politecnico di Bari	roberto.grisorio@poliba.it
Elena Groppo	Università di Torino	elena.groppo@unito.it
Marco Grotti	Università di Genova	grotti@unige.it
Andrea Gualandi	Università di Bologna	andrea.gualandi10@unibo.it
Alice Guarneri	Università di Trieste	alliguarneri@gmail.com
Federica Guarra	Università di Pisa	guarraf@hotmail.it
Lorenzo Guazzelli	Università di Pisa	lorenzo.guazzelli@unipi.it

Cesare Guercia	IDAEA-CSIC	cesare.guercia@gmail.com
Gaetano Guerra	Università di Salerno	gguerra@unisa.it
Remo Guerrini	Università di Ferrara	remo.guerrini@unife.it
Gianfranco Guglielmetti	Azienda Privata	gugliel28010@libero.it
Matteo Guidotti	Consiglio Nazionale delle Ricerche	m.guidotti@istm.cnr.it
Marcella Guiso	Università di Roma "La Sapienza"	
Giuseppina Gullifa	Università di Roma "La Sapienza"	gullifaj@gmail.com
Monica Gulmini	Università di Torino	monica.gulmini@unito.it
Anders Hagfeldt	École Polytechnique Fédérale de Lausanne	
Rosa Iacovino	Università della Campania "Luigi Vanvitelli"	Rosa.IACOVINO@unicampania.it
Antonella Iacovone	Università di Firenze	antonella.iacovone@unifi.it
Francesco Iadaresta	Università di Salerno	
Grazia Iannucci	Università di Pisa	graziaiannucci@hotmail.it
Maria Carmela Iapalucci	Università di Bologna	maria.iapalucci@unibo.it
Gaetano Iaquaniello	KT – Kinetics Technology SpA	G.Iaquaniello@kt-met.it
Roberta Ibba	Università di Sassari	roberta.ibba91@gmail.com
Laura Ielo	Università di Messina	lauielo@unime.it
Anna Illiano	Università di Napoli Federico II	anna.illiano@unina.it
Paolo Ingallinella	Diasorin Spa	paolo.ingallinella@diasorin.it
Valentina Innamorati		
Gabbriella Innocenti		gabbriella.innocenti@unipd.it
Giada Innocenti	Università di Bologna	giada.innocenti2@unibo.it
Massimo Innocenti	Università di Firenze	m.innocenti@unifi.it
Riccardo Innocenti	Università di Firenze	riccardo.innocenti@unifi.it
Adriano Intiso	Università di Salerno	aintiso@unisa.it
Daniela Intrieri	Università di Milano	daniela.intrieri@unimi.it
Giuseppina Ioele	Università della Calabria	giuseppina.ioele@unical.it
Pasquale Iovino	Università della Campania "Luigi Vanvitelli"	pasquale.iovino@unicampania.it
Pasquale Iovino	Università della Campania "Luigi Vanvitelli"	
Anna Irto	Università di Messina	airto@unime.it
Carla Isernia	Università della Campania "Luigi Vanvitelli"	carla.isernia@unicampania.it
Arlette Itken-fuder	Wiley-VCH	eurjic@wiley-vch.de
Veronica Iuliano	Università di Salerno	
Lorella Izzo		
Koen Janssens	University of Antwerp	
Jae Ho Jung	Seoul National University Bundang Hospital	jaehoboa@paran.com
Christian Oliver Kappe	Kerl-Franzens-Universitat Graz	
Giorgia La Barbera	Università di Roma "La Sapienza"	giorgia.labarbera@uniroma1.it
Massimo La Deda	Università della Calabria	massimo.ladeda@unical.it
Barbara La Ferla	Università di Milano Bicocca	barbara.laferla@unimib.it
Simona La Gatta	Università di Bari "Aldo Moro"	simona.lagatta@uniba.it
Pellegrino La Manna	Università di Salerno	plamanna@unisa.it
Fabio La Mantia	Univerity of Bremen	lamantia@uni-bremen.de
Diego La Mendola	Università di Pisa	
Andrea La Monaca	Università di Bologna	andrea.lamonaca2@unibo.it
Valeria La Pietra		
Giuseppe La Regina	Università di Roma "La Sapienza"	giuseppe.laregina@uniroma1.it

Mario Vincenzo La Rocca	Università dell'Insubria	mvlarocca@uninsubria.it
Marcello La Rosa	Università di Bologna	marcello.larosa3@unibo.it
Luca Labella	Università di Pisa	luca.labella@unipi.it
Joanna Izabela Lachowicz	Università di Cagliari	lachowicz@unica.it
Aldo Lagana'	Università di Roma "La Sapienza"	aldo.lagana@uniroma1.it
Luigi Lai		
Francesco Lamberti	Università di Padova	cescofanti@gmail.com
David Hermann Lamparelli	Università di Salerno	
Isabella Lancellotti	Università di Modena e Reggio Emilia	isabella.lancellotti@unimore.it
Alessandro Landi	Università di Salerno	alelandi1@unisa.it
Clark Landis	University of Wisconsin-Madison	landis@chem.wisc.edu
Gabriele Lando	Università di Messina	glando@unime.it
Heiko Lange	Università di Roma "Tor Vergata"	heiko.lange@uniroma2.it
Osvaldo Lanzalunga	Università di Roma "La Sapienza"	osvaldo.lanzalunga@uniroma1.it
Rosita Lapenta	Università di Salerno	roslapenta@gmail.com
Alessandra Lattanzi	Università di Salerno	lattanzi@unisa.it
Luciano Lattuada	Bracco Imaging S.p.A.	luciano.lattuada@bracco.com
Gianluigi Lauro	Università di Salerno	glauro@unisa.it
Cristina Lazzerini		
Andrea Le Donne	Università di Roma "La Sapienza"	andrea.ledonne@uniroma1.it
Byung Chul Lee	Seoul National University Bundang Hospital	leebc@snu.ac.kr
Antonella Leggio	Università della Calabria	antonella.leggio@unical.it
Giuseppe Legname	Scuola Internazionale Superiore di Studi Avanzati	
Elena Lenci	Università di Firenze	elena.lenci@unifi.it
Federica Leone	Politecnico di Torino	federica.leone@polito.it
Linda Leone	Università di Napoli Federico II	linda.leone@unina.it
Francesca Leonelli	Università di Roma "La Sapienza"	francesca.leonelli@uniroma1.it
Grazia Leonzio	Università de L'Aquila	grazia.leonzio@virgilio.it
Joannes Lercher	Technische Universität München	
Andreas Lesch	EPFL Valais Wallis	andreas.lesch@epfl.ch
Marco Lessi	Università di Pisa	marco.lessi@unipi.it
Emanuela Licandro	Università di Milano	emanuela.licandro@unimi.it
Giulia Licini	Università di Padova	giulia.licini@unipd.it
Domenico Licursi	Università di Pisa	domenico.licursi@virgilio.it
Angelo Liguori	Università della Calabria	angelo.liguori@unical.it
Lucio Litti	Università di Padova	lucio.litti@unipd.it
Massimiliano Lo Faro	Consiglio Nazionale delle Ricerche	lofaro@itae.cnr.it
Carmelo Lo Vecchio	Consiglio Nazionale delle Ricerche	lovecchio@itae.cnr.it
Erica Locatelli	Università di Bologna	erica.locatelli2@unibo.it
Marco Lolli	Università di Torino	marco.lolli@unito.it
Matteo Longhi	Recordati S.p.a.	longhi.m@recordati.it
Francesco Longobardi		
Gianluca Longoni	Istituto Italiano di Tecnologia	gianluca.longoni@iit.it
Francesco Lopez	Università del Molise	
Antonia Lopreside	Università di Bologna	antonia.lopreside2@unibo.it
Francesca Lorandi	Università di Padova	francesca.lorandi.2@studenti.unipd.it
Marco Lucarini	Università di Bologna	marco.lucarini@unibo.it

Jannette Luceico		
Lapo Luconi	Consiglio Nazionale delle Ricerche	lapo.luconi@iccom.cnr.it
Eleonora Macchia	Università di Bari "Aldo Moro"	eleonora.macchia@uniba.it
Alceo Macchioni	Università di Perugia	alceo.macchioni@unipg.it
Elias Maccioni	Università di Cagliari	maccione@unica.it
Marco Macis	Università di Bologna	macismarco@gmail.com
Antonella Macrì	Università di Parma	antonella.macri@studenti.unipr.it
Anna Madaio	Itt Focaccia Salerno	annamariamadaio@libero.it
Valentina Noemi Madia	Università di Roma "La Sapienza"	valentinanoemi.madia@uniroma1.it
Giovanni Maestri	Università di Parma	giovanni.maestri@unipr.it
Vito Maggi	Istituto Italiano di Tecnologia	vito.maggi@iit.it
Michele Maggini	Università di Padova	
Emanuele Magi	Università di Genova	emanuele.magi@unige.it
Vittorio Maglia	Federchimica	
Ornella Maglio	Consiglio Nazionale delle Ricerche	
Loredana Maiuolo	Università della Calabria	maiuolo@unical.it
Anna Malafronte	Università di Napoli Federico II	anna.malafronte@unina.it
Gianluca Malavasi	Università di Modena e Reggio Emilia	gmalavasi@unimo.it
Marino Malavolti	Vinavil S.p.A.	m.malavolti@vinavil.it
Marialuce Maldini	Sciex	
Cristina Malegori	Università di Genova	malegori@difar.unige.it
Gaetano Malgieri		
Cosimino Malitesta	Università del Salento	cosimino.malitesta@unisalento.it
Gabriele Manca	Consiglio Nazionale delle Ricerche	gmanca@iccom.cnr.it
Fabrizio Mancin	Università di Padova	fabrizio.mancin@unipd.it
Raffaella Mancuso	Università della Calabria	raffaella.mancuso@unical.it
Michele Manfra	Università della Basilicata	michele.manfra@unibas.it
Carla Manfredi	Università di Napoli Federico II	carla.manfredi@unina.it
Marcello Manfredi	Università del Piemonte Orientale	marcello.manfredi@uniupo.it
Stefano Mangani		
Vincenzo Mangini	Istituto Italiano di Tecnologia	vincenzo.mangini@iit.it
Alfonso Mangoni	Università di Napoli Federico II	alfonso.mangoni@unina.it
Paola Manini	Università di Napoli Federico II	pmanini@unina.it
Matteo Mannini	Università di Firenze	matteo.mannini@unifi.it
Enrico Mansueti	Istituto di Istruzione Superiore di Ceccano	enricomansueti@virgilio.it
Simone Mantegazza	Dipharma Francis Srl	simone.mantegazza@dipharma.com
Giulia Marafon	Università di Padova	giulia.marafon@gmail.com
Daniela Marasco	Università di Napoli Federico II	daniela.marasco@unina.it
Valentina Marassi	Università di Bologna	valentina.marassi2@unibo.it
Patrick Marcantelli	Istituto Tecnico Statale T. Buzzi	patrick.marcantelli@gmail.com
Giuliana Marchesani	Istituto Zooprofilattico Puglia e Basilicata	giuliana.marchesani@gmail.com
Marta Marchesi	Università di Milano	marchesi.marta@gmail.com
Nicola Marchetti	Università di Ferrara	nicola.marchetti@unife.it
Simone Marchetti	Università di Pavia	simone.marchetti01@universitadipavia.it
Nadia Marchettini	Università di Siena	nadia.marchettini@unisi.it
Marianna Marchini	Università di Bologna	marianna.marchini2@unibo.it

Caterina Marcoaldi	Università di Roma "Tor Vergata"	caterina.marcoaldi@enea.it
Antonio Marcomini		
Giovanna Maresca	Università di Roma "La Sapienza"	giovanna.maresca@uniroma1.it
Luigi Margarucci	Phenomenex	
Alessandro Mariani	ESRF Grenoble	alessandro.mariani@esrf.fr
Annaluisa Mariconda	Università di Salerno	amariconda@unisa.it
Luciana Marinelli		
Tiziana Marino	Università della Calabria	tmarino@unical.it
Michael J. Maroney	University of Massachusetts - Amherst	mmaroney@chem.umass.edu
Andrea Giacomo Marrani	Università di Roma "La Sapienza"	andrea.marrani@uniroma1.it
Giovanna Marrazza	Università di Firenze	giovanna.marrazza@unifi.it
Agostino Marrazzo	Università di Catania	marrazzo@unict.it
Giulia Marsico	Università della Basilicata	giuliamar86@hotmail.it
Teo Martin	Università di Roma "Tor Vergata"	teo.martin@uniroma2.it
Gianmario Martra	Università di Torino	gianmario.martra@unito.it
Salvatore Marullo	Università di Palermo	salvatore.marullo@unipa.it
Giovanni Marzaro	Università di Padova	giovanni.marzaro@unipd.it
Tiziano Marzo	Università di Pisa	tiziano.marzo@dcci.unipi.it
Domiziana Masci	Università di Roma "La Sapienza"	domiziana.masci@uniroma1.it
Giuseppe Mascolo	Consiglio Nazionale delle Ricerche	
Arianna Massaro	Università di Napoli Federico II	arianna.massaro@live.it
Raffaella Mastrocinque	Università di Salerno	rmastrocinque@unisa.it
Stefano Materazzi	Università di Roma "La Sapienza"	
Luisa Mattoli	Aboca S.p.A.	lmattoli@aboca.it
Luciano Mayol	Università di Napoli Federico II	mayoll@unina.it
Vincenzo Mazzaracchio	Università di Roma "Tor Vergata"	vincenzo.mazzaracchio@uniroma2.it
Luca Mazzei	Università di Bologna	luca.mazzei2@unibo.it
Mina Mazzeo	Università di Salerno	mmazzeo@unisa.it
Rocco Mazzeo	Università di Bologna	
Angelica Mazzolari	Università di Milano	angelica.mazzolari@unimi.it
Gloria Mazzone	Università della Calabria	gmazzone@unical.it
Rita Mazzoni	Università di Bologna	rita.mazzoni@unibo.it
Laura Anett Medve	Università di Milano	laura.medve@unimi.it
Michele Melchionna	Università di Trieste	melchionnam@units.it
Massimo Mella		
Döerthe Mellman	Wiley-VCH	
Mattia Melloni	Università di Bologna	mattia.melloni2@unibo.it
Mattia Melosso	Università di Bologna	mattia.melosso2@unibo.it
Marco Mendolicchio	Scuola Normale Superiore	marco.mendolicchio@sns.it
Federica Menegazzo	Università Ca' Foscari Venezia e INSTM	fmenegaz@unive.it
Moreno Meneghetti	Università di Padova	moreno.meneghetti@unipd.it
Gabriel Menendez Rodriguez	Università di Perugia	gabriel.mr1988@gmail.com
Maria Menichincheri	Nerviano Medical Sciences Srl	maria.menichincheri@nervianoms.com
Sara Meninno	Università di Salerno	smeninno@unisa.it
Maria Cristina Menziani	Università di Modena e Reggio Emilia	mariacristina.menziani@unimore.it
Daniele Merli	Università di Pavia	daniele.merli@unipv.it

Francesco Mesiti	Università "Magna Graecia" - Catanzaro	francesco.mesiti@hotmail.it
Andrea Mezzetta	Università di Pisa	mezzetta.andrea@virgilio.it
Laura Micheli	Università di Roma "Tor Vergata"	micheli@uniroma2.it
Matteo Micucci	Università di Bologna	matteo.micucci2@unibo.it
Ylenia Miele	Università di Salerno	ylenia.miele@hotmail.it
Vittorio Milanesi	Versalis S.p.A.	vittorio.milanesi@versalis.eni.com
Francesco Milano		
Demetrio Milea	Università di Messina	dmilea@unime.it
Ivana Miletto	Università del Piemonte Orientale	ivana.miletto@uniupo.it
Stefano Milione	Università di Salerno	smilione@unisa.it
Ciro Milite	Università di Salerno	cmilite@unisa.it
Marco Minella	Università di Torino	marco.minella@unito.it
Claudio Minero	Università di Torino	claudio.minero@unito.it
Alessandro Minguzzi	Università di Milano	alessandro.minguzzi@unimi.it
Mara Mirasoli	Università di Bologna	mara.mirasoli@unibo.it
Domenico Misiti	Università di Roma "La Sapienza"	domenico.misiti@uniroma1.it
Nico Mitro	Università di Milano	nico.mitro@unimi.it
Adriano Mollica	Università "G. D'Annunzio" Chieti-Pescara	
Guglielmo Monaco	Università di Salerno	gmonaco@unisa.it
Matteo Monai	Università di Trieste	matteomonai@gmail.com
Magda Monari	Università di Bologna	magda.monari@unibo.it
Calogera Monastero	Università di Palermo	linda.monastero@iamc.cnr.it
Luigi Monsù Scolaro	Università di Messina	lmonsu@unime.it
Daniela Montesarchio	Università di Napoli Federico II	daniela.montesarchio@unina.it
Damiano Monticelli	Università dell'Insubria	damiano.monticelli@uninsubria.it
Carmela Maria Montone	Università di Roma "La Sapienza"	carmelamaria.montone@uniroma1.it
Paola Montoro	Università di Salerno	pmontoro@unisa.it
Alessandro Mordini	Consiglio Nazionale delle Ricerche	alessandro.mordini@unifi.it
Carlo F. Morelli	Università di Milano	carlo.morelli@unimi.it
Mattia Mori	Istituto Italiano di Tecnologia	m.mattia79@gmail.com
Lucia Morillas Becerril	Università di Padova	lucia.morillasbecerril@studenti.unipd.it
Stefano Moro	Università di Padova	stefano.moro@unipd.it
Stefano Moro	Università di Padova	
Elva Morretta	Università di Salerno	emorretta@unisa.it
Elva Morretta	Università di Salerno	
Danila Moscone	Università di Roma "Tor Vergata"	danila.moscone@uniroma2.it
Manuela Mostacci	Società Chimica Italiana	
Lionnel Mounier	Thermo Fisher	
Claudio Mucchino	Università di Parma	claudio.mucchino@unipr.it
Marina Munari	Università di Udine	goigianfranco@alice.it
Ana Belen Munoz Garcia	Università di Napoli Federico II	anabelen.munozgarcia@unina.it
Simona Musella	Università di Salerno	smusella@unisa.it
Marco Musiani	Consiglio Nazionale delle Ricerche	marco.musiani@cnr.it
Patrizia Romana Mussini	Università di Milano	patrizia.mussini@unimi.it
Giuseppe Musumarra	Università di Catania	gmusumarra@unict.it
Attilio Naccarato	Istituto sull'Inquinamento Atmosferico - Cnr	attilio.naccarato@iia.cnr.it
Valentina Naccarato	Università di Roma "La Sapienza"	valentina.naccarato@uniroma1.it

Sabino Napoletano	Min. Int. Polizia Scientifica	
Anna Napoli	Università della Calabria	
Assunta Napolitano	Università di Salerno	anapoli@unisa.it
Maria Incoronata Nardella	Università di Bari "Aldo Moro"	maria.nardella@uniba.it
Monica Nardi	Università della Calabria	nardi@unical.it
Giovanni Natile	Università di Bari "Aldo Moro"	giovanni.natile@uniba.it
Cristina Nativi	Università di Firenze	
Maria Assunta Navarra	Università di Roma "La Sapienza"	mariassunta.navarra@uniroma1.it
Wanda Navarra	Università di Salerno	wandanavarra@gmail.com
Wanda Navarra	Università di Salerno	
Daniele Naviglio	Università di Napoli Federico II	naviglio@unina.it
Esmeralda Neri	Università di Bologna	esmeralda.neri@unibo.it
Placido Neri	Università di Salerno	neri@unisa.it
Luigi Nicolais		
Simone Nicolardi	Leiden University Medical Center	s.nicolardi@lumc.nl
Benedetto Nicolini		
Francesco Nicotra	Università di Milano Bicocca	francesco.nicotra@unimib.it
Lara Nobili	Università di Bologna	lara.nobili3@unibo.it
Alessio Nocentini	Università di Firenze	alessio.nocentini@unifi.it
Paola Nocera	Università di Napoli Federico II	paola.nocera@unina.it
Mirco Nodari	Versalis S.p.A.	mirco.nodari@versalis.eni.com
Donato Ivan Notar		
Mario Novelli	Polynt	mario.novelli@polynt.com
Leone Oliva	Università di Salerno	loliva@unisa.it
Rosario Oliva	Università di Napoli Federico II	rosario.oliva2@unina.it
Paolo Oliveri	Università di Genova	oliveri@difar.unige.it
Valentina Oliveri	Università di Catania	oliveri.valentina22@gmail.com
Giorgia Oliviero	Università di Napoli Federico II	golivier@unina.it
Fabio Olmi		fabio.olmi@gmail.com
Barbara Onida	Politecnico di Torino	barbara.onida@polito.it
Massimo Onor	Consiglio Nazionale delle Ricerche	onor@pi.iccom.cnr.it
Alessandra Operamolla	Università di Bari "Aldo Moro"	alessandra.operamolla@uniba.it
Laura Orian	Università di Padova	laura.orian@unipd.it
Marco Emilio Orlandi	Università di Milano Bicocca	marco.orlandi@unimib.it
Francesco Orofino	Università di Siena	francesco.orofino@icloud.com
Fausto Ortica	Università di Perugia	fausto.ortica@unipg.it
Gianfranco Pacchioni	Università di Milano Bicocca	gianfranco.pacchioni@unimib.it
Andrea Pace	Università di Palermo	andrea.pace@unipa.it
Sara Padoan	Università Ca' Foscari Venezia	sara.padoan@unive.it
Luigi Paduano	Università di Napoli Federico II	
Maria Cristina Paganini	Università di Torino	mariacristina.paganini@unito.it
Angela Pagano	Università di Genova	angela_pagano@alice.it
Bruno Pagano	Università di Napoli Federico II	bruno.pagano@unina.it
Francesco Pagano	Università di Napoli Federico II	fpagano@unisa.it
Rosanna Pagano		
Gioele Pagot	Università di Padova	gioele.pagot@gmail.com
Anna Painelli	Università di Parma	anna.painelli@unipr.it

Ilaria Palchetti	Università di Firenze	ilaria.palchetti@unifi.it
Pasquale Palladino	Università di Firenze	pasquale.palladino@unifi.it
Marco Pallavicini	Università di Milano	marco.pallavicini@unimi.it
Giuseppe Palleschi	Università di Roma "Tor Vergata"	giuseppe.palleschi@uniroma2.it
Alessandro Palmioli	Università di Milano Bicocca	alessandro.palmioli@unimib.it
Marta Palombo	Università di Bologna	marta.palombo2@unibo.it
Vincenzo Pantone		
Marco Paolino	Università di Siena	paomar@oneonline.it
Francesco Paolucci	Università di Bologna	francesco.paolucci@unibo.it
Emilia Paone	Università "Mediterranea" di Reggio Calabria	emilia.paone@unirc.it
Alessandra Papacchini	Università di Firenze	alessandra.papacchini@unifi.it
Veronica Paradiso	Università di Salerno	vparadiso@unisa.it
Eleonora Pargoletti	Università di Milano	eleonora.pargoletti@gmail.com
Emmanuele Parisi		emmanuele.parisi@hotmail.it
Michelangelo Pascale		
Carolina Pasero	Università di Siena	carolina.pasero@tiscali.it
Maurizio Passaponti	Università di Firenze	maurizio.passaponti@unifi.it
Fabrizio Passarini	Università di Bologna	fabrizio.passarini@unibo.it
Cristina Pastore	Università di Salerno	
Paolo Pastore	Università di Padova	paolo.pastore@unipd.it
Michele Pavone	Università di Napoli Federico II	michele.pavone@unina.it
David Peck	Delft University of Technology	
Alfonso Pedone	Università di Modena e Reggio Emilia	alfonso.pedone@unimore.it
Lucio Pellacani	Università di Roma "La Sapienza"	lucio.pellacani@uniroma1.it
Valentina Pellicciolì	Università di Milano	valentina.pellliccioli@studenti.unimi.it
Chiara Pennetta	Politecnico di Milano	pennetta90@gmail.com
Giacomo Pepe	Università di Salerno	gipepe@unisa.it
Mauro Perfetti	Università di Firenze	mauro.perfetti@unifi.it
Francesco Peri	Università di Milano Bicocca	francesco.peri@unimib.it
Elena Perin	Università del Piemonte Orientale	elenaperin89@alice.it
Emanuela Perra	Università Ca' Foscari Venezia	839127@stud.unive.it
Maurizio Peruzzini	Consiglio Nazionale delle Ricerche	direttore.dsctm@cnr.it
Maria Pesavento		
Chiara Petiti	Politecnico di Milano	chiara.petiti@polimi.it
Elena Petricci	Università di Siena	PETRICCI@UNISI.IT
Chiara Petroselli	Università di Perugia	petrosellichiara@gmail.com
Alessandro Pezzella	Università di Napoli Federico II	
Sara Piantini	Università di Firenze	sara.piantini@unifi.it
Rosaria Anna Picca	Università di Bari "Aldo Moro"	rosaria.picca@uniba.it
Gennaro Piccialli	Università di Napoli Federico II	picciall@unina.it
Luca Piemontese	Università di Bari "Aldo Moro"	luca.piemontese@uniba.it
Maurizio Piergiovanni	Università di Urbino "Carlo Bo"	m.piergiovanni1@campus.uniurb.it
Marco Pierini	Università di Roma "La Sapienza"	marco.pierini@uniroma1.it
Pamela Piermattei	Università di Camerino	pamela.piermattei@unicam.it
Marco Pieroni	Università di Parma	marco.pieroni@unipr.it
Giovanni Pierri	Università di Salerno	
Andrea Pietropolli Charmet	Università Ca' Foscari Venezia	jacpnike@unive.it

Francesco Pignataro	SCI - Divisione Chimica Industriale Presidente	francescoluigi.pignataro@fastwebnet.it
Gabriella Pinto	Università di Napoli Federico II	gabriella.pinto@unina.it
Susy Piovesana	Università di Roma "La Sapienza"	susy.piovesana@uniroma1.it
Giovanni Pipolo		
Silvio Pipolo	Università di Lille	silvio.pipolo@univ-lille1.fr
Tracey Pirali	Università del Piemonte Orientale	tracey.pirali@pharm.unipmn.it
Concetta Pironti	Università di Salerno	cpironti@unisa.it
Valentina Pirovano	Università di Milano	valentina.pirovano@unimi.it
Leonardo Pisani	Università di Bari "Aldo Moro"	leonardo.pisani@uniba.it
Vincenzo Pisapia	Università di Salerno	v.pisapia3@gmail.com
Demetrio Pitea	Università di Milano Bicocca	manuela.mostacci@soc.chim.it
Cristina Pizzolitto	Università Ca' Foscari Venezia	cristina.pizzolitto@unive.it
Maddalena Pizzotti	Università di Milano	maddalena.pizzotti@unimi.it
Sara Pogliali		
Rebecca Pogni	Università di Siena	rebecca.pogni@unisi.it
Paolo Pollesel	ENI Spa	paolo.pollesel@eni.com
Valeria Polliotto	Università di Torino	valeria.polliotto@unito.it
Annalisa Polo	Università di Milano	annalisa.polo@unimi.it
Alessandro Poma	Università di Milano	alessandro.poma@unimi.it
Christian Silvio Pomelli	Università di Pisa	christian.pomelli@unipi.it
Fortuna Ponte	Università della Calabria	fortuna.ponte@unical.it
Alessandro Porchetta	Università di Roma "Tor Vergata"	alessandro.porchetta@uniroma2.it
Melania Francesca Porco	Università della Calabria	melania.francesca.porco@outlook.it
Emanuele Porru	Università di Bologna	emanuele.porru2@unibo.it
Simone Potenti	Scuola Normale Superiore	simone.potenti@sns.it
Marianna Potenza	Università di Salerno	mpotenza@unisa.it
Andrea Pozzi	Università dell'Insubria	andrea.pozzi@uninsubria.it
Cecilia Pozzi	Università di Siena	pozzi4@unisi.it
Veronica Praglia	Università di Milano	veronica.praglia@studenti.unimi.it
Stefania Pragliola	Università di Salerno	spragliola@unisa.it
Cristina Prandi	Università di Torino	cristina.prandi@unito.it
Alessandro Pratesi	Università di Firenze	alessandro.pratesi@unifi.it
Laura Prati	Università di Milano	laura.prati@unimi.it
Luca Prati	Università di Bologna	luca.prati2@unibo.it
Maurizio Prato	Università di Trieste	
Giovanni Predieri	Università di Parma	giovanni.predieri@unipr.it
Mario Prejano'	Università della Calabria	mariopre991@hotmail.it
Emanuele Priola	Università di Torino	
Federica Proietto	Università di Palermo	prtfrc.fp@gmail.com
Carmela Tania Prontera	Università di Napoli Federico II	carmelatania.prontera@unina.it
Antonio Proto	Università di Salerno	aproto@unisa.it
Stefano Protti	Università di Pavia	prottistefano@gmail.com
Rinaldo Psaro	Consiglio Nazionale delle Ricerche	r.psaro@istm.cnr.it
Federico Maria Pulselli	Università di Siena	fpulselli@unisi.it
Giovanni Pupo	Università di Roma "La Sapienza"	giovanni.pupo@uniroma1.it
Cristina Puzzarini	Università di Bologna	cristina.puzzarini@unibo.it
Francesco Puzzo	Università di Bologna	francesco.puzzo2@unibo.it

Eliana Quartarone		
Luca Quattrini	Università di Pisa	quattro16@hotmail.it
Maurizio Quinto	Università di Foggia	maurizio.quinto@unifg.it
Simona Raffo	Università di Bologna	simona.raffo2@unibo.it
Fabio Ragaini	Università di Milano	fabio.ragaini@unimi.it
Giulio Ragazzon	Università di Bologna	giulio.ragazzon@unibo.it
Gaetano Ragno	Università della Calabria	gaetano.ragno@unical.it
Sergio Rampino	Scuola Normale Superiore	srampino84@gmail.com
Simona Ranallo	Università di Roma "Tor Vergata"	simona.ranallo@uniroma2.it
Antonio Randazzo	Università di Napoli Federico II	antranda@unina.it
Rosalba Randazzo	Università di Catania	rrandazzo@unict.it
Stefania Rapino	Università di Bologna	stefania.rapino3@unibo.it
Giulio Rastelli	Università di Modena e Reggio Emilia	giulio.rastelli@unimore.it
Umberto Raucci	Università di Napoli Federico II	
Davide Ravelli	Università di Pavia	davide.ravelli@gmail.com
Mauro Ravera	Università del Piemonte Orientale	mauro.ravera@uniupo.it
Carlotta Raviola	Università di Pavia	carlotta.raviola01@universitadipavia.it
Gabriele Razzetti		
Nazzareno Re	Università G. D'Annunzio - Chieti	nre@unich.it
Sandro Recchia	Università dell'Insubria	sandro.recchia@uninsubria.it
Nadia Rega	Università di Napoli Federico II	
Gianna Reginato	Consiglio Nazionale delle Ricerche	gianna.reginato@iccom.cnr.it
Polyssena Renzi	Universität Regensburg	plyssnrnz@gmail.com
Donatella Rescigno	Università di Salerno	drescigno@unisa.it
Erika Ribechini	Università di Pisa	erika.ribechini@unipi.it
Andreina Ricci	Università della Campania "Luigi Vanvitelli"	andreina.ricci@unina2.it
Carla Ricci	Società Chimica Italiana	
Francesco Ricci	Università di Roma "Tor Vergata"	francesco.ricci@uniroma2.it
Maria Ricciardi	Università di Salerno	mariaricciardi91@outlook.it
Dario Ricciardi		
Raffaele Riccio	Università di Salerno	raffaele.riccio@soc.chim.it
Francesca Ridi	Università di Firenze & Consorzio CSGI	ridi@csgi.unifi.it
Angelo Ripamonti	Bruker	
Caterina Risi	Università di Siena	risi@student.unisi.it
Roberta Risoluti	Università di Roma "La Sapienza"	roberta.risoluti@uniroma1.it
Silvia Rivara		
Luca Rivoira	Università di Torino	luca.rivoira@unito.it
Vito Rizzi	Università di Bari "Aldo Moro"	vitorizzi@hotmail.com
Luciana Rizzo	Università di Milano Bicocca	luciana.rizzo@null.it
Paola Rizzo		
Elisa Robotti	Università del Piemonte Orientale	elisa.robotti@uniupo.it
Aldo Roda	Università di Bologna	
Barbara Roda		
Carlos Rodriguez	Elsevier	
Dominga Rogolino	Università di Parma	dominga.rogolino@unipr.it
Valeria Romanucci	Università di Napoli Federico II	valeria.romanucci@unina.it
Alessandro Girolamo	Università di Bologna	alessandro.rombola@unibo.it

Rombolà		
Daniele Rosa Gastaldo	Università di Padova	daniele.rosagastaldo@studenti.unipd.it
Ilario Rosito		
Marianna Rossetti	Università di Roma "Tor Vergata"	marianna.rossetti@uniroma2.it
Antonella Rossi	Università di Cagliari	
Elisabetta Rossi	Università di Milano	elisabetta.rossi@unimi.it
Alfredo Roverselli	Buchi Italia	
Antonio Roviello	Università di Napoli Federico II	antonio.roviello@unina.it
Valentina Roviello	Università di Napoli Federico II	valentina.roviello@gmail.com
Nazari Roya		
Andrea Rozzi	Università di Parma	andrea.rozzi@studenti.unipr.it
Riccardo Ruffo	Università di Milano Bicocca	riccardo.ruffo@unimib.it
Olga Russina	Università di Roma "La Sapienza"	olga.russina@uniroma1.it
Alessandra Russo	Università di Salerno	alrusso@unisa.it
Eleonora Russo		
Laura Russo	Università di Milano Bicocca	laura.russo@unimib.it
Luigi Russo	Università della Campania "Luigi Vanvitelli"	luigi.russo2@unicampania.it
Nino Russo	Università della Calabria	nrusso@unical.it
Paola Russo	Università di Salerno	paorusso@unisa.it
Saverio Russo	INSTM	russo@chimica.unige.it
Vincenzo Russo	Università di Napoli Federico II	v.russo@unina.it
Vincenzo Russo	Mapei	
Luigia Sabbatini	Università di Bari "Aldo Moro"	luigia.sabbatini@uniba.it
Federica Sabuzi	Università di Roma "Tor Vergata"	federica.sabuzi@uniroma2.it
Maria Dolores Sacchi		gugliel28010@libero.it
Olga Sacco	Università di Salerno	osacco@unisa.it
Francesco Saccoliti	Università di Roma "La Sapienza"	francescosaccoliti@libero.it
Adriana Saccone	Università di Genova	adriana.saccone@unige.it
Filippo Saiano	Università di Palermo	filippo.saiano@unipa.it
Silvana Saiello	Università di Napoli Federico II	silvana.saiello@unina.it
Davide Sala	CERM	d.sala1388@gmail.com
Marina Sala	Università di Salerno	msala@unisa.it
Monica Saladini	Università di Modena e Reggio Emilia	monica.saladini@unimore.it
Maria Luisa Saladino	Università di Palermo	
Gianluca Salerno	Università di Firenze	gianluca.salerno@unifi.it
Loredana Salerno	Università di Catania	l.salerno@unict.it
Severo Salvadori	Università di Ferrara	severo.salvadori@unife.it
Maria Michela Salvatore	Università di Napoli Federico II	mariamichela.salvatore@unina.it
Stefano Salvestrini	Università della Campania "Luigi Vanvitelli"	stefano.salvestrini@unicampania.it
Emanuele Salvietti	Università di Firenze	emanuelesalvietti@gmail.com
Antonella Salvini	Università di Firenze	antonella.salvini@unifi.it
Chiara Salvitti	Università di Roma "La Sapienza"	chiara.salvitti@uniroma1.it
Annamaria Salvo		
Simona Samaritani	Università di Pisa	simona.samaritani@unipi.it
Letizia Sambri	Università di Bologna	letizia.sambri@unibo.it
Silvio Sammartano	Università di Messina	ssammartano@unime.it
Susanna Sampaolesi	Università di Camerino	susanna.sampaolesi@unicam.it

Monica Sanna	Università di Genova	sanna@difar.unige.it
Francesco Sannicolo	Università di Milano	francesco.sannicolo@unimi.it
Francesco Sansone	Università di Parma	francesco.sansone@unipr.it
Monica Santamaria	Università di Palermo	
Ilaria Santoro	Università della Calabria	ilaria.santoro@unical.it
Carla Sappino	Università di Roma "La Sapienza"	carla.sappino@uniroma1.it
Camillo Sartorio	Università di Palermo	camillo.sartorio@unipa.it
Mari Sasaki	TCI Europe N.V.	
Mauro Sassi	Università di Milano Bicocca	mauro.sassi@unimib.it
Paola Sassi	Università di Perugia	paola.sassi@unipg.it
Cristina Satriano		
Sara Sattin	Università di Milano	sara.sattin@unimi.it
Michele Saviano	Consiglio Nazionale delle Ricerche	msaviano@unina.it
Shadi H. Sawalha		
Gianluca Sbardella	Università di Salerno	gsbardella@unisa.it
Maria Carmina Scala	Università di Salerno	mscala@unisa.it
Luca Scalzullo	Scuola Secondaria di I Grado Solimena-de Lorenzo	lucascalzullo@gmail.com
Simona Scarano	Università di Firenze	simona.scarano@unifi.it
Simona Scarpella	Waters	
Giuseppe Scarponi	Università Politecnica delle Marche	
Erika Scavetta	Università di Bologna	erika.scavetta2@unibo.it
Martin Scheringer	ETH Zürich	
Chiara Schettini	Università di Camerino	chiaraschettini@hotmail.com
Rosaria Schettini	Università di Salerno	rosariacatia@alice.it
Eduardo Schiavo	Università di Napoli Federico II	eduardo.schiavo@unina.it
Onofrio Scialdone	Università di Palermo	onofrio.scialdone@unipa.it
Danilo Sciarrone	Università di Messina	dsciarrone@unime.it
Fabio Sciubba	Università di Roma "La Sapienza"	fabio.sciubba@uniroma1.it
Giorgia Sciutti		
Monica Scognamiglio	Max Planck Inst. For Chemical Ecol.	mscognamiglio@ice.mpg.de
Mirko Scortichini	Università di Camerino	mirko.scortichini@unicam.it
Nicola Scotti	Consiglio Nazionale delle Ricerche	nicola.scotti@istm.cnr.it
Paolo Scrimin	Università di Padova	paolo.scrimin@unipd.it
Andrea Secchi	Università di Parma	andrea.secchi@unipr.it
Elena Selli	Università di Milano	elena.selli@unimi.it
Ilaria Serafini	Università di Roma "La Sapienza"	ilaria.serafini@uniroma1.it
Marta Serafini	Università del Piemonte Orientale	marta_19491@live.it
Alessandra Serva	Università di Roma "La Sapienza"	alessandra.serva@uniroma1.it
Francesco Sessa	Università di Roma "La Sapienza"	francesco.sessa@uniroma1.it
Mirko Severi		
Giuseppe Sforazzini	École Polytechnique Fédérale de Lausanne	giuseppe.sforazzini@gmail.com
Andrew Shore	Royal Society of Chemistry	DALTON-RSC@rsc.org
Gabriella Siani	Università "G. D'Annunzio" Chieti-Pescara	siani@unich.it
Marina Sicignano	Università di Salerno	msicignano@unisa.it
Emilia Sicilia	Università della Calabria	emilia.sicilia@unical.it
Michela Signoretto	Università Ca' Foscari Venezia	miky@unive.it

Giovanni Sindona	Università della Calabria	giovanni.sindona@unical.it
Adalgisa Sinicropi	Università di Siena	adalgisa.sinicropi@unisi.it
Valeria Sivo	Università della Campania "Luigi Vanvitelli"	valeria.sivo1989@gmail.com
Alice Solda'	Università di Bologna	alice.solda2@unibo.it
Pavlo Solokha	Università di Genova	pavlo.solokha@unige.it
Eduardo Maria Sommella	Università di Salerno	esommella@unisa.it
Davide Soricelli	Università di Salerno	
Giovanni Sotgiu	Università Roma Tre	giovanni.sotgiu@uniroma3.it
Lucia Spada	Consiglio Nazionale delle Ricerche	
Barbara Spadoni	Società Chimica Italiana	
Gilberto Spadoni	Università di Urbino "Carlo Bo"	gilberto.spadoni@uniurb.it
Claudia Spatari	Università della Calabria	claudia.spatari@unical.it
Andrea Speltini	Università di Pavia	andrea.speltini@unipv.it
Antonia Spensiero	Università di Salerno	aspensiero@unisa.it
Roberto Spezzano	Università di Milano	roberto.spezzano@unimi.it
Maria Chiara Sportelli	Università di Bari "Aldo Moro"	maria.sportelli@uniba.it
Giuseppe Spoto		
Francesca Spyrakis	Università di Torino	francesca.spyrakis@unito.it
Samuele Staderini		stade84@gmail.com
Madia Letizia Stama	Università di Bari "Aldo Moro"	madiastama@alice.it
Azzurra Stefanucci	Università "G. D'Annunzio" Chieti-Pescara	a.stefanucci@unich.it
Mauro Stener		
Valentina Straniero	Università di Milano	valentina.straniero@unimi.it
Giorgio Strukul	Università Ca' Foscari Venezia	strukul@unive.it
Giuseppe Baldovino Suffritti	Università di Sassari	pino@uniss.it
Vincenzo Summa	IRBM Science Park Spa	v.summa@irbm.it
Gian Paolo Suranna	Politecnico di Bari	surannag@poliba.it
Tommaso Tabanelli	Università di Bologna	tommaso.tabanelli@unibo.it
Maurizio Taddei	Università di Siena	maurizio.taddei@unisi.it
Francesco Tadini Buoninsegni	Università di Firenze	francesco.tadini@unifi.it
Janeth Alicia Tafur Marinos	Università di Torino	janethalicia.tafurmarinos@unito.it
Antonio Tagarelli	Università della Calabria	a.tagarelli@unical.it
Sabrina Taliani	Università di Pisa	sabrina.taliani@unipi.it
Carmen Talotta	Università di Salerno	ctalotta@unisa.it
Gaby Brice Taptue Zubou	Università di Genova	brice@difar.unige.it
Nicola Tasinato	Scuola Normale Superiore	
Francesco Tavanti	Università di Modena e Reggio Emilia	francesco.tavanti@unimore.it
Joannis Telioridis	Elsevier	
Veronica Termopoli	Università di Urbino "Carlo Bo"	veronica.termopoli@uniurb.it
Stefania Terracciano	Università di Salerno	sterracciano@unisa.it
Diego Tesauro	Università di Napoli Federico II	dtesauro@unina.it
Riccardo Tesser		
Francesca Tessore	Università di Milano	francesca.tessore@unimi.it
Roberta Teta	Università di Napoli Federico II	roberta.teta@unina.it
Matteo Tiecco	Università di Perugia	matteotiecco@gmail.com
Maria Rosaria Tine'	Università di Pisa	mariarosaria.tine@unipi.it

Mauro Tomassetti	Università di Roma "La Sapienza"	
Maria Rita Tomei	Università di Roma "Tor Vergata"	mariarita.tomei@uniroma2.it
Monica Tonelli	Università di Firenze	tonelli@csgi.unifi.it
Lucia Toniolo	Politecnico di Milano	lucia.toniolo@polimi.it
Paola Torrelli	Università di Roma "La Sapienza"	pao.torrelli@hotmail.it
Giulia Torrielli	Università di Genova	giulia.torrielli86@gmail.com
Edoardo Torti	Università di Pavia	edoardo.torti01@ateneopv.it
Marirosa Toscano	Università della Calabria	m.toscano@unical.it
Sandra Toso	I.t.i.s. Rovigo	tossandra@gmail.com
Arianna Tota	Università di Bari "Aldo Moro"	arianna.tota@uniba.it
Giada Tranchida	Università di Palermo	giada.tranchida@unipa.it
Silvia Traniello Gradassi	Istituto di Istruzione Superiore I.i.s "Viola-Marchesini"	silvia.traniello@alice.it
Mariachiara Trapani	CNR - Ist. Per lo Studio dei Materiali Nanostrutturati	trapani@mail.pa.ismn.cnr.it
Rita Traversi	Università di Firenze	rita.traversi@unifi.it
Alessandra Trencia	Merck (Sigma Aldrich)	
Ferruccio Trifirò	Università di Bologna	ferruccio.trifiro@unibo.it
Leonardo Triggiani	Università di Bari "Aldo Moro"	
Iuni Margaret Laura Trist	Università di Siena	iuni.trist@gmail.com
Claudio Trombini	Università di Bologna	claudio.trombini@unibo.it
Alessandra Truppi	Consiglio Nazionale delle Ricerche	a.truppi@ba.ipcf.cnr.it
Akiko Tsurumaki	Università di Roma "La Sapienza"	akiko.tsurumaki@uniroma1.it
Cristina Tubaro	Università di Padova	cristina.tubaro@unipd.it
Valeria Tudino	Università di Roma "La Sapienza"	vale.tudino@gmail.com
Rosa Turco	Università di Napoli Federico II	rosa.turco@unina.it
Antonio Tursi	Università della Calabria	antonio.tursi@unical.it
Roberto Udisti	Università di Firenze	
Piero Ugliengo	Università di Torino	piero.ugliengo@unito.it
Manuela Vacatello	Merck (Sigma Aldrich)	
Mattia Vacchini	Università di Milano Bicocca	m.vacchini@campus.unimib.it
Gianpiero Valente	Consiglio Nazionale delle Ricerche	gianpiero.valente@uniba.it
Giovanni Valenti	Università di Bologna	g.valenti@unibo.it
Francesca Valentini	Università di Roma "Tor Vergata"	valentini.francesca6@gmail.com
Antonio Valentoni	Università di Sassari	antonio.valentoni@tiscali.it
Jeroen Van Bokhoven	ETH Zürich	jeroen.vanbokhoven@chem.ethz.ch
Gabriele Vannutelli	Università di Roma "La Sapienza"	gabrielevannutelli@gmail.com
Mario Varasi	IFOM-Ist FIRC Oncologia Molecolare	mario.varasi@ifom.eu
Massimiliano Varde'	Consiglio Nazionale delle Ricerche	massimiliano.varde@cnr.it
Andrea Vassoi	Università di Bologna	andrea.vassoi2@unibo.it
Nicola Vecchini	Versalis S.p.A.	nicola.vecchini@versalis.eni.com
Ciprioti Vecchio		
Amalia Velardo	Università di Salerno	avelardo@unisa.it
Mariano Venanzi	Università di Roma "Tor Vergata"	venanzi@uniroma2.it
Francesco Venditti		
Giulia Venditti	Università di Roma "La Sapienza"	giulia.venditti@uniroma1.it
Iole Venditti	Università di Roma "La Sapienza"	iole.venditti@uniroma1.it

Vincenzo Venditto	Università di Salerno	vvenditto@unisa.it
Giovanni Ventura	Università di Bari "Aldo Moro"	giovanni.ventura@uniba.it
Margherita Ventura	Università di Bologna	
Alberto Villa	Università di Milano	alberto.villa@unimi.it
Claudio Villani	Università di Roma "La Sapienza"	claudio.villani@uniroma1.it
Giovanni Villani	Consiglio Nazionale delle Ricerche	villani@iccom.cnr.it
Flaminia Vincenti	Università di Roma "La Sapienza"	flavincenti@gmail.com
Marco Vincenti	Università di Torino	marco.vincenti@unito.it
Alessia Viola	Università di Salerno	
Davide Vione	Università di Torino	davide.vione@unito.it
Antonella Virgilio	Università di Napoli Federico Ii	antonella.virgilio@unina.it
Fabio Vischio	Ipcf-cnr	fabio.vischio@tiscali.it
Elena Visentin	Carlo Erba Reagents	
Giulio Vistoli	Università di Milano	giulio.vistoli@unimi.it
Paola Vitale		
Rosa Vitiello	Università di Napoli Federico II	rosa.vitiello@unina.it
Serena Vittorio	Università di Messina	svittorio@unime.it
Monica Viviano	Università di Salerno	m.viviano86@yahoo.it
Francesco Vizza	Consiglio Nazionale delle Ricerche	francesco.vizza@iccom.cnr.it
Mirco Volanti	Università di Bologna	mirco.volanti@studio.unibo.it
Stefano Volpi	Università di Parma	stefano.volpi@studenti.unipr.it
Marc Wälterman	Biotage	
Laura Zaccaro	Consiglio Nazionale delle Ricerche	lzaccaro@unina.it
Stefano Zacchini	Università di Bologna	stefano.zacchini@unibo.it
Andrea Zaffora	Università di Palermo	andrea.zaffora@unipa.it
Alfonso Zambon	Università di Modena e Reggio Emilia	alfonsozambon@gmail.com
Gerardo Zambrano	Università di Napoli Federico II	gerardo.zambrano@unina.it
Lorenzo Zamirri	Università di Torino	lorenzo.zamirri@unito.it
Giorgia Zampardi	University of Oxford	giorgiazampardi@gmail.com
Angela Zampella	Università di Napoli Federico II	azampell@unina.it
Daniele Zampieri	Università di Trieste	dzampieri@units.it
Franca Zanardi	Università di Parma	franca.zanardi@unipr.it
Danny Zanardo	Università Ca' Foscari Venezia	dzanardo1992@gmail.com
Riccardo Zanasi	Università di Salerno	rzanasi@unisa.it
Giulia Zanetti		
Martina Zangheri	Università di Bologna	martina.zangheri2@unibo.it
Lorenzo Zani	Consiglio Nazionale delle Ricerche	lorenzozani@yahoo.it
Robertino Zanoni	Università di Roma "La Sapienza"	robertino.zanoni@uniroma1.it
Alessandro Zappi	Università di Bologna	alessandro.zappi12@gmail.com
Daniele Zappi	Università di Roma "La Sapienza"	daniele.zappi@outlook.it
Riccardo Zenezini Chiozzi	Università di Roma "La Sapienza"	riccardo.zenezini@uniroma1.it
Luca Zoia	Università di Milano Bicocca	luca.zoia@unimib.it
Cristiano Zonta	Università di Padova	cristiano.zonta@unipd.it