



NANOCHEMISTRY CAMP

21-28 SEPTEMBER 2024 (Iseo, Camping del Sole, Italy)

NANOCHEMISTRY

Nanochemistry deals with the fundamental aspects of nanotechnology, straddling the boundaries of physics, chemistry, and biology. Nanotechnology is the science and technology of objects that have an intermediate size between larger molecules and the smallest structures we are currently able to manufacture; it is the science of objects with dimensions ranging from a few nanometers to hundreds of nanometers (1 nm is one billionth of a meter).

Nanochemistry has profound implications, encompassing both technological advancements and sustainable development. For instance, it has diverse effects on society, particularly in the electronics and energy sectors, resulting in the creation of compact, efficient devices and the advancement of battery technologies. Moreover, it has revolutionized medicine by facilitating targeted drug delivery and early disease detection through highly sensitive sensors. Additionally, nanochemistry significantly contributes to environmental sustainability by aiding in the removal of pollutants from water and air purification, as well as reducing resource consumption and environmental impact in material production.

THE CAMP

The Nanochemistry Camp is an international residential summer school aimed at master's and doctoral students in chemistry and allied fields, where nanochemistry plays a key role. It delivers top-tier, cutting-edge insights on pivotal topics in nanochemistry, by featuring an original and innovative format that brings together students and globally renowned experts in (nano)chemistry, including Nobel laureates, in a comfortable and informal environment at one of the most beautiful campsites overlooking Lake Iseo (<https://www.campingdelsole.it/en/>).

The educational program includes 3-hour classes with each professor, consisting of about 1.5 hours of lecture followed by an equal amount of time for discussion. Additionally, the program incorporates community-building activities where students have the opportunity to engage with professors and each other regarding their research activities and future projects. To promote this interaction, poster pitch presentations, team-building activities, trekking, and responsible tourism outings are scheduled.

Master's and doctoral students, and young post-doctoral researchers are eligible to apply for the Camp. Admission is subject to selection by the Scientific Committee, based on the abstract of the scientific contribution, motivation letter, and CV.

THE SPEAKERS

- FRANÇOISE BROCHARD-WYART, professor at the Sorbonne University - Curie Institute
- PAUL DYSON, professor at Institute of Chemical Sciences and Engineering (École Polytechnique Fédérale de Lausanne)
- ANDRE GEIM, professor at the University of Manchester, Nobel Prize in Physics 2010
- KATHARINA LANDFESTER, professor at Max Planck Institute for Polymer Research
- SIJBREN OTTO, professor at the Centre for Systems Chemistry (University of Groningen)
- ROBERTA SESSOLI, professor at the Laboratory of Molecular Magnetism (Università di Firenze)
- EDMAN TSANG, professor at Wolfson Catalysis Laboratory (Oxford University)



AGENDA*

- **SATURDAY 21ST SEPTEMBER**



Daytime

Participants' arrival to Iseo

7.00 – 8.00 p.m.

Course and participants' introduction

8.00 p.m.

Welcome dinner at the Camping's restaurant

- **SUNDAY 22ND SEPTEMBER**



9.15 a.m. – 5.30 p.m.

Visit to the picturesque island [Monte Isola](#) and hike to Santuario Madonna della Ceriola with its breathtaking view on lake Iseo

7.30 p.m.

Dinner at the Camping's restaurant

- **MONDAY 23RD SEPTEMBER**



9.00 a.m. – 12.00 p.m.

Lecture [Edman TSANG](#) | Wolfson Catalysis Laboratory, Oxford University

Title: "Tailoring Nano-structures in Catalysis"

Abstract: Nanoparticles currently exist in a wide variety of products ranging from fillers, coatings for UV protection, antimicrobial paste, food packaging to odour adsorbents etc. In medicine, gold nanoparticles have been widely studied as a potential agent for targeted drug delivery and cancer detection. For reaction catalysis, nanoparticle effectiveness compared to bulk materials is primarily driven by the huge increase in surface area when particle size decreases. This leads to much more efficient application of the catalyst material. In the field of optical materials, nanoparticles are also exploited to give plasmonic properties that can assist photocatalysis. Our key direction is to design and build a catalyst particle with tunable size, structure and composition through nano-chemistry synthesis. The use of these new synthesized catalyst bodies have been investigated with or without their immobilization on supports, in either liquid phase or in gas phase catalysis. It is demonstrated that these engineered catalyst particles in many cases display superior activity, selectivity, stability and recyclability as compared to conventionally prepared heterogeneous catalysts for a number of catalytic reactions. Hence, in this presentation, some examples on the tailoring of nanostructures in the areas of energy and environment in catalysis will be particularly given. It is hoped that this talk could stimulate new nanoscience/new instrumentation in catalysis and other disciplines in future.

12.30 p.m.

Lunch at the Camping's restaurant



2.00 – 4.00 p.m.

Lake view poster presentation and discussion

7.30 p.m.

Dinner at the Camping's restaurant



• **TUESDAY 24th SEPTEMBER**



9.30 a.m. - 12.30 p.m.

Lecture **Paul DYSON** | Institute of Chemical Sciences and Engineering, École Polytechnique Fédérale de Lausanne

Title: "Developing nanocatalysis for sustainable chemistry"

Abstract: Interest in the transformation of waste materials into valuable products has intensified in recent years with a slow, but steady transition towards a circular economy. Over two decades, we have worked on the development of catalysts that transform complex renewable (polymeric) feedstocks into fuels, platform chemicals or high-value chemical products. In this lecture, I will describe the progression of our research from simple model compounds, through to purified and well-characterized biopolymers, i.e. cellulose and lignin, and eventually to highly complex heterogeneous biomass containing waste streams. In addition, We have also been applying our experience with biopolymers to design catalysts for the valorisation of waste synthetic polymers such as polyamides and polyurethanes, and our studies in this area will also be highlighted. I will demonstrate how the application of a mechanistic-based approach facilitated the delineation of the critical parameters needed to improve the performance of the catalysts.

1.00 p.m.

Lunch at the Camping's restaurant



2.30 - 5.30 p.m.

Lecture **Roberta SESSOLI** | Laboratory of Molecular Magnetism, University of Firenze

Title: "Magnetic molecules in quantum nanoscience: Potential and challenges"

Abstract: Implementing advanced Quantum Technologies might benefit from the remarkable quantum properties and the chemical versatility of molecular spin systems based on the coordination bond. The versatility of the molecular approach combined with rational design has recently boosted the operativity temperature of molecules acting as bits of memory, otherwise known as Single-Molecule Magnets, or the coherence time of molecular spin qubits. The latter class is currently explored because the richness and tunability of the spectrum of spin levels make them particularly suitable for quantum error correction, while spin-spin interaction can be tuned to realize quantum gates and quantum simulators. Molecules can also be processed to be deposited on surfaces, allowing the realization of hybrid nanostructures. However, the molecular approach also poses key challenges, such as the presence of low-energy vibrational modes typical of molecular lattices. Achieving the control of a single molecule is also challenging because the spin is weakly coupled with the magnetic field and even more weakly with the electric field, which can be confined at the molecular scale, with the spin degrees of freedom of the molecule.



6.30 - 8.30 p.m.

Guided tour to Iseo town



8.30 p.m.

Dinner at pizzeria "[Lido dei Platani](#)" in Iseo



• **WEDNESDAY 25th SEPTEMBER**



10 a.m. – 1 p.m.

Lecture **Andre GEIM** | The University of Manchester, Nobel Laureate in Physics 2010

Title: "Wonder Materials"

Abstract: Graphene, a single layer of carbon atoms, is not only the thinnest but also probably the simplest material one can imagine. Nonetheless, graphene has acquired so many superlatives to its name and revealed such a cornucopia of new phenomena that it is often called a wonder material. Following its advent, many other one-atom or one-molecule thick crystals have been isolated and investigated. These so-called two-dimensional materials have become one of the hottest topics in materials science and condensed matter physics. Aiming at an audience unfamiliar with 2D materials, I will briefly describe the research field trying to explain why graphene and its cousins have attracted so much attention.

1.00 p.m.

Lunch at the Camping's restaurant



2.30 – 3.30 p.m.

Kayak tour on lake Iseo in [Sporting Lido Sassabaneck](#)



6.30 – 7.30 p.m.

"I colori dell'invisibile" | Public lecture by Paolo Bergese, University of Brescia, at Berlucchi winery



7.30 – 11.00 p.m.

Guided tour to [Giudo Berlucchi](#) wine cellars, in Franciacorta, and gala dinner at the Berlucchi winery with best poster award and attendance certificate ceremonies

• **THURSDAY 26th SEPTEMBER**



9.30 a.m. – 12.30 p.m.

Lecture **Françoise BROCHARD-WYART** | Curie Institute, Sorbonne University

Title: "How nanoparticles and cells play together"

Abstract: Condensates, formed by proteins phase separation have critical functions as membraneless organelles in cells. Many hollow coacervates have been reported in cells and bioengineered in vitro. We use micropipette aspiration to characterize condensates prepared from bioengineered spider silk proteins. We found that coacervates can burst like soap bubbles upon aspiration. The dynamics of bursting leads to the measurement of surface and bulk viscosity as well as shell thickness and viscosity. Understanding the formation and bursting of hollow coacervates will open new avenues for their use as material building blocks for chemical reaction compartments or drug delivery systems. Gas vesicles are air-filled protein nanostructures produced in bacteria have been genetically encoded in cells to act as contrast agents for ultrasound imaging and as cell-killing agents through inertia-induced cavitation. We report the properties of giant gas vesicles, microbubbles encapsulating perfluoro-butane and coated with surface-active proteins. Polymer or glass Microparticles: we discuss how they interact with cells.

1.00 p.m.

Lunch at the Camping's restaurant



2.30 – 5.30 p.m.

Lecture **Sijbren OTTO** | Centre for Systems Chemistry, University of Groningen

Title: “Assembling Life from Synthetic Components”

Abstract: How the immense complexity of living organisms has arisen is one of the most intriguing questions in contemporary science. In this lecture I will address how organization and function can emerge spontaneously from complex molecular networks. In networks of molecules that can interconvert, interactions between selected molecules leads to their mutual stabilization, which drives the autocatalytic production of more of them. Hence, the interacting and thereby assembling molecules are replicating themselves. Replicators have been discovered that are able to catalyze, in addition to their own formation, also other reactions, amounting to a primitive form of metabolism. Rudimentary Darwinian evolution of these systems has also been achieved very recently. Current work focuses on the integration of the last remaining key feature of life: compartmentalization to yield a (living?) cell-like entity.

7.30 p.m.

Dinner at the Camping's restaurant

• **FRIDAY 27th SEPTEMBER**



9.30 a.m. – 12.30 p.m.

Lecture **Katharina LANDFESTER** | Max Planck Institute for Polymer Research

Title: “The world of nanocapsules”

Abstract: Polymeric nanocapsules offer versatility for sophisticated applications, allowing the design of custom systems through the miniemulsion process. They can encapsulate and release various payloads, both hydrophobic and hydrophilic, with high efficiency and control. A new approach has been developed to create colloidally stable nanocontainers that are not sensitive to osmotic pressure and can release their contents in response to environmental stimuli. This method is particularly useful for biomedical applications requiring aqueous environments.

1.00 p.m.

Lunch at the Camping's restaurant



3.00 – 5.30 p.m.

Guided tour of [Brescia city centre](#): principal squares (Piazza Loggia, Piazza Vittoria, Piazza Duomo), Old Dome and New Dome, Piazza del Foro and Capitolium (Corridoio Unesco)



6.00 – 7.00 p.m.

Researchers' night in Brescia: expositions and activities organized by local academic institutions: [University of Brescia](#), [Catholic University of the Sacred Heart](#), [Laba Academy](#), [Santa Giulia Academy](#), [Luca Marenzio Conservatory](#), and [Fondazione Brescia Musei](#)

7.30 p.m.

Dinner in Brescia at [Carmen Town](#)

• **SATURDAY 28th SEPTEMBER**



Daytime

Participants' departure